El Paso Water Education Series

"Hold My Water" - Lesson Plan

Grade # 4
Subject
Natural resources, Earth's processes and patterns of change.

Duration
45 minutes

Skills
Observe, Record, Explain a phenomena, Analyze and interpret data to derive meaning, identify features and patterns.

Vocabulary
Porosity
Groundwater
Recharge
Aquifer
Infiltration
Caliche

Science TEKS
Grade 4.1(A-G) 4.3(A-C), 4.5(E,F,G), 4.6 (A-C), 4.7

Math TEKS
Grade 4.9 (A),

Social Studies TEKS
Grade 4.6(A), 4.7(A) 4.8(A-C), 4.20(B)

For more lessons, activities, and to schedule a visit to EPWater's $TecH_2O$ Water Resources Learning Center visit:

tech2o.org

Lesson Overview: Evaporation, condensation, and precipitation are all parts of the Water Cycle. This lesson will focus on how precipitation, once on the ground, moves differently through various types of materials such as sand, gravel, rocks and clay. Water from rain, rivers or lakes can collect underground by making its way down through the surface. This process, known as **infiltration**, can create vast areas of underground water called **aquifers**. In some cases, aquifers, can take thousands or millions of years to form.

In El Paso, we are fortunate to have two aquifers: the Mesilla Bolson, west of the Franklin Mountains, and the Hueco Bolson, east of the Franklin Mountains. The Mesilla Bolson sees natural recharge from both precipitation and from the Rio Grande; however, the Hueco Bolson sees only minimal natural recharge due to a dense layer of **caliche**. Caliche is a type of soil that forms in arid regions when calcium carbonate and other minerals bind together. This type of soil prevents water from infiltrating. To preserve the aquifer, EPWater uses recycled clean water to recharge the Hueco Bolson, EPWater must first excavate and remove the layer of caliche. After this lesson, students will have an understanding of how the Hueco Bolson and the Mesilla Bolson formed here in the Chihuahuan desert and how soil type factors into the recharging process.

Objectives:
1. Students will investigate the movement of water through different types of sediment.
2. Students will find that some sediments hold water better than others.
3. Students will become familiar with how aquifers are formed and how our own aquifers are vital to our community.

Engagement Questions:
1. How often does it rain here in our region of the Chihuahuan desert?
2. When it rains, what do you think happens to all the water?

Materials: *(per student or small group)*
Student worksheet
Pea sized Gravel
Sand
Clay
Scissors
Water bottles (empty)
Cotton gauze
Rubber bands
Graduated cylinders
Clear plastic cups
Stop watch
Water
Tray (Optional)

Procedure Part One:
1. Place one clear cup of gravel, sand and clay each in a location where students can observe from all sides. Label cups A, B and C. Ask students what they notice about the particle size of each. After some discussion ask students the following questions:

- Which material has the largest particle size?
- Which has the smallest particle size?
- Which material do you think water will travel through the easiest and why?
- Which material do you think water will travel through the slowest and why?

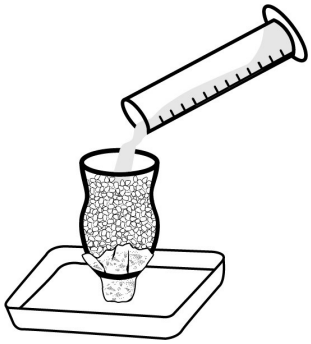
Making Connections: Soil is made of different materials, such as sand, rocks and clay. Water travels through these materials at different rates depending on the **porosity** of the material. This process is called **infiltration.** Water can travel easily through particles of gravel and sand but has difficulty traveling through clay and rocks. Water must find a crack or hole in the rock, dissolve it or find a way around. Hot and dry desert regions often have rocky/gravelly soils. In the El Paso area, most infiltration occurs in and around the riverbed. Underground aquifers have been formed by infiltration over long periods of time. How an aquifer gets refilled or **recharged** and the rate of recharge depends on many factors.

