

Name: _____ Hour: _____

Activity 1: What Does Water Look Like Underground?

Purpose: In order to understand where water comes from, we have to be able to imagine what it looks like underground. Where is the water underground? What does it look like down there?

Directions:

First Day: On the "Before" side of the T chart, draw a picture of what you think water looks like underground. Hand in this page.

Last Day: On the "After" side of the T-chart draw a picture of what you think water looks like underground Write 5 complete sentences to explain what you learned about groundwater. Hand in this page

Before

After

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Student Resources Lesson #3 Groundwater

Name: _____ Hour: _____

Activity 2: Permeability

Purpose: How do sediments (gravel, sand, clay) store water? Is it easier to get water out of gravel or sand?

1. Work as a group to complete the following steps
 - A. Pour 1/3 of the water into the cup of gravel.
 - B. Pour 1.3 of the water into the cup of sand.
 - C. Pour the other 1/3 of the water into the cup of powdered clay.
 - D. Observe what happens to the water.
2. Draw a picture of your observations in the table.

Gravel	Sand	Powdered Clay

As a group, answer questions 3 & 4. Each person should write down the answers.

3. In your group, discuss what you think the term “permeability” means. Base your answer on the cups. Write your group definition here.

4. Based on your observations, which material is more permeable, gravel, sand or clay? Why?

5. .Work as a group to complete the following steps and answer question 6. Each person should write down the answer.
 - A. Use an eye dropper to try to get some of the water out of the cup with the gravel.
 - B. Repeat step A in the sand and clay cups..
