



One River, Two Floods: The Big Thompson River Floods

Driving Questions:

- What are the main causes and impacts of floods?
- When and where are floods most likely to occur in Colorado?
- What action should people take before, during, and after a flood?

Word Bank	
Natural Hazards	naturally occurring phenomena such as flood, wildfire, extreme heat, or drought, which may disrupt or damage a community
Flood	rising and overflowing of a body of water especially onto normally dry land
Flash flood	local flood of short duration generally resulting from heavy rainfall in the immediate vicinity
Streamflow	water flow, or discharge, in a natural channel
Discharge	the volume of water that passes a given point in a period of time, which is measured in cubic feet per second (cfs)
Gage height	measured as the height of the water level relative to a zero point
Flood stage	the stage at which a stream will overflow its banks

Activity 1: What are the main causes and impacts of floods?

1. What do you know about floods? In one minute, jot down as much information as you know about floods in the “What I Know” section of the KWL Chart on page 2.

Watch the news stories [1976: Deadly Big Thompson flood devastates Colorado](#) and [Dramatic images show devastating flooding in Colorado](#) to get a feel for the impacts of floods on people and the environment.



2. Write down your observations and questions about floods as a natural hazard in the “What I Wonder” section of the KWL Chart.





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Student Handout
Middle School
Hazard Lesson: Flood

KWL Chart	
1. What I K now	
2. What I W onder	
What I L earned (Activity 3)	



These materials were developed by CIRES Education & Outreach at CU Boulder.
<https://cires.colorado.edu/outreach/projects/HEARTForce>





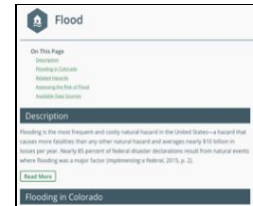
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Activity 2: Flood Data Analysis Stations

Station 1: Colorado Flood Fast Facts

Read the [Colorado Planning for Hazards -- Flood](#) webpage.

3. What are the main causes of floods and flash floods?



4. What are the greatest risks that floods pose in Colorado?



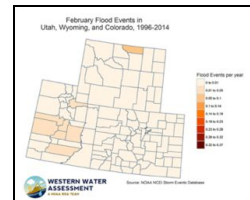


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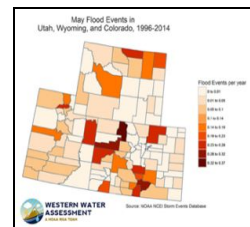
Station 2: Location and Frequency of Flood and Flash Floods in Colorado

Select and analyze the Monthly Maps of Significant Weather Events “[Flood](#)” and “[Flash Flood](#)” series to assess the frequency and locations of floods in the state.

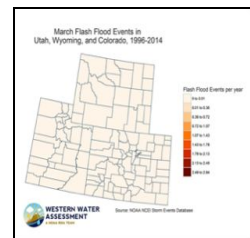
5. In Colorado, when does flooding mainly occur (months/seasons)?



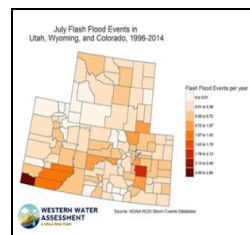
6. In Colorado, where does flooding mainly occur (geographic area/counties)?



7. In Colorado, when does flash flooding mainly occur (months/seasons)?



8. In Colorado, where does flash flooding mainly occur (geographic area/counties)?





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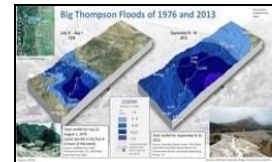
Station 3: Visual Comparison of Big Thompson Flood Events

Explore the topographic map of the [Big Thompson Watershed](#) and the [Big Thompson Floods of 1976 and 2013](#) infographic.

9. Describe the general topography of the Big Thompson River watershed.



10. Compare and contrast the amounts of precipitation and locations of precipitation for the 1976 and 2013 floods (note: read the descriptions below the images, too).





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Station 4: The 2013 Flood Weather Story

Look over the National Weather Service's [Weather Story forecasts](#) from September 10-22 about the 2013 Colorado Front Range Flood, which included the Big Thompson River.



11. On what date was the first flash flood warning issued for the Front Range? When was the last flash flood warning for this area?
12. On what date(s) and in what general location (in relation to key cities) did severe flooding occur? Why do you think severe flooding occurred in this area?
13. Describe the pattern and location of the flood between September 17 and September 22, 2013, during the Weather Story forecasts.



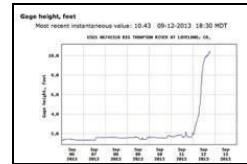


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Station 5: The 2013 Big Thompson Flood Hydrograph

Analyze the [graph](#) about the 2013 Big Thompson Flood and the [data table](#) about the Big Thompson River discharge rates.

14. What data is the graph illustrating? What is the *independent variable* and its units? What are the *dependent variables* and their units? Hint: How is time displayed? What does gage height refer to?



15. Describe the general pattern of the data shown on the graph.

16. Flood level on the Big Thompson River is at a depth of 5 feet of water. Looking at the graph, approximately when did the Big Thompson River exceed its flood level?

17. What information is the data table providing? What do “cfs” units measure? Compare and contrast the cfs values for average discharge rate and flood level discharge rates for the Big Thompson River.

