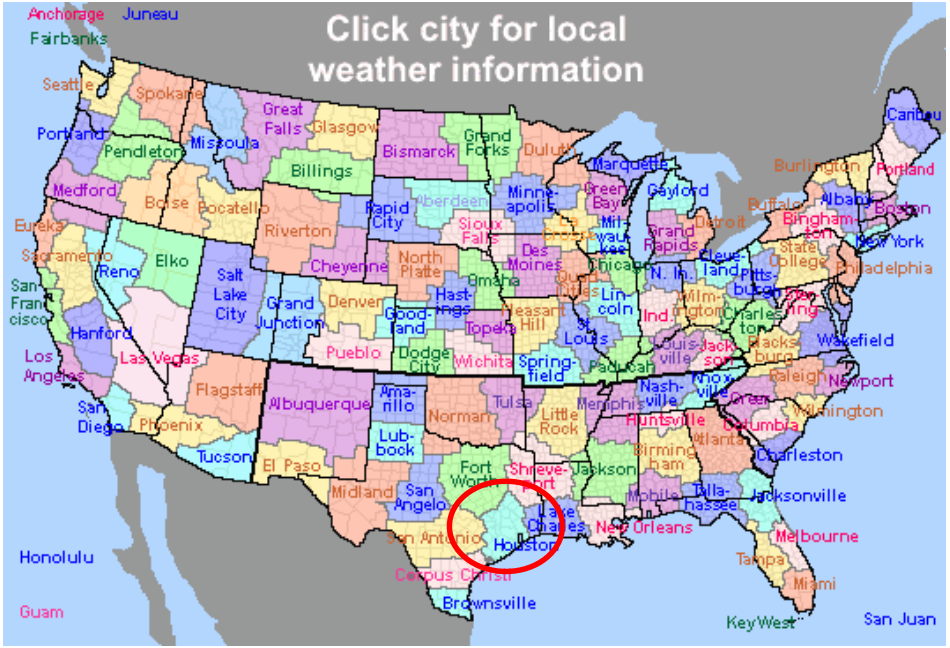
2018 FloodWarn Training

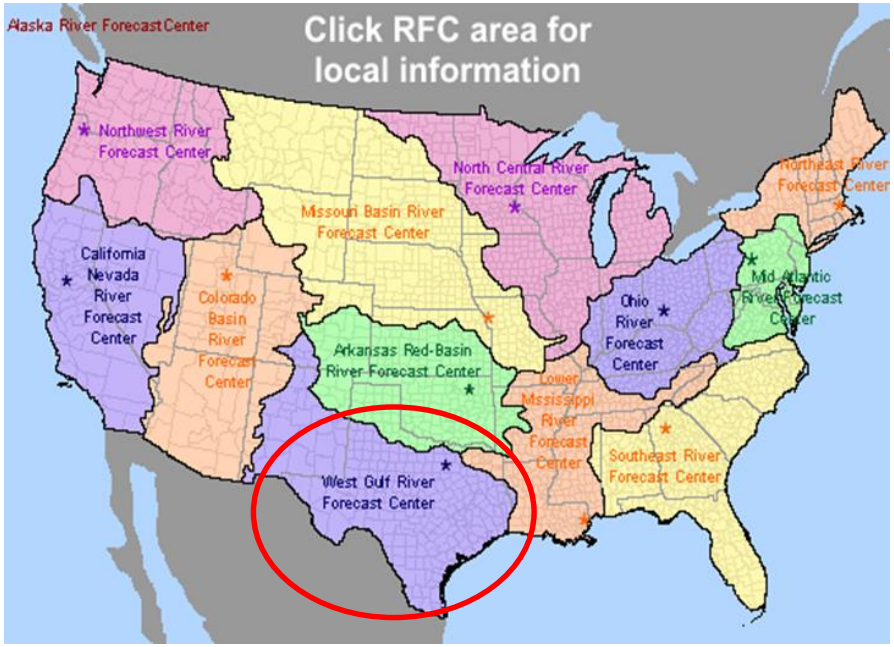
Katie Landry-Guyton
Senior Service Hydrologist/Meteorologist
National Weather Service- Houston/Galveston, TX

National Weather Service

Weather Forecast Offices



River Forecast Centers



Outline

Flooding Importance

Flooding Types and Causes

Flood Products

River Flooding

Partners

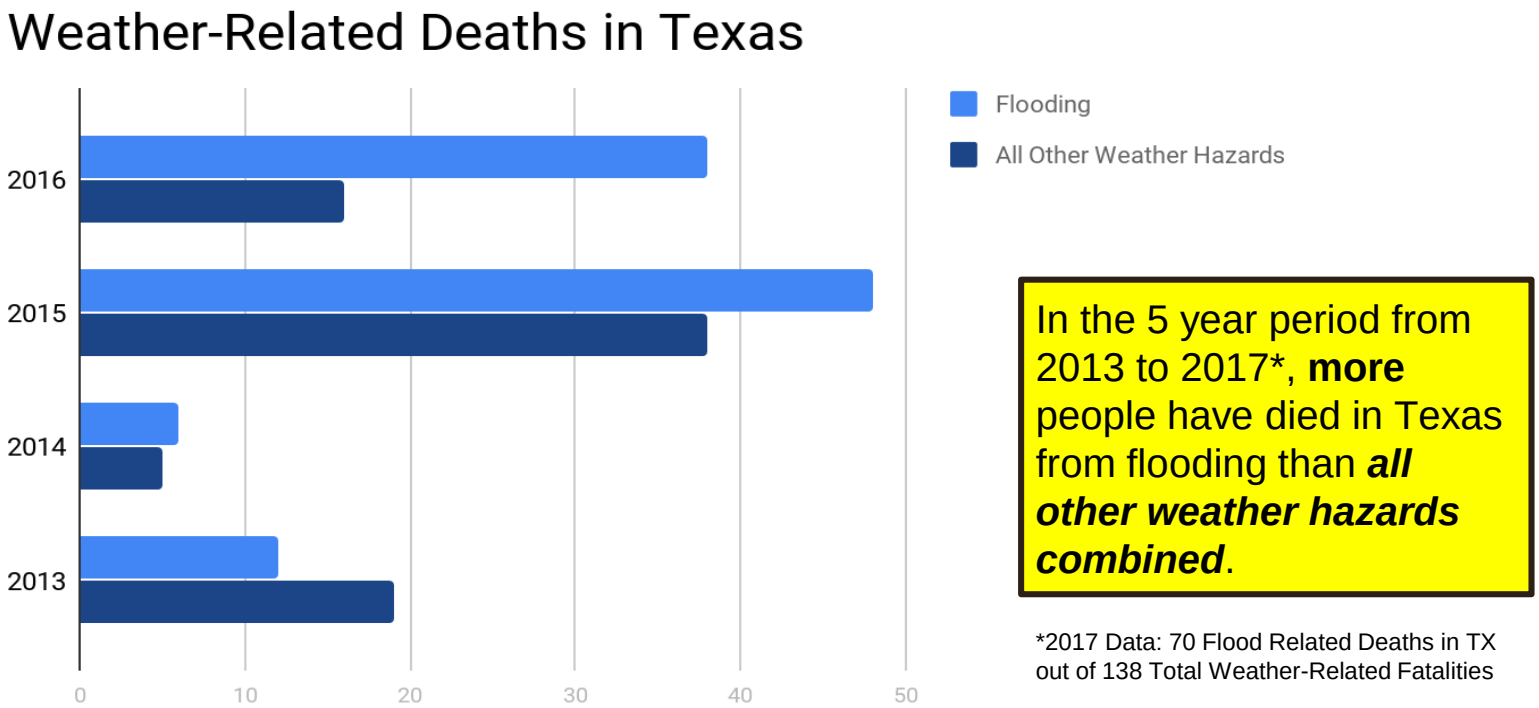
Flood Safety

Reporting Flooding

Flood Risk

Flooding Importance

Flooding is Deadly!

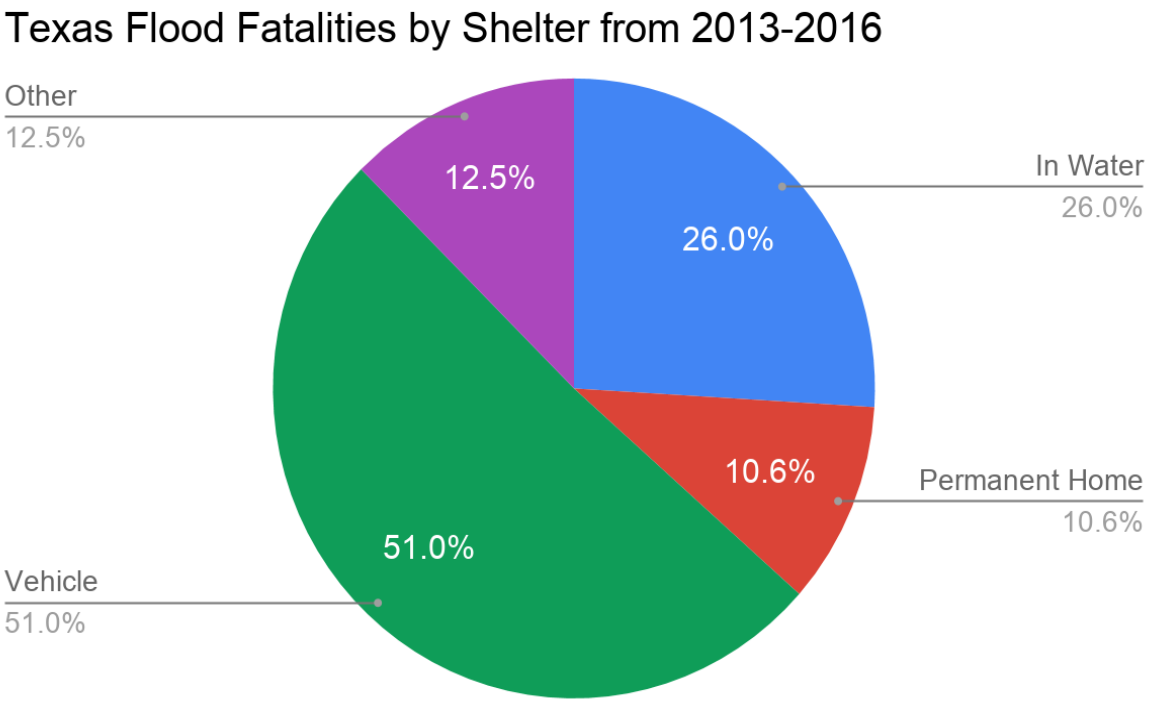


In the 5 year period from 2013 to 2017*, **more** people have died in Texas from flooding than ***all other weather hazards combined***.

*2017 Data: 70 Flood Related Deaths in TX out of 138 Total Weather-Related Fatalities

Data from NWS National Hazard Statistics

Flood Fatalities



Over half of the flood fatalities in Texas occurred while people were in their car.

Data from NWS National Hazard Statistics

Houston Floods: April 18, 2016

Recent Big Floods…

Memorial Day 2015

Tax Day 2016

Brenham 2016

Harvey 2017


Tax Day 2016


Brenham 2016


Harvey 2017

And other historic floods…

Tropical Storm Allison

1994 Flood

Tropical Storm Claudette

Flooding Types and Causes

What Causes Flooding?

- Intense rainfall
- Rain over several days
- Dam/levee failures
- High tides or storm surge
- Snowmelt
- Ice or debris jams

Types of Flooding

Ponding & Sheet Flow Flooding

Flooding that occurs gradually over time, usually 6 hours after the rain begins or longer (longer duration)

Flash Flooding

Flooding that develops quickly (typically 6 hours or less) either from heavy rainfall or dam/levee failure (shorter duration).

River Flooding

Flooding that occurs from water escaping river banks.

Coastal Flooding

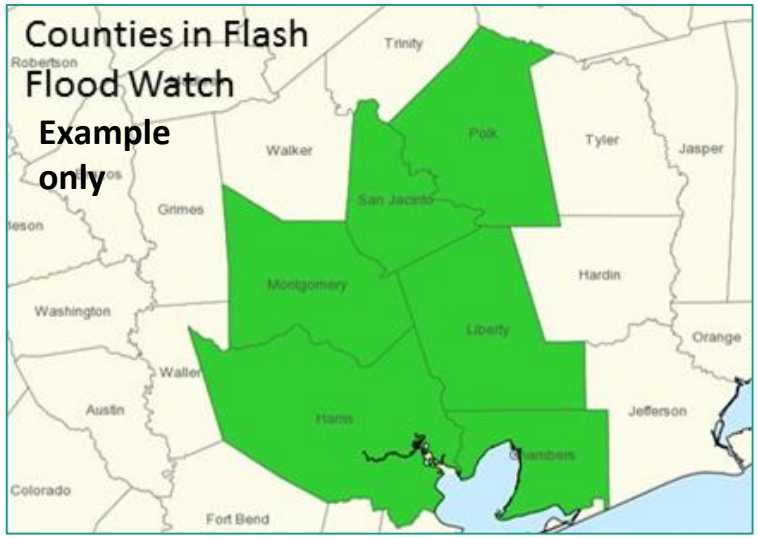
Flooding along a coastline either from high tides or storm surge during a tropical storm or hurricane

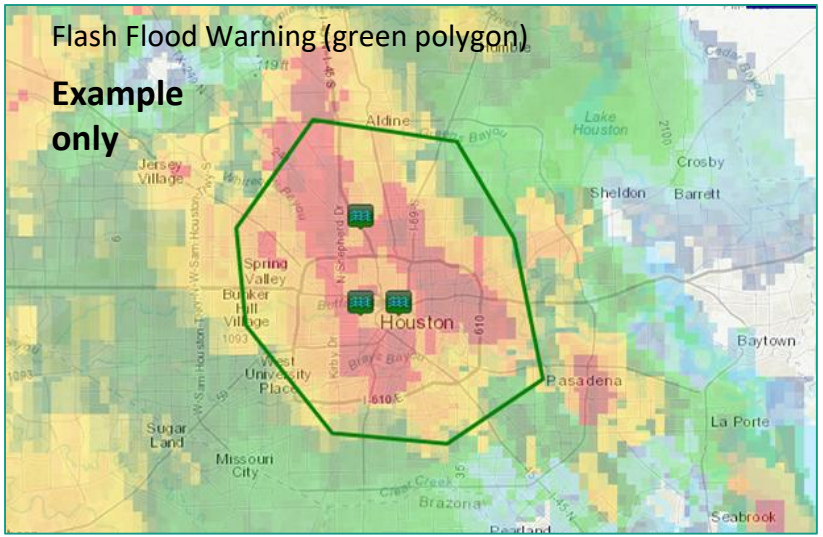
Flood Products

Watch vs Warning

A Watch is issued when conditions are favorable to occur.

A Warning is issued when the threat is *occurring or imminent*, threatening life or property.





Flood vs. Flash Flood

A **Flood** is an overflow of water onto normally dry land likely caused by rising water in a river/bayou or poor drainage. Flooding is a longer term event than flash flooding. It may last days or weeks.

A **Flash Flood** is a flood caused by heavy or excessive rainfall in a short period of time, typically 6 hours or less. Flash floods are defined as:

- ≥ 3 feet of standing water (less if threatening life or property), and/or
- ≥ 6 inches of fast flowing water across a road or bridge, or
- Water in a stream or bayou flowing rapidly out of its banks, or
- A dam break (even on a sunny day)

Understanding Flooding

Urban / Small Stream Advisory	*Flood Watch*	*Flash Flood Watch*	*Flood Warning*	*Flash Flood Warning*	*Flash Flood Emergency*
WHAT IS IT? Flooding of small streams, streets and low-lying areas. **WHAT TO DO?** Stay away from areas that are prone to flooding and stay clear of rapidly moving water	**WHAT IS IT?** Flooding is possible – typically within a 6 to 48 hours before rain is expected to reach the area. **WHAT TO DO?** Stay tuned to local river forecasts; prepare for areas near rivers to spread towards nearby roads and buildings	**WHAT IS IT?** Flash flooding is possible –typically 6 to 48 hours before rain is expected to reach the area. **WHAT TO DO?** Have a way to receive local warnings, expect hazardous travel conditions and have alternate routes available	**WHAT IS IT?** Flooding impacts are occurring or imminent. **WHAT TO DO?** Stay ***alert*** for inundated roadways and follow all local signage! Additional impacts include homes and structures could become flooded and need to be evacuated	**WHAT IS IT?** Flash flooding impacts are occurring or imminent. **WHAT TO DO?** Conditions will ***rapidly*** become hazardous! Do not cross flooded roadways or approach inundated areas as water may still be rising	**WHAT IS IT?** Flash flood situation that presents a clear threat to human life due to extremely dangerous flooding conditions **WHAT TO DO?** ***Immediately*** reach higher ground by any means possible

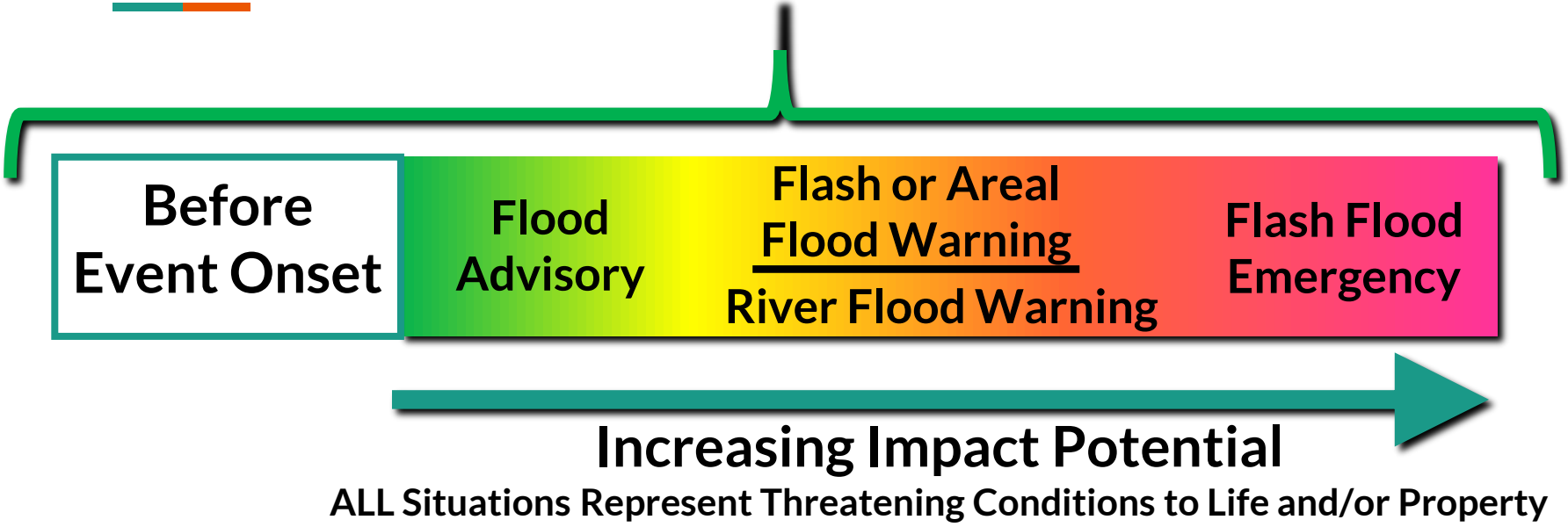
Urban / Small Stream Flood Advisory

Flash Flood Warning

Flash Flood Emergency

Flood Warning (Areal/ River/ Bayou)

Flood Timeline



ALL Situations Represent Threatening Conditions to Life and/or Property

Note: Flooding can (and does) occur without a Flash Flood Watch!

