# 2019 FloodAware Training

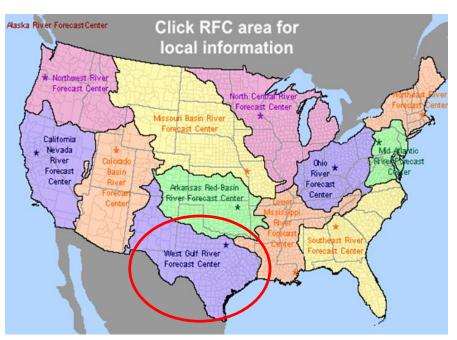
Katie Landry-Guyton
Senior Service Hydrologist/Meteorologist
National Weather Service- Houston/Galveston, TX

## **National Weather Service**

### **Weather Forecast Offices**

## Click city for local Fairbanks weather information Falls Glasgo Billings Fran cisco Albuquerque leston Melbourne Honolulu Guam San Juan

### **River Forecast Centers**



## **Outline**

Flooding Importance

Flooding Types and Causes

Flood Products

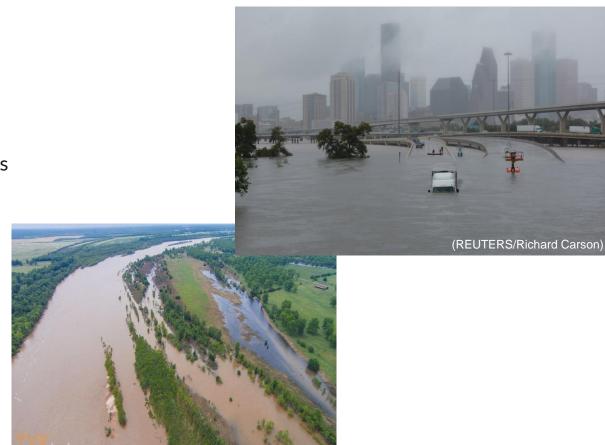
**River Flooding** 

**Partners** 

Flood Safety

Reporting Flooding

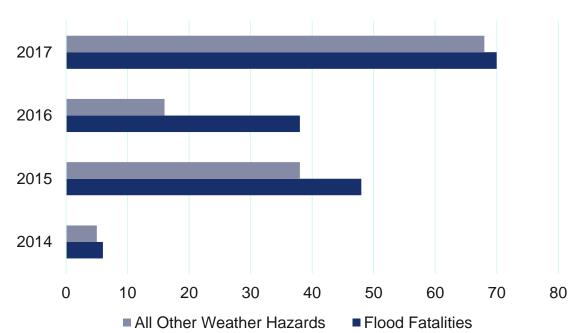
Flood Risk



# Flooding Importance

## Flooding is Deadly!

### **Weather-Related Deaths in Texas**

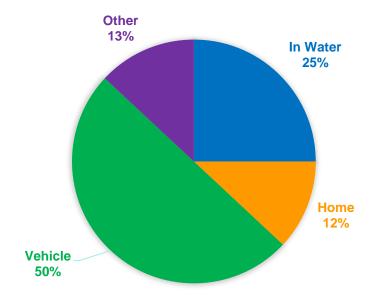


In the 4 year period from 2014 to 2017, more people have died in Texas from flooding than all other weather hazards combined.

Data from NWS National Hazard Statistics

## **Flood Fatalities**

# TEXAS FLOOD FATALITIES BY SHELTER FROM 2014-2016



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

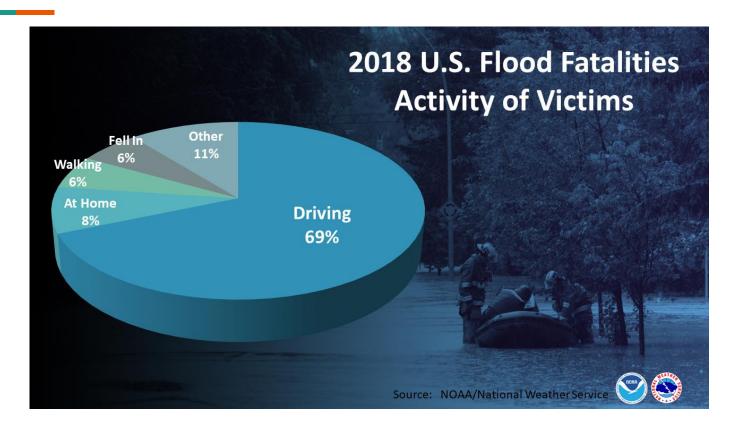
2017 was skewed due to Hurricane Harvey. In 2017, there were 33 flood fatalities in the water and 19 in vehicles.

