SAN ANTONIO RIVER AUTHORITY

WHAT IN THE WORLD IS A WATERSHED?

Build Your Own Watershed Model

EDUCATIONAL ACTIVITY

WHAT IN THE WORLD IS A WATERSHED?

Build Your Own Watershed Model

OBJECTIVES

- Students will understand the concept of watershed, runoff, headwaters, and base level.
- Students will create a watershed model, make predictions, observe runoff and formulate their own definition of watershed.

TOPICS

- **Watersheds**
- **Runoff**

FOR AGES 9+

TEKS ALIGNMENT:
"Models of objects are tools for understanding the natural world and can show how systems work."

6th Grade:
Science 3.A-C
Social Studies-3.C, 20.A

7th Grade:
Science 3. A-C
Social Studies 8.B

Aquatic Science:
4 A & C, 7 A-B

Environmental Science:
5 B & D

World Geography Studies:
9.A-B, 21.C

BACKGROUND MATERIAL

A watershed - also called a drainage area, catchment, or basin - is an area of land that drains surface and subsurface runoff to a common point, usually a stream, river, lake or the ocean. Every piece of land on Earth is part of a watershed, because water always moves off the land to a lower point where it collects to form a water body. Watersheds may range in size from less than an acre to thousands of square miles in area. Everyone lives in a watershed.

There are a number of features that are characteristic to all watersheds. A watershed is shaped somewhat like a bowl that has been cut in half. The rim around the bowl would be like the watershed divide. Watershed divides are the boundaries that define a watershed and separate adjacent watersheds. The highest point or points in the watershed are called the headwaters and are the points at which the stream or river starts. The hills along the sides of the watershed are like the sloping sides of the bowl and are called the side slopes. The relatively flat part near the bottom is called the valley floor. The lowest point in the watershed is called the base level. All the water in the watershed drains down to the base level, which is usually the mouth of the river or stream. The difference in elevation between a stream's headwaters and its base level create the stream's gradient.

All watersheds change over time. Some changes occur rapidly and some require thousands or even millions of years to occur. Many changes that take place within watersheds result from natural processes, like gravity and running water. The force of gravity causes water to erode material from higher elevations in the watershed, where the land is steeper. Eroded soil particles are transported by water until the stream flattens out and the force of water is no longer great enough to transport the soil particles; then the soil particles are deposited on the bottom of the stream or along its floodplain. Heavier particles are deposited first; the lightest particles are deposited at the river's mouth, where it meets the ocean. The build-up of sediments at the mouth of a river may eventually create a delta. Erosion and deposition eventually reach a state of equilibrium when the erosion that wears down hills and the deposition that builds up stream bottoms causes the stream gradient to become flatter.

Texas contains all or part of 23 major watersheds, of which the San Antonio River Watershed is one. The San Antonio River Watershed totals 4,180 square miles and includes all or parts of Bexar, Wilson, Karnes, Goliad, Kendall, Bandera, Medina, Comal, Guadalupe, DeWitt, Kerr, Kendall, Atascosa, Victoria, and Refugio counties. The tributaries of the San Antonio River are the Medina River, Cibolo Creek, Leon Creek, Medio Creek and Salado Creek. The 240-mile-long San Antonio River carries surface water from 2,500-foot elevations within the Texas Hill Country of Bandera and Kerr counties through Wilson, Karnes and Goliad Counties to less than 100-foot elevations in Refugio County.

In this activity, students will investigate watersheds. They will build a model in order to observe stormwater runoff and will use a local map of the San Antonio River Watershed Map to answer specific questions. As enrichment, students will be challenged with finding their own watershed address through GIS technology.

KEY TERMS

Acre is an area of land that is equal to 43,560 square feet. Large areas of land are often measured in acres.

Base level is the lowest point in a watershed and is the point to which the water drains.

Basin is another word for "watershed".

Delta is an area where a river deposits sediment near its mouth; a delta is usually located where a river flows into the ocean.

Deposition is the process by which sediment settles out of the water or wind that is carrying it and is deposited in a new location.

Equilibrium is a state of balance due to the equal action of opposing forces.

Erosion is the process by which water, ice, or wind moves fragments of rock, soil, or sediment.

Floodplain is the area along both sides of a stream where floodwaters deposit sediments.