2013 Big Thompson River Discharge	
Streamflow	Rate (cfs=cubic feet per second)
Average flow	72.5 cfs
Average peak flow	1700 cfs
Average 100-year flood peak flow	7360 cfs
1976 flood peak flow	8710 cfs
2013 flood peak flow	18,400 cfs

18. What is the average discharge rate for the Big Thompson River? How do the 1976 and 2013 flood discharge rates compare to the average peak flow rate and 100-year flood peak flow rates?





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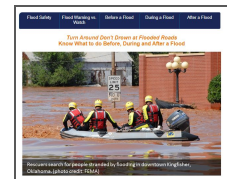
Station 6: Flood Safety

Read the [Floods Ready.gov](https://www.floodsready.gov) webpage and the National Weather Service [Flood Safety](#) plan.

19. What does “Turn Around, Don’t Drown!” mean? Why is trying to cross or drive through a flooded area a risk?



20. If you live in an area at risk of floods, what should you and your family do to prepare? In the event of a flood warning, what should you do to protect yourself and others with you?





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Activity 3: What action should people take before, during, and after a flood?

Activity 3.1 Flood Expert Interview

First, watch the short interview with Jeff Lukas, a flood expert with Western Water Assessment (WWA). WWA is part of the Cooperative Institute for Research in Environmental Sciences, which is based at the University of Colorado Boulder. Jeff talks about many of the concepts that you learned in the previous activities and that you will present in this activity.



[Drought Expert Video](#)

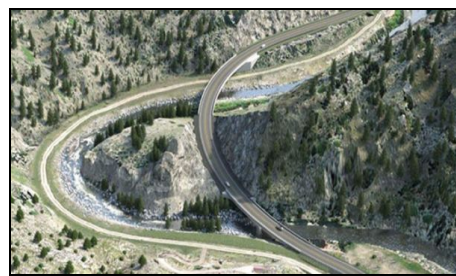
Activity 3.2 Big Thompson Flood Virtual Diary

Next, watch the short video and read one item from the virtual diary on how people and communities prepared for, responded to, and rebounded from the devastating Big Thompson floods.

- Video: [Looking Back at the 2013 Floods](#) (2:12)
- Reading (select one):
 - [Big Thompson Canyon struck again by tragic flooding](#)
 - [Lesson Learned: better notifications, monitoring article and photos](#)
 - [The 2013 Flood: A timeline article and photos](#)
 - [A deadly flood that helped improve weather forecasting](#)
 - [Recovering after rivers rage](#)



A man stands on the bank of the Big Thompson River in front of a huge debris field at the mouth of the 20-mile-long Big Thompson Canyon (Photo: *Denver Post*).



Post-flood bridge repair at Horseshoe Curve, Big Thompson River. This part of Highway 34 was washed out in the 1976 and 2013 floods. (Photo: *Kiewit Infrastructure Company*)





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Activity 3.3 Local Flood News Story

Prompt: Create a local news story in a format of your choice (see options below), that summarizes important information about for people in your community to be “flood wise” before, during, and after a flood.

The format choices for the local flood news story include:

- Newspaper article with one picture and one graph or map (one page)
- Radio story (2-3 minutes in length)
- Video newscast (2-3 minutes in length)

Follow the steps in the table below to create your news story. Be creative, but accurate.





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Local Flood News Story Instructions	
<p>1) KWL Chart “What I Learned” (see page 2)</p> <p><input type="checkbox"/> Check when completed</p>	<p>As a group, reflect on what was learned in Activities 1, 2, and 3. Then independently complete the “What I Learned” section of your KWL Chart (see page 2 of the student handout) to summarize your learning. Use these prompts to reflect on what you learned:</p> <ul style="list-style-type: none"> • What important things do you now know about floods that you didn't know before? • What should people do to be “flood wise” before, during, and after a flood?
<p>2) Choose a Format</p> <p><input type="checkbox"/> Check when completed</p>	<p>As a team, choose one of the following formats for your group’s Local Flood News Story:</p> <ul style="list-style-type: none"> • Newspaper article with one picture and one graph or map (one page) • Radio story (2-3 minutes in length) • Video newscast (2-3 minutes in length)
<p>3) Create a Draft</p> <p><input type="checkbox"/> Check when completed</p>	<p>Referring to notes and responses in your student handout, make a quick draft of your group’s product ideas. Your team’s news story should summarize and share information about:</p> <ul style="list-style-type: none"> • Causes and impacts of floods in Colorado • Locations and times of higher flood risk in Colorado • How to prepare for a flood • How to respond and stay safe during a flood • Describe how people and communities rebound from flood
<p>4) Create the Final Product</p> <p><input type="checkbox"/> Check when completed</p>	<p>Create your team’s Local Flood News Story. Remember to keep your product brief and summarize these key elements for your community audience:</p> <ul style="list-style-type: none"> • What are causes and impacts of floods in Colorado? • Which regions and times of the year have higher flood risk in Colorado? • How can people prepare before a flood? • How should people respond to stay safe during a flood? • What are some ways that people and communities have rebounded after a flood?
<p>Lesson Rubric</p>	<p>Refer to the rubric to understand expectations for your final product.</p>