Data from NWS National Hazard Statistics

# Houston Floods: April 18, 2016



## **Flood Fatalities**



# Recent Big Floods...

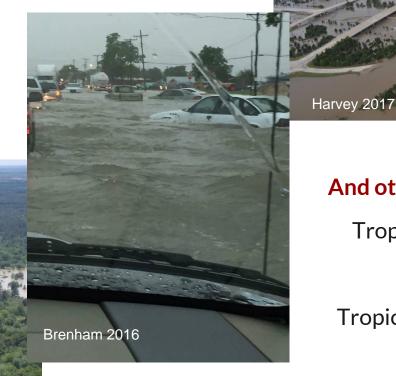
Memorial Day 2015

Tax Day 2016

Brenham 2016

Harvey 2017

Tax Day 2016





Tropical Storm Allison

1994 Flood

**Tropical Storm Claudette** 

# Flooding Types and Causes



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



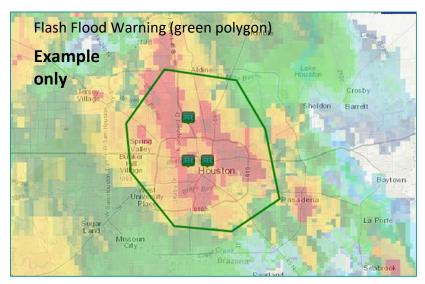
# **Flood Products**

## 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, poor drainage, or high tides/surge. 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

#### 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

### Flood Watch

#### 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

### Flash Flood Watch

### 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

## Flood Warning

### 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

## Flash Flood Warning

### 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

### Flash Flood Emergency

### 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

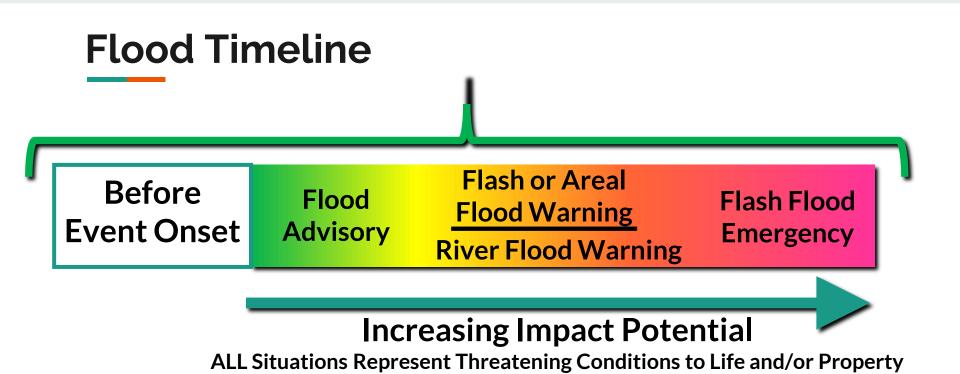


# Flash Flood Emergency



Flood Warning (Areal/ River/ Bayou)





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

## Ways to Receive a Warning

## **NOAA** Weather Radio



# Wireless Emergency Alerts and Weather Apps



### TV and Radio



Social Media



NWS Website: <a href="https://www.weather.gov/hgx/">https://www.weather.gov/hgx/</a>

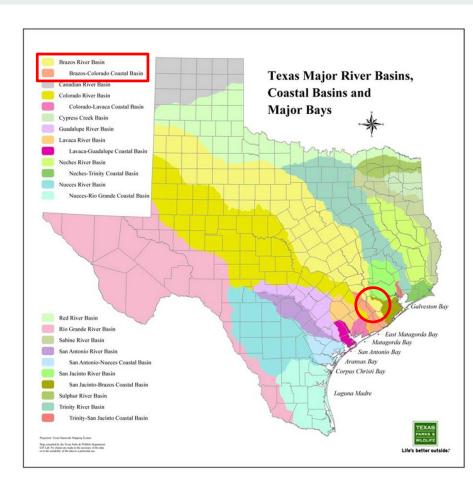
# River Flooding

## **River Flooding**

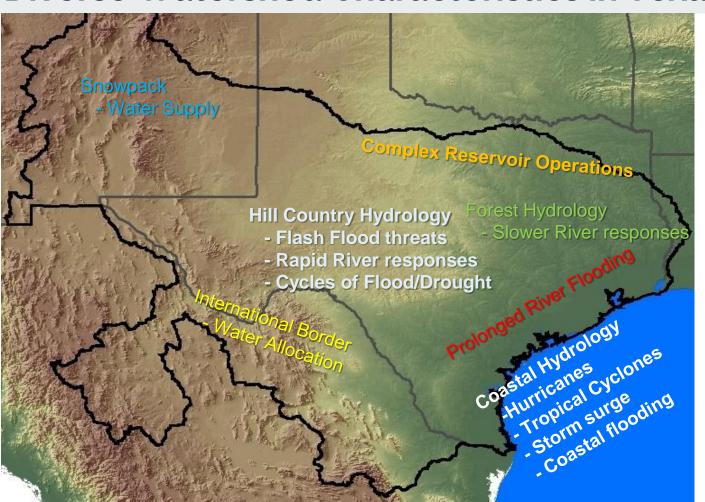


## Watershed

- 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.
- Fort Bend County deals with 3 primary watersheds: Brazos River, San Bernard River and Upper Harris/Brazoria County.