Be sure to have multiple ways to receive warnings.

Ways to Receive a Warning

NOAA Weather Radio

Wireless Emergency Alerts and Weather Apps

TV and Radio

Social Media

NWS Website: https://www.weather.gov/hgx/

River Flooding

Llano River Flooding

River Flooding

River flooding occurs when water escapes the river banks. There are different thresholds for river flooding: action, minor, moderate, major and record flooding. This image depicts what a river flooding looks like.

Understanding River Criteria Levels

BELOW CRITERIA

Impact: Water is within the banks of the river with no impacts to the surrounding area. Flow speeds may still be high during rainfall or releases which could impact recreational activities

ACTION

Impact: Water is over the banks and into the flood plain, but not a threat to structures or roadways. Some action may be required such as moving farm equipment or increasing awareness

MINOR

Impact: Typically water is impacting areas inside of floodplain which can vary by location. Some low water crossings covered by water, agricultural flooding, water approaching public areas (parks, sidewalks etc.). Areas frequently flooded can expect to be impacted

MODERATE

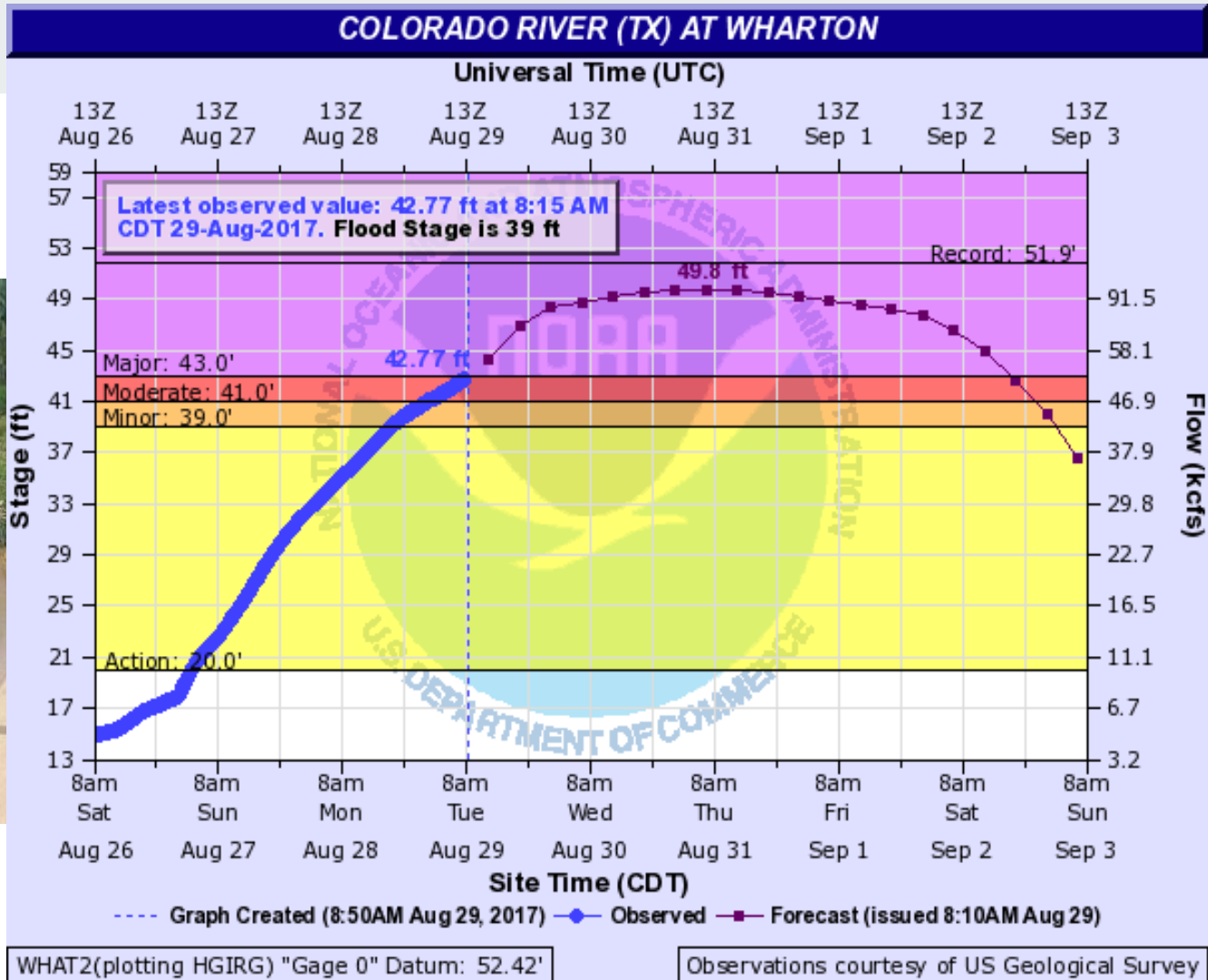
Impact: Water now reaching areas only impacted by significant rain events. Structures can be inundated, several roads covered with water, water may cut off certain areas, widespread agricultural flooding.

MAJOR

Impact: Water is near the highest it's ever been representing rare flooding and significant widespread impacts. Most roads will be covered by water in the area cutting off if not completely flooding subdivisions, rivers can be several miles wide in areas. Homes and structures underwater, bridges inundated and in danger of being hit by debris. Impacts may be greater than ever experienced.

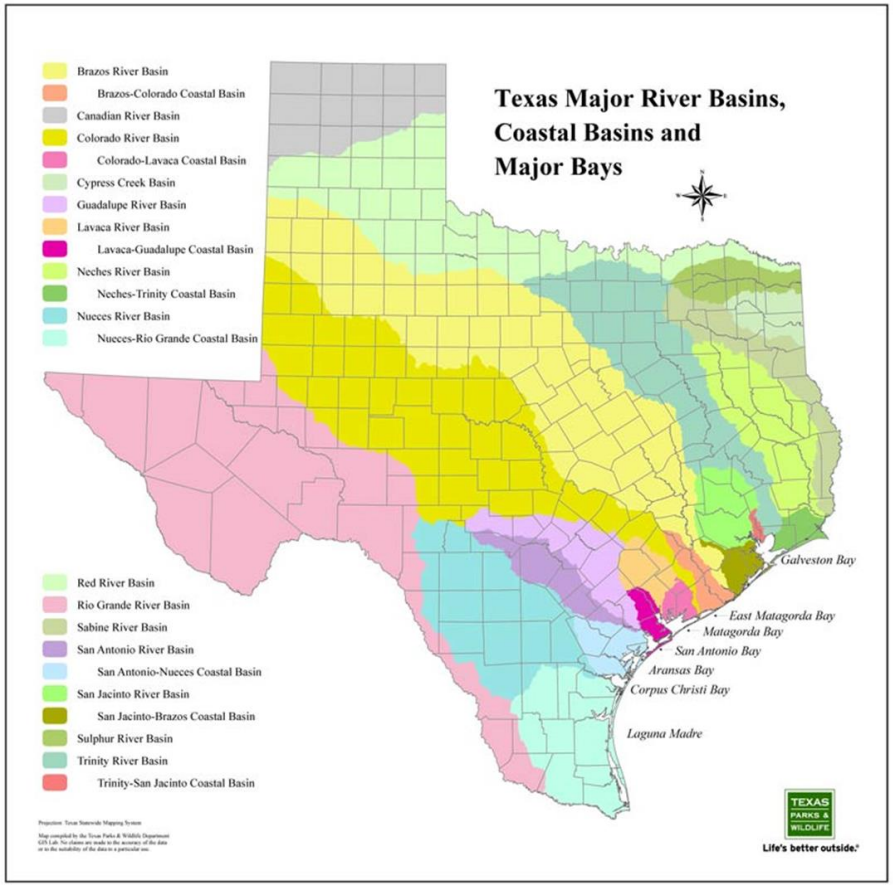
Hydrograph


USGS

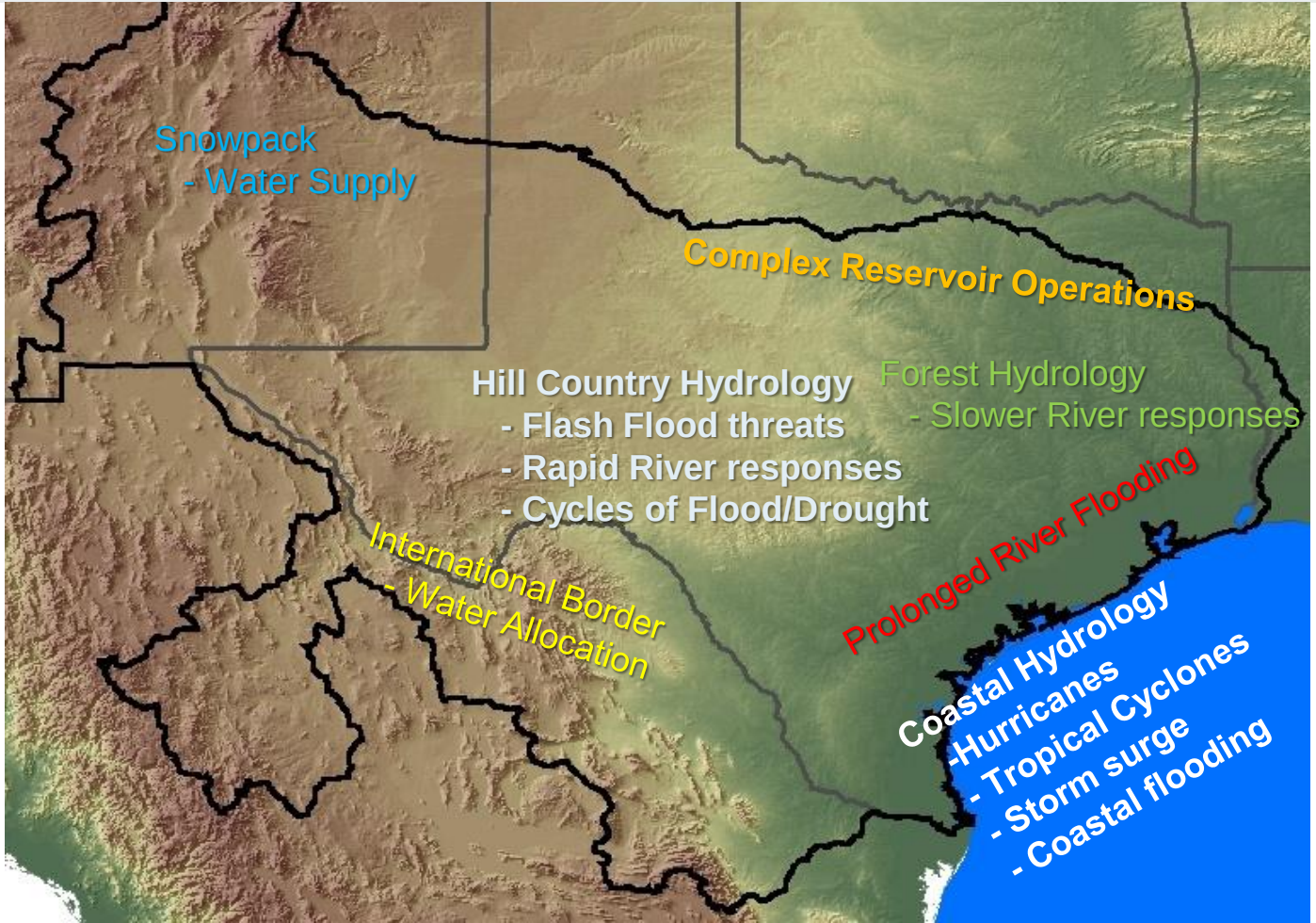

COLORADO RIVER (TX) AT WHARTON
Universal Time (UTC)
13Z Aug 26
13Z Aug 27
13Z Aug 28
13Z Aug 29
13Z Aug 30
13Z Aug 31
13Z Sep 1
13Z Sep 2
13Z Sep 3
Latest observed value: 42.77 ft at 8:15 AM CDT 29-Aug-2017. Flood Stage is 39 ft
Record: 51.9'
49.8 ft
42.77 ft
Major: 43.0'
Moderate: 41.0'
Minor: 39.0'
Action: 20.0'
Stage (ft)
59
57
53
49
45
41
37
33
29
25
21
17
13
Flow (kcfs)
91.5
58.1
46.9
37.9
29.8
22.7
16.5
11.1
6.7
3.2
8am Sat Aug 26
8am Sun Aug 27
8am Mon Aug 28
8am Tue Aug 29
8am Wed Aug 30
8am Thu Aug 31
8am Fri Sep 1
8am Sat Sep 2
8am Sun Sep 3
Site Time (CDT)
Graph Created (8:50AM Aug 29, 2017)
Observed
Forecast (issued 8:10AM Aug 29)
WHAT2(plotting HGIRG) "Gage 0" Datum: 52.42'
Observations courtesy of US Geological Survey

Watershed

- A watershed, or basin, is an area of land that drains runoff from rainfall (stormwater) to a body of water, either a river, bayou, creek, or lake.
- A watershed can flow into another watershed.
- Watersheds vary in shape and size which ultimately lead to unique challenges.
- Topography plays a big role in how watershed boundaries are defined.



Diverse Watershed Characteristics in Texas



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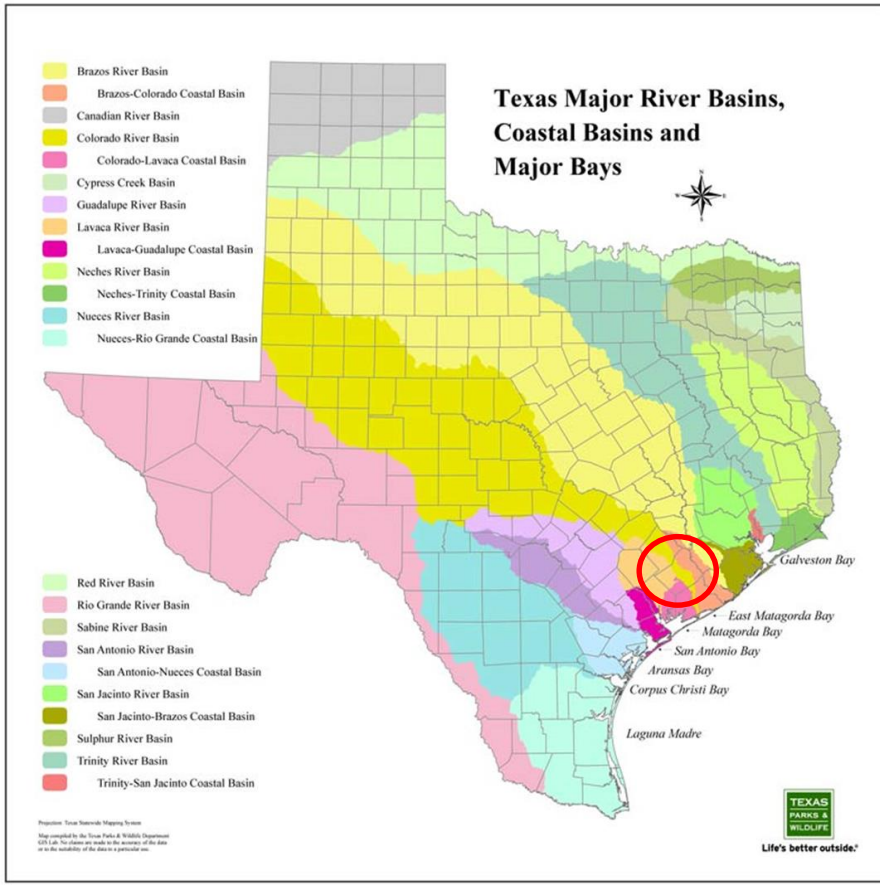
- Wharton County deals with 4 primary watersheds: Colorado River, San Bernard River, Lavaca River, and Tres Palacios River



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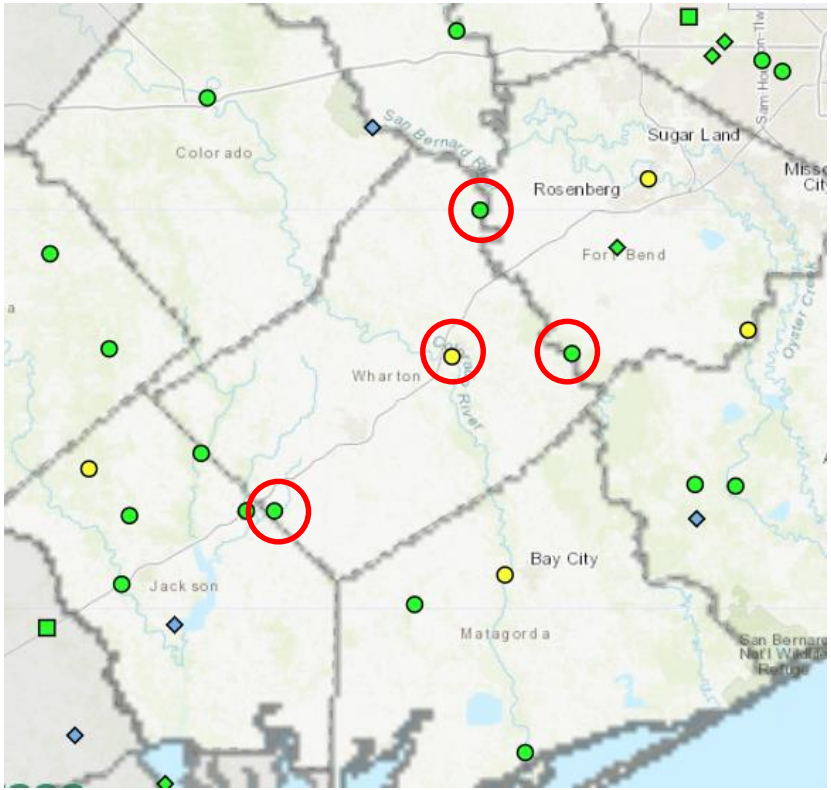
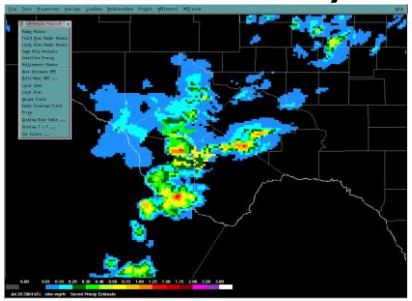
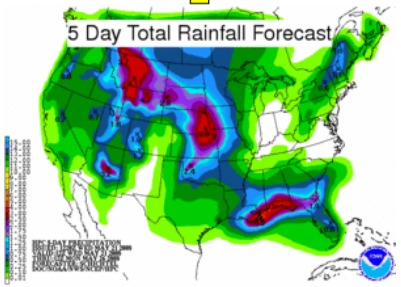
- Wharton County deals with 4 primary watersheds: Colorado River, San Bernard River, Lavaca River, and Tres Palacios River
- NWS issues river forecasts for 4 sites in Wharton County.



River Forecast Process

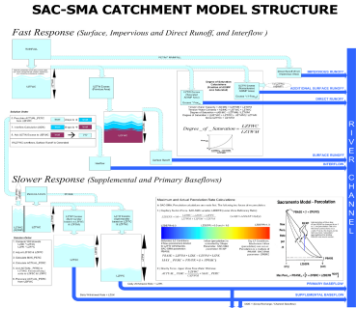
Rainfall Analysis

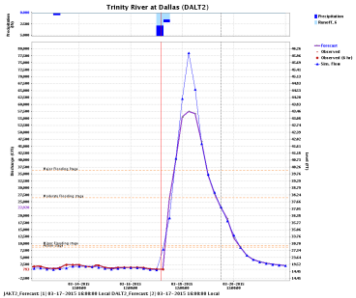




Rainfall estimates and forecasts merged into continuous dataset

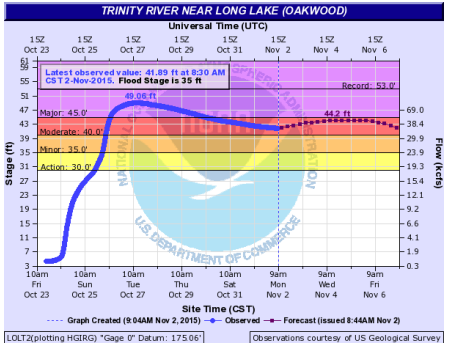
Hydrologic Modeling





Rainfall ingested into hydrologic model. Forecasters adjust model parameters in real time

Forecast



Warning

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FLOOD WARNING
NATIONAL WEATHER SERVICE HOUSTON/GALVESTON, TX
926 PM CDT THU MAY 26 2016

...The National Weather Service in Houston/Galveston has issued a flood warning
for the following rivers...

Brazos River In Richmond affecting the following counties in Texas...Austin
and Fort Bend

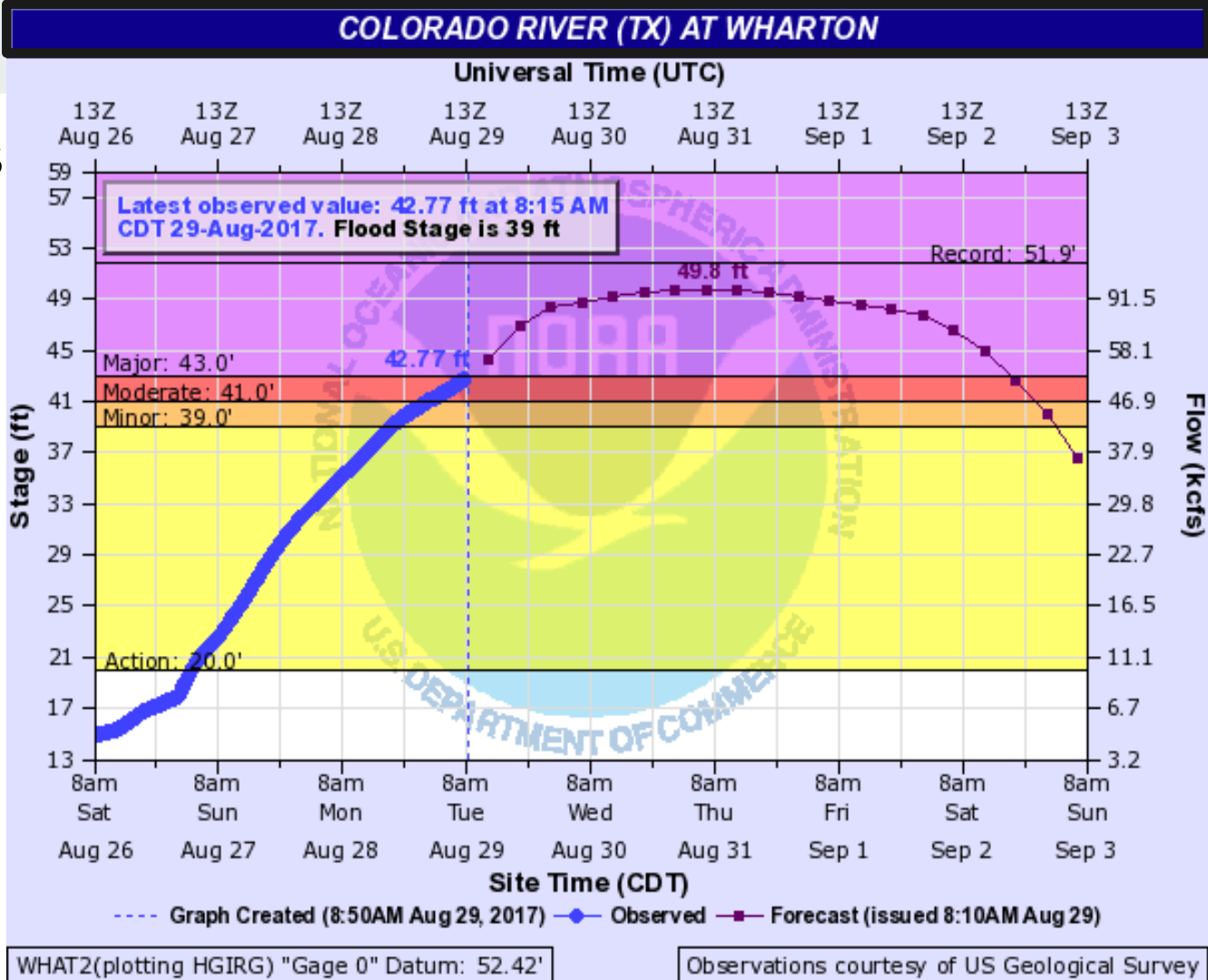
TXC015-039-157-473-271425-
/O.NEW.KHGX.FL.W.0149.160529T0730Z-000000T0000Z/
/RMOT2.1.ER.160529T0730Z.160531T0600Z.000000T0000Z.NO/
926 PM CDT THU MAY 26 2016

The National Weather Service in Houston/Galveston has issued a

* Flood Warning for
  The Brazos River In Richmond.
* from late Saturday night until further notice...or until the warning is
  canceled.
```

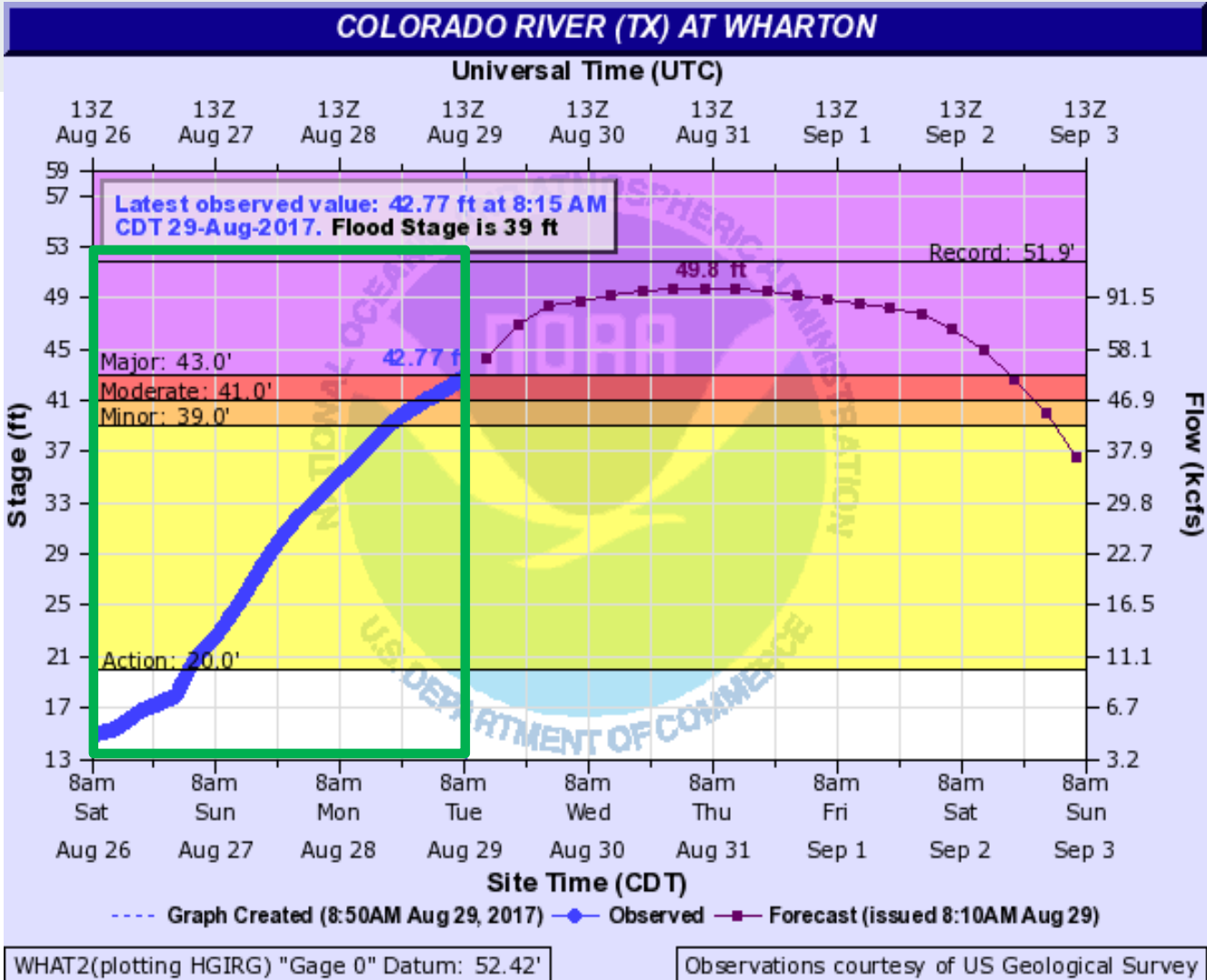
Hydrograph Basics

LOCATION:
Of the gage the forecast is made, AT means the gage is in the limits of the town/city, NEAR or NR means that town/city has the closest post office



Hydrograph Basics

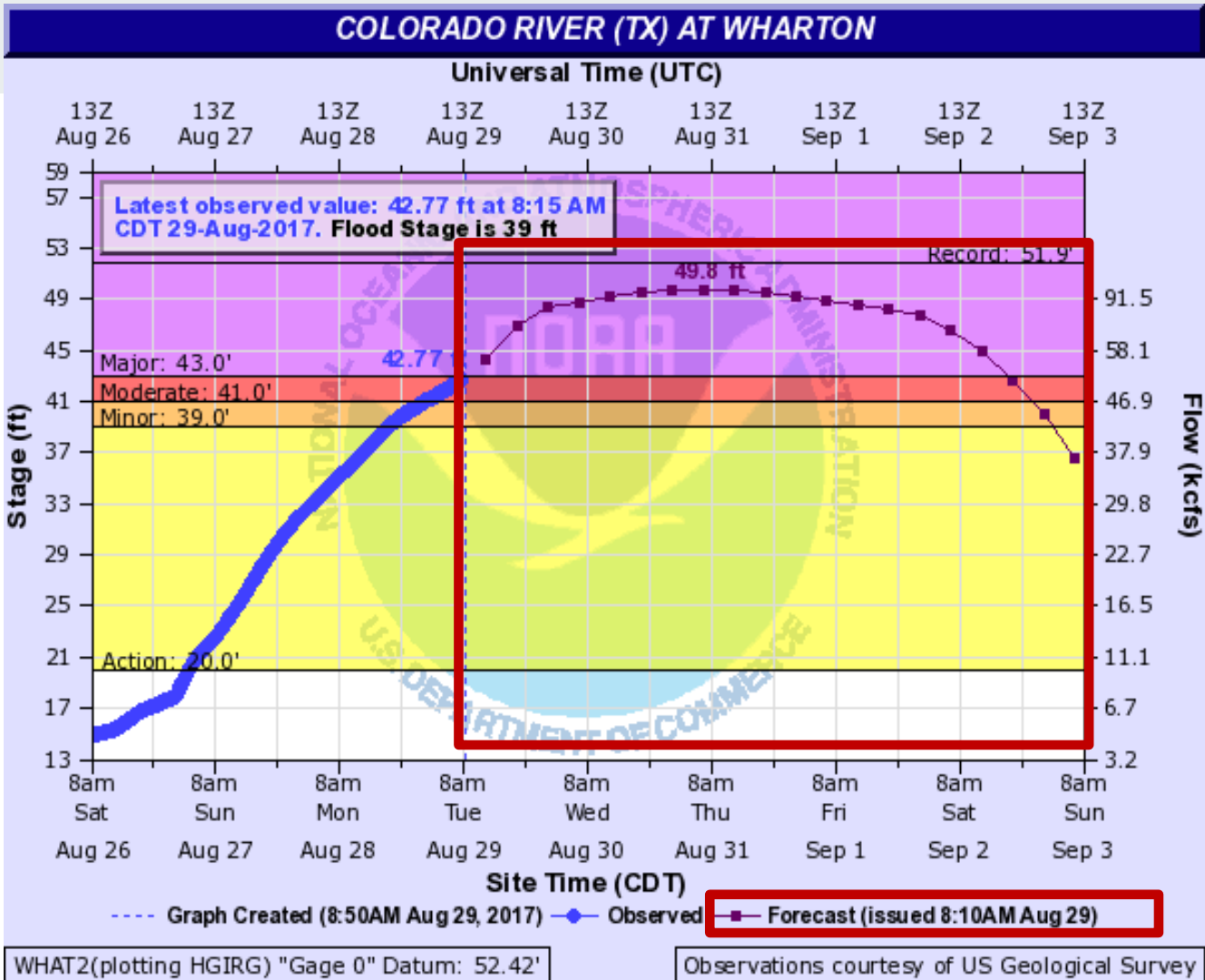
OBSERVATIONS:
Past river stages



Hydrograph Basics

FORECAST:
Forecast River Stages

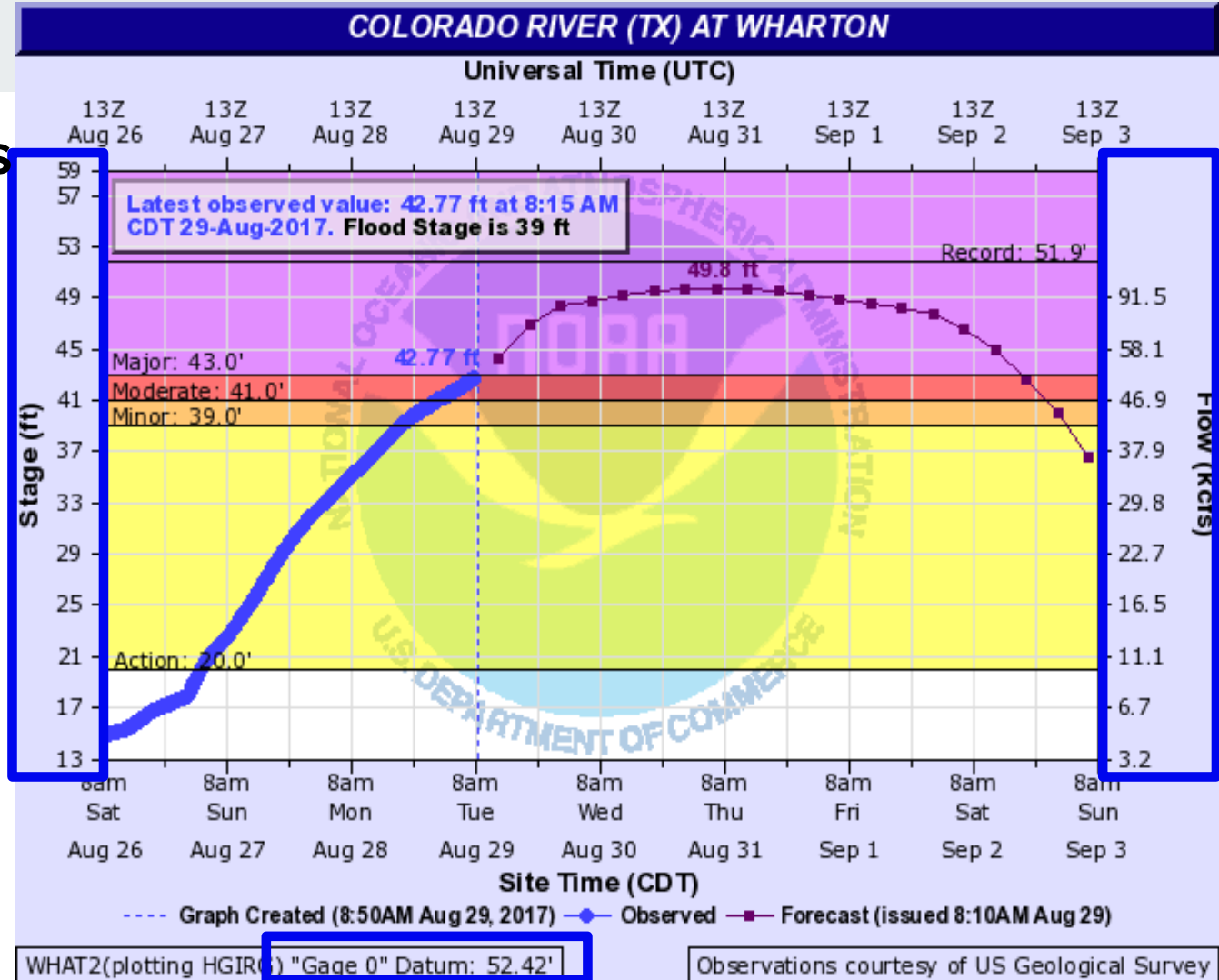
CREST:
Peak Stage



Hydrograph Basics

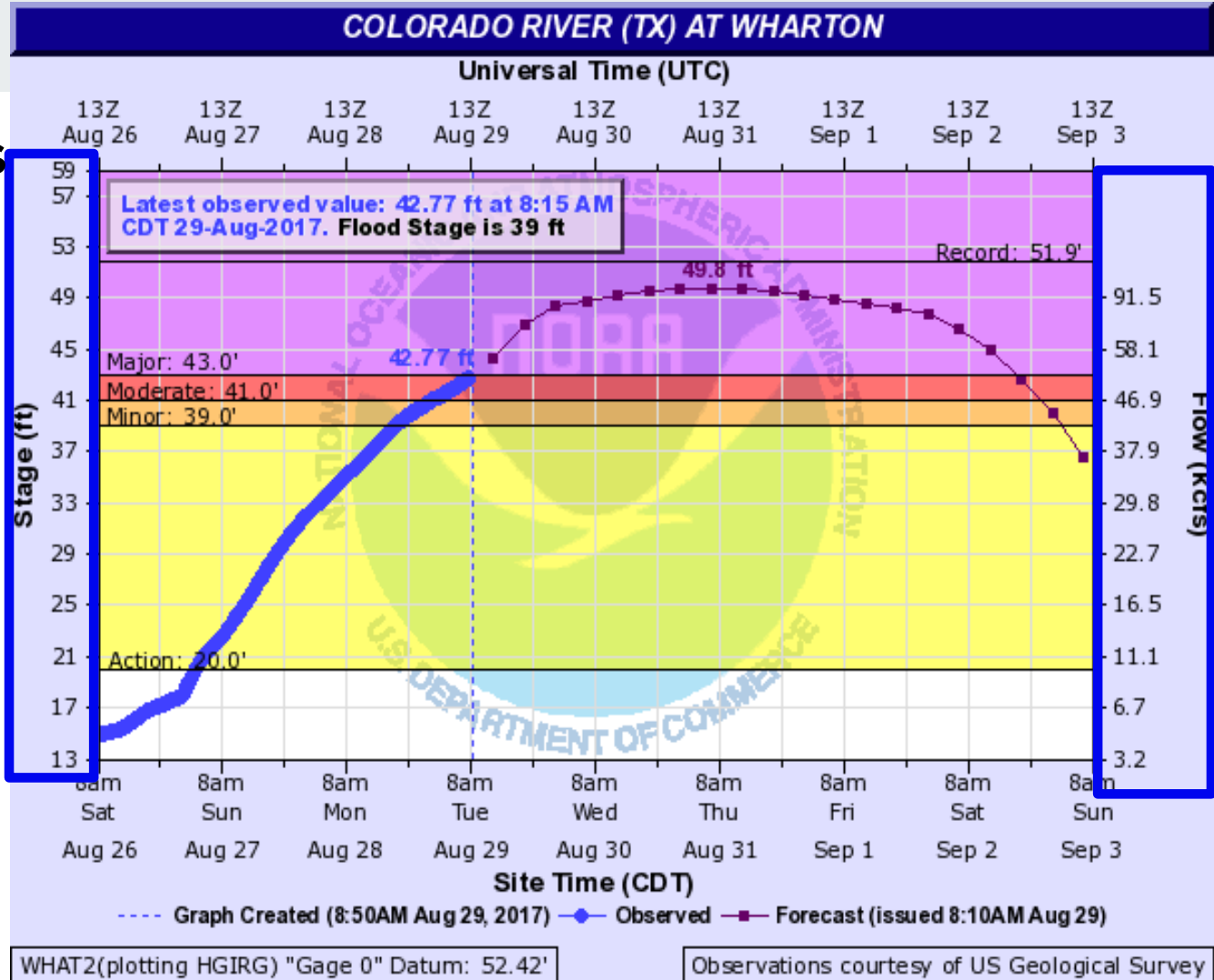
STAGE VS FLOW: Hydrologists, models, reservoirs work in flow. Emergency managers, media, general public work in stage.

What is flow or a cubic foot per second?

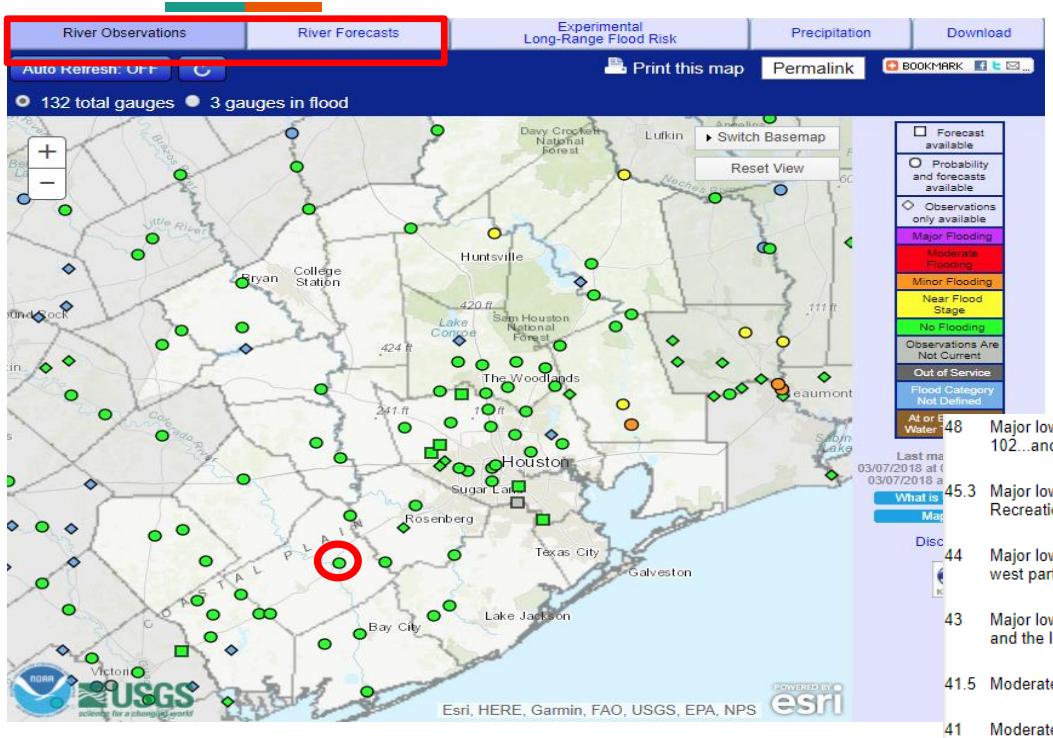


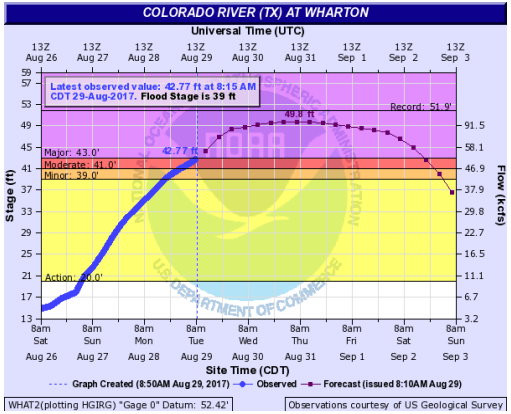
Hydrograph Basics

A basketball is roughly a cubic foot, so 20,000cfs is 20,000 basketballs of water passing the gage every second.



Advanced Hydrologic Prediction System





Flood Categories (in feet)

Major Flood Stage:	43
Moderate Flood Stage:	41
Flood Stage:	39
Action Stage:	20
Low Stage (in feet):	0

Historic Crests

(1) 51.90 ft on 12/13/1913
(2) 50.52 ft on 08/31/2017
(3) 48.72 ft on 10/23/1998
(4) 48.32 ft on 11/26/2004
(5) 48.30 ft on 04/22/2016

Show More Historic Crests

48 Major lowland flooding continues with much of west and southwest Wharton flooded. Most streets between Sunset Street...FM 102...and U.S. Highway 59 are inundated and impassable and several homes have 3 feet or more of water in them.

45.3 Major lowland flooding continues with many homes in the west part of Wharton flooded with 2 to 3 feet of water. The JDIN Recreational Center in southwest Wharton is flooded and isolated.

44 Major lowland floding continues as the JDIN Recreational Center in southwest Wharton is isolated and many homes in the west part Wharton are flooded.

43 Major lowland flooding begins in the vicinity of the gage as numerous streets in west and southwest Wharton are inundated and the lowest homes threatened. The JDIN Recreational Center in southwest Wharton close to being isolated.

41.5 Moderate lowland flooding continues as the JDIN Recreational Center in southwest Wharton is flooded.

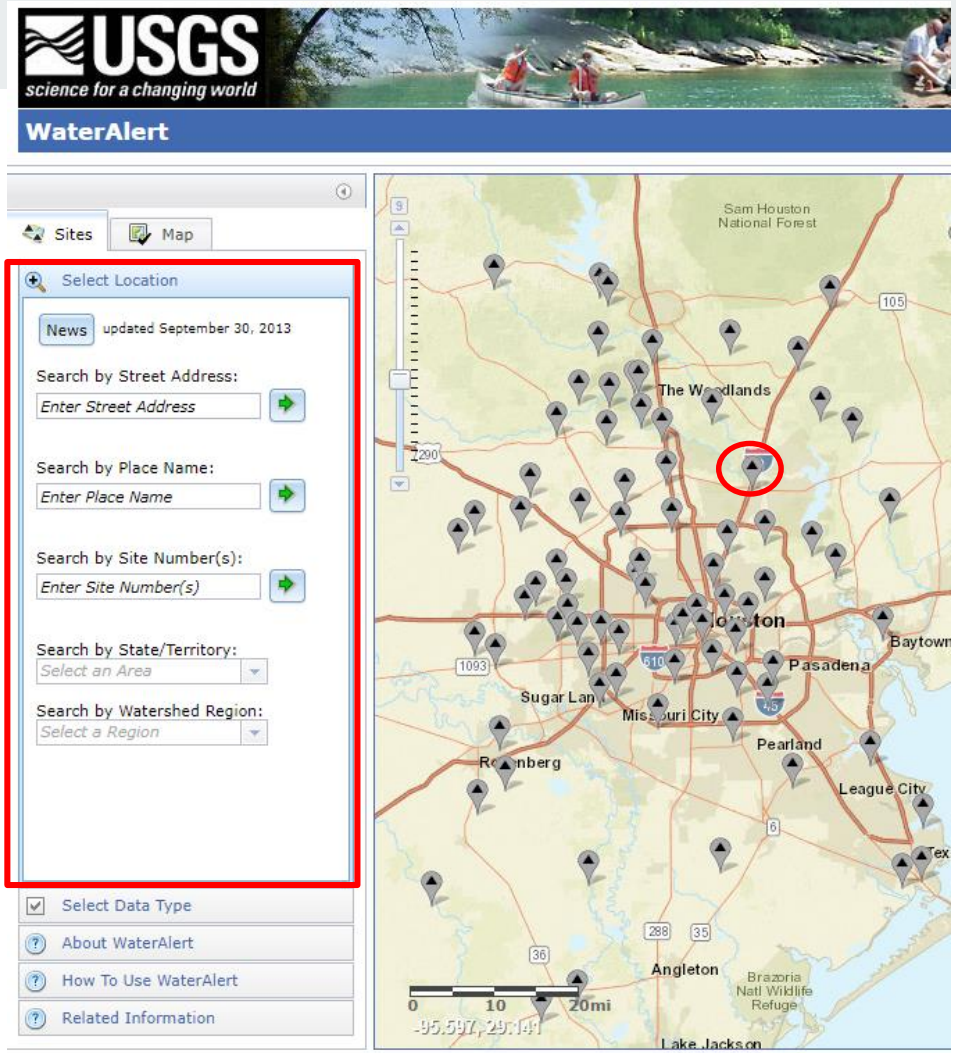
41 Moderate lowland flooding begins in the vicinity of the gage with the JDIN Recreational Center in southwest Wharton threatened.

39 Minor lowland flooding begins in the vicinity of the gage as water excapes tha main channel.

http://water.weather.gov/ahps2/index.php?wfo=hgx

USGS Water Alerts

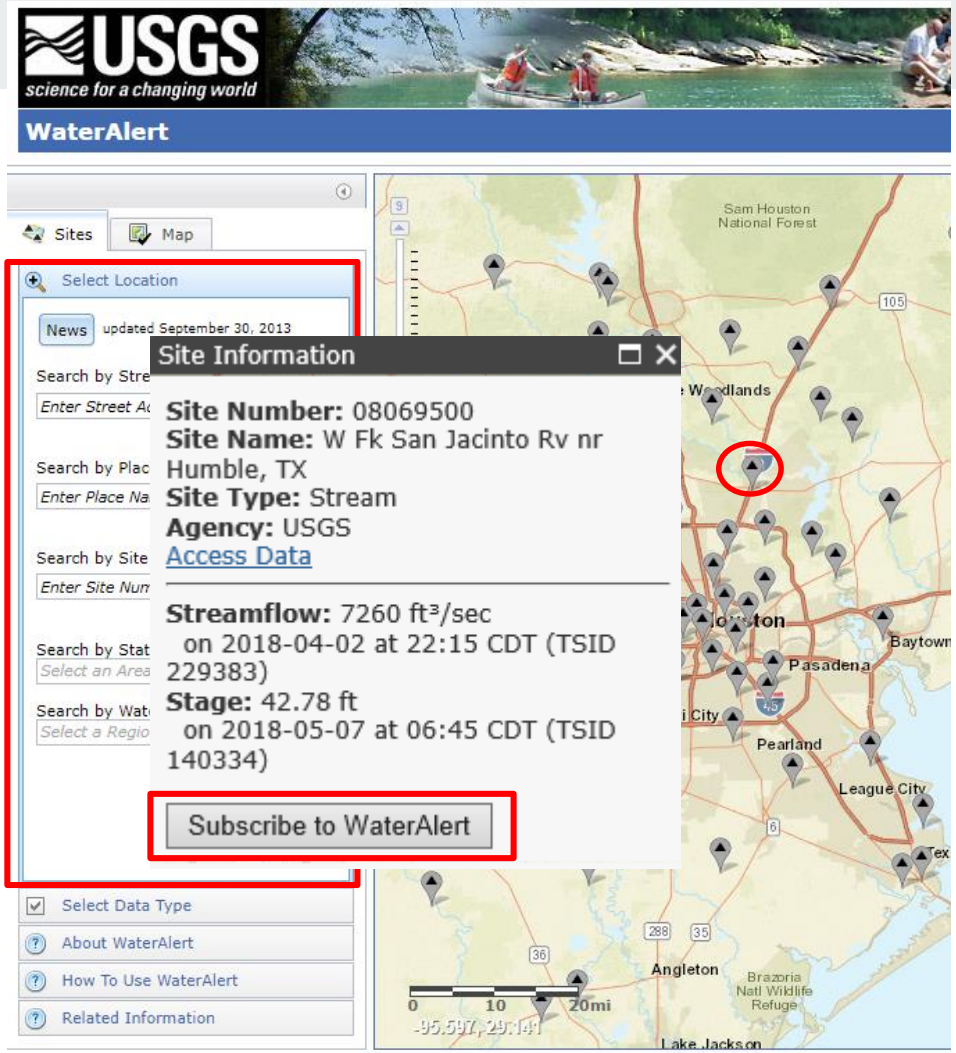
- Set alerts when a gauge reaches certain water surface elevations.
- Identify the gauge nearest you
- Click on the gauge



USGS Water Alerts:
https://maps.waterdata.usgs.gov/mapper/wateralert/

USGS Water Alerts

- Set alerts when a gauge reaches certain water surface elevations.
- Identify the gauge nearest you
- Click on the gauge and select “Subscribe to WaterAlert"



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USGS Water Alerts

- Set alerts when a gauge reaches certain water surface elevations.
- Identify the gauge nearest you
- Click on the gauge and select “Subscribe to WaterAlert"
- Define how you want to receive the information:
  - Email or phone
  - Frequency
  - Stage or Discharge
  - Stream Elevation(s)
- Note: Use Internet Explorer

Subscription Form

The U.S. Geological Survey WaterAlert service sends e-mail or text (SMS) messages when certain parameters, as measured by a USGS real-time data-collection station, exceed user-definable thresholds. The development and maintenance of the WaterAlert system is supported by the USGS and its partners, including numerous federal, state, and local agencies.

Real-time data from USGS gages are transmitted via satellite or other telemetry to USGS offices at various intervals; in most cases, 1 to 4 times per hour. Emergency transmissions, such as during floods, may be more frequent. *Notifications will be based on the data received at these site-dependent intervals.*

Site Info:		
Number:	08069500	
Name:	W Fk San Jacinto Rv nr Humble, TX	
Agency:	USGS	
Transaction ID:	stsCN	
Send Notification To:	about this...	
○ My mobile phone		
○ My email address		
Notification Frequency:	about this...	
Hourly	○	
Daily	◉	
Streamflow Parameter(s):	about this...	Recent value:
Discharge, in ft3/s	◉	7260 [peak chart]
Gage height, in ft	○	42.78 [peak chart]
Alert Threshold Condition:	about this...	
◉ Greater than (>)		
○ Less than (<)		
○ Outside a range (< or >)		
○ Inside a range (> and <)		

Real-time value is greater than: _____ ft3/s

☐ I have read and acknowledge the Provisional Data Statement and Disclaimer.

Submit Reset Cancel

Related Information

0 10 20mi

-95.597, 29.144

Natl Wildlife Refuge

Lake Jackson

USGS Water Alerts:
https://maps.waterdata.usgs.gov/mapper/wateralert/

Partners

Partners

Roles of Primary River Forecast Partners

US Army Corps of Engineers

- Operate Flood Control Reservoirs
- Manage Other WR Projects

USGS science for a changing world

- U.S. Stream Gage Network
- Water Science Studies

National Weather Service

- Issue Weather & Water Forecasts, Watches, Warnings & Data

Shared Data and Resources

US Army Corps of Engineers

- Assist w/Gage Maintenance
- Assist w/Stream Measurements
