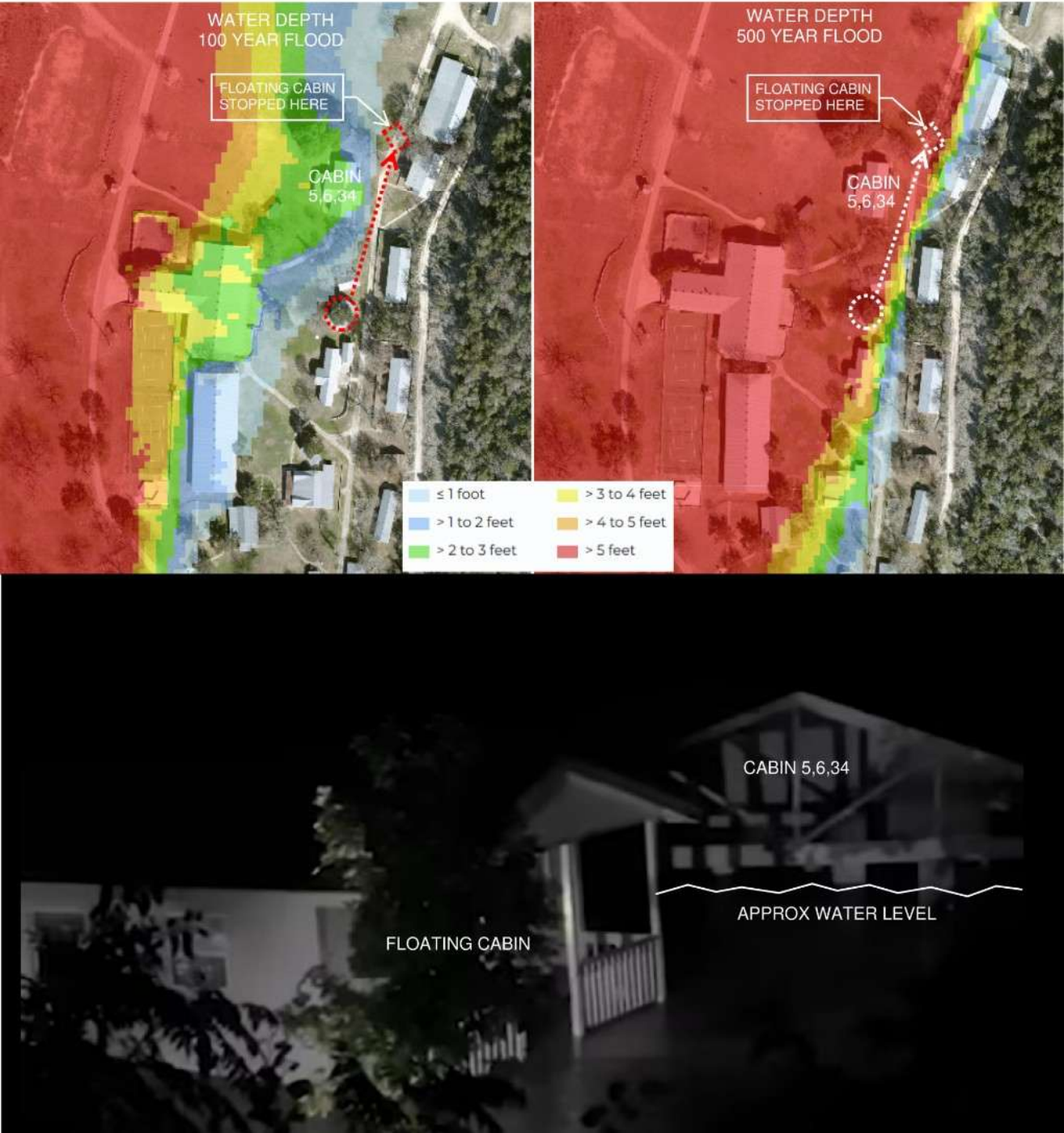


Most everything is designed and constructed based on what FEMA considers a 100-year flood event (i.e. 1/100 probability of happening in any given year). FEMA also publishes the approximate extents of a 500-year flood event for informational purposes, but I don't believe there are any restrictions for buildings within the 500-year floodplain. When looking at the predicted water depths for a 100-year vs 500-year flood event at Camp La Junta, the observed water levels appear to more closely match a 500-year flood event. From the video of the floating cabin, you can see Cabin 5,6,34 in the background with the large roof and exposed wood truss. It appears that the water is a couple feet below the windows/door which is consistent with news reports of campers treading water and climbing into the roof rafters. Also, the floating cabin would not have been in water for a 100-year flood event. Therefore, I believe this was close to a 500-year type flood event (as defined by FEMA).



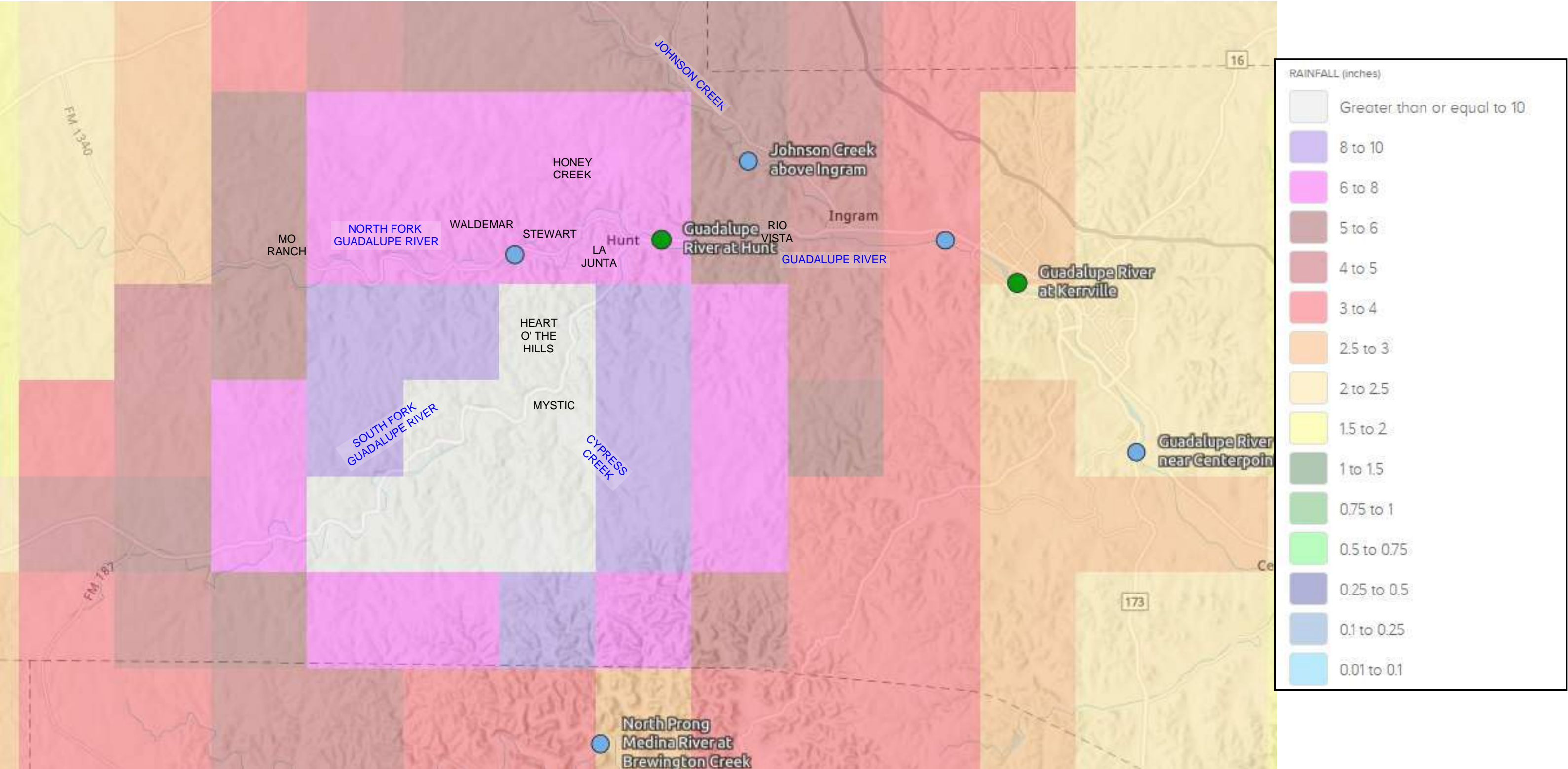
Next, I wanted to understand overall geography and why some camps might have fared better than others. From a big picture standpoint, the Guadalupe starts as a north and south fork which converge in Hunt, TX and then eventually makes its way into Canyon Lake.



There are a lot of summer camps in the area, but it seems the most affected by the flood were located along the south fork of the Guadalupe.

