

Handout A: The Path and Rainfall of Hurricane Helene

Examine the figure below. Then read the two hyperlinked articles. As you are reading, individually, keep track of observations or trends that you are seeing or reading about (What do you see/read?) and reflect on those observations (What do you think about that?). Finally, share with your group and identify some questions you have or things you might need to know (What does it make you wonder?).

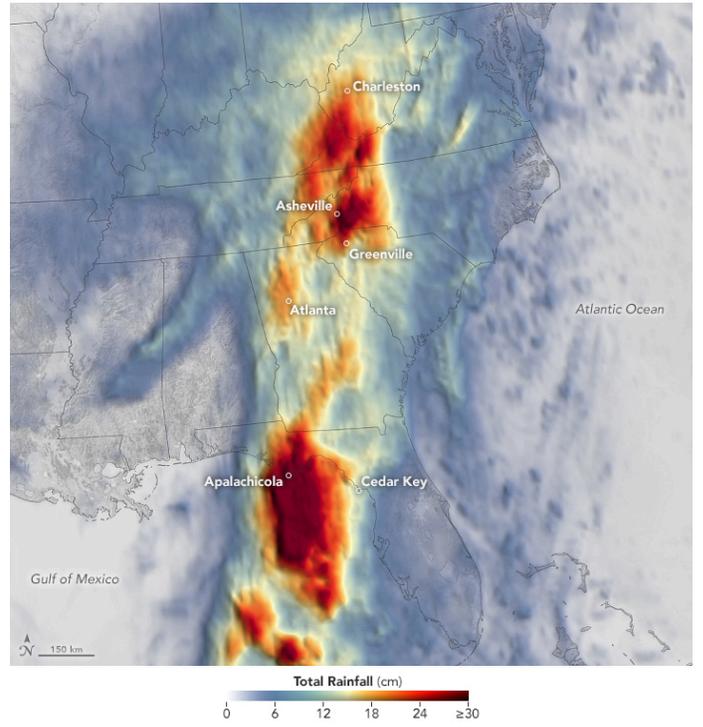


Figure 2. Path of Hurricane Helene. This map shows the path of Hurricane Helene as it made landfall in Florida and continued across the Southeastern United States. The map also shows the classification of the hurricane category as it progressed. Source: [Live Map: Track the path of Hurricane Helene | PBS News](#)

Figure 2. Total rainfall from Hurricane Helene as observed by NASA satellites. The map shows rainfall accumulation over the three-day period between September 25 - September 27. This data presents remotely sensed rainfall estimates from the Integrated Multi-Satellite Retrievals for Global Precipitation Measurement NASA space mission. Source: [Devastating Rainfall from Hurricane Helene](#)

Reading 1: [Devastating Rainfall from Hurricane Helene - NASA Earth Observatory](#)

Reading 2: [Rapid Reaction: Historic Flooding Follows Helene in Western NC - NC State Climate Office](#)

What do you see/read?	What do you think about that?	What does it make you wonder?
<p>Figures 1 & 2</p>		

Reading 1		
Reading 2		

Next, with your group, try to identify and connect causes and effects of Hurricane Helene. Connect the cause(s) to the effect(s) with arrows.

Causes	Effects

Handout B: Exploring Soil Moisture in the TVA Watersheds

Over the course of a couple days, Hurricane Helene dumped 42 trillion gallons of rainwater on the Southern Appalachian region of the US. This rainwater was tracked by NASA satellites, in particular the Land Information System operated by NASA's SPoRT Center. Using NASA's [Land Information System \(LIS\) Web Map for the Southeast US](#), explore the trends in soil moisture between September 25th and October 3rd.

What trends do you see as the map progresses through each day? How are the colors changing?

Next, examine the following maps of the TVA watershed system. What connections can you make from these maps and the soil moisture map from NASA?

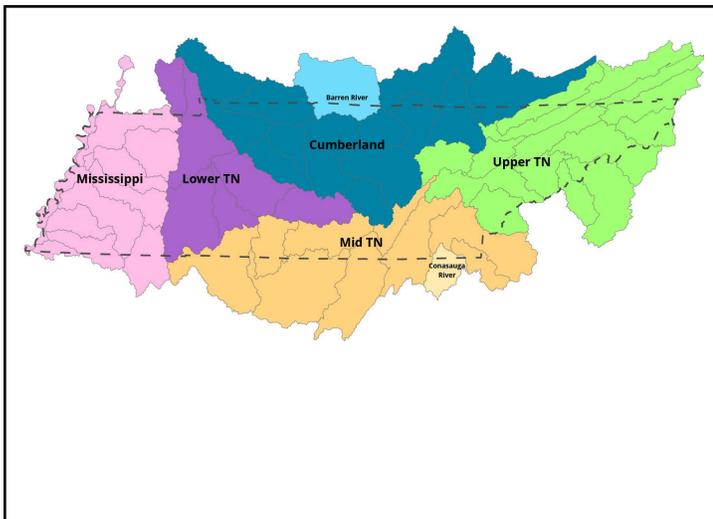


Figure 1. Map of Tennessee Watersheds. Source: [Tennessee Watersheds \(TN.gov\)](#)