- Assist w/Funding Data Networks

USGS science for a changing world

- Gage Maintenance
- Stream Measurements
- Focus Stream Gage Network

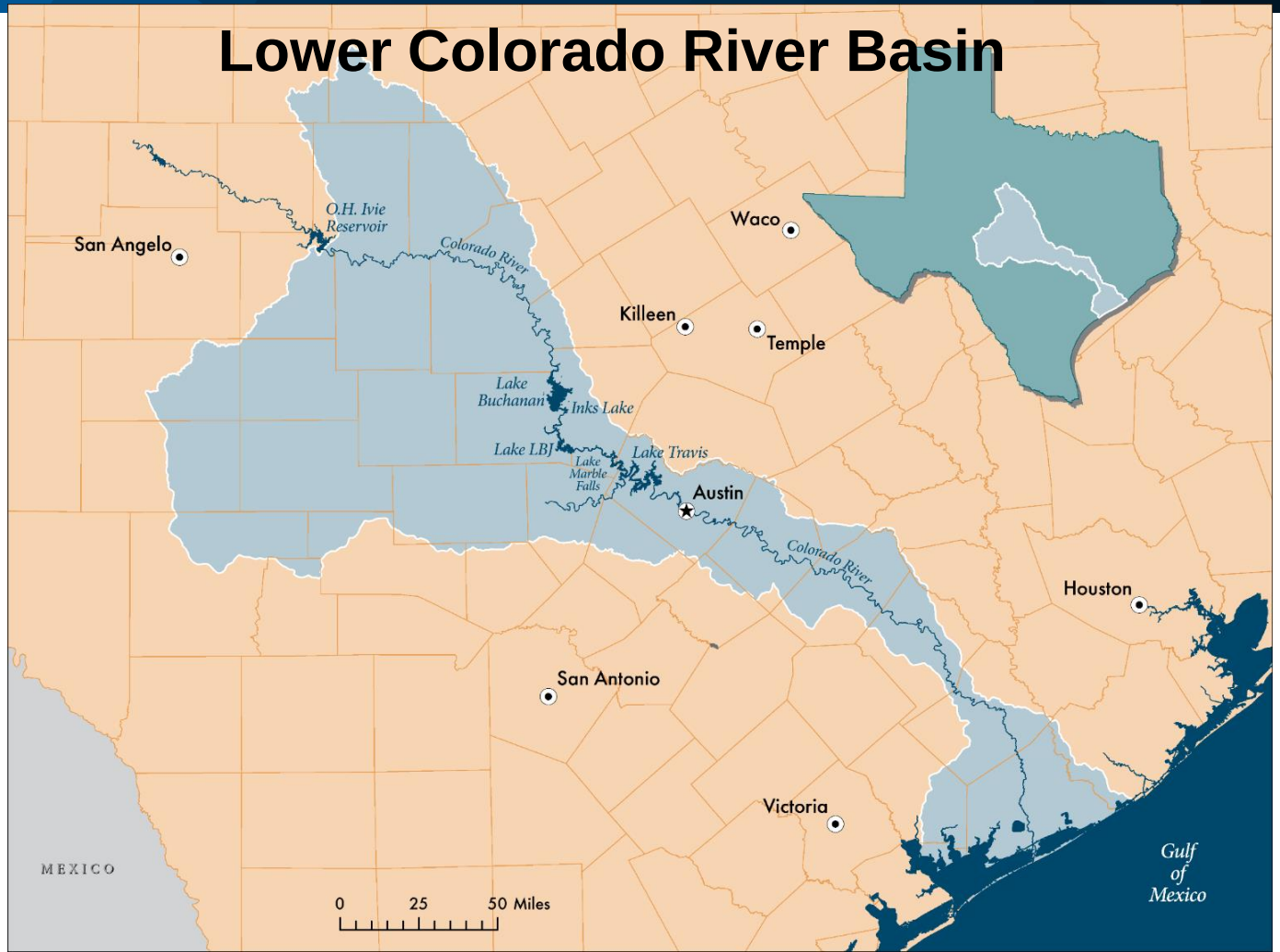
National Weather Service

- Cooperative Data Network
- NOAA/NWS Satellite Transmission
- Forecasts/Data for Operations

LCRA FLOOD OPERATIONS AND HYDROMET SYSTEM

ENERGY • WATER • COMMUNITY SERVICES

Lower Colorado River Basin



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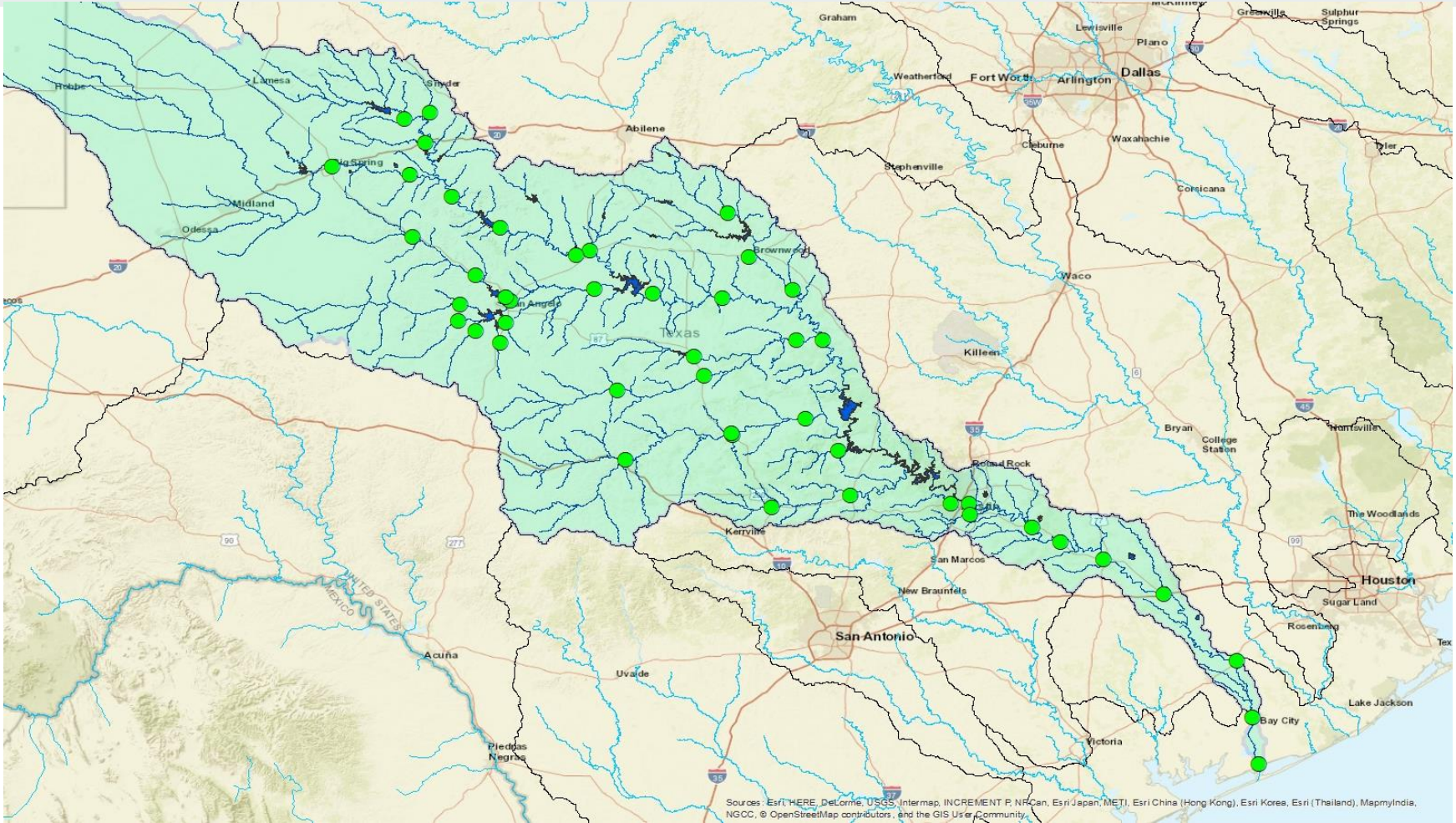
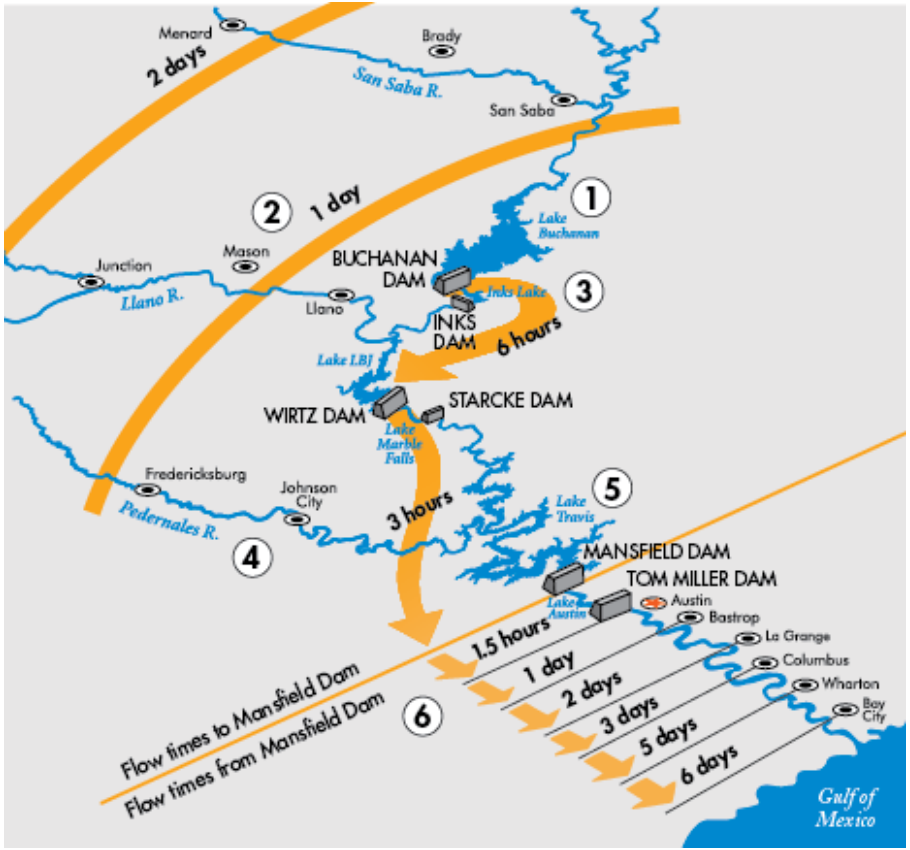
ENERGY • WATER • COMMUNITY SERVICES

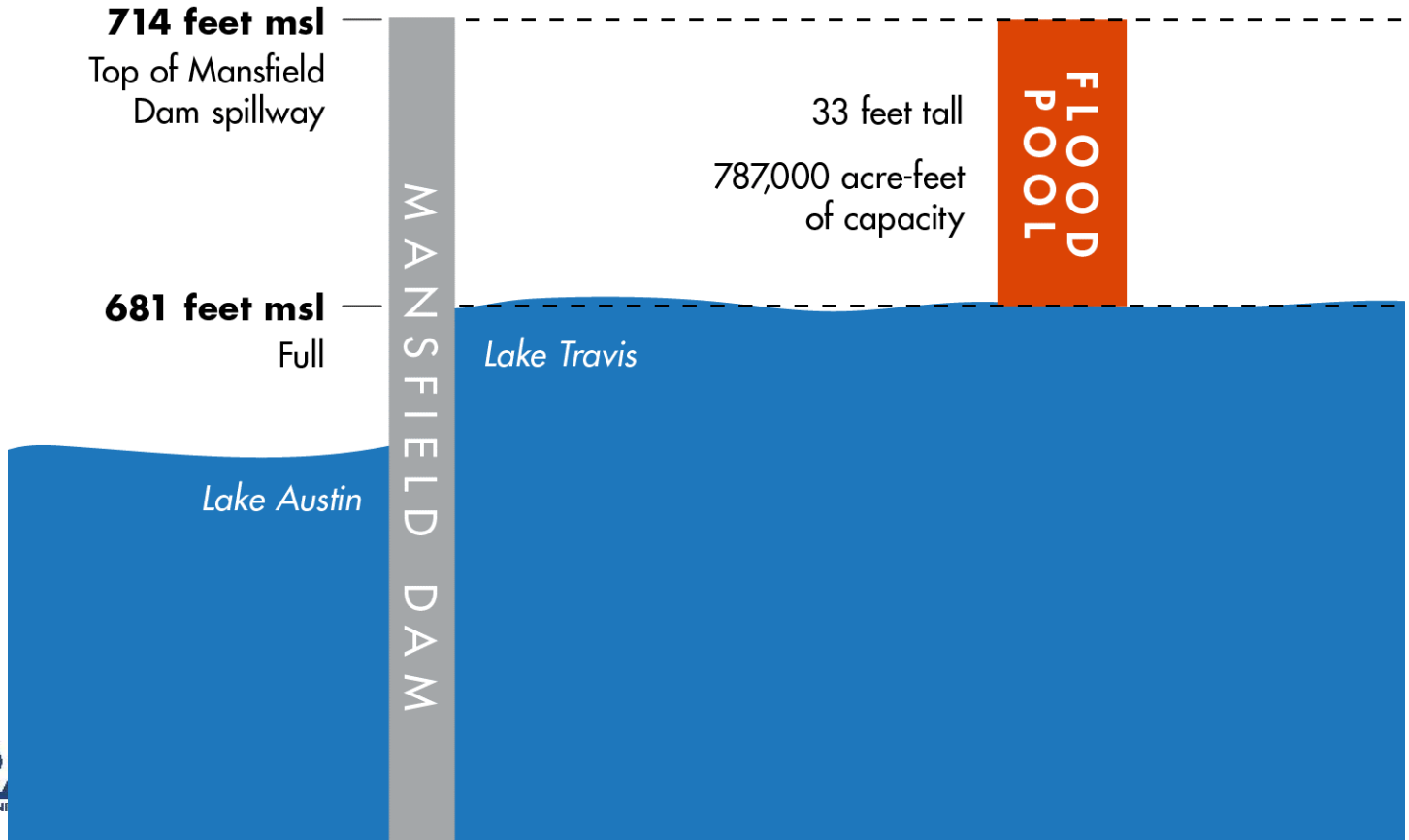
Colorado River Forecast Locations



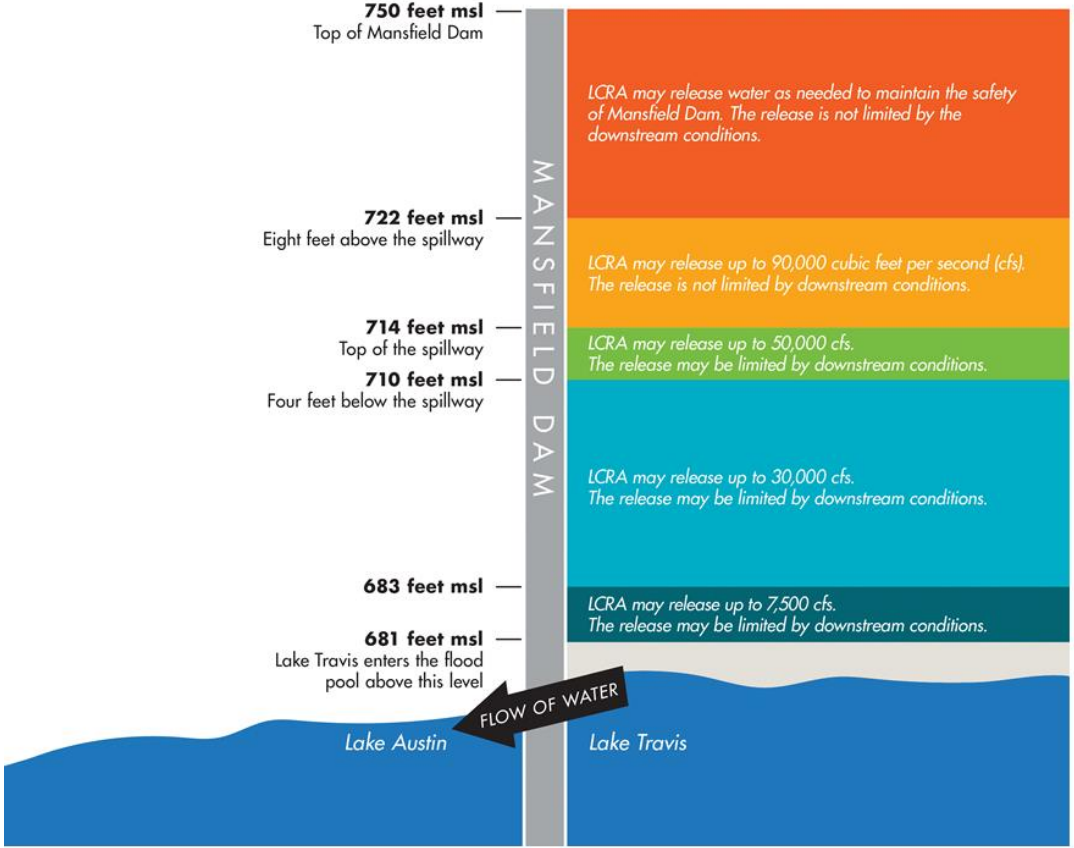
Flood Operations on the Highland Lakes



Lake Travis Elevation



Key Elevations for Mansfield Dam



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Flood Releases and Downstream Controls

- Maximum flood release when Lake Travis forecast is 681-683 feet msl: 7,500 cfs
- Downstream controls:
  - 30,000 cfs at Austin
  - 45,000 cfs at Bastrop
  - 50,000 cfs at Columbus

Flood Releases and Downstream Controls

- Maximum flood release when Lake Travis forecast is 683-710 feet msl: 30,000 cfs
- Downstream controls:
  - 30,000 cfs at Austin
  - 45,000 cfs at Bastrop
  - 50,000 cfs at Columbus

Flood Releases and Downstream Controls

- Maximum flood release when Lake Travis forecast is 710-714 feet msl: 50,000 cfs
- Downstream controls:
  - 50,000 cfs at Austin
  - 50,000 cfs at Bastrop
  - 50,000 cfs at Columbus

Flood Releases and Downstream Controls

- Maximum flood release when Lake Travis forecast is 714-722 feet msl: 90,000 cfs
- Releases are not limited by conditions at Austin, Bastrop or Columbus.

Flood Releases and Downstream Controls

- Maximum flood release when Lake Travis forecast is higher than 722 feet msl: inflow into the lake
- Releases are not limited by conditions at Austin, Bastrop or Columbus.

Hydromet System

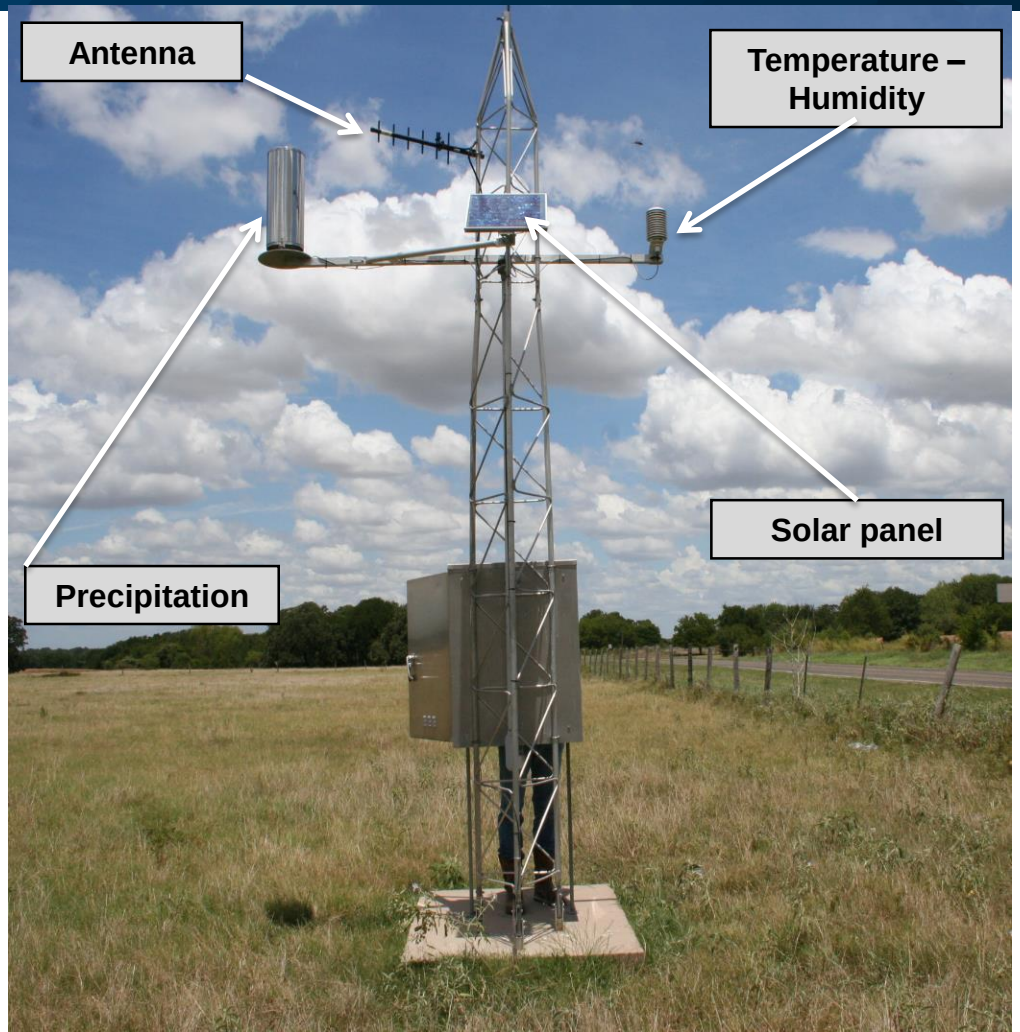
- Critical for flood management
- LCRA's eyes and ears for water
- Data is shared with many others

Typical Hydromet Station

Redundant

-

Reliable



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Flood Response

Team work

- U.S. Geological Survey
- National Weather Service
- U.S. Army Corps of Engineers
- Lower Colorado River Authority
- Emergency Management Officials
- Local elected officials

Communications

- LCRA Flood Operations Notification Service (FONS)
- Internet and social media
- NOAA All Hazard Radios
- LCRA Emergency Hotline
- News media

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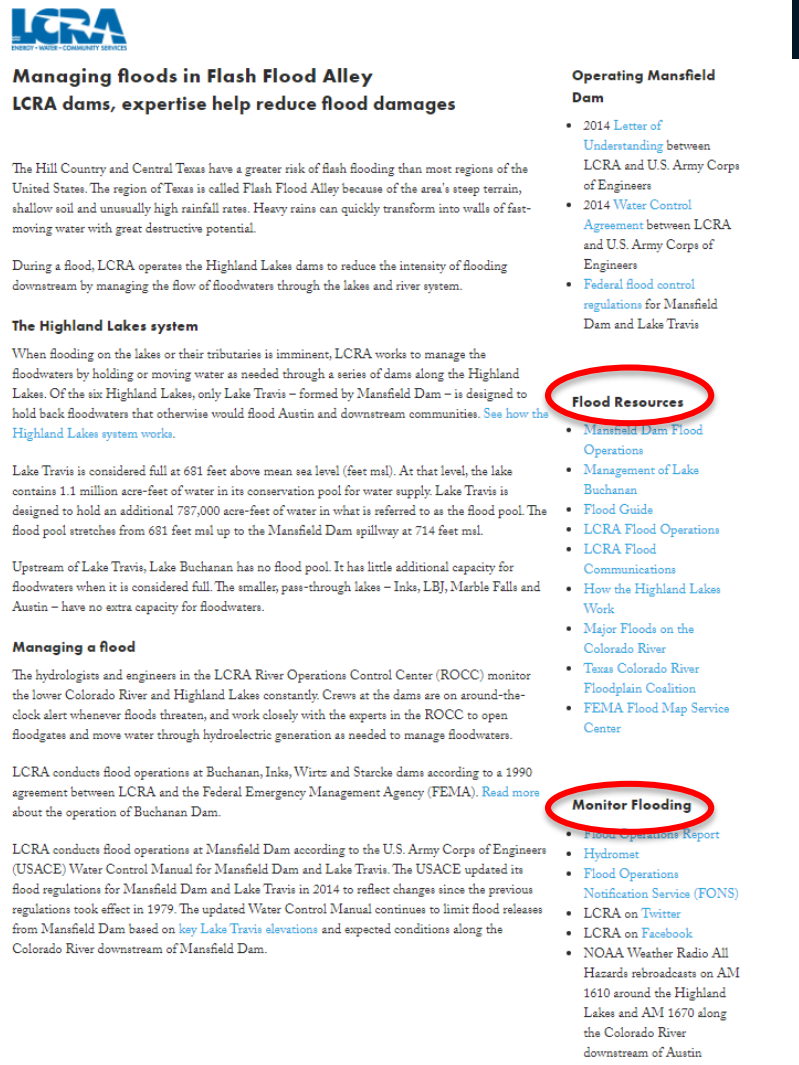
lcra.org/water/floods

Flood Resources:

- Flood guide
- Fact sheets
- Historic floods on the Colorado River
- Links to floodplain resources

Monitor Flooding:

- Flood Operations Report
- Hydromet
- LCRA on social media
- Flood Operations Notification Service (FONS)



LCRA

Managing floods in Flash Flood Alley
LCRA dams, expertise help reduce flood damages

The Hill Country and Central Texas have a greater risk of flash flooding than most regions of the United States. The region of Texas is called Flash Flood Alley because of the area's steep terrain, shallow soil and unusually high rainfall rates. Heavy rains can quickly transform into walls of fast-moving water with great destructive potential.

During a flood, LCRA operates the Highland Lakes dams to reduce the intensity of flooding downstream by managing the flow of floodwaters through the lakes and river system.

The Highland Lakes system

When flooding on the lakes or their tributaries is imminent, LCRA works to manage the floodwaters by holding or moving water as needed through a series of dams along the Highland Lakes. Of the six Highland Lakes, only Lake Travis – formed by Mansfield Dam – is designed to hold back floodwaters that otherwise would flood Austin and downstream communities. See how the Highland Lakes system works.

Lake Travis is considered full at 681 feet above mean sea level (feet msl). At that level, the lake contains 1.1 million acre-feet of water in its conservation pool for water supply. Lake Travis is designed to hold an additional 787,000 acre-feet of water in what is referred to as the flood pool. The flood pool stretches from 681 feet msl up to the Mansfield Dam spillway at 714 feet msl.

Upstream of Lake Travis, Lake Buchanan has no flood pool. It has little additional capacity for floodwaters when it is considered full. The smaller, pass-through lakes – Inks, LBJ, Marble Falls and Austin – have no extra capacity for floodwaters.

Managing a flood

The hydrologists and engineers in the LCRA River Operations Control Center (ROCC) monitor the lower Colorado River and Highland Lakes constantly. Crews at the dams are on around-the-clock alert whenever floods threaten, and work closely with the experts in the ROCC to open floodgates and move water through hydroelectric generation as needed to manage floodwaters.

LCRA conducts flood operations at Buchanan, Inks, Wirtz and Starcke dams according to a 1990 agreement between LCRA and the Federal Emergency Management Agency (FEMA). Read more about the operation of Buchanan Dam.