1. Groundwater recharge depends on water traveling through the earth material. The longer water is held in the soil, the longer it takes to recharge our aquifers.
2. If water takes too long to travel through the soil, it could cause erosion and runoff especially during heavy precipitation events. Or, in the desert on hot summer days, it may simply evaporate.

Procedure Part Two:

Students will investigate how long it takes water to travel though the different materials. The procedure is as follows,

1. Cut off the bottom of the water bottle then cover the top with a thin layer of cotton gauze, hold the gauze in place with a rubber band, and flip over the bottle, repeat 2 more times.
2. Fill 1/2 of one bottle with gravel.
3. Fill 1/2 of one bottle with sand.
4. Fill 1/2 of one bottle with clay.
5. Measure 50 ml of water in the graduated cylinder.
6. You will be using a stopwatch to time how long it takes for water to pass though each material:



A. Pour the water into the bottle so that it travels trough the material and out of the gauze. Use the plastic cups or a plastic tray to catch water that comes out of the bottles.

B. Time how long it takes the water to pass though the gravel, the sand and the clay.

8. Measure how much water exited the bottle using the graduated cylinder.
9. Record your results on the graph.
10. Take notes on what you observed.
11. Have groups share their data with the class and compare results.

Questions:

- What types of manmade structures prevent rainwater from recharging our aquifers?
- If water can't infiltrate its way down to the aquifer, what happens to all that rainwater? Where does it go?

Check for Understanding:
Did students meet the lesson objectives? Can they answer the engagement questions? Below are some key takeaways and questions that students should be able to answer following the lesson.

Key Takeaways:

- The amount of groundwater found in the soil depends on how the different sediment types are arranged. If the upper layer of soil is composed of clay, the water will not travel quickly through the soil layers. If the upper layer is composed of gravel, the water will travel through the soil layers quicker.
- It is easy to remove water from our aquifer system yet it can take a very long time to recharge.
- Without proper management, aquifers can quickly drain out and leave a community without a reliable source of water.
- El Paso is and has been making a great effort at preserving and maintaining our aquifers.
- About half of the water we use in El Paso comes from the Hueco and Mesilla Bolson aquifers.

Questions:

1. How could you combine the materials and create a mini-aquifer in a bottle? Explain how you would accomplish this? What material would go first, second, last? Hint; look at the graphic below.
2. How could you rearrange the materials so that no water infiltrates the first layer ? Explain how you would accomplish this?
3. Write a short paragraph about the graphic below using all 5 vocabulary words. Porosity, Groundwater, Recharge, Aquifer and Infiltration.

Answers:

1. Good Conditions for Aquifer Creation.

⇒ Sand
⇒ Gravel
⇒ Clay

Or

⇒ Gravel
⇒ Sand
⇒ Clay

2. Poor Conditions for Aquifer Creation.

⇒ Clay
⇒ Gravel
⇒ Sand

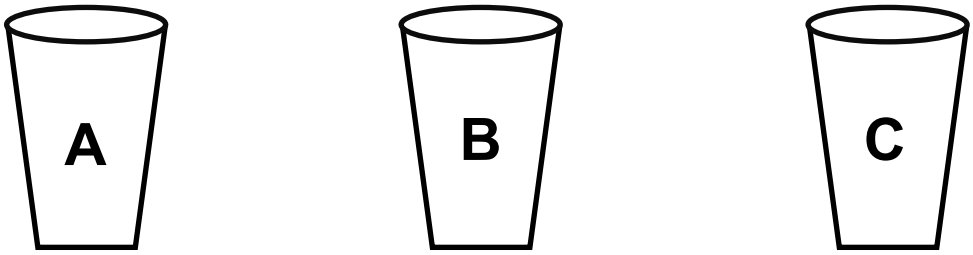
Or

⇒ Clay
⇒ Sand
⇒ Gravel

Hold My Water - Worksheet

Name: _____ Date: _____

Part 1



Part one questions

1. Which material has the largest particle size? _____
2. Which has the smallest particle size? _____
3. Which material do you think water will travel through the easiest and why? _____