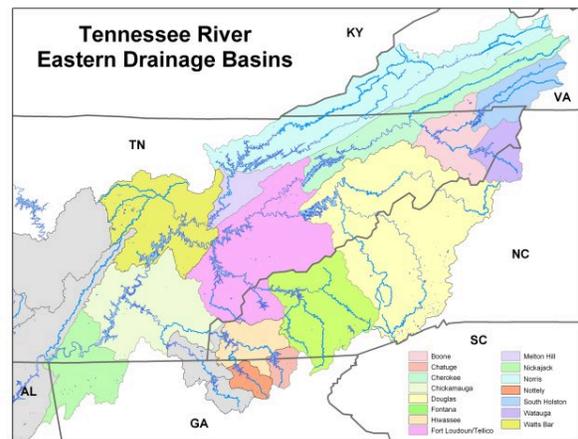


Figure 2. Tennessee Valley Authority Lake Basins. Source: [Tennessee Valley Authority Lake Basins Rainfall Information \(Weather.gov\)](#)

Where does all of that water go? Using [River Runner](#), drop a pin in Eastern Tennessee or Western North Carolina (for instance, Asheville, NC) to observe movement of water through the watershed.

What was the journey water took from your location to the ocean? Identify each location water passes through.

How can you describe the abiotic and biotic conditions of the watersheds?

Handout C: Calculating Rainfall from Hurricane Helene

Over the course of a couple days, Hurricane Helene dumped 42 trillion gallons of rainwater on the Southern Appalachian region of the US. Let's figure out how much water is 42 trillion gallons. Using dimensional analysis, complete the following conversions. One problem is provided as an example.

Example: At the height of the storm, 1.3 million gallons per second ([Nolichucky Dam Update](#)). How many gallons is that over the course of 1 day?

$$\frac{1.3 \text{ million gallons of water}}{1 \text{ second}} \times \frac{60 \text{ seconds}}{1 \text{ minute}} \times \frac{60 \text{ minutes}}{1 \text{ hour}} \times \frac{24 \text{ hours}}{1 \text{ day}} = 1.12 \times 10^{11} \text{ gallons of water per day}$$

1. Olympic sized swimming pools hold 660,000 gallons of water ([Olympic Swimming Pools - Phinizy Center for Water Sciences](#)). How many pools of water is 42 trillion gallons?
2. Tennessee is 42,144 square miles ([Tennessee | Capital, Map, Population, History, & Facts | Britannica](#)). How deep would the state of Tennessee be covered in water by 42 trillion gallons? Given: 7.48 gallons of water cover 1 cubic foot ([Gallons per cubic foot](#)), 1 mile equals 5280 feet.
3. Nissan Stadium is 1.5 million square feet in size ([Nissan Stadium | Nashville.gov](#)). How many Nissan Stadiums would hold 42 trillion gallons of water? Given: the height of Nissan Stadium is 190 feet tall, 7.48 gallons of water cover 1 cubic foot.
4. Water flows over Niagara Falls at a rate of 675,000 gallons per second ([Niagara Falls Facts | Niagara Falls State Park USA](#)). How long would it take in days to flow 42 trillion gallons of water? Given: 60 seconds = 1 minute, 60 minutes = 1 hour, 24 hours = 1 day.

Handout D: Exploring the Dams in the TVA System

Previously, we looked at the movement of water through the TVA watersheds. Now, we will explore the dams that are a part of the TVA system, some of which are hydroelectric, using water to produce electricity.

Take a look at the TVA dam system in the figure below.