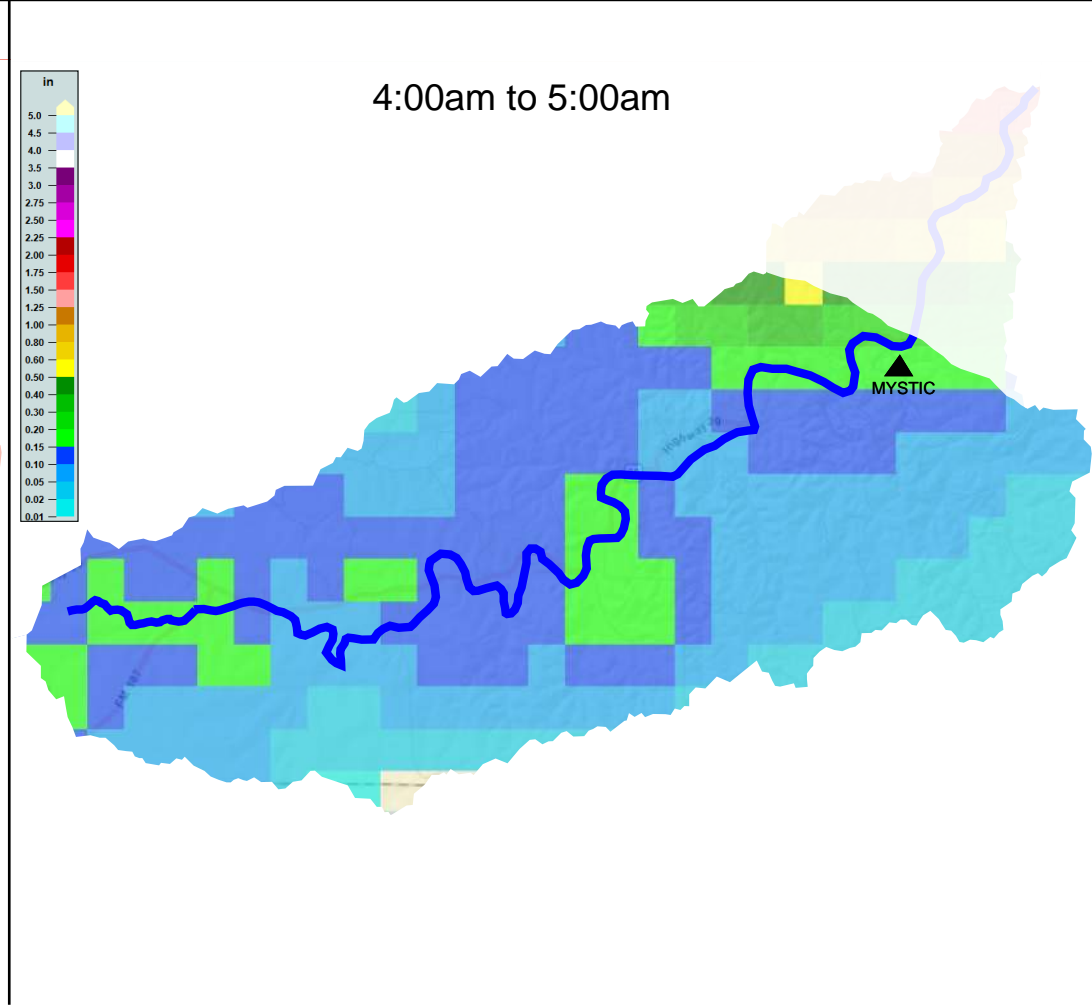
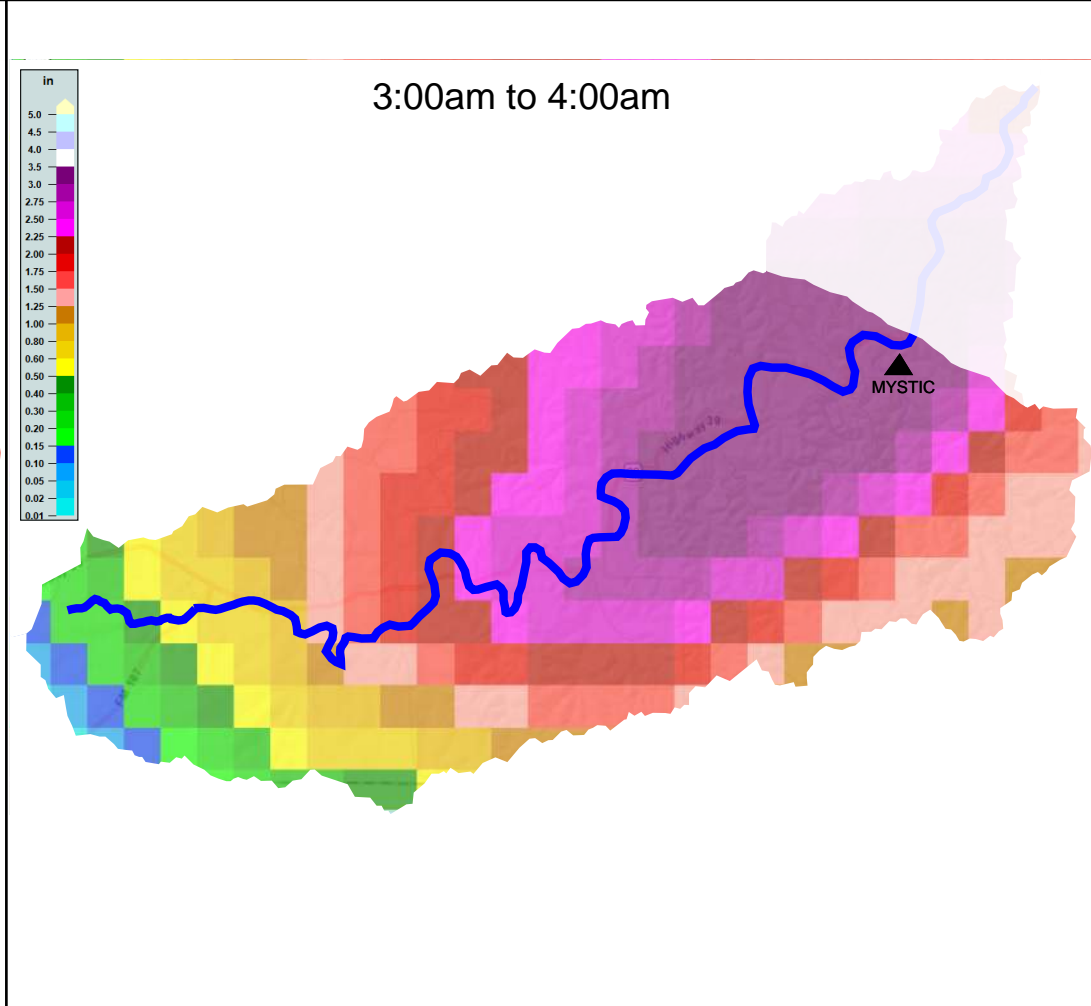
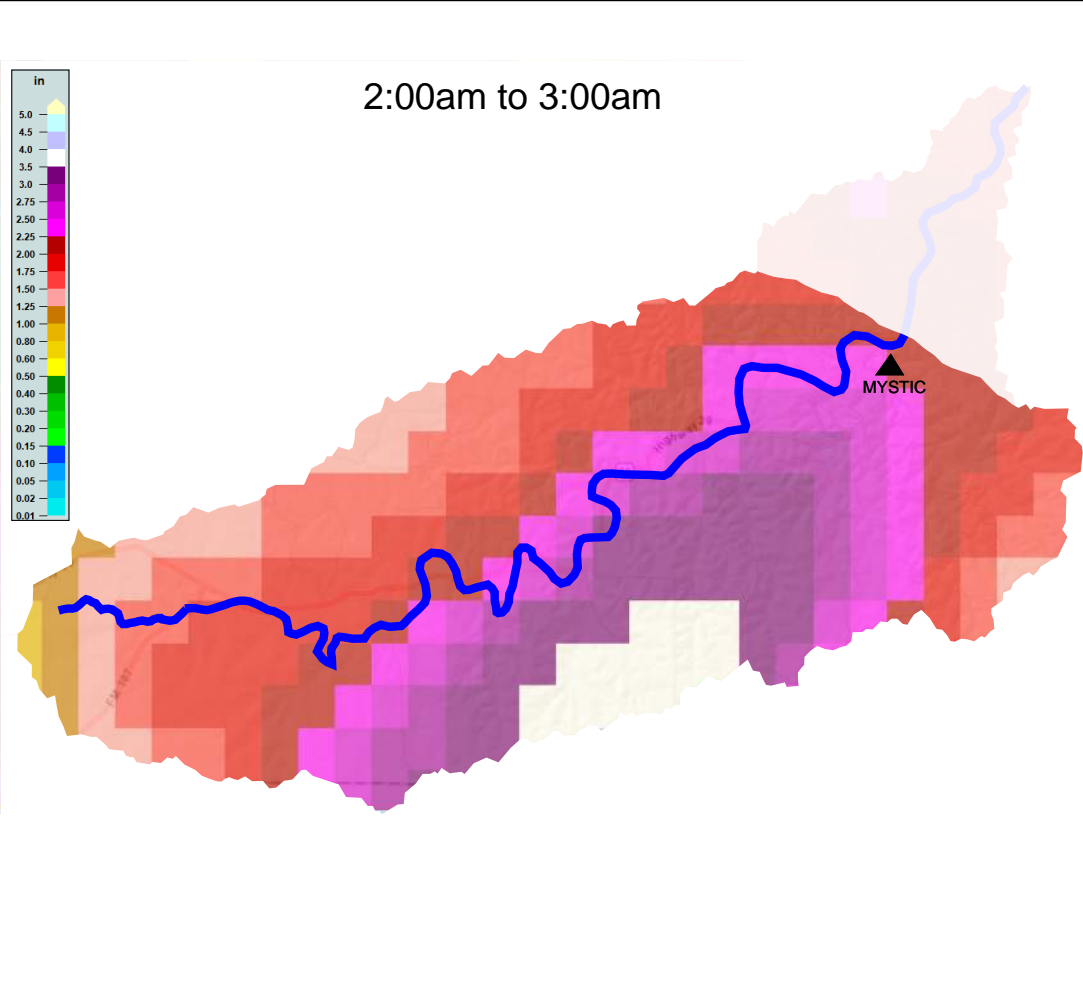
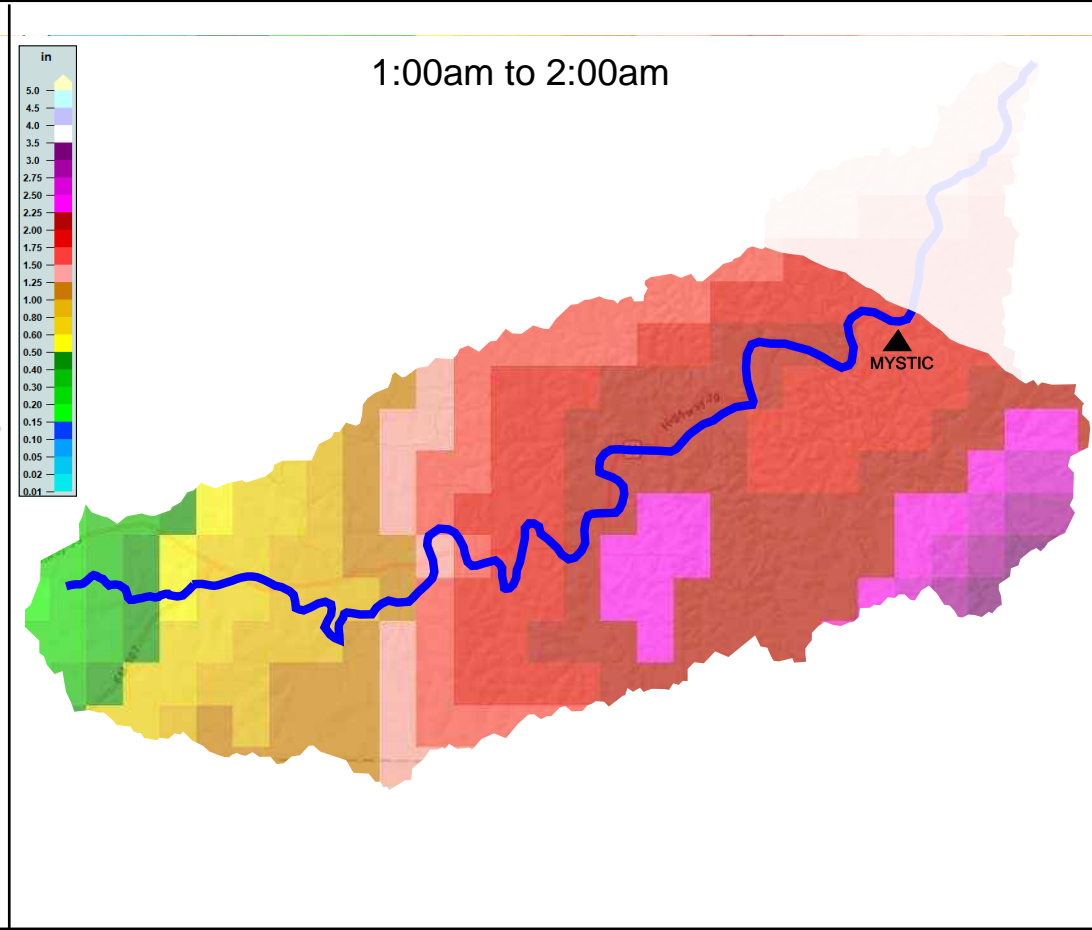
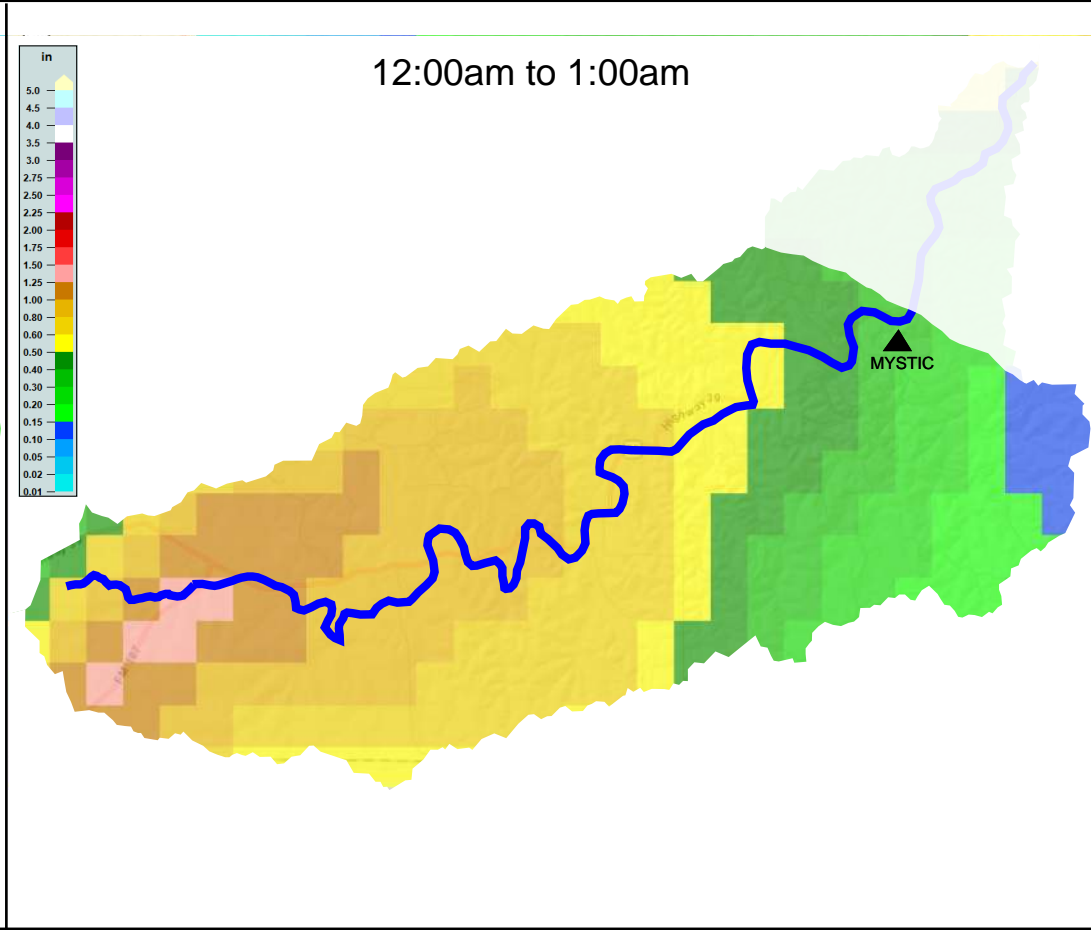
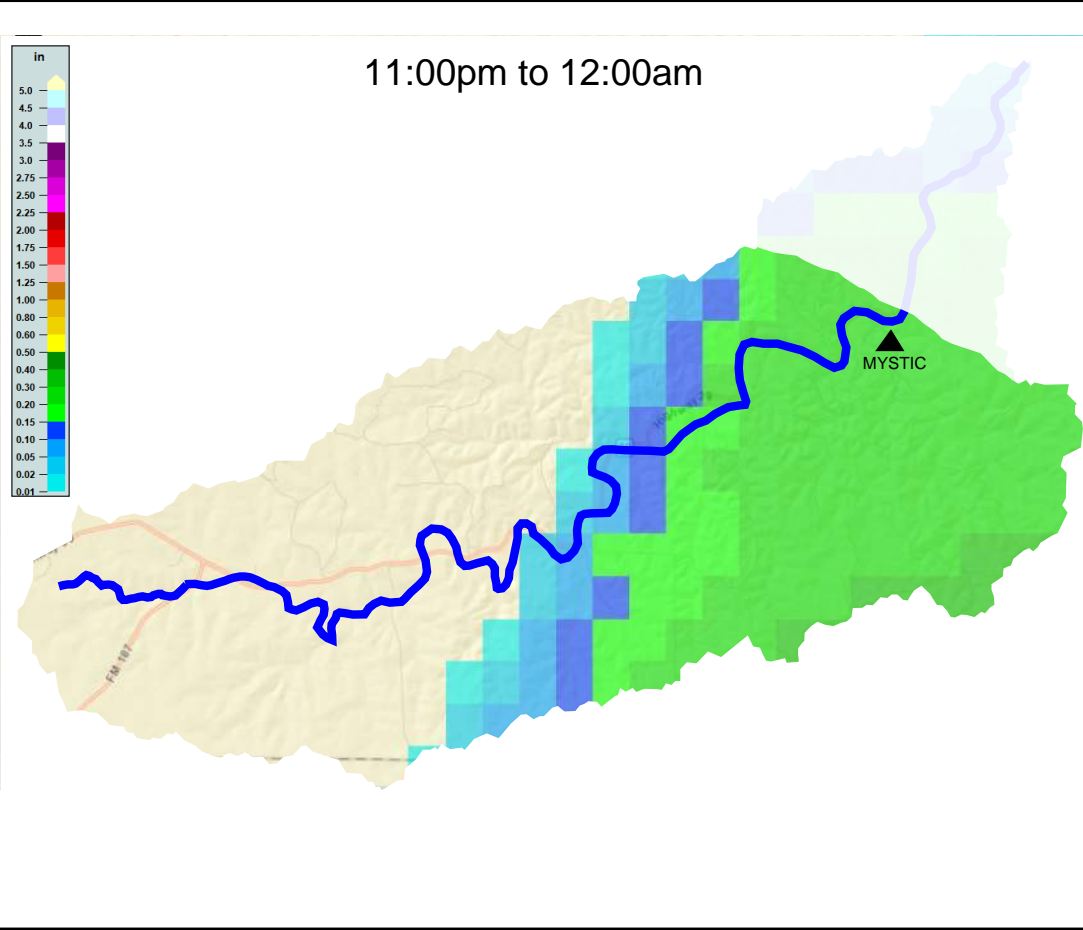


The south fork also received the highest rain totals. There are no flow gauges on the south fork but based on the nearest flow gauges, I'd imagine the south fork was rapidly rising during the 2 to 4 o'clock hours, possibly rising 30 or more feet within those couple of hours.

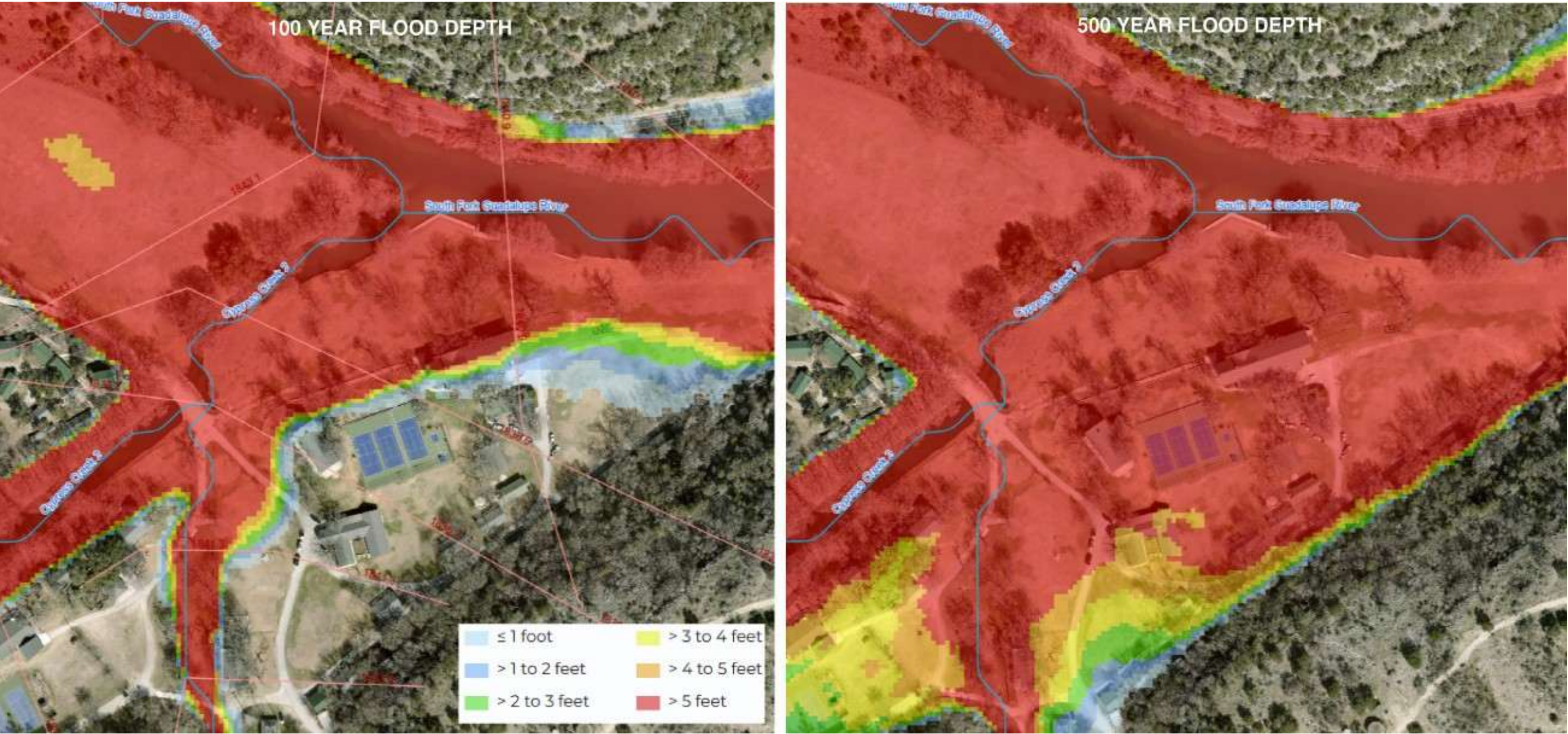


South Fork Watershed Hourly Rainfall

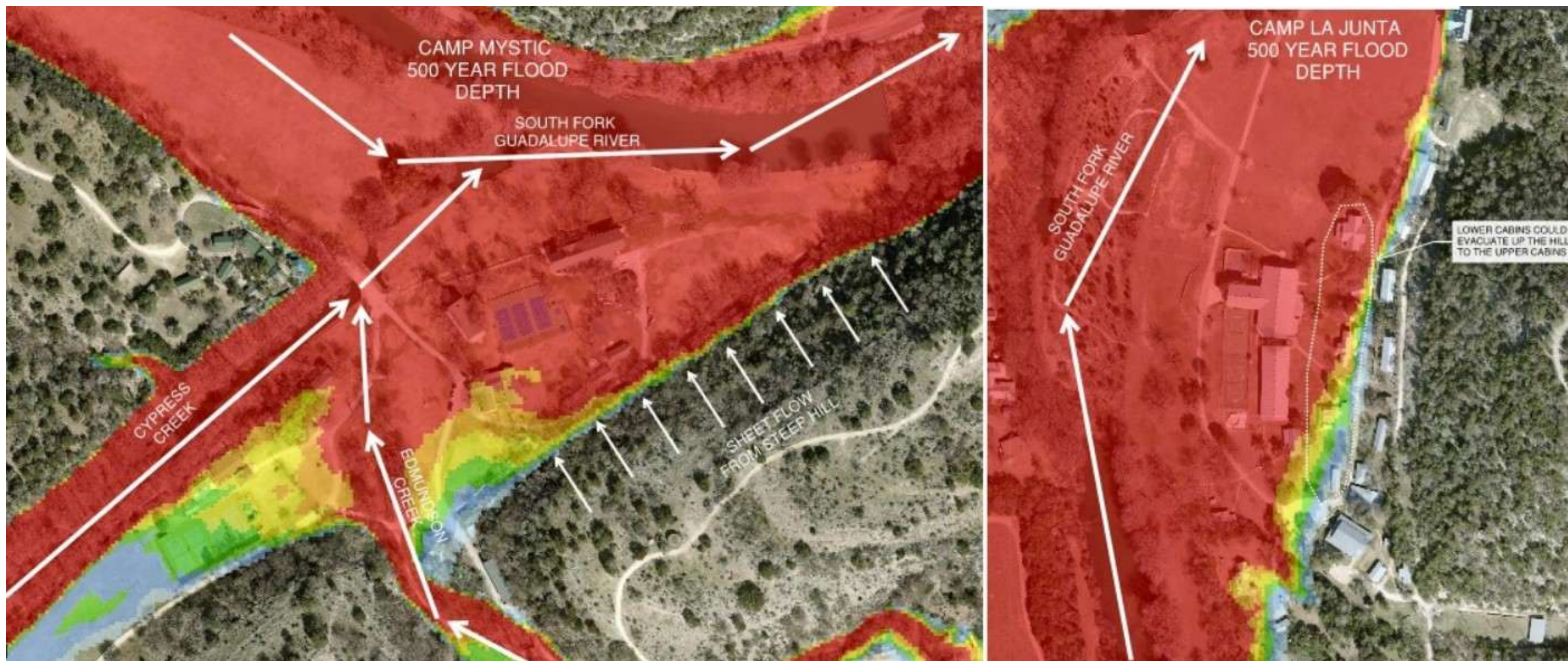
Q3 Multi-Sensor Rain on 1km Grid:
https://mrms.nssl.noaa.gov/qvs/product_viewer/



Mystic is the furthest camp upstream on the south fork and other than the NWS flash flood warning issued at 1:14am, Mystic likely did not know that there was an extreme flood headed at them. From news reports of firsthand accounts, it sounds like the cabins with the lowest elevations were evacuated first. Then when the water kept rising higher, they started evacuating the cabins at higher elevations which housed the youngest campers. At some point during that evacuation, the water may have risen too high or been flowing too fast. That evacuation plan may have been sufficient for a 100-year flood, but they likely need more time to safely evacuate for a 500-year flood.

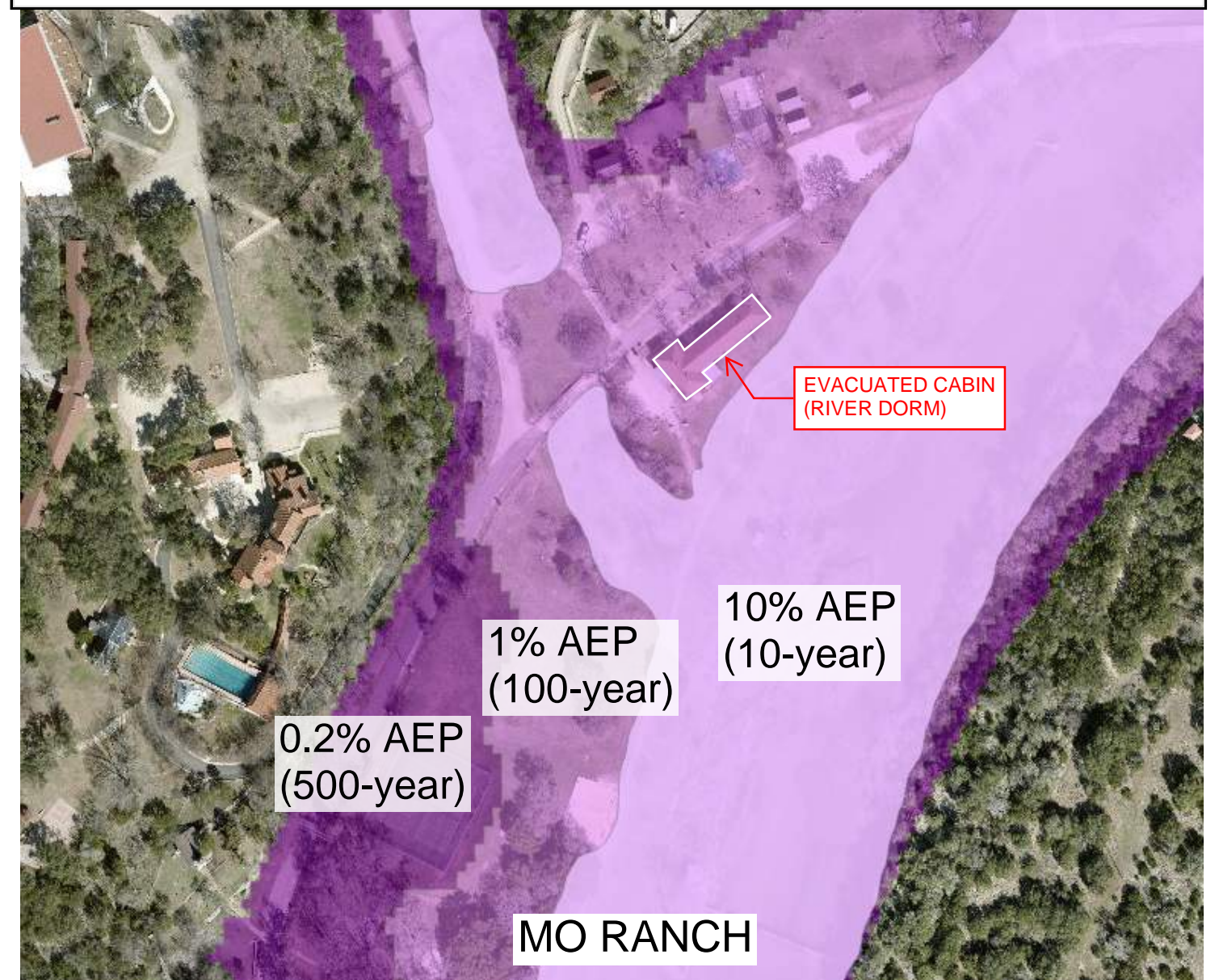
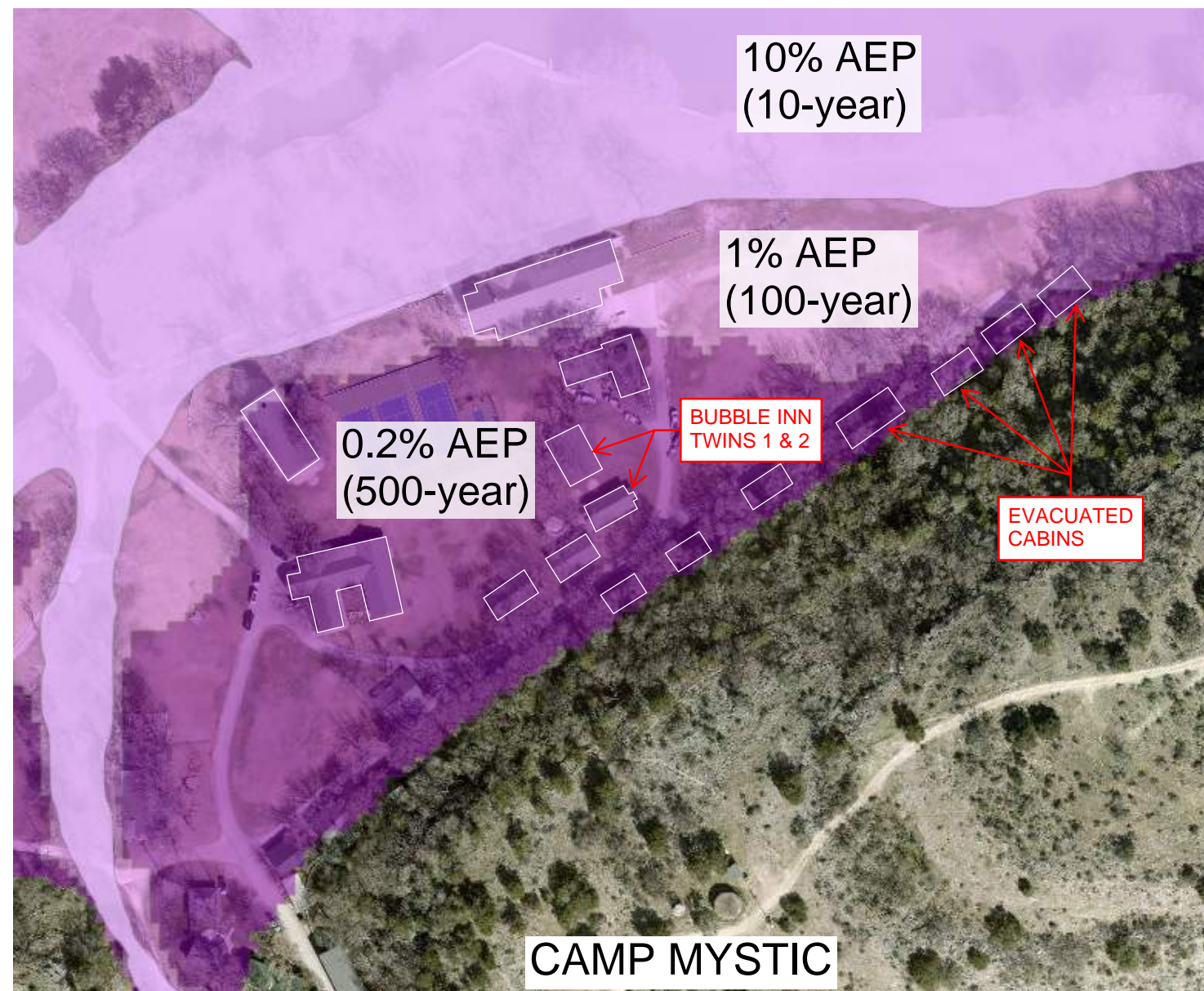
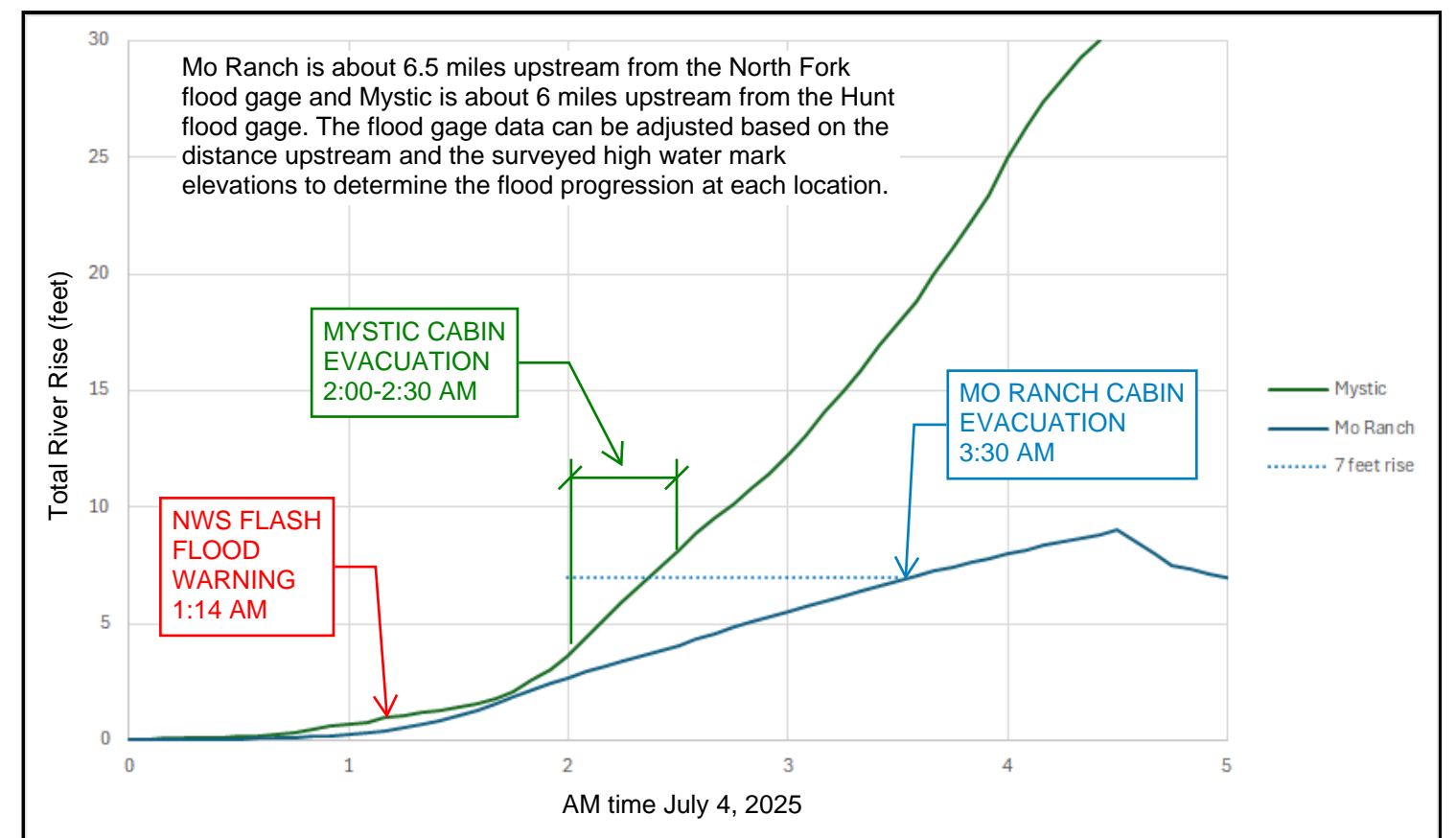


Lastly, I wanted to understand if there were any differences between Camp Mystic and Camp La Junta that contributed to their survival/peril since both are on the lower fork of the Guadalupe. La Junta is further downstream and has a simple layout and water flow. The cabins are built between the river and the hill at different elevations. If needed, the campers in the lower cabins could evacuate to the upper cabins. There is also a road above the upper cabins that could be an additional evacuation location if the water kept rising. The layout and water flow at Mystic is more complicated. The oldest campers are located on senior hill and are cut off from the rest of the camp by Cypress Creek and Edmundson Creek. The middle-aged campers are in cabins along the hill. There were reports that some of these cabins were evacuated to the rec hall and some climbed the hill behind the cabins. The youngest campers were near the office between the hill and the river. Edward Eastland said that the water around these cabins was swirling which seems likely based on the multiple directions of water flow.



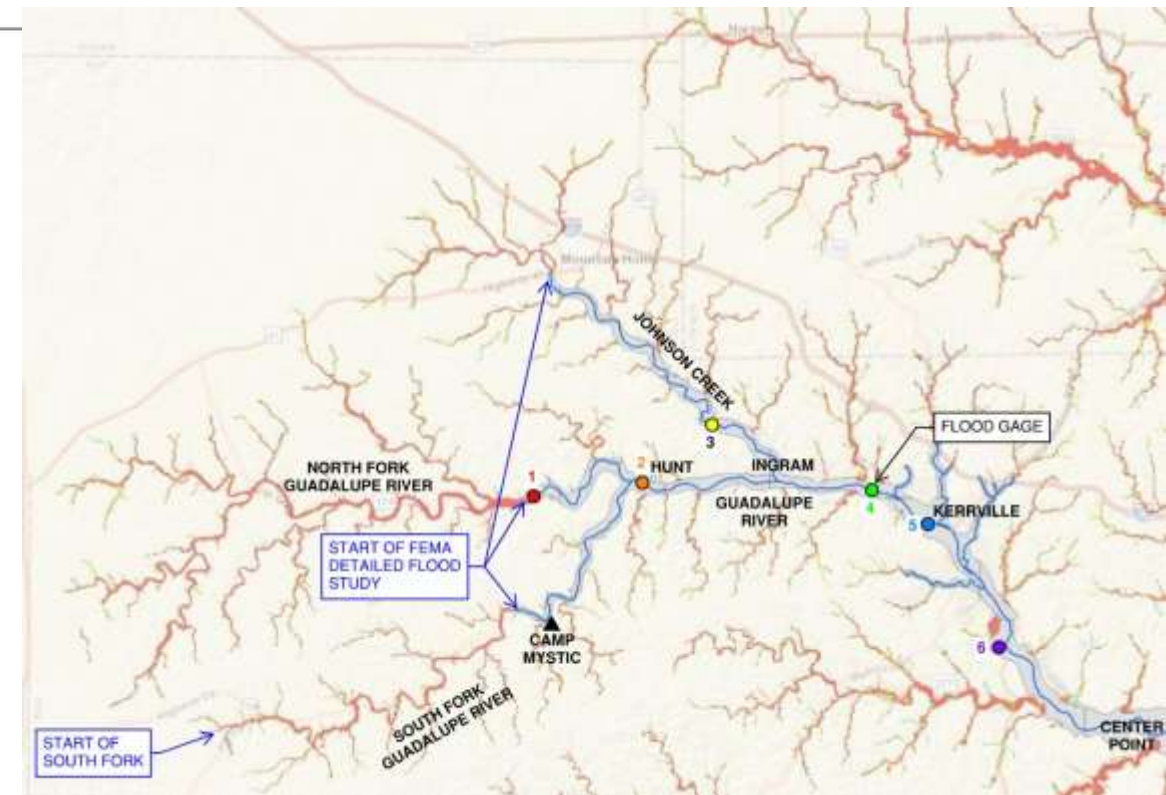
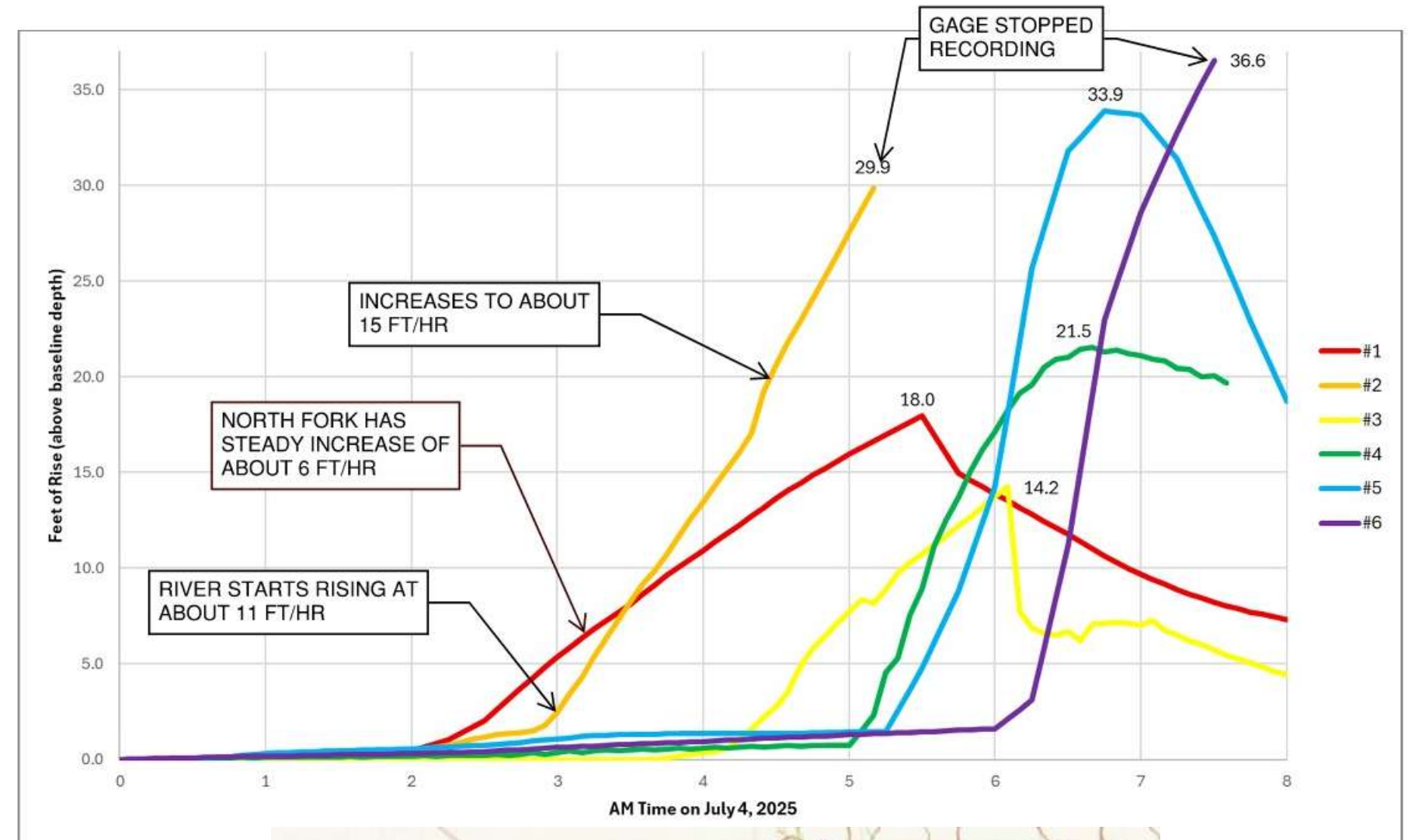
Camp Mystic has received criticism for waiting to begin evacuating cabins until about an hour after the NWS Flash Flood Warning. At the same time, Mo Ranch has been praised for evacuating their campers. It seems the praise/criticism is based on the outcome and does not consider the different circumstances at each camp.

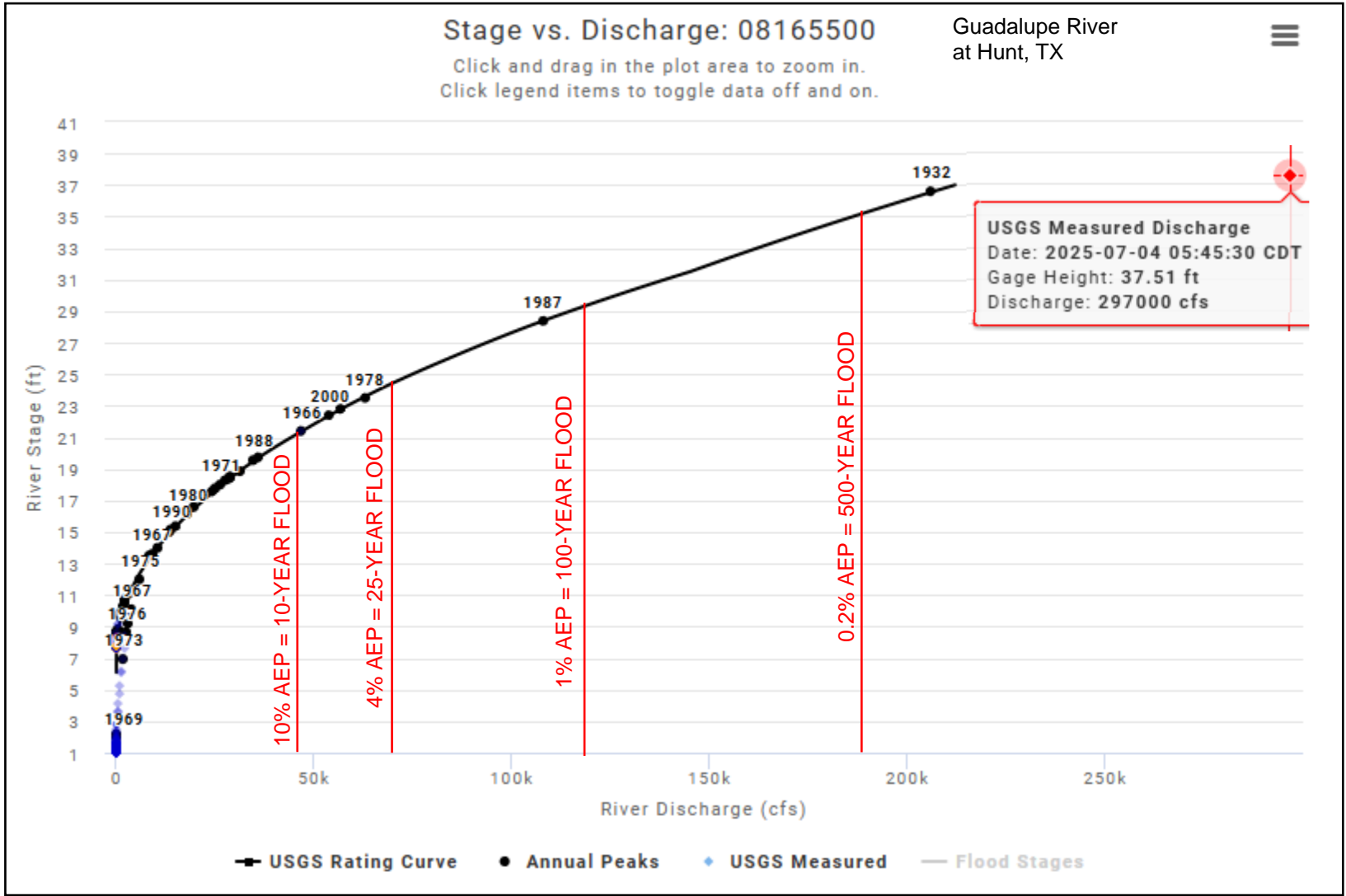
- The cabins at Mystic were located in the 500-year floodplain.
- The cabin that was evacuated at Mo Ranch was in the 100-year floodplain and more vulnerable to flooding.
- Both camps starting evacuating after the river rose about 7 feet.
- The outcome at the two camps was different because of the severity and rate of flooding differences .



Here are some additional thoughts after studying the flood gage data:

- At 2am, the north fork began rising steadily at 6ft/hr. This is probably slow enough for a typical evacuation plan.
- At 3am in Hunt, the river began rapidly rising at a rate of about 11 ft/hr. At 4:30am, the rate of rise increased to about 15 ft/hr. The flood gage reading doesn't predict how high the river will rise, but it does indicate the intensity of the flooding and the urgency for evacuations downstream.
- It sounds like Mystic had already started evacuations at 3am for the cabins at the lowest elevations. If Mystic had known the water was rising at an unsafe rate of 11-15 ft/hr, they could have evacuated all cabins at the same time rather than in phases.
- The NWS issued a flash flood warning at 1:14am and a flash flood emergency at 4:03am. There was sufficient data from the Hunt flood gage at 3am indicating an emergency. A warning system using river flow data rather than rain gages and weather forecasts would have triggered the emergency status 1 hour earlier. (that's not a knock against the NWS since that type of warning system would probably need to be implemented at the local or state level)
- Downstream areas along portions of a major river would probably see the biggest benefit from a warning system because of the all the data from upstream and the time it takes for the flood head wall to travel downstream.

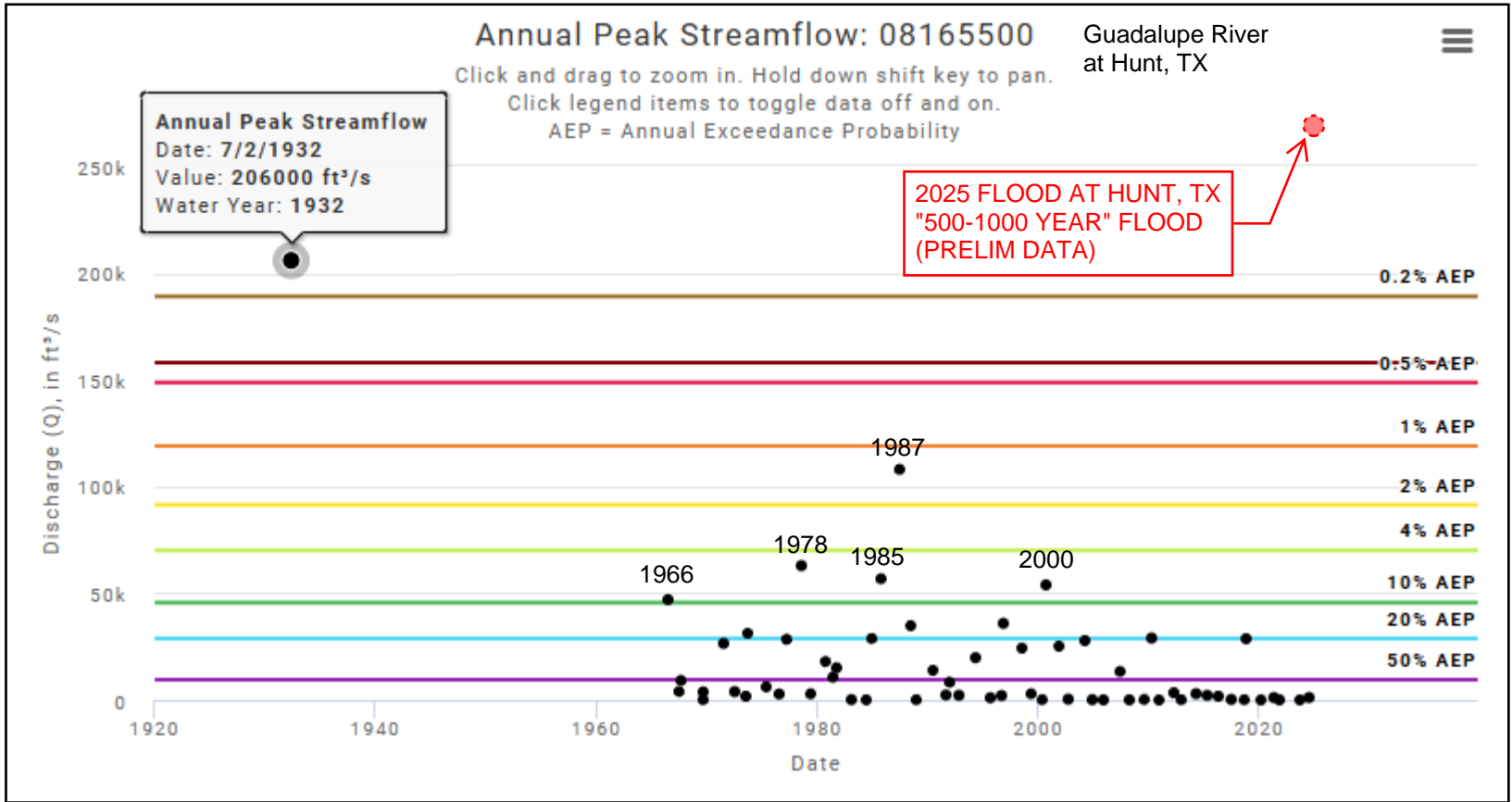




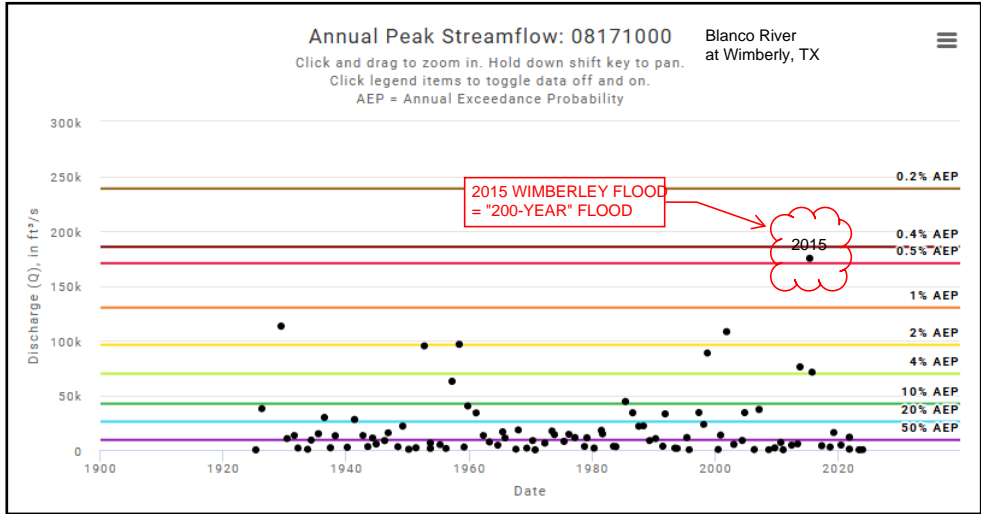
Historic Crests

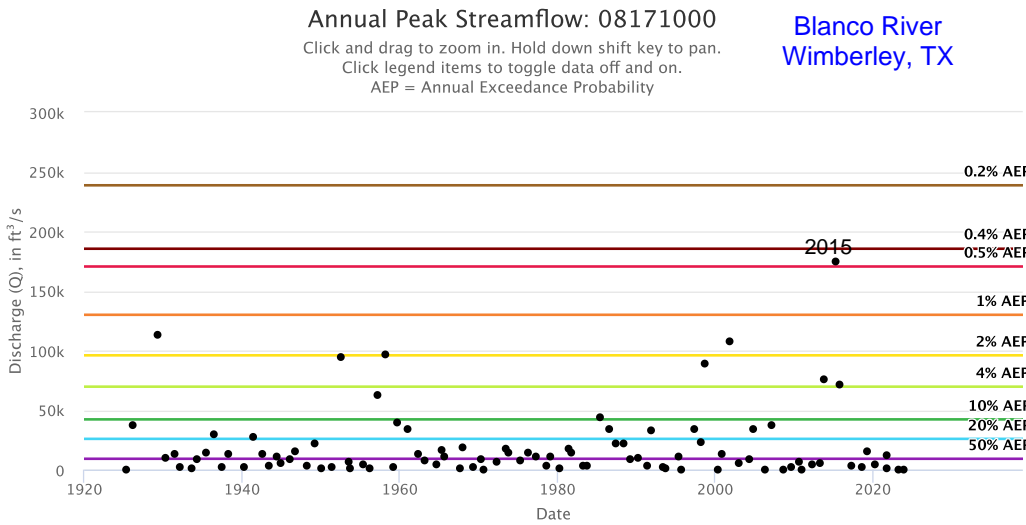
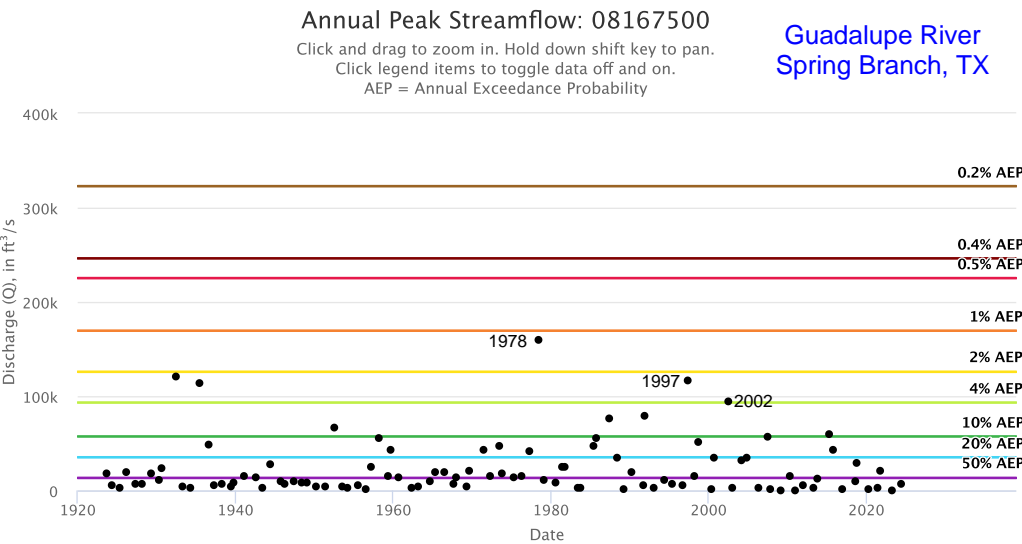
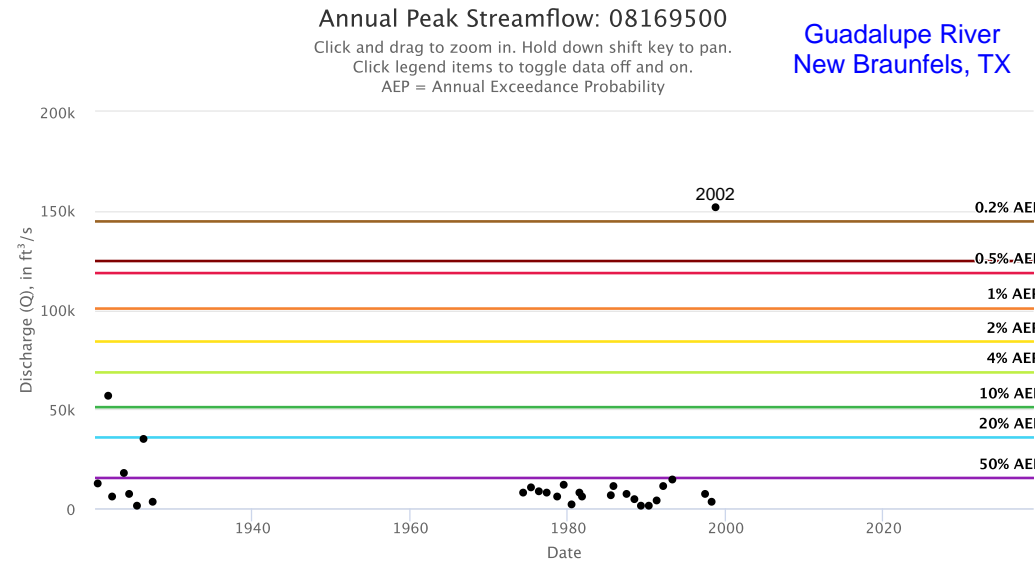
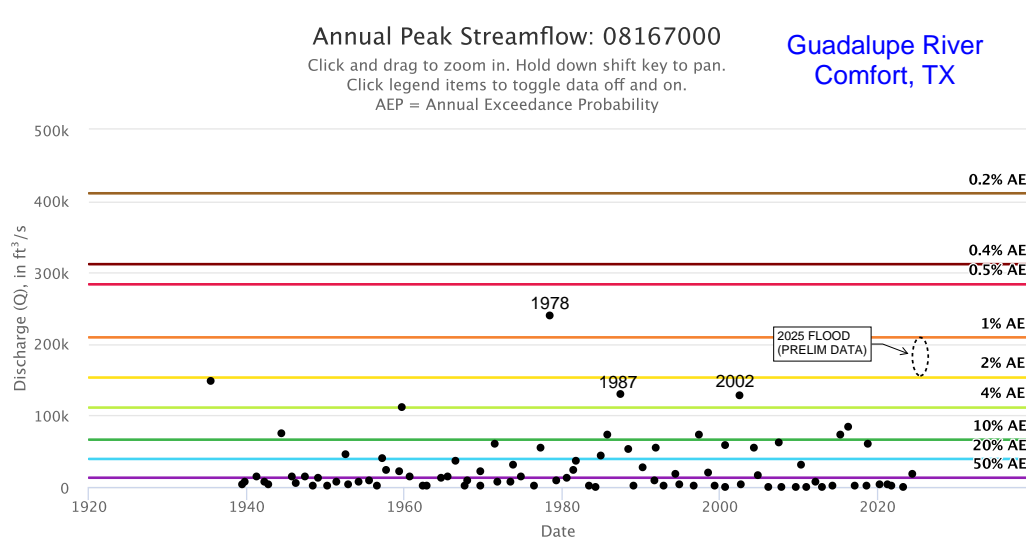
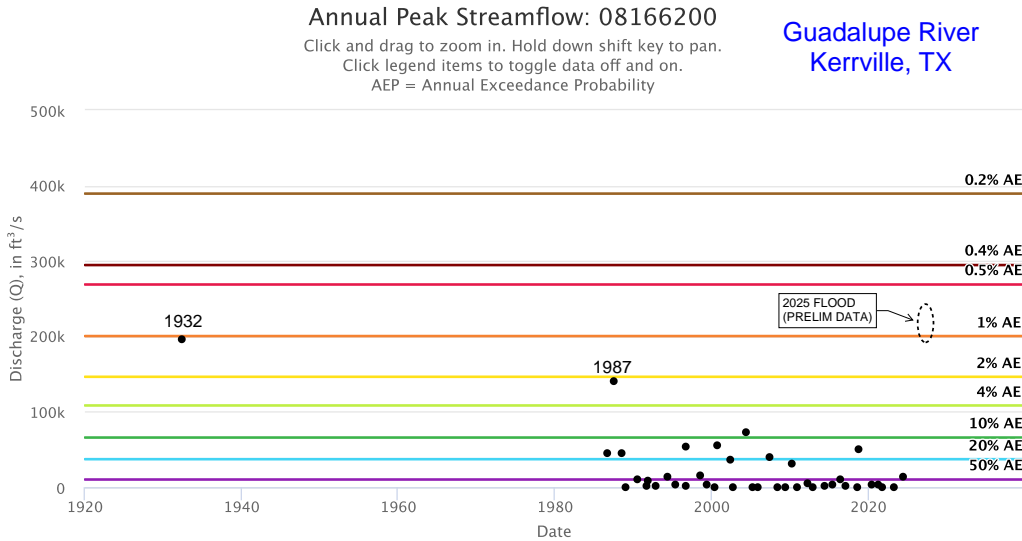
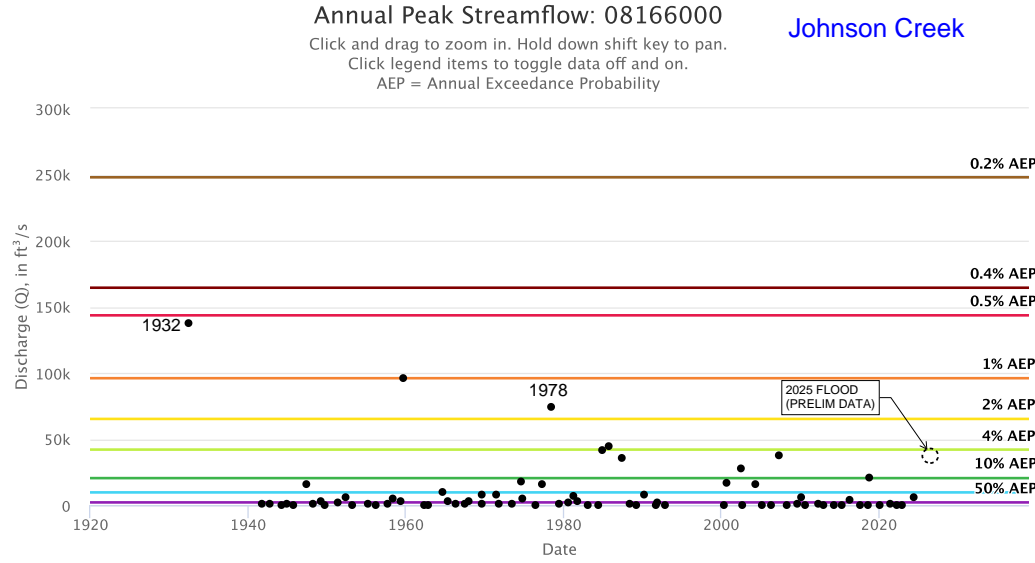
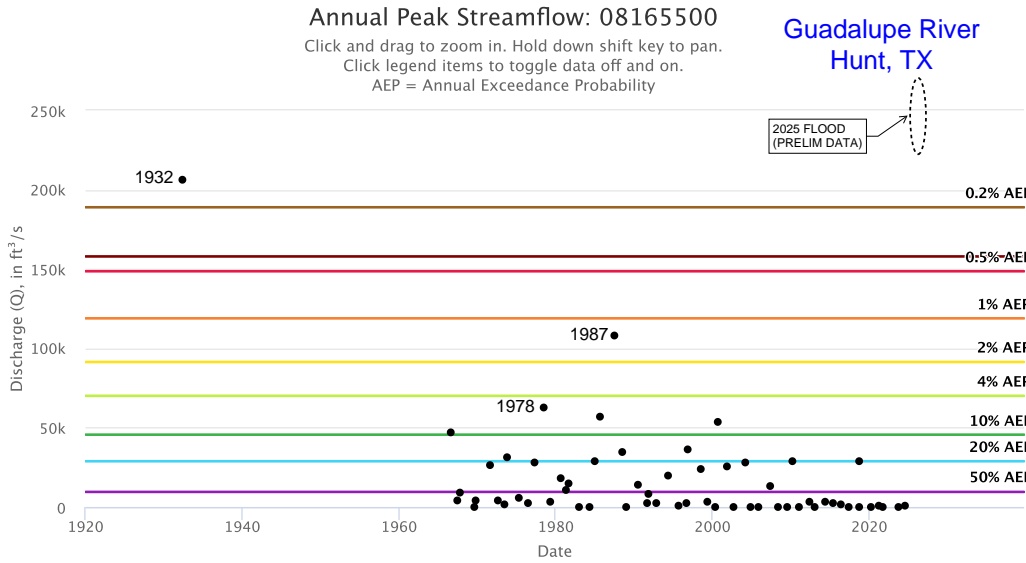
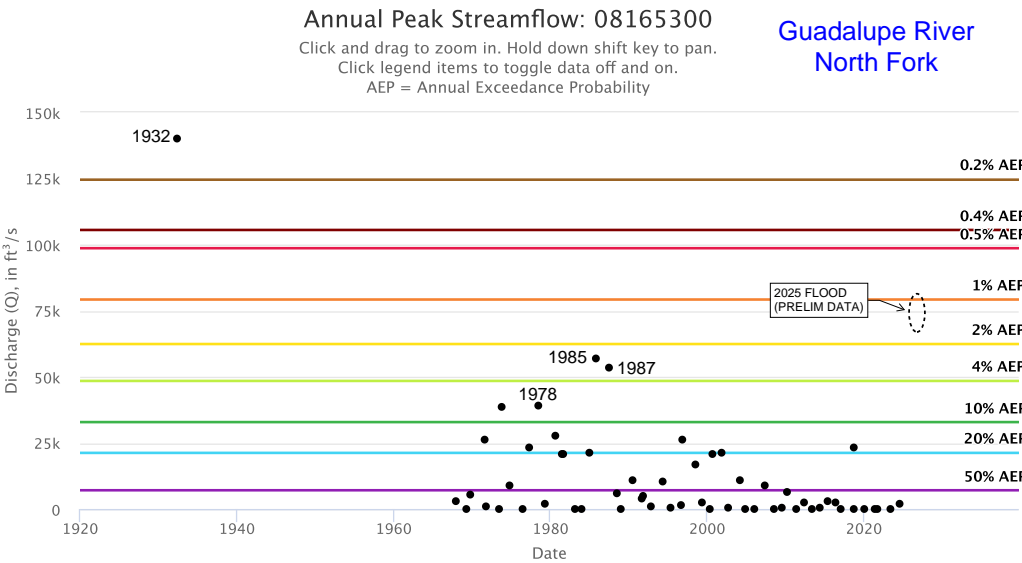
Guadalupe River
at Hunt, TX