   _____
4. Which material do you think water will travel through the slowest and why? _____

   _____

Part 2

Record your data

Cup	Sediment	Time	Water ml
A			
B			
C			

Notes:

_____
_____
_____
_____
_____
_____
_____
_____

Questions

1. What kinds of man-made structures prevent rain water from recharging our aquifers?

   _____
   _____
   _____
2. If water can't infiltrate its way down to the aquifer, what happens to all that water? Where does it go?

   _____
   _____
   _____

Questions: Using the graphic below

1. How could you arrange the materials from cups A, B, and C to create a mini-aquifer in a bottle? Explain how you would accomplish this? What material would go first, second, last? Hint; look at the graphic below.

   _____

   _____

   _____

2. How could you rearrange the materials so that no water infiltrates the first layer? Explain how you would accomplish this?

   _____

   _____

3. Write a short paragraph about the graphic below using all 5 vocabulary words. Porosity, Groundwater, Recharge, Aquifer and Infiltration._____

   _____

   _____

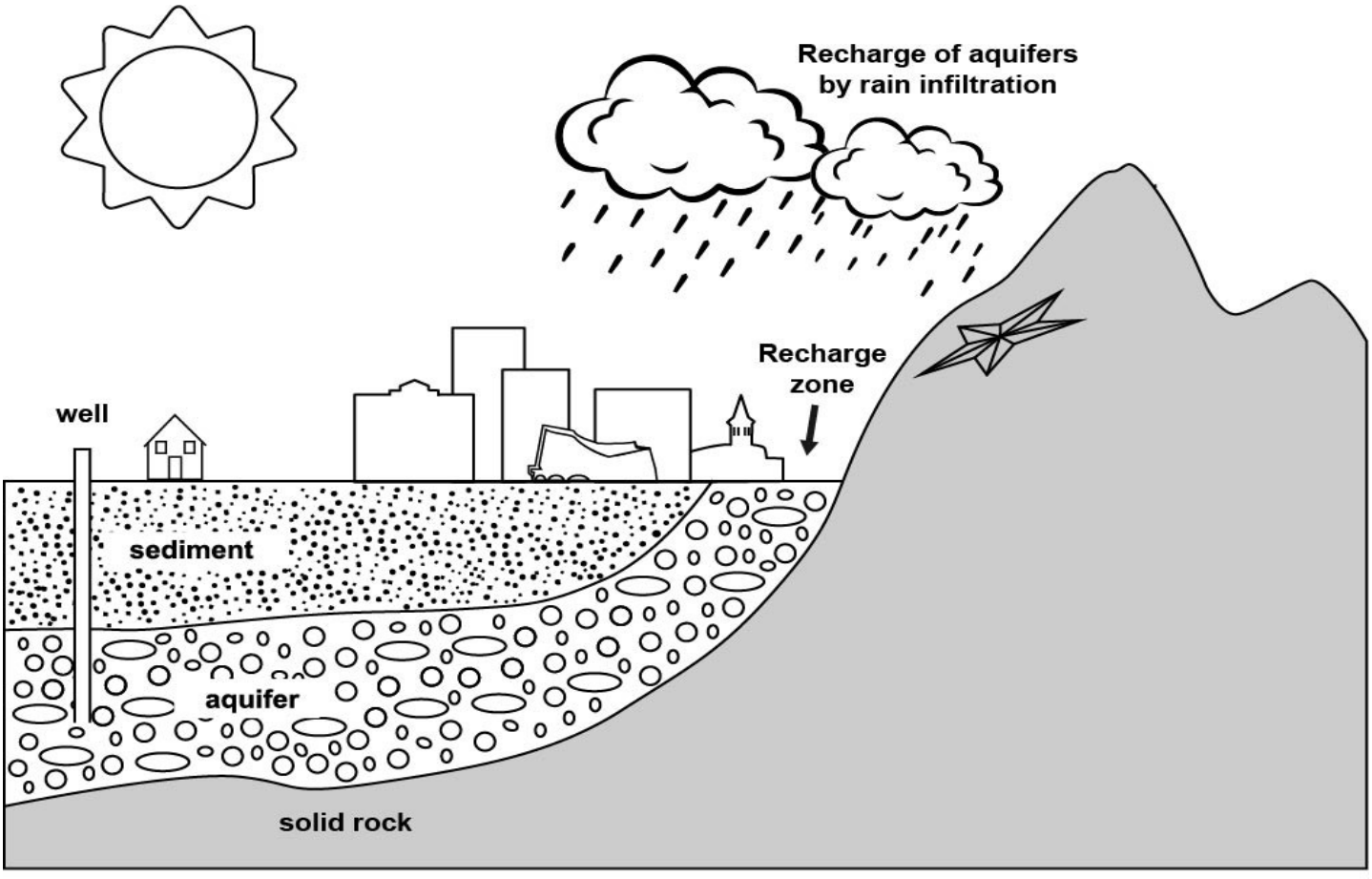
   _____

   _____

   _____

   _____

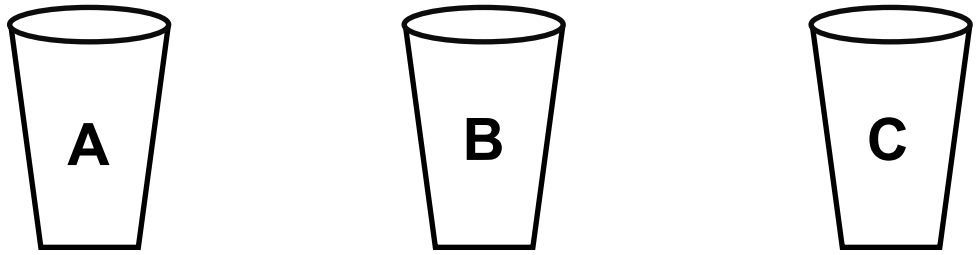
Illustration of an aquifer



Sosten Mi Agua - Hoja de Trabajo

Nombre: _____ Fecha:

Parte 1



Preguntas de Parte 1