Gradient is a slope. The gradient is determined by dividing the vertical distance (the "rise") between two points by the horizontal distance (the "run") between two points.

Groundwater is water that flows or collects beneath the Earth's surface in saturated soil or aquifers.

Headwater is the high ground where precipitation first collects, or it can be a spring from which a stream originates.

Runoff is water that flows over the surface of the land when it is not able to infiltrate into the soil, either because the soil is already saturated with water or because the land surface is impervious.

Sediment is silt, sand, rocks, and other matter that is moved by water or wind, resulting in erosion and deposition.

Side Slopes are the sloping sides of hills.

Surface Water is precipitation that runs off the land surface and is collected in ponds, lakes, streams, river and wetlands.

Tributary is a smaller stream that feeds into a larger stream.

Valley floor is the relatively flat area at the lower elevations of a watershed.

Water body is a stream, river, or lake that receives the runoff water from a watershed.

Watershed is an area of land that drains to a single point, such as a river, a lake or a stream.

Watershed divide is the boundary that separates one watershed from another; the highest point between adjoining watersheds.

PROCEDURES

A. The students will build their own watershed model inside the large aluminum foil baking pan.
B. Instruct the students to place the cups in the pan so that they stand at different heights. The cups represent hills.
C. Using the aluminum foil, tell the students to cover all the cups in the tray with one sheet. Students can use their fingers to shape the aluminum foil a little bit around the cups, but do not have them push it down into all the cracks. Tell the students to imagine the foil as being more of a drape over the cups.
D. Students will make a prediction. Using the blue marker, have the students mark the path on the aluminum foil that they think the water will take when water is sprayed on their model.
E. Next, have students mark the highest points on their watershed (on the tops of the cups) and connect these points with the black marker. This represents the watershed divide.
F. When they are ready, instruct the students to spray water onto their watershed models to simulate precipitation. Ask them to observe what happens to the water as it moves through the model. Suggested "Guiding Questions" are provided below.
G. Student Sheet 1 has been provided to serve as a final evaluation. Ask the students to label the vocabulary terms that refer to components of a watershed.

MATERIALS

- A large rectangular pan/tray
- About 5 cups of varying height
- A spray bottle of water
- An 18" sheet of aluminum foil
- A blue and black permanent marker
- Provide a copy of "Key Terms" to your students or post on the board.
- One copy of Student Sheets 1 and 2 to each student (or each group)
- Download our Creek Book at: https://www.sara-tx.org/resources/creek-book-guide-healthy-creeks-and-rivers

This is an example of a watershed model. Teacher may wish to encourage students to add buildings, soils, plants, or trees. Pervious and impervious surfaces may be addressed.

GUIDING QUESTIONS

- Describe what happened when it “rained”?
- Did the runoff follow the path of the blue line? If so, then you correctly predicted the location of your watershed’s river!
- Did any runoff go into other watersheds? If so, why?
- How is this model like our Earth’s surface?
- What are the limitations of this model? (Note: In our natural world some of the rain gets absorbed by pervious surfaces, like soil, grasses, trees, and plants.)
- Over time, what do you think will happen to soil on the hilltops and the side slopes?
- In our natural world, where do rivers end?

Using the map of the San Antonio River Basin (Student Sheet 2), ask the following questions:

- Where does all the water running off the land in the San Antonio River Basin Watershed go?
- What are the tributaries of the San Antonio River?
- What is the final destination of the San Antonio River?
- Explain why there are other watersheds in the San Antonio River Basin Watershed?

EVALUATION

- Students will label the following terms on the watershed diagram (Student Sheet 1): watershed, run-off, headwaters, tributary, precipitation, river, and base level.
- Students will write a definition of a watershed using their own words and/or illustrate the San Antonio River Watershed.

