What is a Watershed?
Location: Classroom
Time: 50+ Minutes

General Lesson Overview: In this lesson, students will learn what a watershed is and how elevation is important in identifying watershed boundaries in a community. Students will learn how to make a topography map and will practice making a 3D model from a topographical map of a watershed. For this lesson in particular we focus on Burnt Mill Creek, but this could be recreated with any watershed as the location.

- ESS.4.2.3. Use models to explain changes in Earth's surface over time (to include slow changes of erosion and weathering, and fast changes of earthquakes, landslides, and volcanic activity).

Background Information:

What is topography and why is it important?

Topography is the study of the forms and features of land surfaces. When we talk about topographic maps, we are usually referring to maps with elevation contour lines drawn. Understanding variations in elevation helps us to understand how water may move across the surface. We can determine direction by knowing that water moves from higher to lower elevations, or speed by knowing the influence of slope. Elevation and proximity to water features like streams and rivers can also be used to predict potential flooding.

How do you collect elevation data?

Elevation data can be collected in several ways. Ground surveys can be conducted using RTK (Real-Time Kinematic) GPS. Aerial surveys may also be conducted using sensors (typically LiDAR) mounted on drones or piloted aircraft. Stereo photogrammetry, where photographs taken at slightly different locations are cross-referenced against each other and a known surveyed target, may also be used for gathering elevation data.

What is our community's topography?

We reside in the Coastal Plain for North Carolina which is flat and low lying. The gentle slope of the Coastal Plain make the high velocity water associated with flash flooding unlikely, however, we have an abundance of water features, like the Cape Fear River, our

various creeks, and the ocean, which may flood nearby low-lying areas when their water levels rise.

What is GIS, how were the maps made?

Maps are made using Geographic Information Systems (GIS), which are computer systems that analyze geographically referenced information. The data processed using GIS can be gathered via ground survey, aerial survey, or satellite.

Materials and supplies:

- Powerpoint Watershed Modeling Lesson.pptx
- Contour box – with preset measuring units on the side
- Water (in gallon jugs)
- Food coloring - blue
- wet/dry erase
- Sections of watershed topomaps
- White Legos or block landforms
- Lego base or landform base

Procedure:

1. Introductions to the project and the task of today.
    a. Today we are focusing on understanding the watershed that we live in and how water flows in our community by looking at maps and understanding elevation data.
    b. Have you ever been impacted by flooding?
2. What is a watershed? Do you know what watershed you live in?
    a. Have student Think, Pair, Share what is a watershed
    b. Guide students to the definition of a watershed.
        i. A watershed is a land area that drains water to a common outlet, such as a river, bay, or reservoir. Watershed can also be called a drainage basin or catchment.
3. Scientists use maps to talk about land areas. What do you use a map for?
    a. Use the powerpoint to project the google earth map of Wilmington. The purpose of looking at this map is for students to see how we talk about land and how directional and landmark data is displayed on 2D models aka the map.
4. Click to the GIS map of the watershed (the map displayed could be of whatever watershed is in discussion). For this lessons purpose we are focusing on Burnt Mill Creek watershed. The watershed is outlined and shown in blue.
    a. Ask students to tell you where rain would gather if it rained at different places in the map.
    b. Ask student how they think the watershed was identified. What type of data did scientists maybe use? Guide them if you can to elevation data or how high the land is.
5. What is elevation?
    a. Elevation is the height of a location above or below sea level.
    b. Let's find out how scientists use maps to communicate elevation!
6. Contour box activity – students will draw a topographical map.
    a. Demo how students will work in science teams through this activity. By showing how to do the first level at 2cm then pass out the materials to each small group. (prefer 8 small groups)
        i. Pour water to 2cm line
        ii. Replace lid.
        iii. Trace with a marker
        iv. Label with the level and also put a dot on the corner where the ruler is so that you always put the lid on the box the same.
    b. Pass out boxes, water, marker.
    c. Ok everyone goahead and pour to your first line. Once you meet the line set your pitcher down and put the lid on and draw. Raise your hand when you are done.
    d. Alright everyone got that? Awesome. Let's do the next level together. Pour water to the third line. Ready go.
        i. Put your lid on and draw. Raise your hand when you are done.
    e. Next level.
    f. 5th level.
    g. 6th level.
7. Great job! you just drew a topographic map of the mountain.

a. What did you find challenging?
b. What are some observations of your map?
    i. Some lines are tight together. At those spots on the landform what do you notice? The land is steep!
c. How do you think someone might use this type of map?

*** Clean up the activity by pouring water back into the milk jugs.

d. Jug in a bucket, funnel over hole, mountain out of shoe box, and pour.
e. This can be done by one person while the other walks around during the Lego build part.

8. You all just drew a topo map from a 3D representation of land. Now we are going to work in reverse! In your small groups you guys are going to take a section of the Burnt Mill Creek watershed and build a 3D model using Legos (older students) or other stacking tools (watershed).
    a. Each small group has a map in front of them. What do you see on the map in front of you?
        i. There might be landmarks on your map that you recognize or there might not. Have you ever looked at your neighborhood on a map?
        ii. What other things do you see on your map?
            1. Numbers – the numbers represent elevations just like what you did on the previous activity. That elevation data was most likely collected using LiDar attached to a drone or via satellite. may have been collected using a
            2. A grid – to provide you with guidance as you build up the watershed.
        a. To do this you will follow the grid pattern on the lego board and map.
            i. 1 grid (1.5cmX1.5cm) = 2X2 lego brick = 845ft
            ii. 1 brick height = 5 ft. In elevation
        b. Demo doing a grid or 2 with the group. Let the groups test it out. Walk around and support students. If everyone is really struggling get the classes attention and open the floor for students share their challenge and work as a class to solve.
9. What does the elevation LOOK like? How does water flow?
10. Any thoughts on why we would start our discussions of flooding by talking about elevation?
    - Water flow to the lowest point and it important to understand when those low spots are in a community.
    - As rain increase what else increases? Amount of water the the covers more land.
    - What is the other thing scientists should study when they are studying flooding and also want communities to stay safe?
        - Water LEVEL! The next time we see you we will be engineering a tool that scientists could use to monitor water levels.
11. Put the landform models into the AR Sandbox and see what happens when it rains.