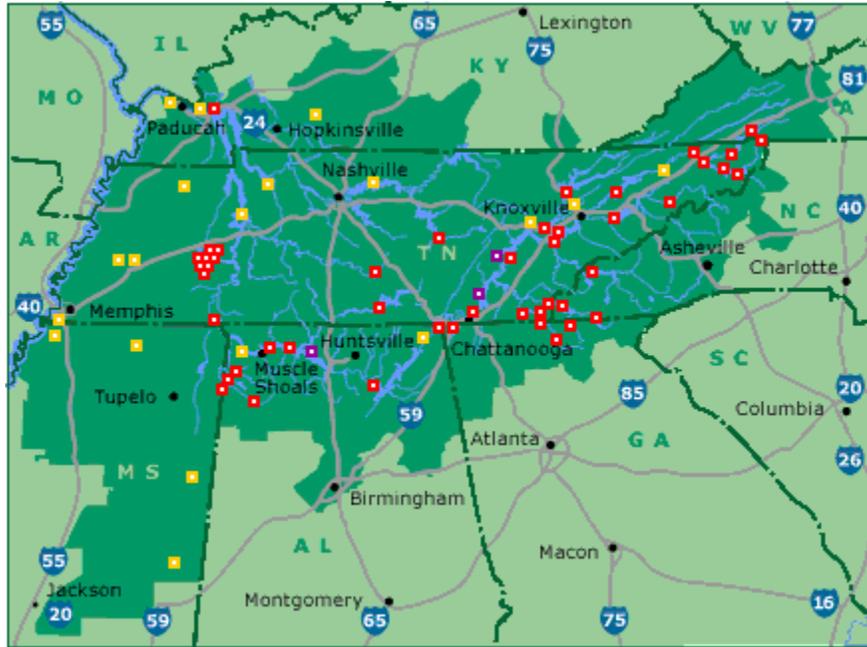


Figure 1. TVA reservoirs and power plants. Source: [TVA: Dams and Power Plants](#)

Next, watch the following drone footage of the flooding at Nolichucky Dam in Greeneville, TN which was in code red imminent breach warning during the hurricane: [Nolichucky Dam Flood Footage](#).

What do you notice?	What do you wonder?

Where does all of that water go? What does the TVA use it for? As you watch the following video, take notes of the general process of hydroelectric power production. Video: [How a dam generates electricity](#)

Notes:
Now answer: <i>How does a hydroelectric dam use water to generate electricity?</i>

Handout E: Mitigating a Flood Risk Infographic & Rubric

Background

During Hurricane Helene, the Southern Appalachian area of the United States received historic amounts of rainfall leading to devastating and deadly flooding. Weather and the conditions of the local watershed system played a significant role in those effects. Now, you will investigate water in your local community and identify a plan to minimize the risk of flooding in your community.

Your Task

You will create an infographic outlining the journey that water takes from your community to the ocean, traveling through different watersheds. Then, you will identify a feature of your community that could potentially increase the risk of flooding. And, finally, you will propose and evaluate a solution to minimize that flood risk.

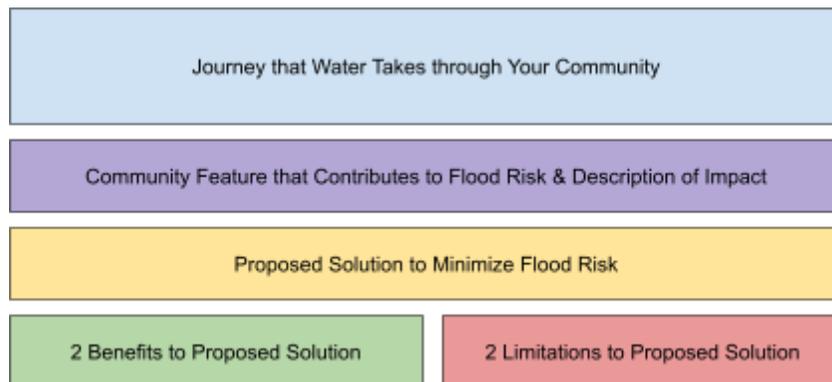
Your infographic must contain the following information:

- Identify the path that water takes from your local community to the ocean using River Runner: <https://river-runner.samlearner.com/>
 - *You may wish to include a map of the journey of water through your community!*
- Identify a feature of your community that could increase the risk of flooding from storms
 - *Ex: there may be areas of bare soil that don't have any vegetation that are prone to flooding*
- Describe at least 2 impacts that feature has on the risk of flooding for your community
- Describe at least 1 potential solution to minimize the risk of flooding in your community
- Describe at least 2 benefits AND limitations to the solution you proposed

It is suggested that you use a premade template using your school Canva account - there are tons of options out there. But, if you want a general outline, regarding the sections needed, see the diagram below.

Be sure to cite your sources in APA format. Here's a couple good launching points:

- [Flood Risk Information | Nashville.gov](#) (Metro Government)
- [Flooding and Climate Change: Everything You Need to Know](#) (National Resources Defense Council)
- [Flood Related Hazards](#) (NOAA)
- [Flood Risk | FloodSmart](#) (FEMA)



Presentation Peer Review Rubric

Component	Present	Absent	Comments
Path of water through community			
ID community feature that contributes to flood risk			
Description of impact #1			
Description of impact #2			
Description of solution to minimize flood risk			
Discussion of benefit #1			
Discussion of benefit #2			
Discussion of limitation #1			
Discussion of limitation #2			

Identify TWO new things you learned from this research: