



Colorado Flood - Teacher Guide

Setting the Stage

In 1976, and again in 2013, the Big Thompson River in Colorado experienced major rain-related flooding events that greatly impacted the people and environment of this Front Range watershed. The 1976 flood resulted in 144 deaths and \$35 million in damage in the Big Thompson drainage. The 2013 Colorado flood caused nine deaths and \$2 billion in damage in the Front Range overall, including two deaths and \$80 million in damage in the Big Thompson drainage.



Aerial scene of Big Thompson Flood of 2013 along Hwy.34.
Photo Credit: U.S. Air National Guard, Capt. Darin Overstreet

Lesson Overview

In this lesson, students will build understanding about floods in Colorado through the following learning activities:

- *Part 1 – Engage (20 minutes) An Introduction to Flood Concepts & Case Study*
As a class, watch news clips about floods in Colorado and have a brief class discussion.
- *Part 2 – Explore (50 minutes) Flood Data Analysis Jigsaw*
In groups, analyze flood information and data to build understanding of the causes, impacts, locations, and frequency of floods.
- *Part 3 – Explain (65 minutes) Community Flood Risk & Response*
In teams, students create a local news story for their community to share information about flood causes and impacts, and how people prepare for, respond to, and rebound from floods.

This project is funded by the NOAA Environmental Literacy Program, award number NA18SEC0080007.



| Instructional Overview | |
|-------------------------|--|
| Grade Level | Middle School |
| Instructional Time | 135 minutes |
| Unit Driving Question | How can we make our community more resilient to floods? |
| Lesson Driving Question | What can we learn from past flooding events to help us prepare for future floods? |
| Building Toward | NGSS: MS-ESS3-2 CDE: MS3.ESS.GLE9 |
| Three Dimensions | Science and Engineering Practices: <ul style="list-style-type: none">Analyzing and Interpreting DataObtaining, Evaluating, and Communicating Information Disciplinary Core Ideas: <ul style="list-style-type: none">ESS3.B: Natural Hazards Crosscutting Concepts: <ul style="list-style-type: none">PatternsCause and effect |
| What Students Will Do | <ul style="list-style-type: none">Analyze flood data to identify patterns of flood history and risk in Colorado.Communicate information about historic causes and effects of floods in your community. Explain what community members should do to be safe in the event of a flood. |
| Materials | <ul style="list-style-type: none"><input type="checkbox"/> Flood Student Worksheet<input type="checkbox"/> Flood Student Worksheet Key<input type="checkbox"/> Lesson Slides<input type="checkbox"/> Individual student computer devices or classroom computer with projector, and internet<input type="checkbox"/> Materials for Part 3, depending on the format each group chooses (e.g., poster paper, audio/video recording, internet, etc.) |
| Material Preparation | <ul style="list-style-type: none"><input type="checkbox"/> Print student worksheets<input type="checkbox"/> For Part 2 stations: If internet access is available, use student handouts with embedded links with student personal devices or two to four shared devices with links bookmarked at each station. If internet access is unavailable, print slides 8-28 of the lesson slides to put at tables around the room. |
| Vocabulary | <p><u>Natural hazards</u> are naturally occurring phenomena such as flood, wildfire, extreme heat, or drought, which may disrupt or damage a community.</p> <p><u>Flood</u> is a rising and overflowing of a body of water especially onto normally dry land.</p> |



| | |
|---------------------------------|--|
| | <p><u>Flash flood</u> is a local flood of short duration generally resulting from heavy rainfall in the immediate vicinity.</p> <p><u>Streamflow</u> is water flow, or discharge, in a natural channel.</p> <p><u>Discharge</u> is the volume of water that passes a given point in a period of time, which is measured in cubic feet per second (cfs).</p> <p><u>Flood stage</u> is the stage at which a stream will overflow its banks.</p> |
| Instructional Strategies | <ul style="list-style-type: none">• Jigsaw (optional, used in Part 2): A cooperative learning strategy in which each group is responsible for learning one “piece of the puzzle” and then sharing that information with other groups to complete the whole picture. Consider using Part 3 for students to present the information they learned at their stations. Teachers can choose to use this strategy if time is limited, and stations can be differentiated for different student abilities and levels of teacher assistance.• <u>Mind mapping</u> (optional; used in Part 2): A creative way to “map out” students’ thoughts and ideas. Similar to a concept map, multiple formats can be used to develop students’ trains of thought and make connections between main ideas or concepts. |