LCRA conducts flood operations at Mansfield Dam according to the U.S. Army Corps of Engineers (USACE) Water Control Manual for Mansfield Dam and Lake Travis. The USACE updated its flood regulations for Mansfield Dam and Lake Travis in 2014 to reflect changes since the previous regulations took effect in 1979. The updated Water Control Manual continues to limit flood releases from Mansfield Dam based on key Lake Travis elevations and expected conditions along the Colorado River downstream of Mansfield Dam.

Operating Mansfield Dam

- 2014 Letter of Understanding between LCRA and U.S. Army Corps of Engineers
- 2014 Water Control Agreement between LCRA and U.S. Army Corps of Engineers
- Federal flood control regulations for Mansfield Dam and Lake Travis

Flood Resources

- Mansfield Dam Flood Operations
- Management of Lake Buchanan
- Flood Guide
- LCRA Flood Operations
- LCRA Flood Communications
- How the Highland Lakes Work
- Major Floods on the Colorado River
- Texas Colorado River Floodplain Coalition
- FEMA Flood Map Service Center

Monitor Flooding

- Flood Operations Report
- Hydromet
- Flood Operations Notification Service (FONS)
- LCRA on Twitter
- LCRA on Facebook
- NOAA Weather Radio All Hazards rebroadcasts on AM 1610 around the Highland Lakes and AM 1670 along the Colorado River downstream of Austin

LCRA
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LCRA Flood Operations Report

Flood Operations

- Current Lake Levels at Dams and Gate Operations
- Lake Levels Over the Last 14 Days and Forecasts
- River Levels - Current Conditions
- River Levels - Forecast Conditions
- Links
- Words and Definitions

Last Update: Mar 30 2018 4:23PM

Summary

This report provides the latest information when LCRA conducts flood operations, and is updated when conditions warrant. Flood operations are not anticipated at this time.

Unscheduled releases from the Highland Lakes dams may occur suddenly and unexpectedly due to emergency hydroelectric generation or other reasons. The public should exercise caution and avoid being in the water near the dams.

For information about current water supply operations, including long-range forecasts for lakes Buchanan and Travis, see the River Operations Report.

Current Lake Levels at Dams and Gate Operations

*Disclaimer: Data is automatically retrieved and subject to revision.

Lake/Dam	Time	Head Elevation (Above Dam)	Tail Elevation (Below Dam)	Gate Operations/Spillway
Buchanan/Buchanan	Apr 25 2018 10:15AM	1015.82	887.43	Mar 30 2018 4:23PM No gate operations to pass floodwaters are expected at Buchanan Dam at this time.
Inks/Inks	Apr 25 2018 10:15AM	887.36	825.01	Mar 30 2018 4:23PM Flow over the spillway of Inks Dam is not expected at this time. (Inks Dam has no floodgates.)
Wirtz/LBJ	Apr 25 2018 10:15AM	824.77	736.75	Mar 30 2018 4:23PM No gate operations to pass floodwaters are expected at Wirtz Dam at this time.
Starcke/Marble Falls	Apr 25 2018 10:15AM	736.42	675.93	Mar 30 2018 4:23PM No gate operations to pass floodwaters are expected at Starcke Dam at this time.
Mansfield/Travis	Apr 25 2018 10:15AM	667.71	491.73	Mar 30 2018 4:23PM No gate operations to pass floodwaters are

Back to Top

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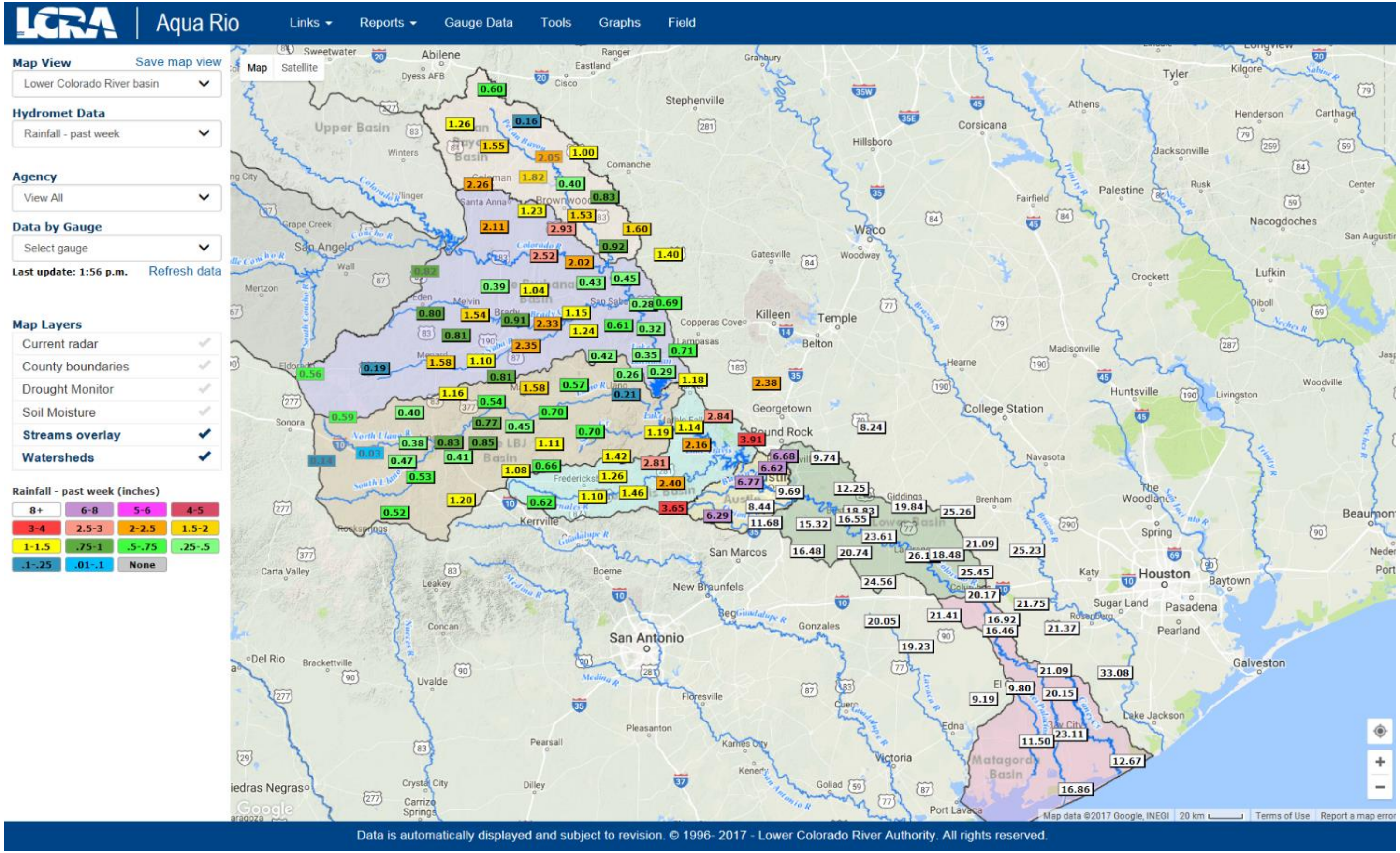

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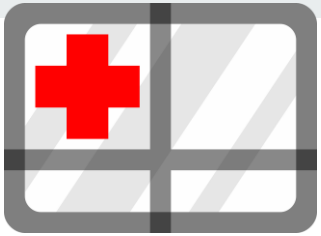
Flood Safety

What to do before, during, and after a flood?

Safety Before a Flood



- Prepare a family disaster plan.
- Check if your insurance covers flood damages. If not, get flood insurance.
- Keep insurance and other important documents, such as copies of driver's licenses and credit cards, and other valuable items, in a safe deposit box.
- Assemble a disaster supplies kit. Be sure to include prescription medications, food, and water.
- Find out where you can go if ordered to evacuate.
- Arrange to keep in contact with relatives and friends.
- Know your resources.

Knowing what to do when a flood occurs will increase your family’s safety and possibly its survival.

Safety During a Flash Flood

- Turn around, don’t drown when encountering flooded roads.
- Be especially cautious at night when it is harder to recognize the dangers of flooding.
- Stay away or be swept away. River banks and culverts can become unstable and unsafe.
- You should monitor the latest forecasts and be prepared to take action should additional Flash Flood Warnings be issued.
- Have multiple ways to receive weather information (cell phone, NOAA weather radio, television, etc.)

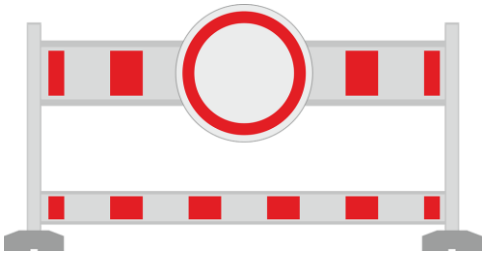
Turn Around, Don't Drown!

- Most flood deaths occur in vehicles.
- It only takes six inches of water for a vehicle to lose contact with the road surface.
- Most vehicles can be swept away in just 18 to 24 inches of water!
- Don't Rely on Your Big Vehicles
- Flooded roads may have hidden dangers, such as washed out road beds or underwater obstructions.
- If your vehicle is caught in rising water, leave it immediately and seek higher ground.

Minnesota road damaged by flood waters, courtesy of FEMA.

Safety During a Flood

- Have multiple ways to receive weather information (cell phone, NOAA weather radio, television, etc.)
- Do not sightsee!
- Evacuations are ongoing and first responders are working hard to get people to safety. Do not get in their way!
- Flood waters from creeks, bayous and rivers will be swiftly moving. *Do not go near the flood waters!* They will sweep you away if you go in the water.
- Roads may still be closed as they could be damaged or still under water. Barricades are for your protection; do not drive around them!



