

What Happens If It Floods In Kalamazoo?

Using Topographic Maps to Understand Watersheds and Stream Flow

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Introduction:

A topographic map, also sometimes called a contour map, is an essential tool for earth scientists. Contour lines are used to connect points of equal elevation. Thus, topographic maps reveal vital information about the area, and can be used to determine the boundaries of the watershed and the direction of water flow.

Notes for the teacher:

There is an abundant amount of information available to help you teach your students about their own local watershed. Please use the sources identified in the bibliography to explore the information already provided. It is encouraged that you modify any parts of this lesson to include your school's local watershed. Also, it is suggested that you visit your stream/creek ahead of time and make sure it is open to the public or secure the proper permission from the land owner if it is on private property.

Grade Level:

6th-8th Grade

Objectives:

1. Students will use topographic maps to describe the flow of water through a watershed and how the parts of the watershed are connected.
2. Students will explain how human activities affect the watershed and change the surface of Earth.

MI Content Benchmarks met or partially met:

- **E.ES.07.82** Analyze the flow of water between the components of a watershed, including surface features (lakes, streams, rivers, wetlands) and groundwater.
- **E.ES.07.41** Explain how human activities (surface mining, deforestation, overpopulation, construction and urban development, farming, dams, landfills, and restoring natural areas) change the surface of the Earth and affected the survival of organisms.

Earth Science Literacy Principles met or partially met:

- 8.3 – Human activities can contribute to the frequency and intensity of some natural hazards.
- 8.5 – Natural hazards can be local or global in origin.
- 8.8 – An Earth-science-literate public is essential for reducing risks from natural hazards.
- 9.5 – Human activities alter the natural land surface.

Engage

Capture the students' attention, stimulate their thinking and help them access prior knowledge.

Using photographs as well as news articles from the 2008 flooding in Kalamazoo, allow students to make observations and inferences, and share what they might remember – schools closing, boil water orders, etc.

Explore

Give students time to think, plan, investigate and organize collected information.

Using “red/blue” glasses and 3D maps, give students an opportunity to make observations on the landforms they see in Michigan and/or the Midwest. Maps may be laminated which would allow students to note observations or points of interest right on the map using overhead pens or dry erase markers. The National Center for Earth-Surface Dynamics has produced a Midwest Map which is suitable for this activity.

Some specific questions/instructions for engaging students in thought for the upcoming lesson:

1. What are some high points on the map?
2. What are some low points on the map?
3. Identify 5 lakes on the map, not including the Great Lakes.
4. Identify 5 rivers on this map.
5. Identify the direction of flow for those rivers.
6. Note three special observations of the area around Kalamazoo.

Explain

Involve students in an analysis of their explorations. Use reflective activities to clarify and modify their understanding.

Using a very basic topographic map, allow students time to develop an understanding of how to read the contour lines on the maps. A basic map that could be used to develop this understanding, along with some questions to check for understanding can be found at <http://regentsprep.org/Regents/earthsci/mapping.htm>. To assist students in visualizing the “rings” made by contour lines, one may use the infant toy pictured here, explaining that the smaller circles often represent areas of higher elevation.



After reading this simple topographic map, I will provide students with a topographic map of a small section or two of the city of Kalamazoo. The selected section(s) may be a representation of the area immediately surrounding their school, or Western Michigan University, or downtown. The topographic maps for each county in Michigan can be downloaded at http://www.michigan.gov/dnr/1,1607,7-153-10371_14793-31264--,00.html. The questions below are tailored to fit the area surrounding Linden Grove Middle School. Some specific questions/instructions for guiding students in their explanations of the topographic map(s) include:

1. Color the area(s) outlined by a 940ft. contour line RED.
2. Color the area(s) outlined by a 930ft. contour line ORANGE.
3. Color the area(s) outlined by a 920ft. contour line YELLOW.
4. Color the area(s) outlined by a 910ft. contour line GREEN.
5. Color the area(s) outlined by a 900ft. contour line BLUE.

(These elevations may vary if teachers use a map for their specific location. The color coding is intended to match that of the infant toy so that students can build on that visualization.)

After students have had time to make observations on the area surrounding their school, it is important to compare this area to a second location that they are familiar with. In this case, students will compare the map of the area immediately surrounding LGMS to the area near

Bronson Methodist Hospital, located in the downtown area, which is the location of the flooding in the photographs used in the opening part of the lesson. If it isn't possible for students to go to the locations identified in this portion of the lesson, Google Earth is a useful tool as it can help students visualize what they are seeing on the map. Using the middle school and the hospital as points of reference on the map and on Google Earth can assist students in understanding what they see.