6. If you were going to drill a well for drinking water, which type of material would you choose to drill into to get the most water? Why would this type of material be easier to get water out of?

Name: _____ Hour: _____

Activity 3: Building a Groundwater Model

Purpose: Models help us understand complex ideas. Sometimes, models help us understand things we cannot see. In the next two activities, you will build a model of a groundwater system and see what we can learn from the model.

Building the Groundwater Model

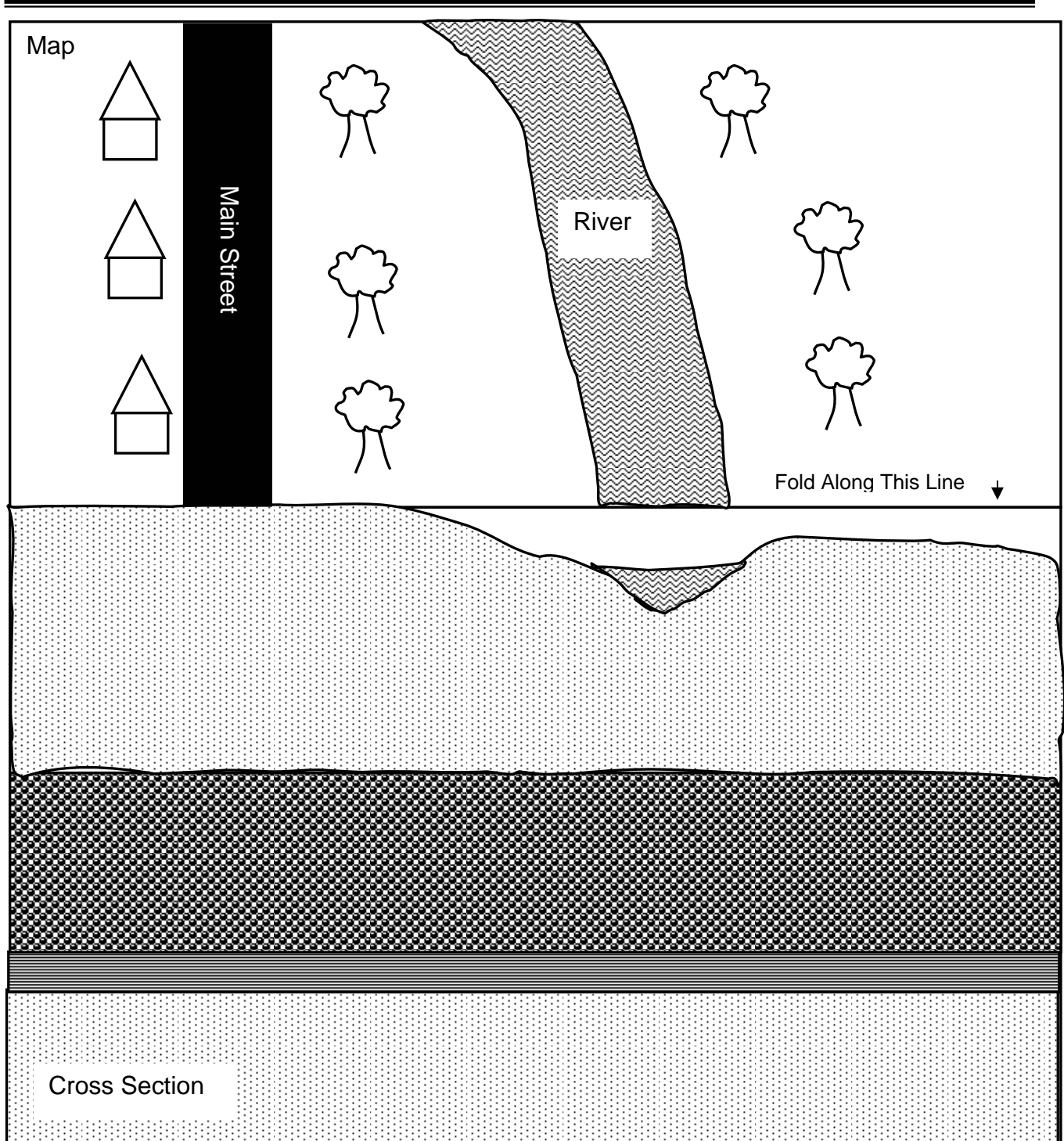
1. Fold the Groundwater Model plan in half along the line.
2. Unfold the paper so that it makes a 90 degree bend. Hold the side labeled “map” horizontally (surface points toward the ceiling) and the side labeled “cross-section” vertically (surface points toward the wall).
3. The vertical side represents looking a slice of the ground from the side. It shows the layers underground. This is called the cross-section view. The horizontal side is what is on top of the ground. It is called the map view.
4. Construct the groundwater system pictured in the cross-section of the Groundwater Model Plan. Hints:
 - A. Insert the stopper tightly into the hole in the plastic tank.
 - B. Put the well in first, up against a side of the tank so that you can see it through the tank wall.
 - C. Pour the sand layer into the tank.
 - D. Use a cup to pour just enough water into the tank to fill up the sand. There should be no water standing on top of the sand. The sand should just be wet.
 - E. Pour in the rest of the sediments in layers carefully and evenly. Don't mix the sediments.
5. When you are done, the model should look like the one pictured in the cross-section. The map-view picture represents what the ground looks like on top.