Safety During a Flood

- Stay out of the flood waters!
- Floodwaters can contain chemicals, sewage, disease, and animals
- Unseen underwater debris can be sharp and cause injury
- Downed power lines under the water could lead to death or injury from electrocution
- Water depth can change unexpectedly (storm drains, washed-out roads)

Safety After a Flood

- Don’t put yourself in danger.
- Return home only when authorities indicate it is safe.
- Stay away from damaged areas unless your assistance has been specifically requested by police, fire, or a relief organization.
- Use extreme caution when entering buildings; there may be hidden damage, particularly in foundations.

weather.gov/flood

Safety After a Flood

- Don’t leave lit candles unattended
- Cut power to flooded areas of your home
- Only use generators in well-ventilated areas—never in a closed garage!
- Take breaks and drink plenty of fluids
- Do not use power tools while standing in water
- If you smell or hear gas, call the Fire Department.

Reporting/Wrap Up

What to Report

Flash Flooding

- Underpasses filling with water
- Impassible roadways
- Any fast-moving water greater than 6 inches in depth

Any River or Bayou Flooding

Flooding, Washington County (2016)

Formatting Reports

Reports should include the following information:

WHO is calling

WHERE the flooding is located

WHAT type of flooding is occurring (flash, river, or bayou)

WHEN the flooding occurred (is it ongoing?)

HOW deep is the water (if you can *safely* evaluate this)

The Good

"I'm a storm spotter located in Sealy at the intersection of Meyer and FM 2187. Water is flowing over curbs; it's at least 6-8 inches deep in some locations on the road."

The Bad

"Hey, we got some flooding here a few minutes ago!"

The Ugly

"My sister-in-law said the bayou got really closer to her house, did you have a warning out for that?"

How to Report

Call us!

Spotter line: 1-800-846-1828

Report via amateur radio

Call sign WX5HGX

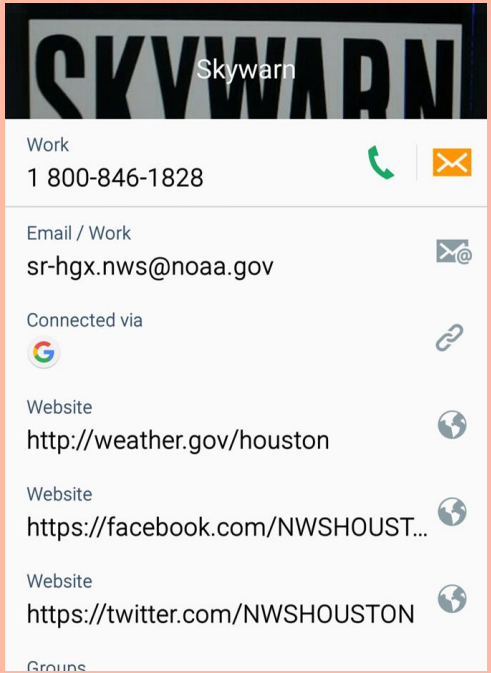
Email

sr-hgx.nws@noaa.gov

Social Media

Twitter: @NWSHouston

Facebook: NWSHouston

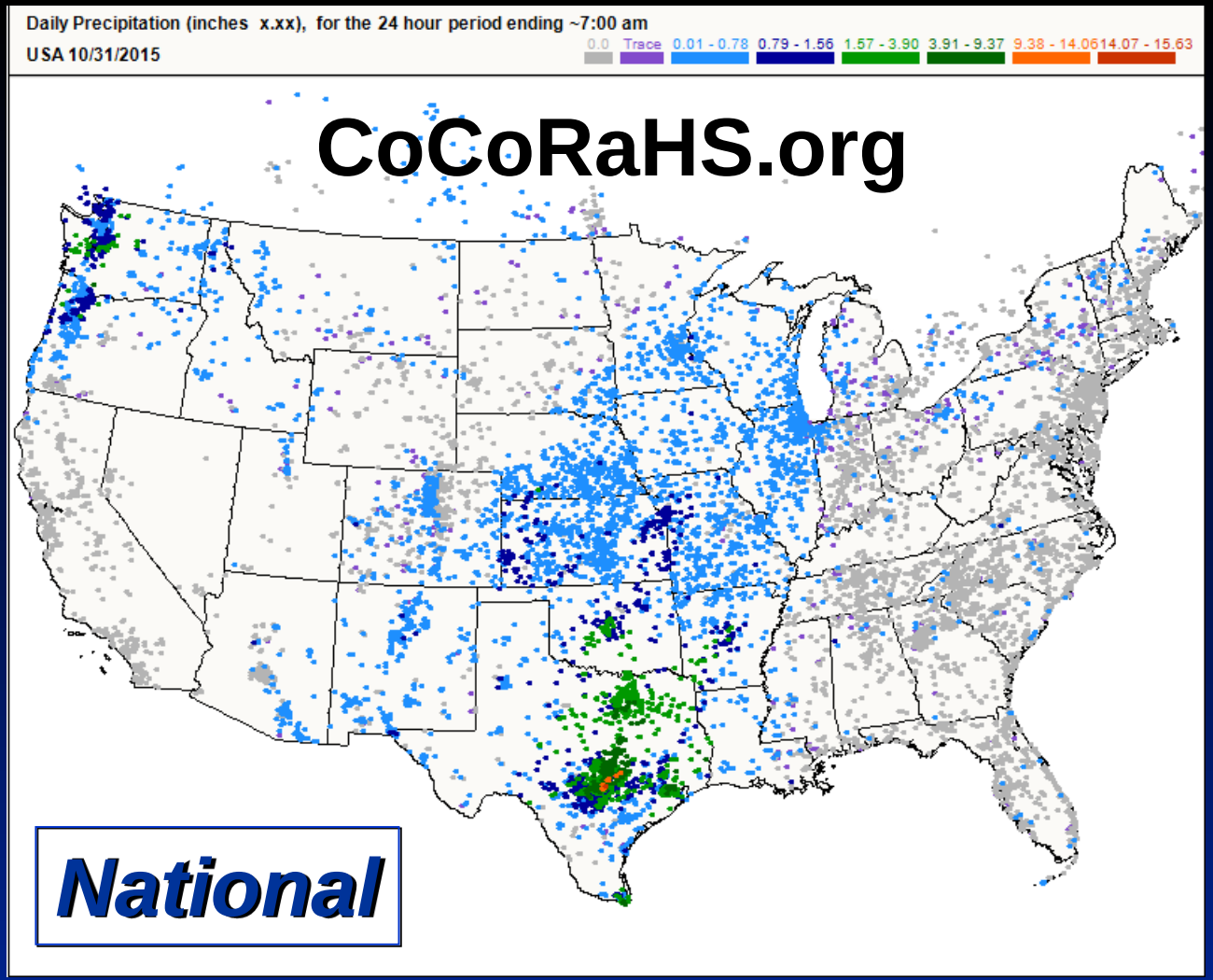


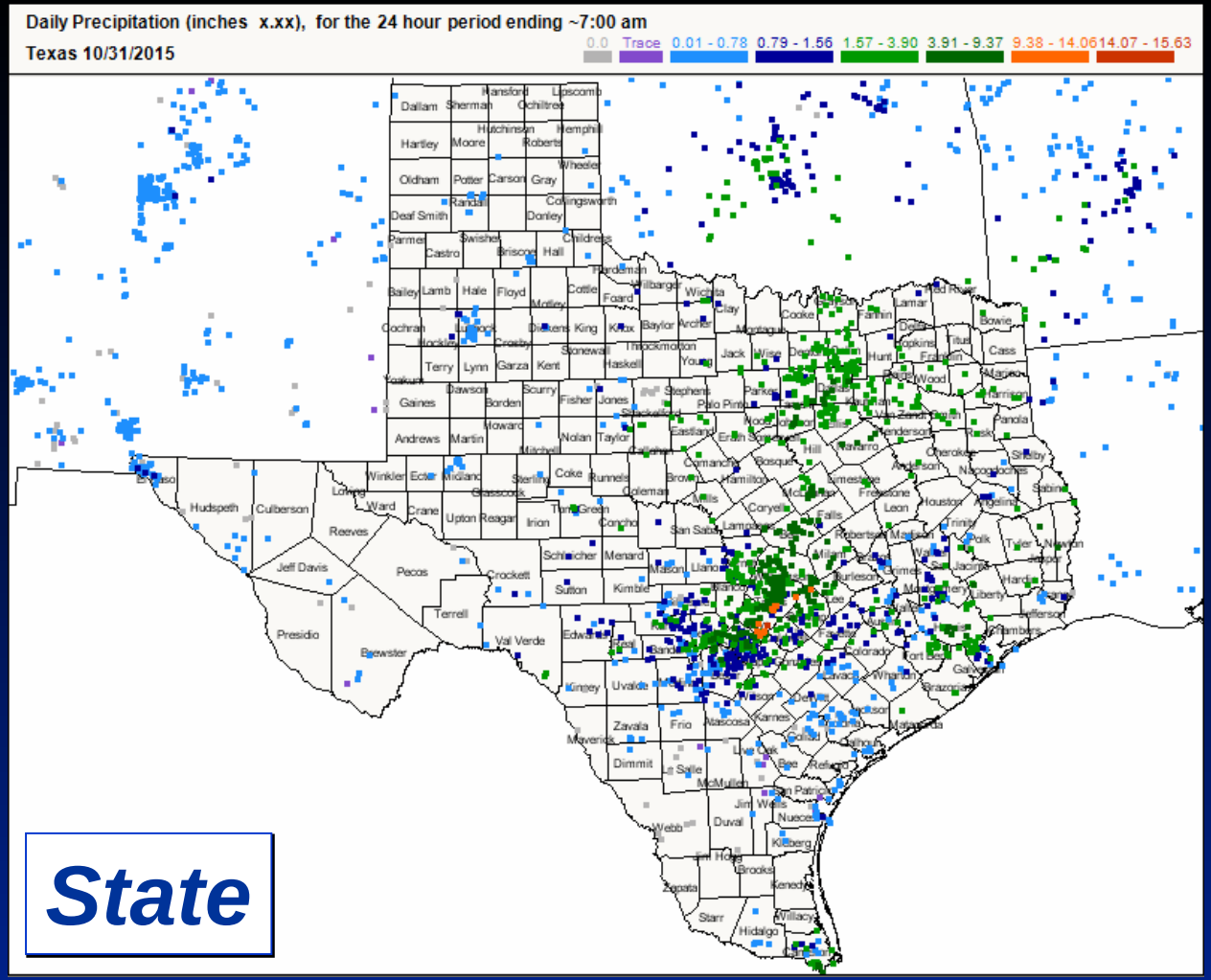
Spotter Tip

Set up SKYWARN as a contact in your smartphone

CoCoRaHS

"Because every drop counts"


Daily Precipitation (inches x.xx), for the 24 hour period ending ~7:00 am
USA 10/31/2015
0.0
Trace
0.01 - 0.78
0.79 - 1.56
1.57 - 3.90
3.91 - 9.37
9.38 - 14.06
14.07 - 15.63
CoCoRaHS.org
National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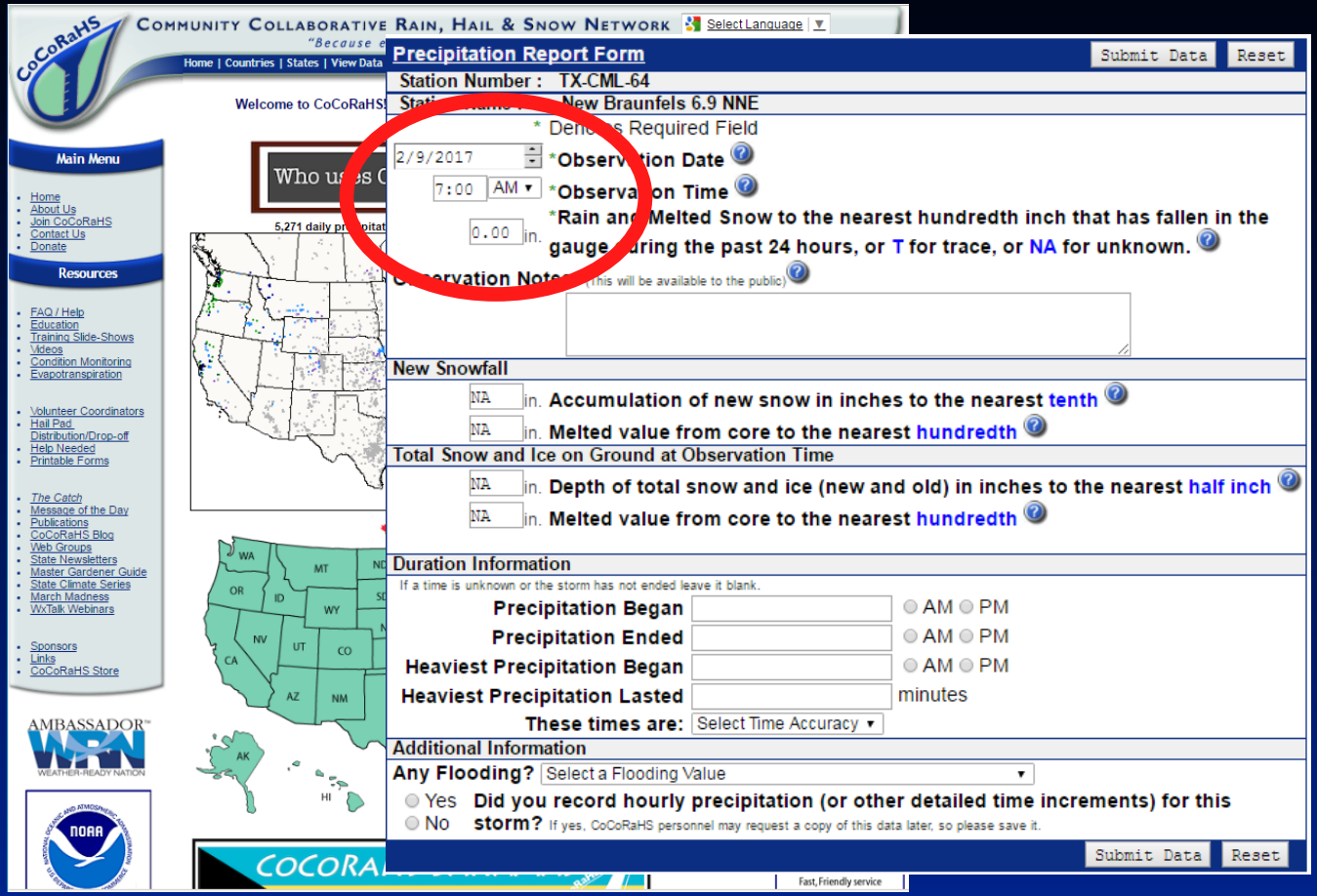
1.57 - 3.90
3.91 - 9.37
9.38 - 14.06
14.07 - 15.63
State

Measure & Report Daily Rainfall on Interactive Web site: www.cocorahs.org

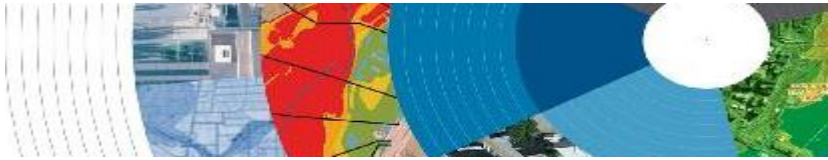


Flood Risk

FEMA

FloodWarn Workshop

Topics



- What is Flood Risk?
- NFIP – National Flood Insurance Program.
- Flood Hazard Mapping and FIRMs

FEMA

Flood Risk?

Any situation involving exposure to a Flood danger, harm or loss.

"While levees can help reduce flood risk…they do not eliminate the risk."

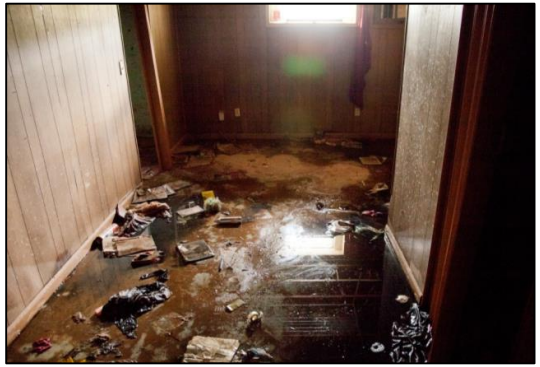
FEMA

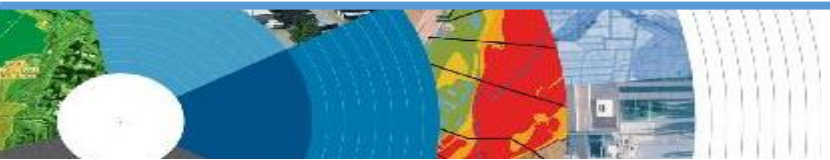
Flood Insurance

A tool for individuals to manage risk.

NATIONAL FLOOD INSURANCE PROGRAM

- Everyone is at risk for flooding.
  - *For most events 26% of NFIP claims are outside the SHFA.*
- A few inches can cause tens of thousands in damage.
- If your mortgage company "forced" you to buy flood insurance, check that structure and CONTENTS are covered. Most cover structure only.





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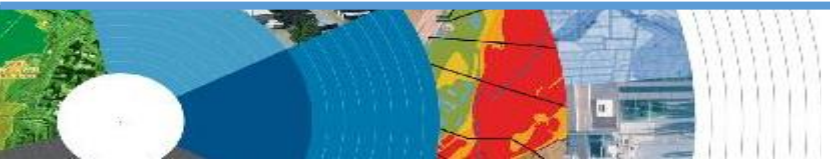
What is the NFIP Definition of a Flood?

Inundation of 2 or more acres of normally dry land or of two or more properties (one of which is your property) from:

- Overflow of inland or tidal waters;
- Unusual, rapid accumulation or runoff of surface waters from *any source*;
- Mudflow; or
- Collapse or sinking of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated levels that result in a flood.



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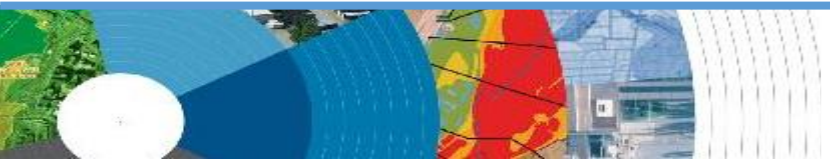
NFIP Flood Insurance Coverages

- **Structure Coverage**
  - Replacement Cost on single-family, primary residence (structure) if insured to at least 80% of replacement cost.
  - Max coverage $250,000

- **Contents coverage**
  - Contents is an optional addition, except for Preferred Risk Policy.
  - Max coverage $100,000 coverage for Actual Cash Value (depreciation applies.)

- **Wait Period**
  - Typically - 30-days from purchase until effective.
  - Exceptions:
    - Flood Insurance required by a federally regulated and insured lender—0 days.
    - Wildfire 30-day waiting period exception—0 days.
    - Initial purchase of flood insurance as the result of a map revision—1 day.



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Misconception: Homeowners Insurance is Enough

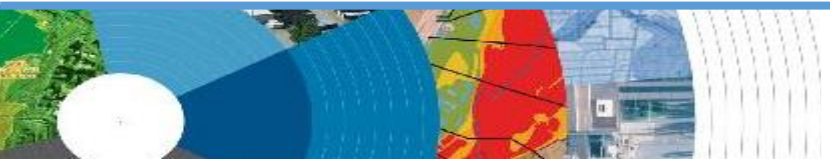
- **Misconception:**

  "I'm already covered—my homeowners policy covers flooding."

- **Fact:**

  Most insurance policies do not cover flooding; only flood insurance covers flood damage.

  Renters and Business owners should also consider flood insurance for contents.



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Group Flood Insurance Policy (GFIP)

IF in the 1% risk area (100yr floodplain)

AND received FEMA Individual Assistance(IA),

A GFIP policy was purchased