- 37.52 ft on 07-04-2025 (P)
- 36.60 ft on 07-02-1932
- 28.40 ft on 07-17-1987
- 23.50 ft on 08-02-1978
- 22.80 ft on 10-19-1985
- 21.40 ft on 08-13-1981
- 19.73 ft on 10-28-1996
- 18.96 ft on 10-16-2018
- 16.70 ft on 07-05-2002
- 16.59 ft on 05-13-1994
- 15.00 ft on 05-25-2007
- 14.89 ft on 10-09-2018
- 14.25 ft on 02-20-1997
- 13.50 ft on 12-21-1991
- 10.58 ft on 05-24-2015



Wimberley Flood AEP (For Reference)

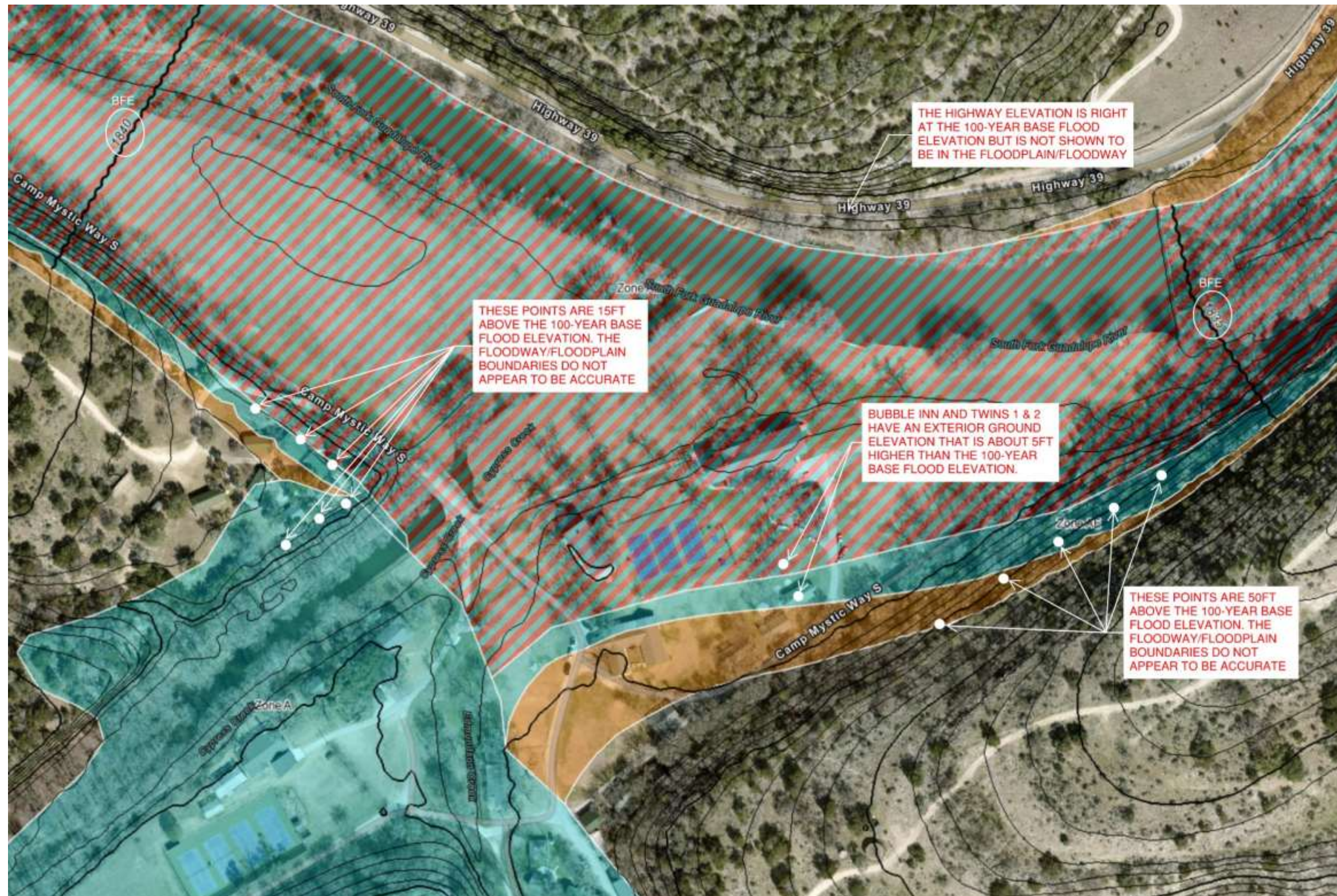




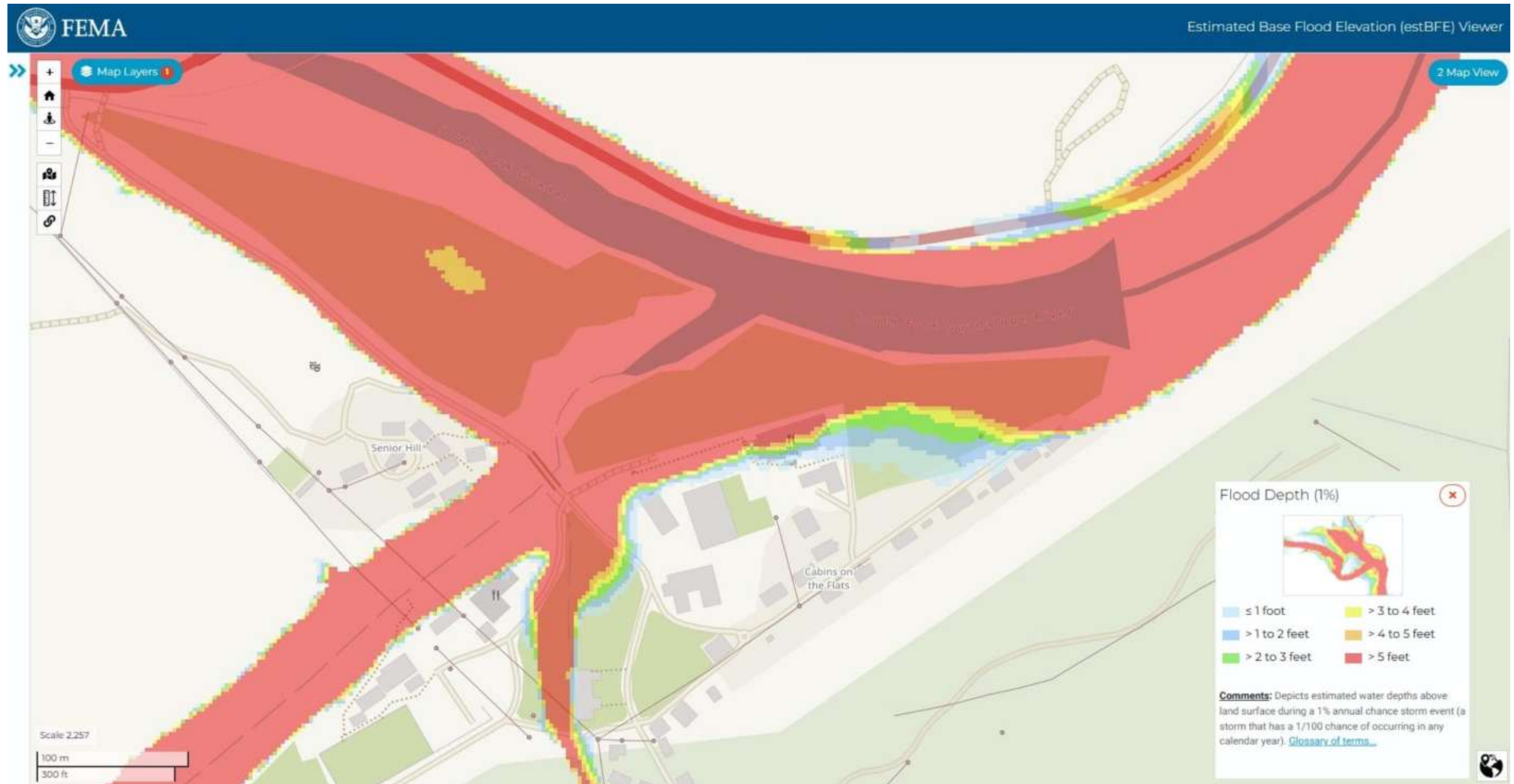
It seems that many news outlets have simply looked at the 2 dimensional FEMA FIRM map, saw that some cabins are located within the floodplain/floodway boundary, and have been quick to criticize the camp for putting the kids in harms way. Most of the articles I read do not mention anything about vertical elevation. The ground outside most of the cabins are at least 5ft above the 100-year base flood elevation. In addition, some cabins are built up further above the ground. This graphic shows the ground elevations outside the cabins based on USGS LIDAR data. You can find the interactive map here: <https://apps.nationalmap.gov/viewer/>