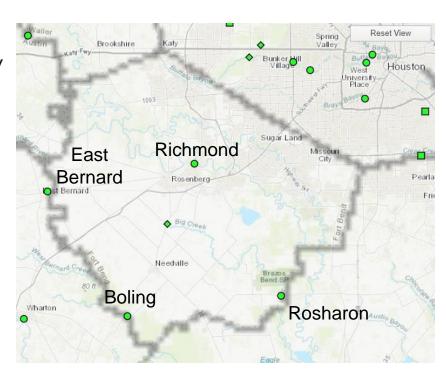


## **Diverse Watershed Characteristics in Texas**



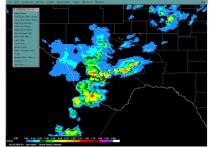
## Watershed

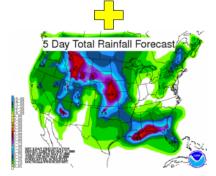
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- Topography plays a big role in how watershed boundaries are defined.
- Fort Bend County deals with 3 primary watersheds: Brazos River, San Bernard River and Upper Harris/Brazoria County.
- NWS issues river forecasts for 4 sites in Fort Bend County.



## **River Forecast Process**

## Rainfall Analysis

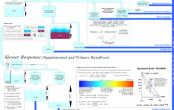


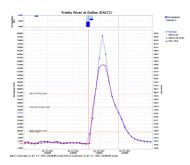


Rainfall estimates and forecasts merged into continuous dataset

## Hydrologic Modeling





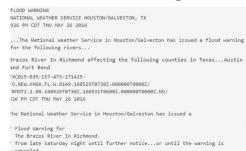


Rainfall ingested into hydrologic model.
Forecasters adjust model parameters in real time

## **Forecast**



## Warning

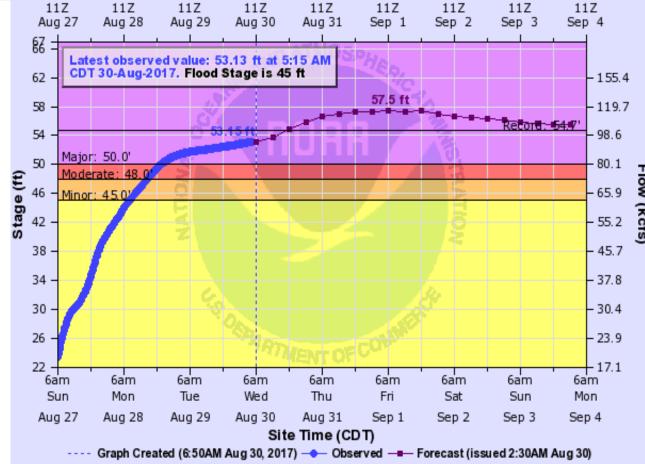


## LOCATION:

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

### BRAZOS RIVER AT RICHMOND

Universal Time (UTC)



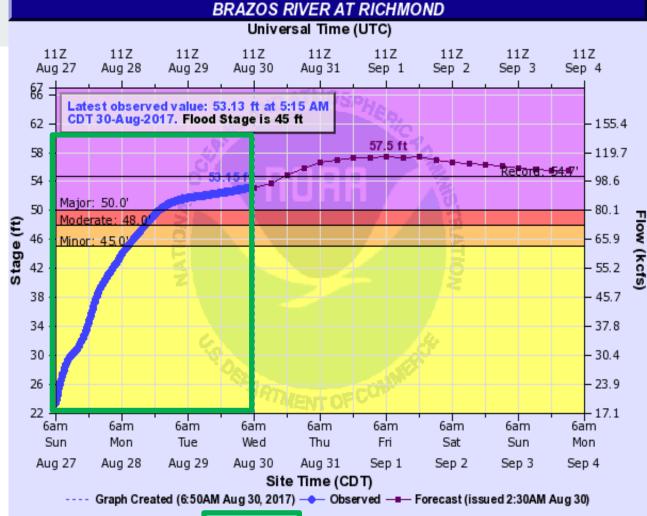
RMOT2(plotting HGIRG) "Gage 0" Datum: 27.94'

