



## Flash Flood Alley: The Power of Water

Name: \_\_\_\_\_

**Grade Level and Course:** 6<sup>th</sup>-8<sup>th</sup> Grade Science

**Science TEKS:** 6.3B, 6.3C, 6.8B; 7.3B, 7.3C, 8.3B, 8.3C, 8.6A

**Time:** 45-90 minutes

**Lesson Objectives:** Students will:

- 1) Understand factors that cause flooding.
- 2) Conduct an experiment with a model of a low-water crossing to demonstrate that the force of water can push a car off the road.
- 3) Use an online maps and resources found at [www.ATXFloodSafety.com](http://www.ATXFloodSafety.com) to determine if they live in a floodplain, if there are low water crossings on their way to school, and what they can do to stay safe during a flood.

**Materials:** Kits that include models of a low-water crossing are available for checkout out to teachers in Austin from: [www.austintexas.gov/watersheddetectives](http://www.austintexas.gov/watersheddetectives). Alternatively, students can watch this short video of the model in action: <https://flic.kr/p/2iLjDq>.

**Engagement:**

Students watch a short video about flooding and flood safety.

**Exploration:**

Students conduct an experiment with watershed model of a low-water crossing in Austin to observe flood water washing a car off the road (or watch a video of the experiment).

**Explanation:**

Students learn what factors contribute to flooding in Austin and what they can do to stay safe during a flood.

**Elaboration:**

Students explore maps to determine if they live in a floodplain, find out information about road closures during floods, and plan a safe route to school that avoids low-water crossings.

**Evaluation:**

Students answer questions about flooding and flood safety.

**Extension:**

Students calculate the power of water.

**TURN AROUND - DON'T DROWN!**



## Flash Flood Alley: The Power of Water

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**Engagement:** Watch *Flash Flood Alley: Swept Away*:  
[www.austintexas.gov/department/flood-safety-preparedness](http://www.austintexas.gov/department/flood-safety-preparedness)

**Exploration:** Conduct an experiment with a model of a low-water crossing or watch this short video: <https://flic.kr/p/2iLjjDq>.



Experiment: Place the car on the road. Submerge the raincloud in the water and put your finger on top of the hole. Release your finger when you are ready to rain on the model.

- 1) What happened to the car at the low-water crossing?
- 2) What color(s) of clay represent the floodplain on your model?
- 3) What are advantages and limitations of your model (such as size, scale, properties, and materials)?
- 4) What should you do at a low-water crossing if there is a flood?



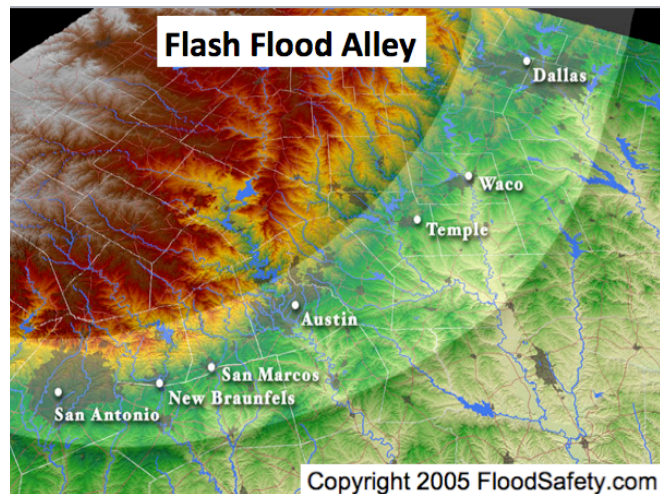


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### **Explanation:** Why does it flood in Austin?

Austin lies in the heart of Flash Flood Alley, where there is a higher potential for flooding than in any other region of the United States. Rocky and clay-rich soils, steep terrain and very intense rainfall make Central Texas uniquely vulnerable to major flooding. Major storms coming from Pacific Ocean, Atlantic Ocean, and Gulf of Mexico can collide over Central Texas, causing severe storms and record rainfalls. When rain falls too quickly for the soil to absorb, it will run off into the nearest stream.