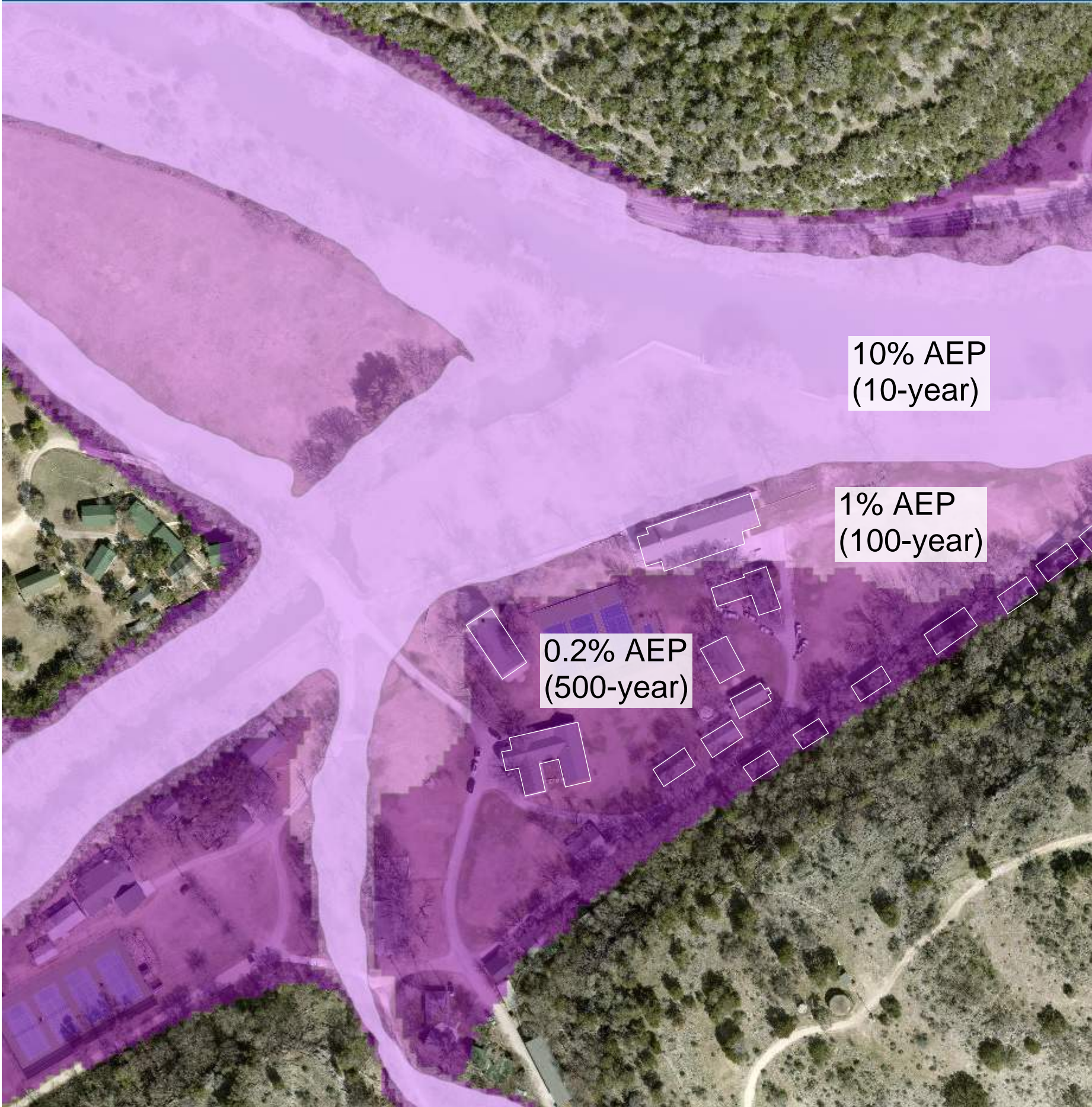


When overlaying the FEMA floodplain/floodway boundaries with the ground contours, I noticed that the FEMA FIRM map seems off. For example, FEMA shows the floodplain to extend into the hill behind the cabins which is significantly higher than the BFE and it also shows most of the cabins on senior hill to be in the floodplain. Also, the FEMA map does not show Hwy 39 to be in the floodplain even though it is near the BFE. It seems that the FEMA FIRM maps are using less accurate elevation data to generate the boundaries.

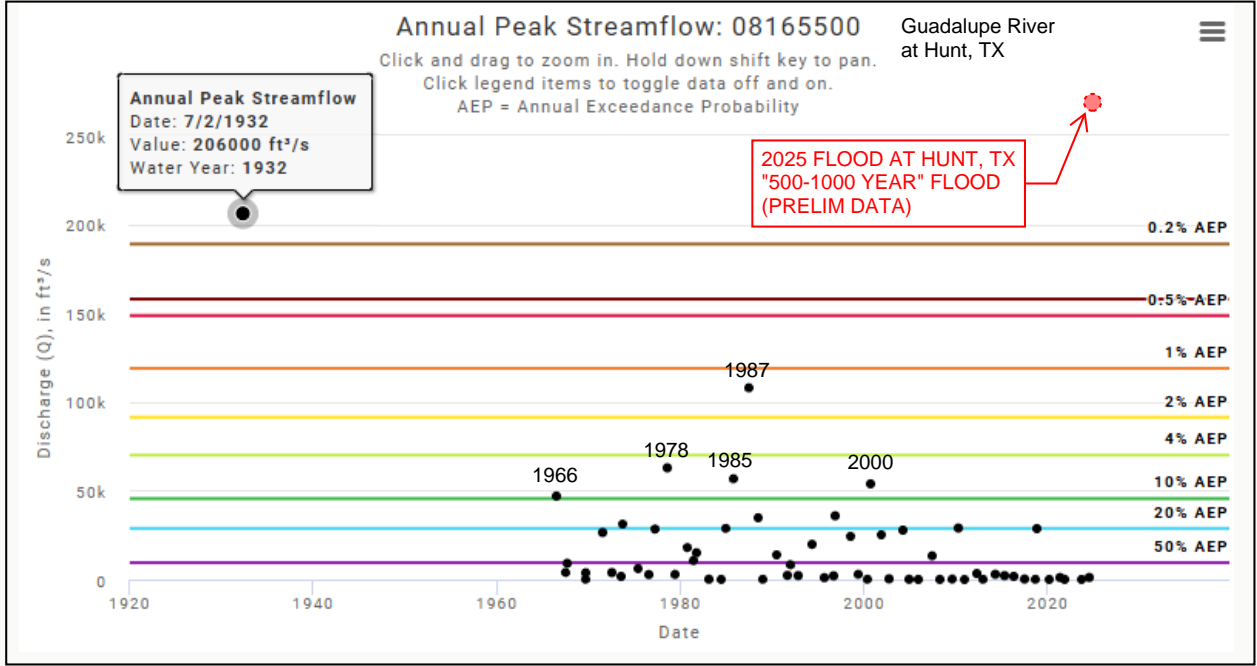
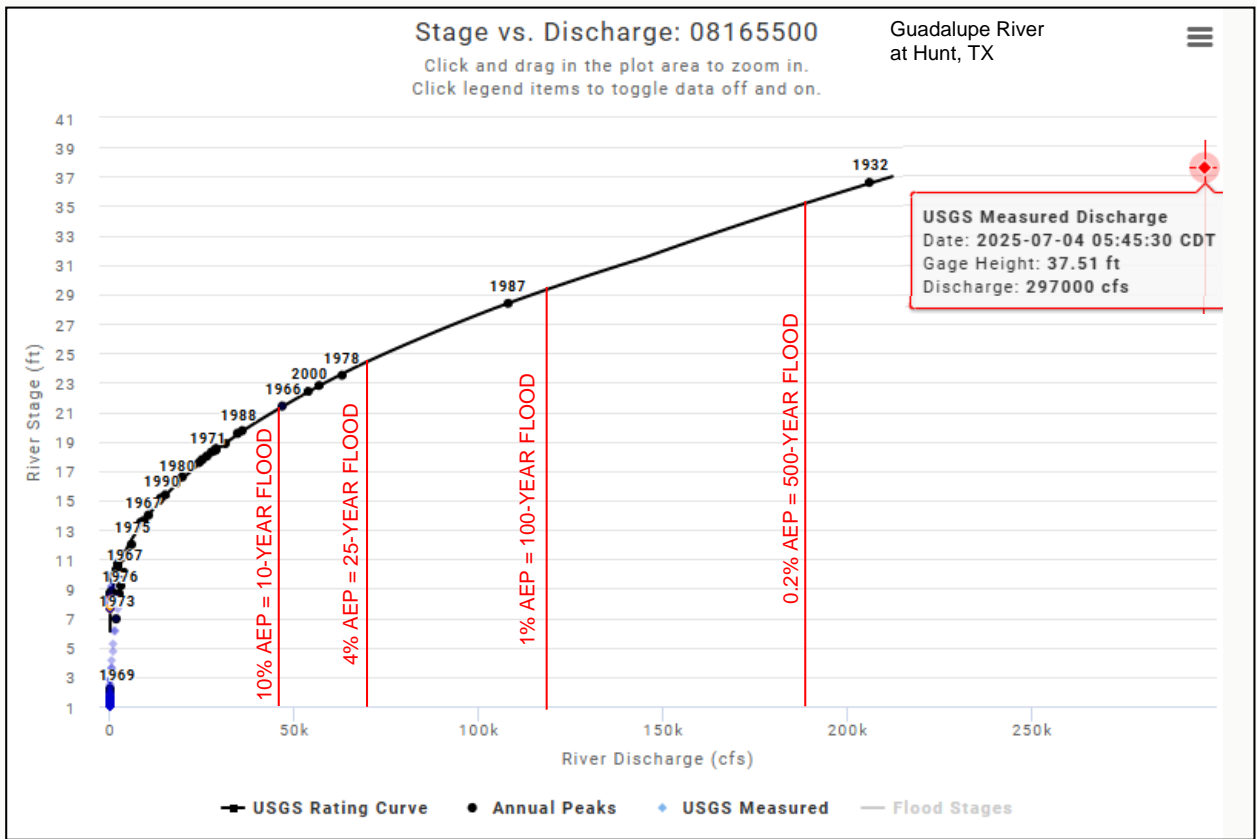


The online FEMA estBFE Viewer seems to show a more accurate depiction of the flood extents for a 100-year flood. As I have mentioned before, this was clearly an extreme flood event and probably closer to what FEMA currently considers a 500-year flood event. You can find the interactive map here: <https://webapps.usgs.gov/infrm/estbfe/>





2 Map View





REC HALL FLOOR
APPEARS TO BE
ABOVE THE BFE

Dinning
Hall
(2-story)

FLOOR OF DINING HALL
APPEARS TO BE AT OR
ABOVE THE BFE

FLOOR OF CABINS ARE
MUCH HIGHER THAN
THE GROUND & ABOVE
THE BFE

ACTUAL 100-YEAR FLOODPLAIN
BOUNDARY BASED ON LIDAR
ELEVATION DATA AND LATEST
HYDRAULICS MODELING.

Rec Hall
(2-story)

Office

Twins
1 & 2

Bubble
Inn

Giggle
Box

Wiggie
Inn

Chatter
Box

Nut
Hut

Jumble
House

Tumble
Inn

Hang
Out

Look
Inn

Bug
House

The current Kerr County Flood Damage Prevention order says new structures:
"shall have the lowest floor elevated one foot above the base flood level."
It appears that most if not all the existing cabins and buildings meet the current
elevation standards for new construction.

From the FEMA website about amending maps to "remove" structures from the floodplain:

"FEMA uses the most accurate flood hazard information available and applies rigorous standards in developing Flood Insurance Rate Maps (FIRMs). However, because of limitations of scale or topographic definition of the source maps used to prepare a FIRM, small areas may be inadvertently shown within a Special Flood Hazard Area (SFHA) even though the property is on natural ground and is at or above the elevation of the one-percent-annual-chance flood. This elevation is most commonly referred to as the Base Flood Elevation (BFE). Such cases are referred to as **"inadvertent inclusions."**

Recognizing that these situations do occur, FEMA established administrative procedures to change the designation for these properties on the FIRM. These processes are referred to as the Letter of Map Amendment (LOMA) process..."

The National Weather Service has issued Flash Flood Warnings at Camp Mystic on 91 different days in the last 25 years. As of 2009**, there have been 35 days where a Flash Flood Warning was issued at Camp Mystic. As you can see from the graph, most of those warnings amounted to a minimal rise.

**Historical data for NWS alerts goes back as far as 2000. Historical data for the daily max water rise at the flood gage in Hunt, TX is available back as far as 2009.

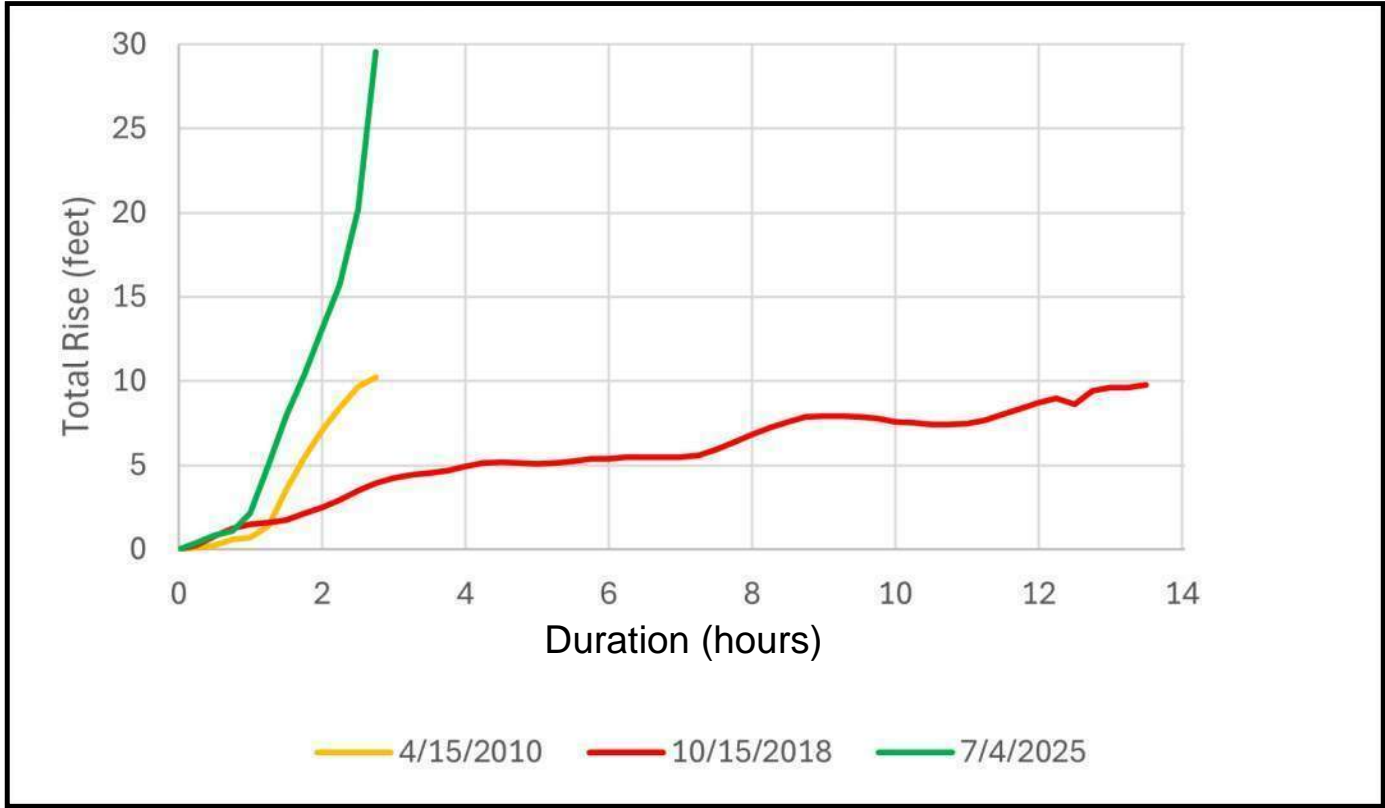
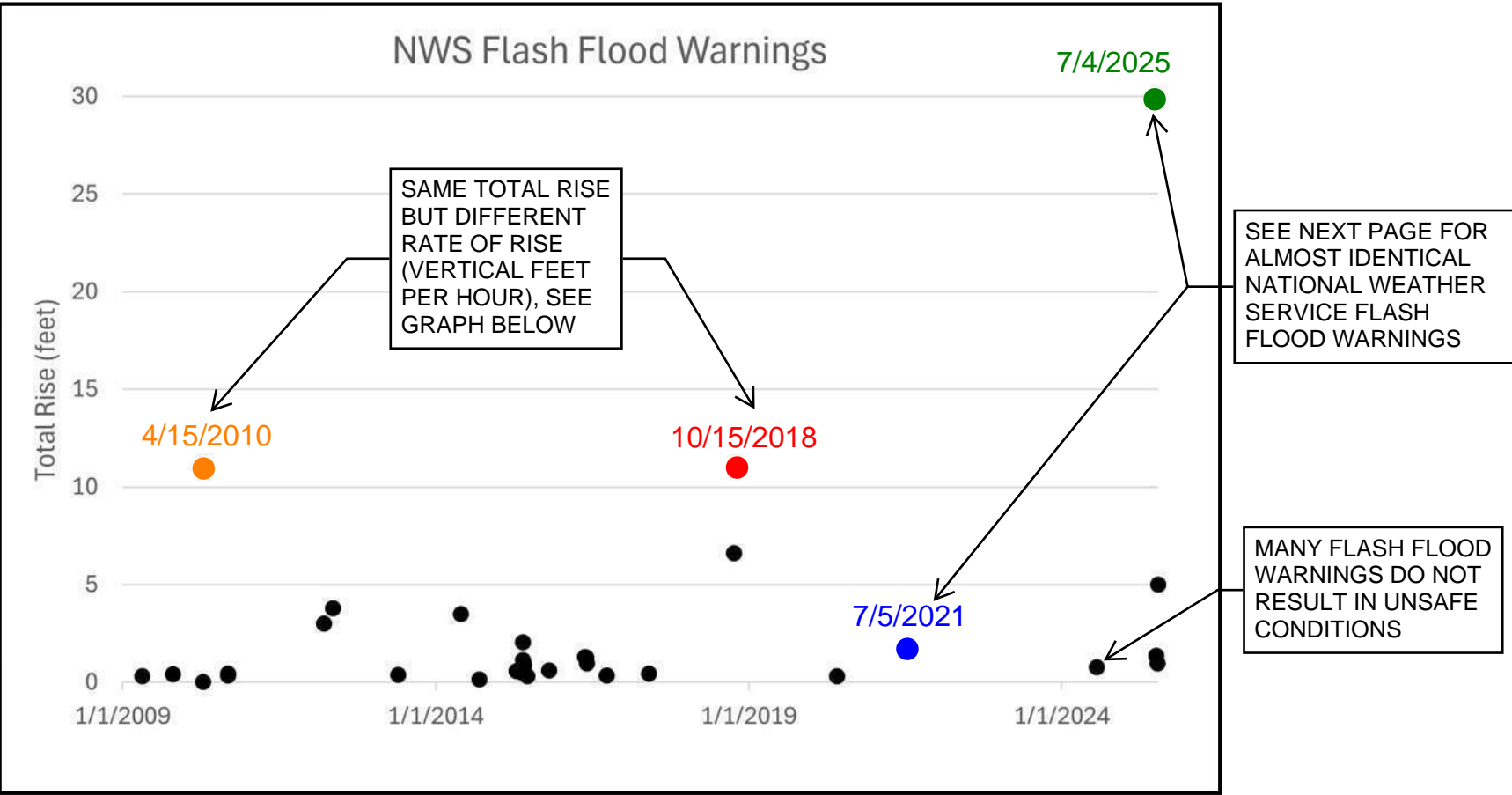
Looking at the flood data for the three dates with the largest rise in that timespan, you can see how each flood progresses differently.