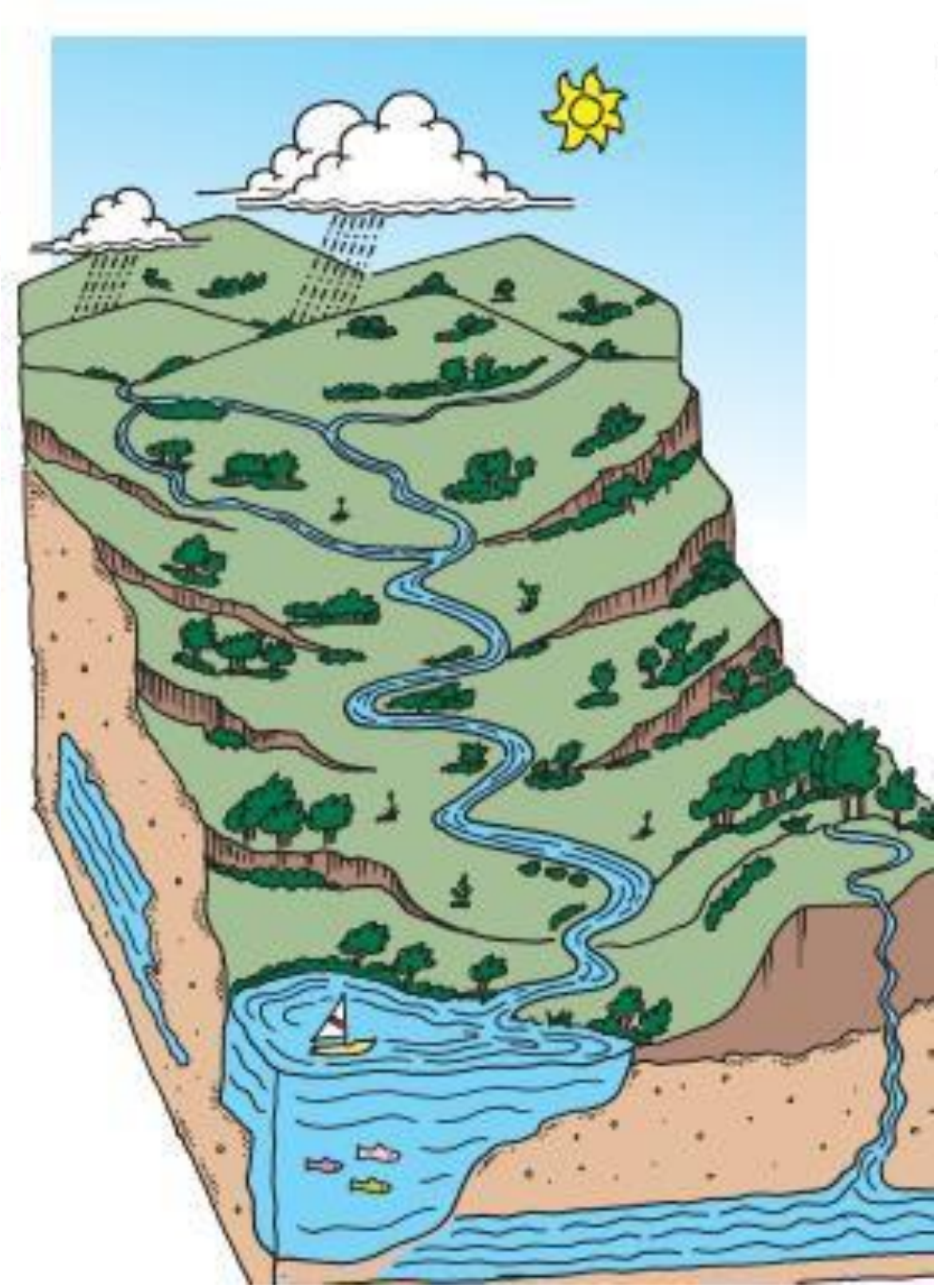
ENRICHMENT

1. Students may observe the water runoff at their home, neighborhood, park, or school. Encourage students to “map” the runoff and identify where it goes. (Ultimately, it goes into the San Antonio River.)

