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 of land to a lower point where it collects in a water body. Watersheds may range in size from less than an acre to thousands of square miles in area.

There are a number of features that are characteristic to all watersheds. To use a simpler analogy, 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.

OBJECTIVES
- Define a watershed and describe how it functions
- Learn how to read and comprehend a contour map

TOPICS
- Watersheds
- Topographic maps

TEKS ALIGNMENT
Grade 7 Science:
1A, 2A, 2C, 2E, 3B, 3C, 4A, 8C
All watersheds change over time. Some changes happen 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 river basins (watersheds), of which the San Antonio River Basin is one. The San Antonio River Basin 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. Each of these tributaries also has its own smaller watershed that drains into it, known as subwatersheds.

In this activity, students will learn about watersheds by studying how land is shaped through the examination of topographic maps. The students will start with a hypothetical watershed, and use this knowledge as a launching point for understanding the San Antonio River Basin in which they live.

**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 near where a river flows into the ocean.

*Deposition* is the act of depositing sediments.

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

*Erode* is a process by which soil and rocks are worn away and removed from a location.
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.

Headwater is the place or are the places where a stream or river starts.

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

Sediment is the material that is laid down or deposited by water, air or ice.

Side Slopes are the sloping sides of hills.

Subwatersheds are watersheds for smaller creeks or streams, often tributaries of larger rivers.

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. Start by introducing the students to the concepts and the key vocabulary terms described above to help them begin to understand what a watershed is. Have the students label the diagram of a watershed on Student Sheet 1 with the appropriate vocabulary terms.

B. If you have not yet done this in your class, introduce the students to the concept of a topographic, or contour, map. Go over the six cardinal rules of contours:

1. Lines of the same elevation always occur in pairs on opposite sides of a ridge or hill.
2. There is equal vertical distance between the lines.
3. The lines always close on themselves to make a circle, oval or elliptical shape.
4. Lines showing the same elevation do not touch or cross one another.
5. Lines of the same elevation do not split apart or come together.
6. The steepest slope is a line that runs perpendicular to the contour line.

MATERIALS

- Student Sheets
- Pen or Pencil
C. Using the diagram found on Student Sheet 2, have the students draw the boundaries of the hypothetical subwatershed using the following steps:
   1. Start at the watershed outlet (the low point of the stream, where it enters another stream or the ocean) and work upstream.
   2. Mark the highest points upstream and uphill of the stream or river. These will be on hills or ridges.
   3. Connect these points, drawing the connecting lines perpendicular to the contour slopes, to determine the watershed boundary.
   4. The watershed boundary will always come back to the starting point, making a circle, oval or elliptical shape.
   5. Indicate where the following are located: watershed divide, side slopes, valley floor, stream channel.

D. Introduce the students to the San Antonio River Basin and its characteristics, and have them study the map found on Student Sheet 3.

GUIDING QUESTIONS

- Name and describe the different parts of a watershed.
- What is a topographic map and what does it show?
- What is the main river in the San Antonio River Basin?
- What are the tributaries of the San Antonio River?
- What is the destination of the San Antonio River?
- What counties are in the watershed of the San Antonio River?

EVALUATION

Provide the students with a copy of a real topographic map for an area near the school, but make sure that you choose an area that has a small stream or creek in it. Have the students repeat the exercise that they did with the hypothetical watershed, only this time using a real topographic map. Topographic maps can be obtained through the US Geological Survey (www.usgs.gov).
Students:
Beginning with the red dot, trace subwatersheds within this map.
REFERENCES