## OBSERVATIONS:

Past river stages

## **DATUM:**

Adjustment to mean sea level

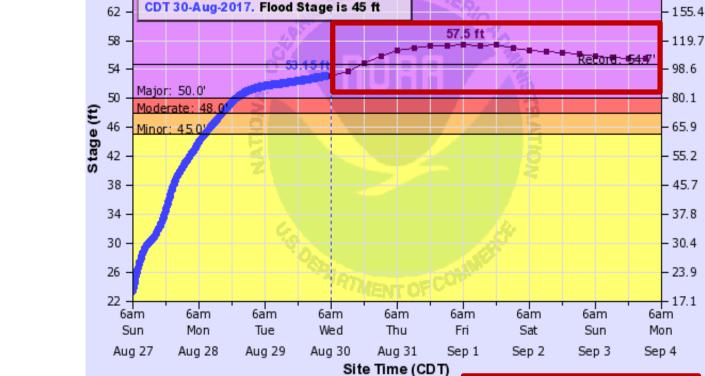


RMOT2(plotting HGIRG) "Gage 0" Datum: 27.94"

## Forecast River Stages

**FORECAST:** 

# **CREST:** Peak Stage



BRAZOS RIVER AT RICHMOND
Universal Time (UTC)

11Z

Sep 1

11Z

Sep 2

11Z

Sep 3

11Z

Sep 4

11Z

Aug 31

Graph Created (6:50AM Aug 30, 2017) - Observed - Forecast (issued 2:30AM Aug 30)

RMOT2(plotting HGIRG) "Gage 0" Datum: 27.94'

11Z

Aug 27

11Z

Aug 28

11Z

Aug 29

11Z

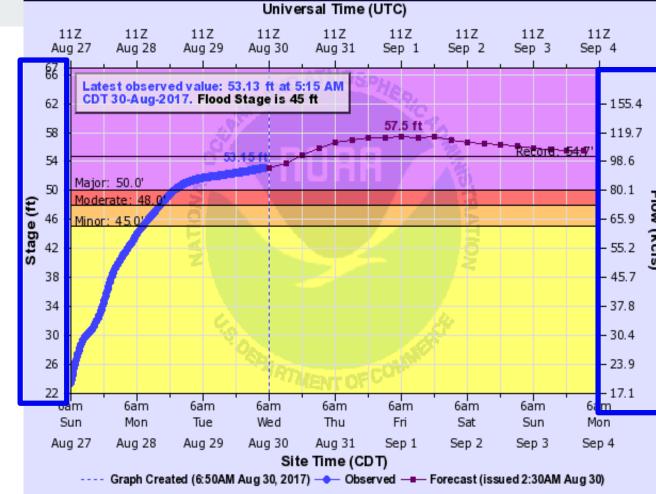
Aug 30

# **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?

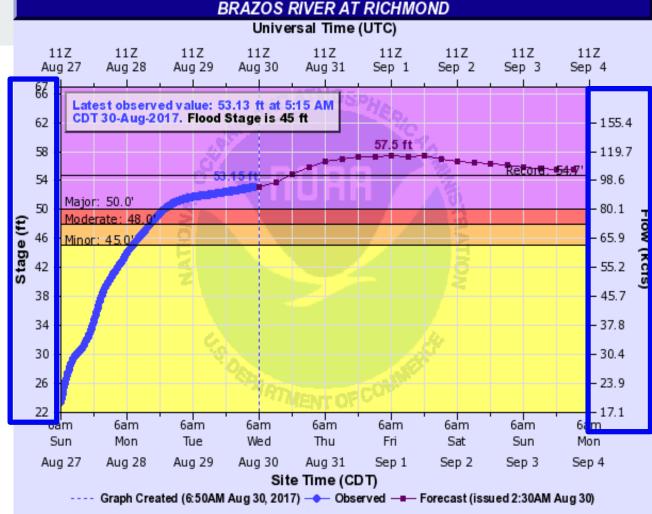


BRAZOS RIVER AT RICHMOND

RMOT2(plotting HGIRG) "Gage 0" Datum: 27.94'

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





RMOT2(plotting HGIRG) "Gage 0" Datum: 27.94"

## **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

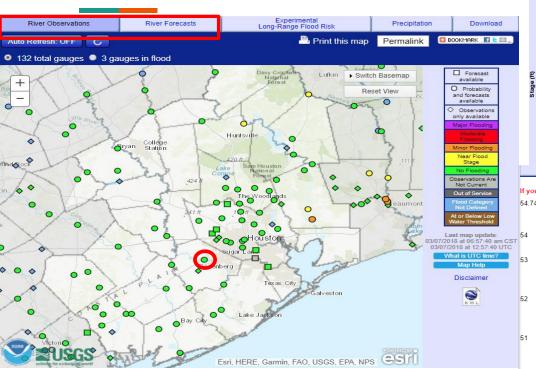
### **MODERATE**

**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.

## Advanced Hydrologic Prediction System





Flood Categories (in feet)
Major Flood Stage: 50
Moderate Flood Stage: 48
Flood Stage: 45
Action Stage: 20
Low Stage (in feet): 0

#### Historic Crests

(1) 55. 19 ft on 09/01/2017 (2) 54.74 ft on 06/02/2016 (3) 50.30 ft on 10/21/1994 (4) 50.01 ft on 06/03/2015

(5) 49.68 ft on 01/01/1992 Show More Historic Crests

(P): Preliminary values subject to further review.