Flooding is a natural part of the hydrologic cycle. During a large storm, water spills out over the banks of the channel and into the floodplain. A floodplain is the area of land around a stream that is naturally subject to flooding when the channel can't hold any more water. When it rains on the land, the water travels downhill into a creek or stream. Rain falling upstream can mean flooding downstream. During major storms, flash flooding occurs suddenly and can easily overtake roadway crossings. It is critical that you be alert to the dangers of flooding.

### **Flood Safety Facts:**

- Flooding is the #1 weather-related cause of death in Texas
- 75% of those deaths are caused by people trying to drive across a flooded road or bridge
- You can lose control of your vehicle in as little as 6" of water
- Most cars will float and be swept away in 18" of moving water

**Save Yourself!** Taking the following steps during a storm can help you stay safe:

- Be alert to your surroundings
- Check out [www.ATXFloodSafety.com](http://www.ATXFloodSafety.com) and monitor local media
- Avoid driving
- Stay away from creeks, trails, culverts, ponds and other drainage infrastructure
- If water starts to rise, seek higher ground (this may mean getting on your roof)
- If you have to drive, take the following precautions:
  - Check [ATXfloods.com](http://ATXfloods.com) for flooded roads
  - Avoid low-water crossings
  - Turn around if a road is barricaded or if water is over the road (the road may be heavily damaged underneath the flood water)

**TURN AROUND - DON'T DROWN!**

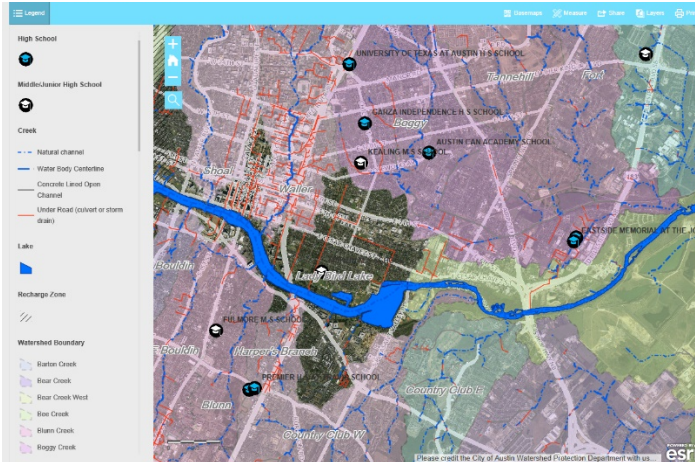


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**Elaboration:** The Power of Maps

## Watershed Detectives Interactive Web Map



Use the Watershed Detectives [Interactive Web Map](https://arcg.is/0XujTy) (<https://arcg.is/0XujTy>) to find out what watershed you live in and whether you live in a floodplain. You can search for your address, click layers of information on or off and adjust the opacity of layers to create your own map. Click on the magnifying glass to search for your home address and school address. Zoom out so you can see your home and your school.

The current 25-Year Floodplain is shown in light blue. Do you cross the 25-Year Floodplain on your route to school?

Yes      No

## Storm Levels and Atlas 14

Since storms are reoccurring, we can calculate the probability of a storm occurring at a location in a given year. Storm levels are based on the percent chance of them occurring in a year. A 100-year flood has a 1% chance of happening every year. It can occur multiple times per year. A 25-year flood has a 4% chance of happening every year, so it is more likely to occur than a 100-year flood. Whereas a 500-year flood has a 0.02% chance of occurring in a year, so it is less likely to occur than a 100-year flood.