- April 15, 2010: 10ft rise in about 2.75 hours
- October 15, 2018: 10ft rise in about 13.25 hours
- July 4, 2025: 30ft rise in about 2.75 hours

When looking at other Flash Flood Warnings, many are almost identical to the one that was issued at 1:14am on July 4, 2025. For example, an almost identical alert was issued 4 years prior and only resulted in 1.4 feet of rise in Hunt, TX.

Additionally, the weather forecast did not predict anywhere close to a 500-year rain event.

In summary, it is difficult to judge in real time whether a rainstorm poses an actual flood risk. It would not be reasonable to expect an immediate evacuation based on a simple Flash Flood Warning.



July 5, 2021 Flash Flood Warning

Total Rise = 1.4 feet (at Hunt flood gage)

BULLETIN - EAS ACTIVATION REQUESTED

Flash Flood Warning

National Weather Service Austin/San Antonio TX

516 PM CDT Mon Jul 5 2021

The National Weather Service in Austin/San Antonio has issued a

* Flash Flood Warning for...

Southwestern Gillespie County in south central Texas...

Central Kerr County in south central Texas...

* Until 830 PM CDT.

* At 516 PM CDT, Doppler radar indicated thunderstorms producing heavy rain across the warned area. Between 2 and 3 inches of rain have fallen. Additional rainfall amounts of 1 to 2 inches are possible in the warned area. Flash flooding is ongoing or expected to begin shortly.

HAZARD...Life threatening flash flooding. Thunderstorms producing flash flooding.

SOURCE...Radar.

IMPACT...Life threatening flash flooding of creeks and streams, urban areas, highways, streets and underpasses.

* Some locations that will experience flash flooding include...
Kerrville, Ingram, Hunt, Waltonia, Mountain Home, Kerr Wildlife Management Area, Harper and Kerrville-Schreiner Park.

July 4, 2025 Flash Flood Warning

Total Rise = 29.9 feet (at Hunt flood gage)

BULLETIN - EAS ACTIVATION REQUESTED

Flash Flood Warning

National Weather Service Austin/San Antonio TX

114 AM CDT Fri Jul 4 2025

The National Weather Service in Austin/San Antonio has issued a

* Flash Flood Warning for...

Northwestern Bandera County in south central Texas...

Central Kerr County in south central Texas...

* Until 415 AM CDT.

* At 114 AM CDT, Doppler radar indicated thunderstorms producing heavy rain across the warned area. Between 1 and 2 inches of rain have fallen. The expected rainfall rate is 2 to 3 inches in 1 hour. Additional rainfall amounts of 1 to 3 inches are possible in the warned area. Flash flooding is ongoing or expected to begin shortly.

HAZARD...Life threatening flash flooding. Thunderstorms producing flash flooding.

SOURCE...Radar.

IMPACT...Life threatening flash flooding of creeks and streams, urban areas, highways, streets and underpasses.

* Some locations that will experience flash flooding include...
Kerrville, Ingram, Hunt, Waltonia, Kerr Wildlife Management Area and Lost Maples State Natural Area.

3:19 AM (Projected to be a 5-year flood)

TXC265-050230-
/O.NEW.KEWX.FL.W.0012.250704T0819Z-250705T0649Z/
/HNTT2.2.ER.250704T0759Z.250704T1100Z.250704T1848Z.NO/
319 AM CDT Fri Jul 4 2025

...FLOOD WARNING IN EFFECT FROM EARLY THIS MORNING TO JUST AFTER MIDNIGHT TONIGHT...

* WHAT...Minor flooding is occurring and moderate flooding is forecast.

* WHERE...Guadalupe River at Hunt.

* WHEN...From early this morning to just after midnight tonight.

* IMPACTS...At 18.0 feet, Automobiles parked near the North Fork of the Guadalupe River at Camp Waldemar wash downstream. Roads and low bridges near the North and South Forks flood badly and are dangerous to motorists. The Highway 39 bridge floor near Hunt is under six feet of water. Some residents are cut off and should stay put. Secondary roads and bridges near the river are extremely dangerous to motorists. Near the USGS 1:5 year flood level.

* ADDITIONAL DETAILS...

- At 3:05 AM CDT Friday the stage was 11.0 feet.
- Bankfull stage is 10.0 feet.
- Recent Activity...The maximum river stage in the 24 hours ending at 3:05 AM CDT Friday was 11.0 feet.
- Forecast...The river is expected to rise to a crest of 16.6 feet this morning. It will then fall below flood stage this afternoon.
- Flood stage is 10.0 feet.
- Flood History...This crest compares to a previous crest of 16.6 feet on 05/13/1994.
- http://www.weather.gov/safety/flood

3:33 AM (Projected to be a 10-year flood)

TXC265-050245-
/O.EXT.KEWX.FL.W.0012.000000T0000Z-250705T0530Z/
/HNTT2.2.ER.250704T0759Z.250704T1100Z.250704T1730Z.NO/
333 AM CDT Fri Jul 4 2025

...FLOOD WARNING NOW IN EFFECT UNTIL JUST AFTER MIDNIGHT TONIGHT...

* WHAT...Moderate flooding is occurring and moderate flooding is forecast.

* WHERE...Guadalupe River at Hunt.

* WHEN...Until just after midnight tonight.

* IMPACTS...At 22.0 feet, Major flooding of low areas of recreation camps along the North and South Forks washes canoes and gear downstream from docks and low areas. Roads near the river, including along Highway 39, are extremely dangerous for auto traffic and travel is highly discouraged. Autos in low areas of Camp Waldemar are swept downstream. Flow is near the USGS 1:10 year flood level.

* ADDITIONAL DETAILS...

- At 3:20 AM CDT Friday the stage was 14.0 feet.
- Bankfull stage is 10.0 feet.
- Recent Activity...The maximum river stage in the 24 hours ending at 3:20 AM CDT Friday was 14.0 feet.
- Forecast...The river is expected to rise to a crest of 20.2 feet this morning. It will then fall below flood stage this afternoon.
- Flood stage is 10.0 feet.
- Flood History...This crest compares to a previous crest of 19.9 feet on 09/26/1986.
- http://www.weather.gov/safety/flood

4:00 AM (Projected to be similar to 1978 flood) (25-year flood)

TXC265-050300-
/O.EXT.KEWX.FL.W.0012.000000T0000Z-250705T0615Z/
/HNTT2.3.ER.250704T0759Z.250704T1100Z.250704T1815Z.NO/
400 AM CDT Fri Jul 4 2025

...FLOOD WARNING NOW IN EFFECT UNTIL JUST AFTER MIDNIGHT TONIGHT...

* WHAT...Moderate flooding is occurring and major flooding is forecast.

* WHERE...Guadalupe River at Hunt.

* WHEN...Until just after midnight tonight.

* IMPACTS...At 25.0 feet, Major flooding severely floods resort camps along the South Fork below the River Inn resort to Hunt. Parts of Highway 39 are flooded and very dangerous as well as numerous secondary roads and bridges. Areas in the flood plain are cut off. Residents cut off by Highay 39 flooding should stay put rather than drive on extremely dangerous roads escaping. Lowest homes downstream near Center Point will flood.

* ADDITIONAL DETAILS...

- At 3:50 AM CDT Friday the stage was 19.4 feet.
- Bankfull stage is 10.0 feet.
- Recent Activity...The maximum river stage in the 24 hours ending at 3:50 AM CDT Friday was 19.4 feet.
- Forecast...The river is expected to rise to a crest of 23.8 feet this morning. It will then fall below flood stage this afternoon.
- Flood stage is 10.0 feet.
- Flood History...This crest compares to a previous crest of 23.5 feet on 08/02/1978.
- http://www.weather.gov/safety/flood

4:45 AM (Projected to exceed 1987 flood) (100-year flood)

TXC265-050345-
/O.EXT.KEWX.FL.W.0012.000000T0000Z-250705T0715Z/
/HNTT2.3.ER.250704T0759Z.250704T1100Z.250704T1915Z.NO/
445 AM CDT Fri Jul 4 2025

...FLOOD WARNING NOW IN EFFECT UNTIL JUST AFTER MIDNIGHT TONIGHT...

* WHAT...Major flooding is occurring and major flooding is forecast.

* WHERE...Guadalupe River at Hunt.

* WHEN...Until just after midnight tonight.

* IMPACTS...At 28.0 feet, Life threatening flooding puts water to the roofs of lowest facilities and dwellings of resort camps along the South Fork above River Inn to Hunt. Roads near the river are deadly to auto travel. Lowest homes will flood in the North Fork as well as outbuildings, tennis courts and swimming pools. Lowest homes near Center Point and below to Comfort flood. Flow exceeds the USGS 1:25 year flood.

* ADDITIONAL DETAILS...

- At 4:35 AM CDT Friday the stage was 29.5 feet.
- Bankfull stage is 10.0 feet.
- Recent Activity...The maximum river stage in the 24 hours ending at 4:35 AM CDT Friday was 29.5 feet.
- Forecast...The river is expected to rise to a crest of 29.9 feet this morning. It will then fall below flood stage this afternoon.
- Flood stage is 10.0 feet.
- Flood History...This crest compares to a previous crest of 28.4 feet on 07/17/1987.
- http://www.weather.gov/safety/flood

5:01 AM (Projected to greatly exceed 1987 flood) (almost 500-year flood)

TXC265-050415-
/O.CON.KEWX.FL.W.0012.000000T0000Z-250705T0715Z/
/HNTT2.3.ER.250704T0759Z.250704T1100Z.250704T1915Z.NO/
501 AM CDT Fri Jul 4 2025

...FLOOD WARNING REMAINS IN EFFECT UNTIL JUST AFTER MIDNIGHT TONIGHT...

* WHAT...Major flooding is occurring and major flooding is forecast.

* WHERE...Guadalupe River at Hunt.

* WHEN...Until just after midnight tonight.

* IMPACTS...At 32.0 feet, Disastrous life threatening flooding puts water over the roads of lowest camps and resorts from the headwaters of the North and South Forks to below Comfort. Much of Highways 27 and 39 will flood as the disastrous flood wave moves downstream over the next several hours. Motorists should avoid any travel in the flood plain. Low residences above Center Point to below Comfort will flood. Many homes and businesses in Kerrville will flood.

* ADDITIONAL DETAILS...

- At 4:35 AM CDT Friday the stage was 29.5 feet.
- Bankfull stage is 10.0 feet.
- Recent Activity...The maximum river stage in the 24 hours ending at 4:35 AM CDT Friday was 29.5 feet.
- Forecast...The river is expected to rise to a crest of 33.9 feet this morning. It will then fall below flood stage this afternoon.
- Flood stage is 10.0 feet.
- Flood History...No available flood history.
- http://www.weather.gov/safety/flood

6:03 AM

TXC265-050515-
/O.EXT.KEWX.FL.W.0012.000000T0000Z-250705T0848Z/
/HNTT2.3.ER.250704T0759Z.250704T1200Z.250704T2048Z.NO/
603 AM CDT Fri Jul 4 2025

...FLOOD WARNING NOW IN EFFECT UNTIL LATE TONIGHT...

* WHAT...Major flooding is occurring and major flooding is forecast.

* WHERE...Guadalupe River at Hunt.

* WHEN...Until late tonight.

* ADDITIONAL DETAILS...

- At 4:35 AM CDT Friday the stage was 29.5 feet.
- Bankfull stage is 10.0 feet.
- Recent Activity...The maximum river stage in the 24 hours ending at 4:35 AM CDT Friday was 29.5 feet.
- Forecast...The river will oscillate above flood stage with a maximum value of 34.1 feet this morning. It will fall below flood stage late this afternoon.
- Flood stage is 10.0 feet.
- Flood History...No available flood history.
- http://www.weather.gov/safety/flood