#### Recent Crests

(1) 55.19 ft on 09/01/2017

(2) 5/1 7/1 ft on 06/02/2016 ♠ Collapse

#### If you notice any errors in the below information, please contact our Webmaster

- 54.74 Major flooding continues with significant home flooding in the following areas: Valley Lodge near Simonton, Bar Rd, Baker Rd/Cumings Rd/Rio Brazos area north of Rosenberg, Edgewood/Baudet Rd in Richmond, and FM 2759 near Thompsons. Low living homes in Grand River Rivers Edge. Pecan Estates in Thompson, and Pecan Bend flood as well.
  - Major flooding continues with US90A eastbound lanes inundated and impassible between Harlem Rd and New Territory. Pitts Rd is impassible between US90A and Savannah Dr.
  - Major lowland flooding continues with FM 359 impassible between US90A and the Pecan Grove levee near Southern Place Dr. The intersection of FM 359 and Mason Rd is impassible. FM 2759 is completely inundated east of Agnes Rd. Street flooding occurs along Sienna Parkway between McKeever Rd and Steep Bank Trace. Street flooding occurs along McKeever Rd between Sienna Parkway and SH6. Miller Rd near Arcola is inundated.
  - Major lowland flooding continues with homes near intersection of Sixth St. and Avenue B in Rosenberg beginning to take on water. FM 1489 is inundated south of Simonton to Johnson Rd. FM 723 is inundated north of Rosenberg to FM 359, making the Kingdom Heights and Riverside ranch subdivisions inaccessible. FM 359 between US90A and Pecan Grove begins taking on water. Thompson Ferry Rd south of LJ Parkway is inundated outside of the leveed area.
  - Major lowland flooding continues with homes flooding along Cumings/Baker Roads and in Rio Brazos north of Rosenberg. FM 1093 is inundated to Stansberry Rd in Simonton. Underpass at intersection of SH36/90A west of Rosenberg is inundated/impassible. Fort Bend County flood flight operations in Simonton are exceeded and cease. Low lying streets on west side of Quail Valley take on water. Feeder roads along SH6 near intersection of FM 521/McKeever Rd are inundated. Low lying areas along Knights Ct take on water.
  - Major lowland flooding begins as homes in Richmond begin flooding and many homes in Simonton and Thompsons have water in them. FM 1458 near FM 1093 remains inundated and closed. Homes along Carrol and McKeever Roads near FM 2759 in southeast Fort Bend County are close to taking water. Strange Drive...Greenwood Drive...and Second Street in Richmond and Sixth Street...Avenue B...and River Road in Rosenberg and Pittman Road in Thompsons are inundated with over one find of water.

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

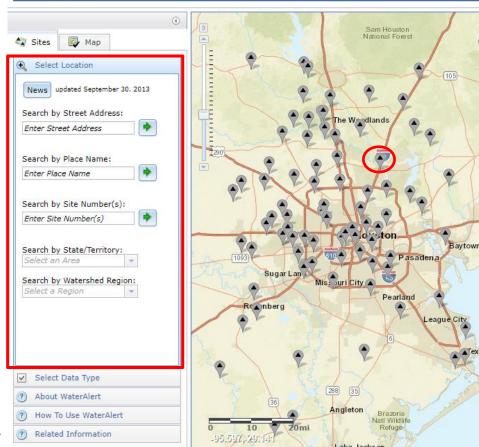
## **USGS Water Alerts**

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

### **USGS Water Alerts:**

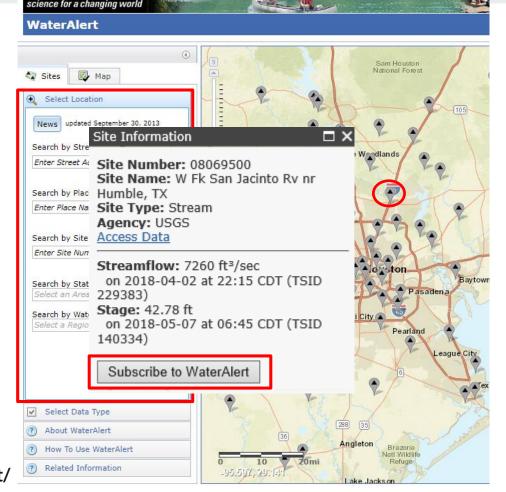
https://maps.waterdata.usgs.gov/mapper/wateralert/





## **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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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"
- 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		
O My mobile phone			
O My email address			
Notification Frequency:	about this		
Hourly	0		
Daily	•		
Streamflow Parameter(s):	about this	Recent value:	
Discharge, in ft3/s	•	7260 [peak chart]	
Gage height, in ft	0	42.78 [peak chart]	
Alert Threshold Condition:	about this		
Greater than (>)     Less than (<)	Real-time value is greater than: ft3/s		
Outside a range (< or >)			
O Inside a range (> and <)			

Reset

Cancel

**USGS Water Alerts:** 

https://maps.waterdata.usgs.gov/mapper/wateralert/

? Related Information

## **Partners**

#### **Partners**

#### **Roles of Primary River Forecast Partners**



- Operate Flood Control Reservoirs
- Manage Other WR Projects



US Army Corps of Engineers

#### **Shared Data and Resources**

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



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



- Gage Maintenance
- Stream Measurements
- Focus Stream Gage Network



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



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



# Brazos River Authority Operations 2019 FloodAware Training

Presented by
Brad Brunett, Regional Manager – Central & Lower Basins
Aaron Abel, Water Services Manager
Chris Higgins, Senior Hydrologist

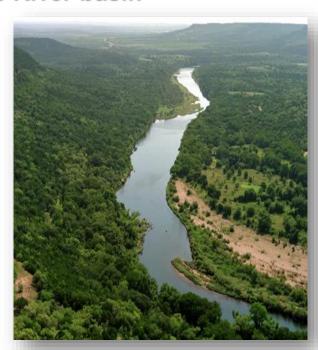


#### Brazos River Authority Overview

## Our Mission

# To develop, manage, and protect the water resources of the Brazos River basin

- Oldest river authority in Texas
- Created by the Texas Legislature in 1929
- First entity of its kind in the nation
- Self-funded (not appropriated), do not levy taxes
- 21 member Board appointed by Governor
- Territory:
  - Extends from the Texas-New Mexico state line west of Lubbock to the Gulf of Mexico near Freeport
  - More than 42,000 square miles
  - All or part of 76 counties





## **Our Business**

- Raw Water Supply
- Water & Wastewater Treatment
- Water Quality & Environmental Stewardship



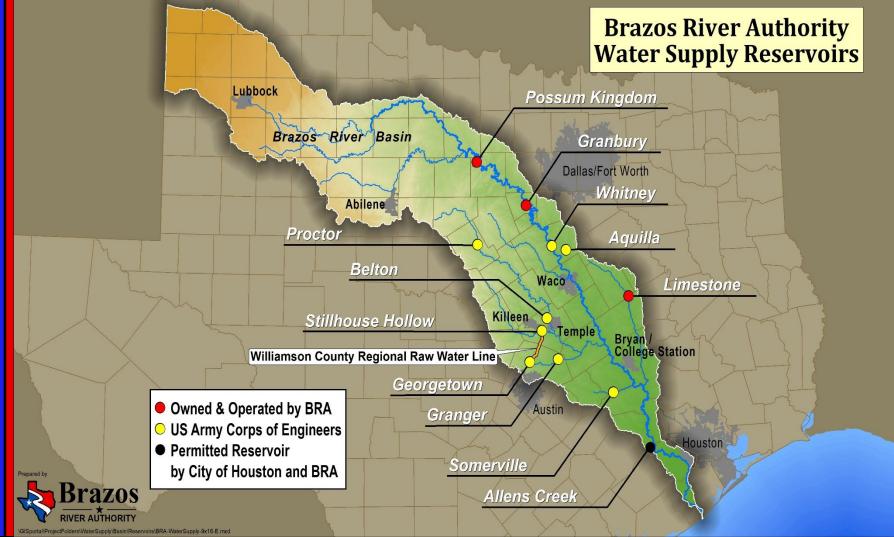






M







## Storage in Brazos Basin Corps of Engineers Reservoirs

Flood Storage

4 Million Acre-Feet

 Brazos Basin Corps of Engineers Reservoirs have prevented \$1.6 billion in flood damages as of the end of 2017 Normal Full Storage
1.7 Million
Acre - Feet