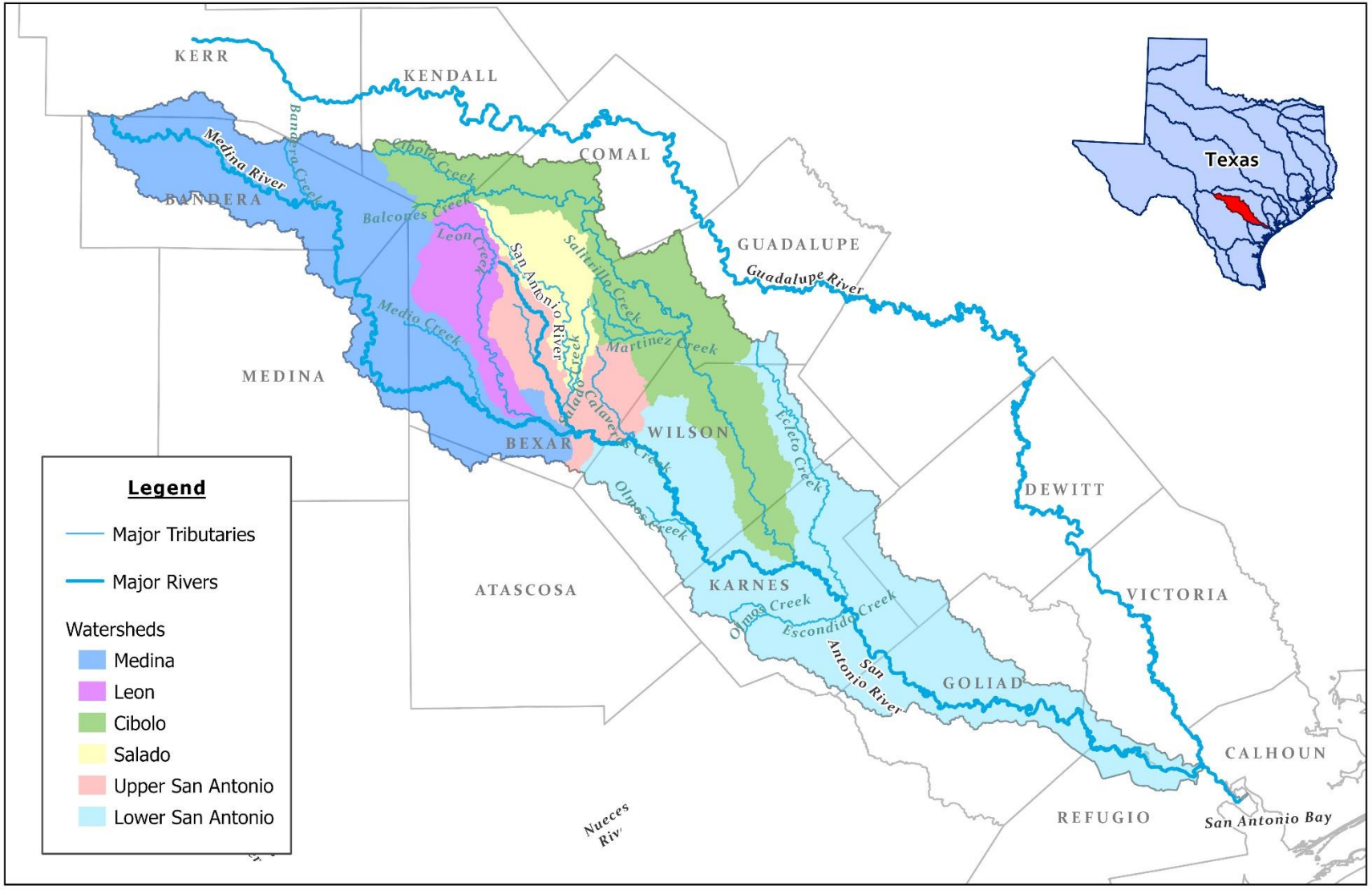
   Students may find their own watershed address by visiting our Watershed Explorer: https://saratx.maps.arcgis.com/apps/webappviewer/index.html?id=5c67e6d0418c477491aa309fcea7f37

SUSTAINABILITY TIP:

- Save this model for our next lesson entitled, “WHY IS THERE POLLUTION IN MY RIVER?”.
- Reuse the aluminum pan.
- Recycle the pan and the aluminum foil.



EDUCATIONAL ACTIVITY



SAN ANTONIO RIVER AUTHORITY

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Disclaimer:
The GIS material included with this transmittal is made available as a public service. The maps and/or data are to be used for reference and/or informational purposes only and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. It does not represent an on-the-ground survey and represents only the approximate relative location of property boundaries. The data herein shall be used and relied upon only at the user's sole risk, and the user agrees to indemnify and hold harmless the San Antonio River Authority, its officials and employees from any liability arising out of the use of the data or information provided. If there are any questions about the appropriateness of this data, please email saragis@sara-tx.org.

Produced by: smendiola Date: 4/1/2020

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