The National Weather Service recently completed a historical rainfall study called Atlas 14. This study shows that Central Texas has been experiencing larger storms than previously thought. This means that severe flooding is more likely to occur than previously believed. Prior to this study, it was thought that there was a 1 percent chance of 10.2 inches of rain falling in 24 hours in Austin in any given year. This was the official definition of the 100-year storm. The Atlas 14 study shows that this amount of rainfall is now likely to occur more frequently. The new 100-year storm will be closer to 13 inches of rain in some parts of Austin, which resembles the current 500-year storm. Many floodplain regulations are based on the 100-year flood. The City of Austin is proposing an interim 100-year floodplain for our regulations until floodplain maps can be redrawn

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This interim floodplain is based on the current 500-year floodplain (see Table 1).

**Table 1. Table of Storm Levels and Amount of Rainfall Based on Atlas 14 Study.**

Storm Level	Current Rainfall Depth (24 hour storm)	Updated Rainfall Depth* (24 hour storm)
25-year (4% chance)	7.6 inches	Almost 10 inches
100-year (1% chance)	10.2 inches	Up to 13+ inches
500-year (0.2% chance)	13.5 inches	Not yet available

## Floodpro

Go to [www.austintexas.gov/floodpro/](http://www.austintexas.gov/floodpro/). Click on ***I want to... Explore Atlas 14 Changes.*** In the address search, type in your address.

Is your house in the current 100-Year Floodplain?    Yes            No

Is your house in the interim Atlas 14 100-Year Floodplain?    Yes            No

## Road Closures

If you drive through a low-water crossing on a frequent basis, you should plan alternate routes around the crossing. Go to [www.atxfloods.com/closures](http://www.atxfloods.com/closures) to see real-time road closures. Click on ***All Crossings.*** Zoom into where you live to see if there are any low-water crossings on your way from home to school. Click on ***Cameras*** to see photos from particular low-water crossings. Click on ***Closures*** to see low-water crossings that are closed.

Do you travel over any low-water crossings on your way to school?    Yes            No

Can you plan a route to school that avoids low-water crossings?    Yes            No

## Evaluation

1) Why is Central Texas called “Flash Flood Alley”?

2) What factors affect flooding in Central Texas?

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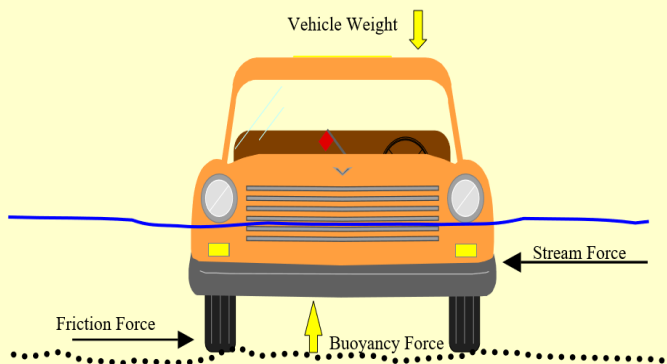
- 3) What is the chance of a 100-year storm event happening?
- 4) Can three 100-year floods happen in the same year? Explain why or why not.
- 5) What can you do to protect yourself during a flood?

### Extension: Calculating the Power of Water

- 1) How much does one cubic foot of water weigh? (*hint: there are 7.48 gallons in one cubic foot of water, and each gallon weighs 8.33 pounds*)
- 2) If the water is flowing at 100 cubic feet / second (cfs), how many pounds of force would be hitting an object? (*hint: In order to determine the amount of force that is hitting an object every second, multiply the amount of cfs by the weight of one cubic foot of water*)

### Forces on Vehicles Crossing Streams

The car will float downstream when:  
 $\text{Stream Force} > \text{Friction Force}$



3) What direction the car will go if  $\text{Stream Force} > \text{Friction Force}$ ?

4) What direction the car will go if  $\text{Buoyancy Force} > \text{Vehicle Weight}$ ?

Image on the left (and additional information about Physics of Stream Forces) from:

[www.nws.noaa.gov/os/water/tadd/pdfs/WaterPhysics.pdf](http://www.nws.noaa.gov/os/water/tadd/pdfs/WaterPhysics.pdf)

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