Exploring the Groundwater Model

1. Use the cup with holes in it as the “rain cup”.
2. Hold the rain cup over the top of the model.
3. Slowly pour water into the rain cup so that it sprinkles into the model. Stop pouring water after the water has filled within 1 inch of the top of the top layer of the model.
4. Observe carefully where the water goes.
5. Label the following features on the Groundwater Model Plan
 - A. The unconfined aquifer – the aquifer that is open to the ground surface.
 - B. The confined aquifer – an aquifer that is underneath an impermeable (confining) layer
 - C. The confining layer – an impermeable layer
 - D. The top of the water table - draw a line across the entire cross-section to mark the top of the water table and label it "water table". You can also use an upside down triangle to mark the water table (∇).
 - E. Use arrows on the cross-section view of the Groundwater Model Plan to show the path of the water from the rain.

Name: _____ Hour: _____

Activity 3: Groundwater Model Plan



-  Gravel
-  Clay
-  Sand
-  River

Name: _____ Hour: _____

Activity 4: Well Problem

Purpose: Understanding how groundwater systems work is important for helping people figure out where to put their wells.

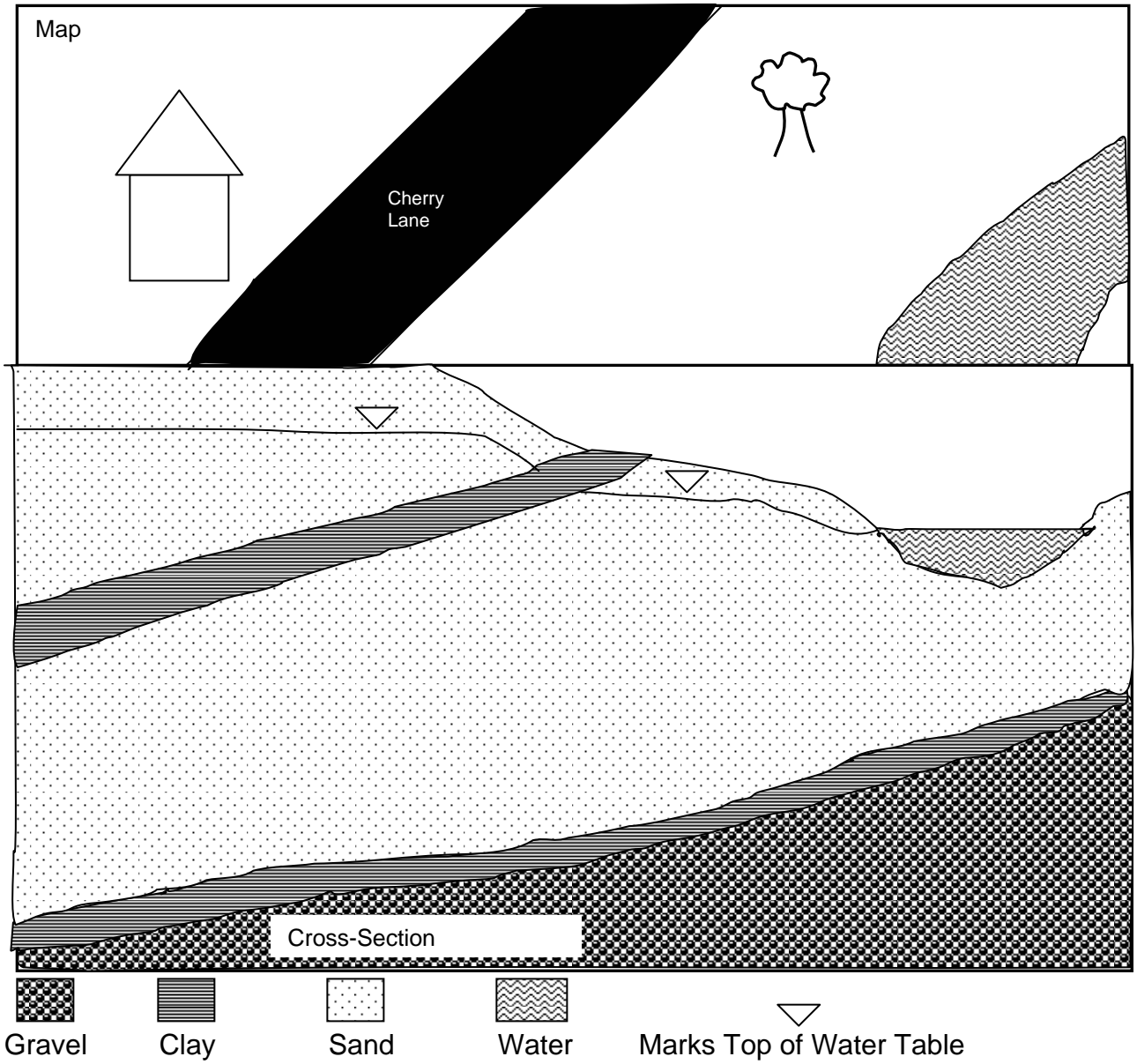
Directions

1. You own all of the land in the picture. You need to drill a well for water for your house. You do not want to take the water directly from the river because the river water is not as clean as the groundwater.
2. Examine the picture of the cross-section below. Label the following features:
 - A. Unconfined aquifer(s)
 - B. Confined aquifer(s)
 - C. Confining layer(s)
3. Remember, it costs about \$9 per foot to drill a well. So, you don't want to have to spend too much money, but you also want to make sure you have enough water for your house.
4. Decide where would be the best place to drill the well so that you will have water all year long. Draw in your well. Be sure to show how deep your well should go.
5. Justify your well location below. Explain
 - A. Why you chose to put it where you did.
 - B. Why you drew it as deep as you did.

6. Share your answers with your group members.
7. If you decide to change your answer, draw in a second well in a different color from the first well (do not erase your first well). Be sure to use a key to identify which well was your first well and which well was you second well.
8. Justify your change below. Explain why you changed your well location and why the new location is better.

Name: _____ Hour: _____

Activity 4: Well Problem Cross-Section & Map



Name: _____ Hour: _____

Activity 5 - Groundwater Pollution Models

Purpose: In this activity you will simulate different causes and effects of groundwater pollution using the groundwater models your group constructed previously. You will be asked to predict what will happen after you pollute your model using a particular method, as well as to carefully examine and describe what actually happened.