## The Drought, 2011 – 2015...(RIP!)







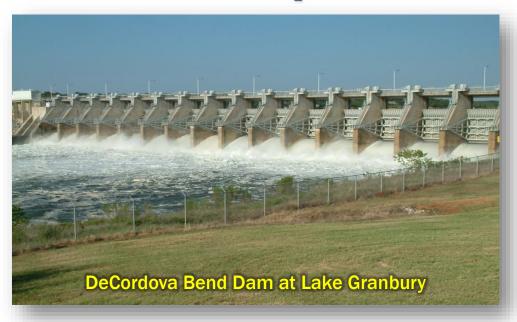
					aggregated by stream segment i	reacnes
1.	Possum Kingdom Lake	74,166	10. Lake Proctor	10,180	19. Little-San Gabriel conf. to Little Rv at Cameron	5,000
2.	Possum Kingdom Lake dam to Palo Pinto gage	e 4,800	11. Lake Proctor dam to Leon Rv at Gatesville gage	2,909	20. Brazos-Little conf. to Bryan gage	200
3.	Palo Pinto gage to Dennis gage	1,050	12. Leon Rv at Gatesville gage to Lake Belton dam	76,062	<ol><li>Bryan gage to Brazos-Yegua conf.</li></ol>	150
4.	Dennis gage to Lake Granbury dam	89,244	13. Lake Belton dam to Leon Rv nr Belton gage	30,453	22. Lake Somerville	4,200
5.	Lake Granbury dam to Glen Rose gage	1,200	<ol><li>Leon Rv nr Belton gage to Little Rv gage</li></ol>	200	<ol><li>Brazos-Yegua conf. to Brazos-Navasota conf.</li></ol>	540
6.	Glen Rose gage to Lake Whitney dam	11,510	15. Stillhouse Hollow Lake	39,255	24. Lake Limestone	50,875
7.	Lake Aquilla	6,500	16. Stillhouse Hollow Lake dam to Lampasas Rv nr Beltor	gage 8	<ol><li>Easterly gage to Brazos-Navasota conf.</li></ol>	7,600
8.	Lake Whitney dam to Brazos nr Aquilla gage	11,403	17. Lake Georgetown	74,561	26. Hempstead gage to Richmond gage	113,070
9.	Brazos-Aquilla conf. to Highbank gage	2,300	18. North San Gabriel gage to Lake Granger dam	13,015	27. Richmond gage to Gulf of Mexico	46,780

\WaterSupply\Basin\LongTermContracts\LTWC-8x11-3D-ContractAmount.mxd 2012-May-31 vw

source: Brazos River Authority



## Reservoir Operations

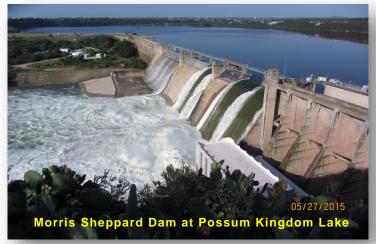


- BRA reservoirs contain no flood storage space
- What comes in must go out real-time



# Significant Operating Rules

- Don't release based on weather forecasts
- Don't make flooding worse downstream than it would have been without the reservoir being present
- Prevent water overtopping flood gates
- Attempt to minimize flood potential on upper end of lakes
- Ensure good communication
  - BRA Central Office and Lake Office staff
  - Downstream Call Lists
  - West Gulf River Forecast Center& Other Agencies
  - Emergency Management Officials
  - General Public
  - Social Media





# Lower Brazos Flood Study

### Why?

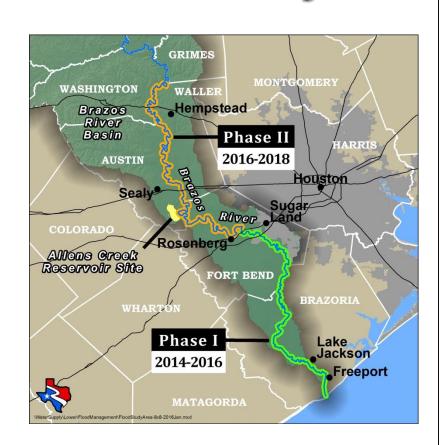
High growth area with outdated and inconsistent Brazos River floodplain information

#### Who?

 Texas Water Development Board, lower basin entities, BRA, & Halff Associates, Inc.

#### What?

- New models
- New estimates of how much water, how fast, and how high
- New maps
- Alternatives to reduce/mitigate future damages