(if they did not have flood insurance.)

GFIP is a 3 yr. abridged Flood Insurance Policy. The policy is paid for from the IA funds.

You can purchase the standard NFIP policy to increase your coverage. *(GFIP cancels)*

Group Flood Insurance Policy (GFIP)

FEMA Group Flood Insurance Policy
Making Survivors More Resilient

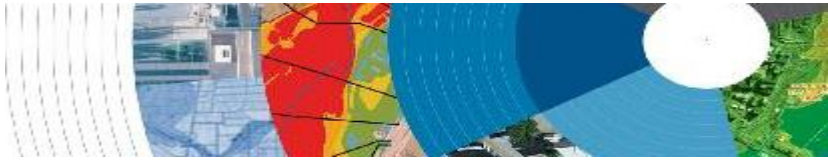
Requirement *- property owner MUST purchase and maintain a traditional NFIP policy when GFIP expires.*

If not…they are not eligible for IA that would cover the replacement of real or personal property for the damaged location with a future event.

The insurance requirement is forever – including new homeowners.

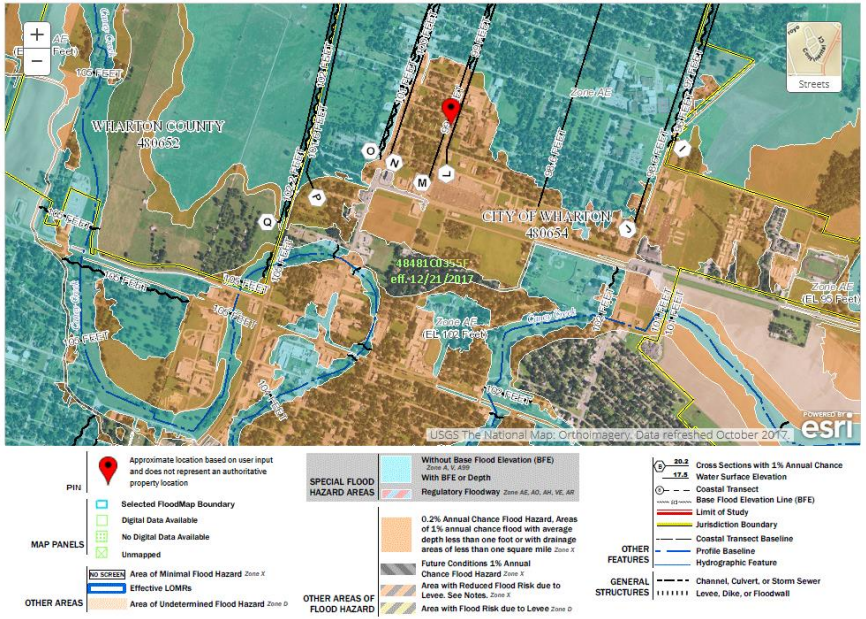
FEMA

What is a FIRM?



Flood Insurance **Rate** Map

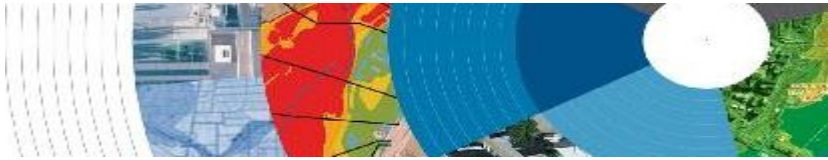
- Identifies the Special Flood Hazard Area (SFHA) and Non-SFHA's
- Used for rating flood insurance policies
- Mandatory purchase requirement if property is in SHFA **AND** is a federally backed mortgage.



FIRM's show Coastal and Riverine flood risk.

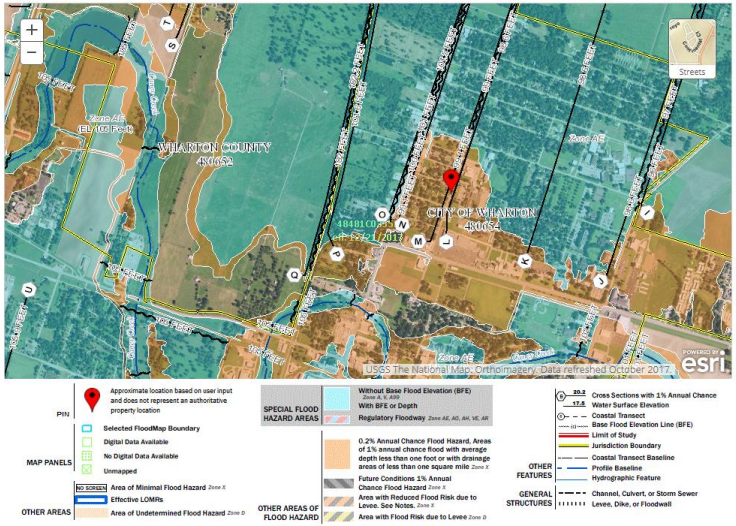
FEMA

What is a Flood Zone?



Zones on a FIRM:

- SFHA (high risk)
  - A, AE, AO, AH, VE, V etc. (Aqua)
    - 1% annual chance flood
    - 26% chance of flooding in a 30-yr mortgage
- Non-SFHA (low to moderate risk)
  - B, C and X (Shaded – orange or gray color & non-Shaded)
    - Orange/Gray area – outlines areas protected by Levees
    - Even the non-shaded is a flood zone – a minimal risk.



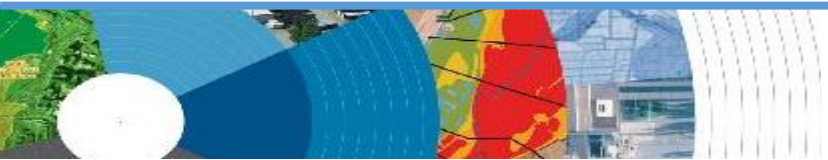
Find your zone at
https://msc.fema.gov/portal/home

FEMA

Flood Hazard Mapping

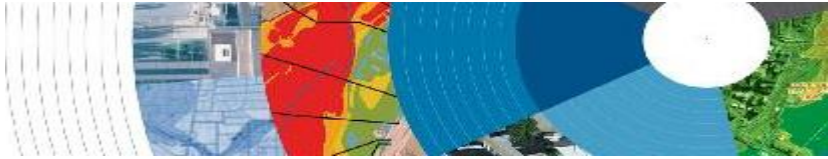
- The maps are **NOT** a prediction or forecast.
- Flood waters are not confined to the at the 1% risk line (aka 100yr flood) on the FIRM.

"Yes, this is a beautiful river. But it wasn't here when we purchased the land. Maybe we should've checked to see if it was in a flood zone before investing in it."

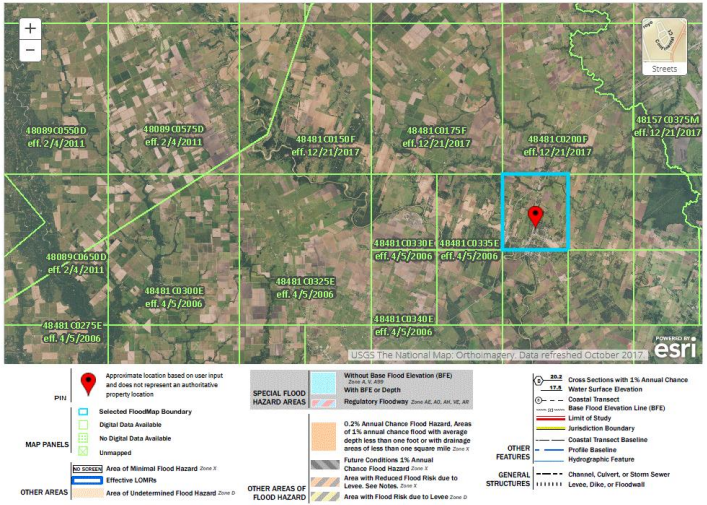


FEMA

Flood Hazard Mapping

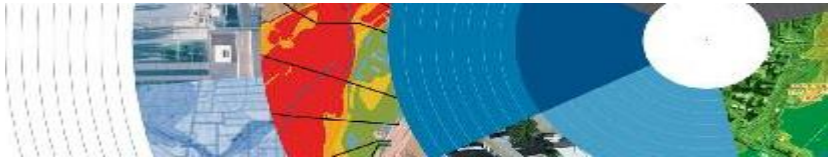


- FIRMs are subdivided by panels to cover a jurisdictional boundary (each has a unique panel number.)
  - Each panel has a specific code and effective date.
  - FIRMs are a single snapshot for one scenario.



FEMA

Flood Hazard Mapping



- Assumptions are made in the river modeling
  - Precipitation input the 100 year/24 hr. design storm *(actual events rain intensities vary - not consistent rate over a 24 hr. period.)*
  - Assumptions about the vegetation in the flood plain – do NOT differentiate dead vs growing vegetation (increased friction during growing season)
  - Snapshot of land use when the models were developed – a challenge in rapidly developing areas
- One event is never the same as another, FIRMs will not exactly match an individual event.

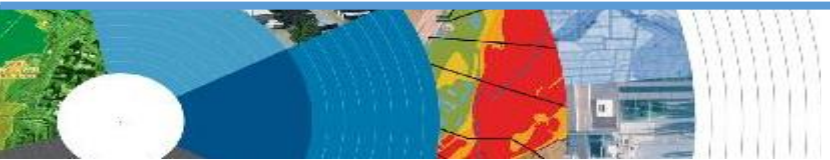
FEMA

Misconception: Only 100yr Floodplain is at Risk

- **Misconception:**

  "I don't live in a flood zone."

- **Facts:**
  - Floods are the #1 natural disaster in the United States.
  - If it can rain, it can flood.
  - FIRMs do not show localized flooding from drainage ditches/sewers/road ponding.
  - To some degree overland flooding…but not property to property drainage problems.



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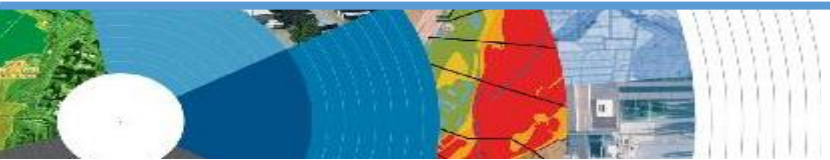
Cost of Flood Damage?

2,500 sqft, one-story home with possessions worth $50,000

Interior Water Depth (Inches)	Cost to Home	Cost to Personal Property	Combined Loss Potential
1"	$23,635	$3,172	$26,807
2"	$23,720	$3,172	$26,892
3"	$24,370	$4,917	$29,287
4"	$31,345	$7,207	$38,552
5"	$31,425	$13,914	$45,339
6"	$37,260	$14,777	$52,037
7"	$37,691	$17,700	$55,391
8"	$38,122	$20,624	$58,746
9"	$38,553	$23,547	$62,100
10"	$38,983	$26,470	$65,453
11"	$39,414	$29,394	$68,808
12"	$39,845	$32,317	$72,162
24"	$44,325	$43,001	$87,326
36"	$47,905	$46,633	$94,538
48"	$53,355	$50,000	$103,355



FEMA

Structure Elevation Impact Insurance Rates

High Risk = $$$

Medium Risk = $$

Lower Risk = $

The elevation is just one factor, others include: when was the structure, has it flooded in the past, etc.

EVERY Structure has a risk…

generally the higher the structure the less the risk.

EMA

Harvey Numbers

Insurance claims

- Harris Co (includes cities such as Houston) – all claims 55,570**
- Wharton County (unincorporated only) –68 (Losses over 125K)

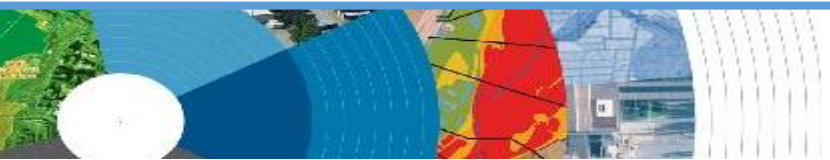
New GFIP's Due to Harvey

- Wharton County –147

Harris County Numbers**

- 154,170 Homes 48,850 in 1% Risk Area (100-yr)
- 34,970 in 0.2% (500-yr) floodplain
- **68% OUTSIDE of the 1% Risk Area.**

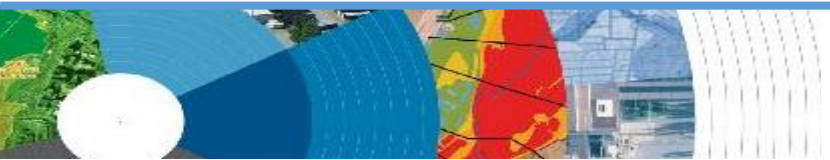
**Data HCFCD Finale Hurricane Harvey Storm and Flood Information – https://www.hcfcd.org/media/2678/immediate-flood-report-final-hurricane-harvey-2017.pdf



FEMA

Summary

- Living in Texas means we have a flood risk even with heavy rain.
  - Tax Day 2016 and Memorial Day 2015 – not with a tropical system
- Flood Risk is from multiple sources.
  - FIRMs focus on river flooding and some overland flow.
- Flood insurance allows individual property owners to manage their risk.
  - **Buy policies that cover the structure AND contents**.



FEMA

Contact Information

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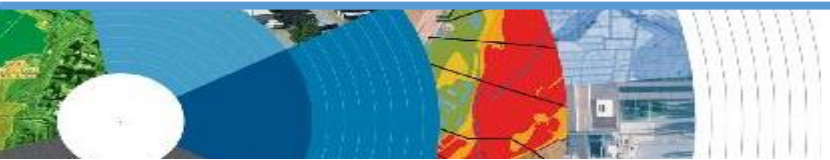

FEMA

Questions

National Weather Service
FEMA