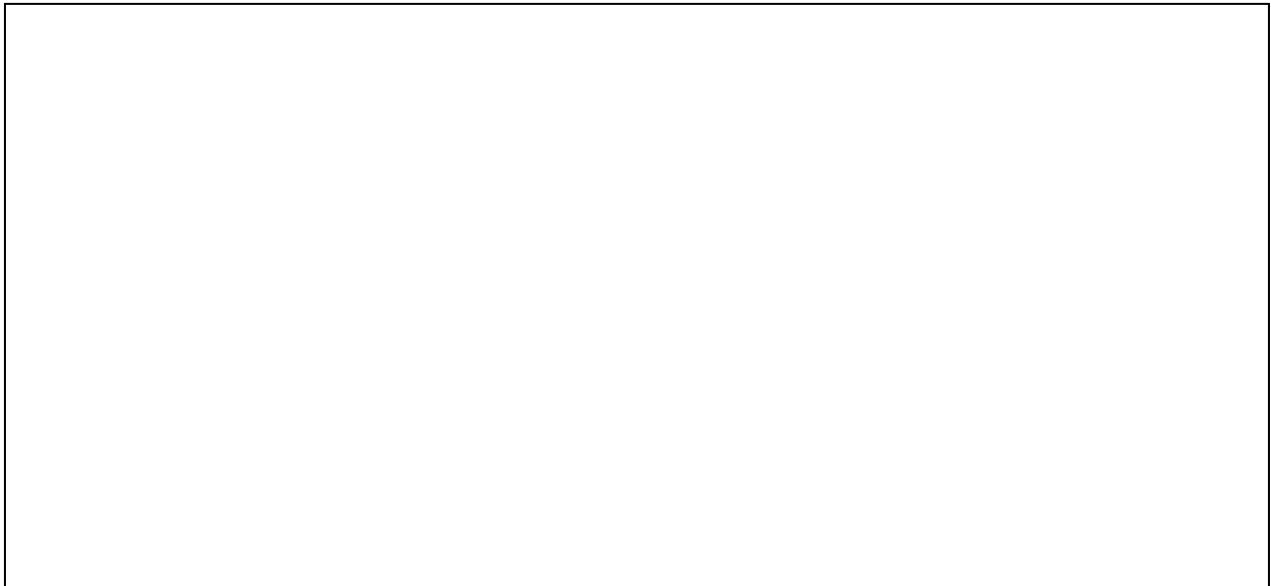
Directions:

2. Return to your groups from the previous groundwater model lesson.
3. Select one of the following examples to study. If you have your own groundwater pollution example, you may use it instead, with approval from your teacher.
 - Example #1: Fertilizer/Pesticides on Agricultural Fields* - Use colored powdered drink mix to simulate contaminant. Observe the path of the contamination in the model.
 - Example #2: Landfill* - Bury a paper towel soaked in colored water. Observe the path of the contamination in the model.
 - Example #3: Leaking Underground Storage Tank (Gasoline Station)* - Bury a film canister punctured with holes and filled with colored water. Observe the path of the contamination in the model.
 - Example #4: Abandoned Well* - Insert a straw with holes into the model to represent an abandoned well. Pour colored water into the straw to represent pollution. Observe the path of the contamination in the model.
 - Example #5: Unlined Sewage Lagoon or Surface Contamination Model* - Place a paper cup with holes in the bottom on surface of the model. Pour colored water into the cup to simulate pollution leaking out of the lagoon. Observe the path of the contamination in the model.
4. Which scenario did your group decide to use? _____
5. Use the space below to draw a diagram of what you think will happen. Show the path that you think the pollution will take. Be sure to include and label the important parts of the groundwater system (aquifers, layers, etc.)

Name: _____ Hour: _____

7. Set up your groundwater pollution scenario.
8. Use the rain cup (cup with holes in the bottom) to sprinkle water onto the model and watch what happens. It's important not to flood it, so pour enough water onto your model to make the contamination spread, but not too much! You don't want to flood your model.
9. Describe what happened.

10. Draw a cross section picture of what your model looks like now. Use colored pencils to show the contamination.



Name: _____ Hour: _____

Activity 6 – Clean-Up of the Models

Purpose: Now that your model is polluted, you have to figure out how to clean it up. After your class discusses different options, develop a clean-up plan with your group and then implement your plan.

Directions:

1. Within your group, develop a plan for cleaning up the pollution. Describe your plan here. Be sure to explain the steps you will take to remove the pollution and what you will do with any contaminated water that you might pump out and any contaminated sediment (sand or gravel) that you might remove from the area.

2. Have your teacher approve your plan.
3. Obtain the materials to implement your plan.
4. Use your plan to clean-up your model as best you can.
5. Did your plan work? _____ As a group, decide why your plan did or did not work.

6. In your group, discuss how your clean-up model is similar to and different from what might happen in real life?

Similar to real life _____

Different from real life _____

Name: _____ Hour: _____

7. Can you imagine this pollution event happening in real life? What kinds of effects could this type of pollution event have on human and other living organisms in a community?

8. Should people care about pollution? Why or why not? Write what you think.

9. How could we prevent this sort of pollution and clean-up problem from happening in the first place?