1. ¿Qué material triene el tamaño de partícula más grande?_____
2. ¿Cuál tiene el tamaño de partícula más pequeño? _____
3. ¿Qué material crees que atravesará el agua más fácilmente y por qué? _____

   _____
4. ¿A través de qué material crees que viajará el agua más lentamente y por qué?

   _____

Parte 2

Registra tus Datos

Vaso	Sedimento	Tiempo	Agua ml
A			
B			
C			

Notas:

_____
_____
_____
_____
_____
_____
_____
_____

Preguntas

¿Qué tipo de estructuras hechas por el hombre evitan que el agua de lluvia recargue nuestros acuíferos?

_____

_____

_____

2. Si el agua no puede infiltrarse en el acuífero, ¿qué pasa con toda esa agua? ¿A dónde va?

   _____

   _____

   _____

Preguntas: Usando el siguiente gráfico

1. ¿Cómo podrías organizar los materiales de las tazas A, B y C para crear un miniacuífero en una botella? Explique cómo lograría ésto. ¿Qué material iría primero, segundo y último? Indirecta; Observe el gráfico a continuación. _____

_____

_____

¿Cómo podrías reorganizar los materiales para que no se infiltre agua en la primera capa? Explique cómo lograría esto. _____

_____

3. Escribe un párrafo corto sobre el gráfico a continuación usando las 5 palabras del vocabulario. Porosidad, Aguas Subterráneas, Recarga, Acuífero y Infiltration._____

_____

_____

_____

_____

_____

_____

Illustración de acuífero