Some specific questions/instructions for guiding students in their explanations of the topographic map(s) include:

1. Identify the elevation of Bronson Methodist Hospital.
2. Identify the elevation of Upjohn Playground.
3. Identify the elevation of the Library.
4. How do these elevations compare with those surrounding Linden Grove Middle School?
5. What waterway is located between Upjohn Park and Bronson Methodist Hospital?
6. Follow this waterway from Bronson to an area of lower elevation (the direction water flows). Where is the water flowing?

Elaborate

Give students the opportunity to expand and solidify their understanding of the concept and/or apply it to a real-world situation.

The creek identified in the above activity is Portage Creek. It flows into the Kalamazoo River. Portage Creek is located in a very urbanized area of downtown Kalamazoo. The immediate surrounding area is highly comprised of paved parking lots and roads, businesses, and other buildings. In the immediate area are a hospital, a park, a police station/court building, etc. The Portage Creek itself is in a man-made channel. The channel is tunneled under a road within the flood plain, and bridges are constructed over the creek in many locations. This area of Kalamazoo is also a relatively flat area. The flat topography coupled with the urbanization in the immediate area creates a very large flood plain. After an extended duration of extremely heavy rains, the area around Portage Creek flooded in 2008. Because of the relatively flat topography of this land, this flooding spanned several blocks in downtown Kalamazoo.

Another look at Google Earth would be helpful for students to see the area they are discussing, especially since it includes elevation. Additionally, Google Earth can be used to guide students in comparing land use, developed and undeveloped, surrounding the Portage Creek. Printed photos from Google Earth would allow students to color the different sections. Creating a grid on the photo would also help students estimate the percentage of developed land (roads, buildings, and parking lots) leading to runoff versus the percentage of undeveloped land (vegetation) allowing for infiltration.

Some specific questions/instructions expanding and solidifying understanding of watersheds include:

1. Using the topographic map, color the area which could potentially flood due to overflow of Portage Creek in BLUE. Use a dark blue line to outline the area which borders the flood plain.
2. What did you use to identify the border of the flood plain?
3. What areas of everyday use would be affected by flooding of Portage Creek?
4. What man-made features surround Portage Creek?
5. Using the grid and photos of Kalamazoo provided, estimate the percentage of area immediately surrounding Portage Creek that will lead to surface runoff.
6. Using the grid and photos of Kalamazoo provided, estimate the percentage of area immediately surrounding Portage Creek that will allow for infiltration.
7. Could these man-made features have an effect on Portage Creek?
8. If these man-made features do affect Portage Creek, what does that mean for the Kalamazoo River?
9. What steps could developers take in Kalamazoo to prevent flooding of the Portage Creek in

the future? Is there anything currently happening to prevent flooding?

Evaluate

Evaluate throughout the lesson. Present students with checklists or data sheets at the beginning. Provide ways of documenting observations that they and you can see. Also develop a simple evaluation tool that the teacher can use later to gauge learning.

Using the topographic maps, students will provide responses to the following scenario. Students must decide whether they agree or disagree with the following student responses and provide supporting evidence/arguments.

Student Assessment:

A heavy rain had been going on for three days in the Kalamazoo area, and it finally stopped, but the news is reporting widespread flood damage. The students below are texting you, wondering if you want to hang out for the day since school is closed. Decide whether or not you should be able to do this using the topographic maps provided.

Jacob says that he has tickets to a basketball game at WMU and wants you to go with. His dad said he will just take Michigan Avenue (Stadium Drive) to get there.

Katie says that she wants to go shopping at the downtown mall. She says you'll need to take Burdick Street to get there. She said to meet you there by riding the city bus.

Thomas wants to go to the YMCA to play basketball. The YMCA is located on the corner of Maple St. and Crosstown Parkway. He thinks you should be able to ride your bike there.

Jenna wants to go feed the ducks and swing at Milham Park since it finally stopped raining. She said take the city bus that goes down Portage Road to get there.

References

National Science Foundation. (2010, 3). Retrieved 7 30, 2012, from Earth Science Literacy Principles: <http://www.earthscienceliteracy.org/index.html>

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