Part 1 (Engage) Introduction to Flood Concepts & Case Study (20 minutes)

What are the main causes and impacts of floods?

Begin the lesson with a warm-up KWL Chart (Know, Want to Know, Learned) on the first page of the [student worksheet](#). Use Think, Pair, Share for students to share out what they already know and what they want to learn.

Use the news stories [1976: Deadly Big Thompson flood devastates Colorado](#) (3:00) and [Dramatic images show devastating flooding in Colorado](#) (3:02) to get a feel for the impacts of floods on people and the environment.



Part 2 (Explore) Flood Data Analysis Jigsaw (50 minutes)

Part 2 is designed as a jigsaw in which students work in small groups to complete the activities at six different stations and then share their findings in a class discussion. Consider giving the small groups expert names, like “hydrologists,” “emergency managers,” etc. Alternatively, you may decide to run some stations as whole-class, teacher-led activities before assigning the remaining stations as a student-led, small-group jigsaw.

Use the [student worksheet](#) pages 2-7 for the jigsaw. [Slides](#) 8-28 have larger versions of the graphs and can be used to introduce the stations or for the class discussion.

Once students have completed the jigsaw, lead a 10-minute [mind mapping](#) session or consensus discussion session about your findings and learning from the jigsaw stations. Start



the class mind map with “Flood” labeled in the center of a large Post-It, poster paper, or shared digital document.

Ask students to share their findings from the station to check and correct your responses, as needed, and add key information to the flood mind map.

Suggested discussion questions:

- What are the causes and impacts of flooding?
- Is the severity of flooding changing because of actions humans have taken?
- When do most floods occur in Colorado?
- Where do most floods occur in Colorado?
- Can floods occur in all sizes of waterways (creeks, rivers, irrigation ditches)?
- How should people prepare for and respond to be safe in the event of a flood?

Collect student worksheets and/or have them digitally share their copy with you. Student worksheets will be used for Part 3 and it is important for students to have complete and correct responses to communicate information.

Part 3 (Explain) Community Flood Risk & Response (65 minutes)

How can communities manage their exposure to flood risk in Colorado?

For Part 3, students will work in new groups, or hazard expert teams. Each hazard expert team is made up of one student from each of the jigsaw groups, so that the team consists of students that collectively completed each of the Part 2 stations. The goal is to have an expert from each station in order to communicate key flood information to your (or another) community that faces flood risk and/or has experienced a flood in the past.

Flood Expert Interview (5 minutes)

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. The video is a good summary of the topics covered in the jigsaw.



[Flood Expert Video](#)

Big Thompson Floods Case Study (10 minutes)

Watch the short video and have students read one of the readings on how people and communities prepared for, responded to, and rebounded from the devastating Big Thompson



floods. *Teacher note: Use video or press coverage from a local flood in place of the Big Thompson floods if available.*

- 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*)

Local Flood News Story (50 min)

Give students page 8-11 of the [student worksheet](#) with the prompt to create a local news story as their summative assessment.

After students have completed the assignment, lead a class gallery walk, where teams share and learn from other groups' News Stories.

Finish the lesson by returning to the KWL Chart on page 1 of the student worksheet, and have students complete the "What I Learned" section.

Find more HEART Force Curriculum here:

<https://cires.colorado.edu/outreach/projects/HEARTForce>