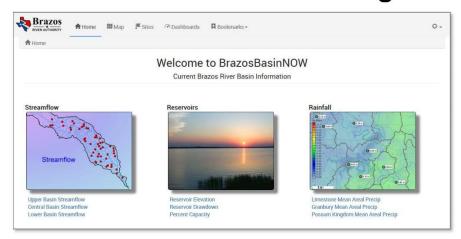
### information@brazos.org







#### www.BrazosBasinNow.org

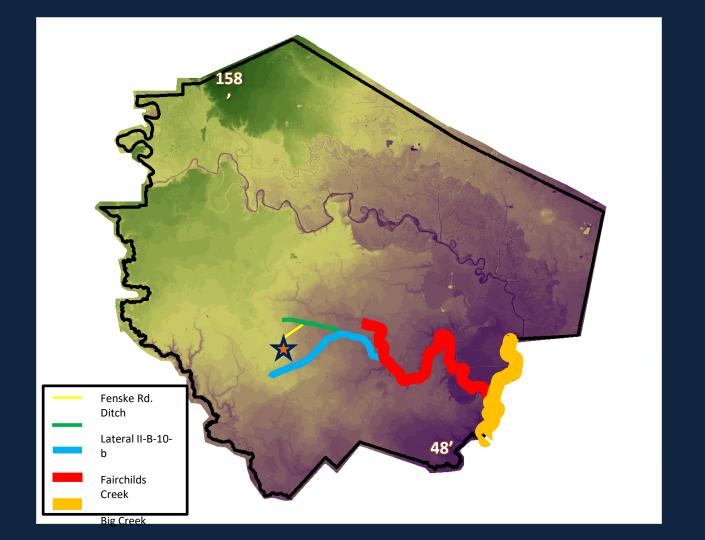


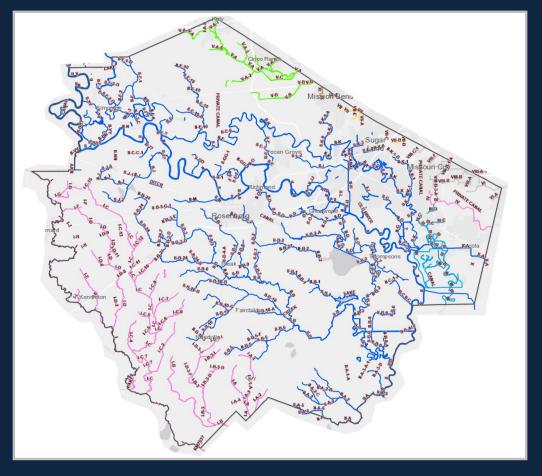




## NWS FloodAware – Sugar Land March 25, 2019 Fort Bend County Drainage District







**Fort Bend County Major Streams & Drainage Channels** 

#### **San Bernard River**

- Mound Creek
   Guy Creek
- Cedar Creek

  Buffalo Creek
- Snake Creek

Moody Creek

- Turkey Creek
   Dry Branch
- Means Ditch
- East Bernard Ditch
- Jackson Ditch
- San Bernard Lateral I-J
- Oldag Ditch

#### **Brazos River**

- Cow Creek
   Bee Creek
   Turkey Creek
   Hoggs Bayou
   Parrot Creek
- Big Creek
   Waters Lake Bayou

Dutch John Creek Dry Creek Gapps Slough

Cow Creek Lat. II-A-5

Theatre Ditch

#### **Brazos River (cont.)**

Big Creek (cont.)

Seabourne Creek
Deer Creek

Deer Creek Big Creek Lat. II-B-7

Big Creek Lat. II-B-9

Fairchilds Creek Cottonwood Creek

Rabbs Bayou

Middle Bayou

Jones Creek

Andrus Creek
Rosenbush Ditch

Tara Lateral

Flewellen Creek

Jones Lateral II-E-1 Brynmawr Lateral Woods Edge Lateral

**Brookshire Creek** 

#### Fulshear Creek

Hady Creek Orchard Creek Pool Hill Ditch

- Steepbank Creek
- Ditch H
- Duval Ditch
- Flat Bank Creek
- Bullhead Slough
- Upper Oyster Creek
  Stafford Run
  Red Gulley

#### **Brazos River (cont.)**

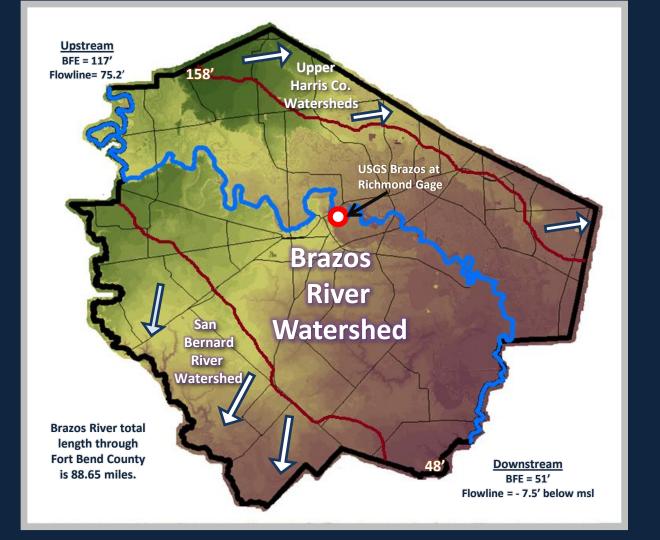
- Lower Oyster Creek
- Robinowitz Ditch
- Fulshear Farms Ditch
- Pleasant Gulley
- Guyler Ditch
- Moore Gulley
- Sugar Land Ditch
  Briscoe Ditch
- Aylor Ditch
- Aylor Ditch
- Schuech DitchCounty Line Ditch
- West Simonton Ditch
- Brazos Lateral II-0

#### **Upper Harris/Brazoria**

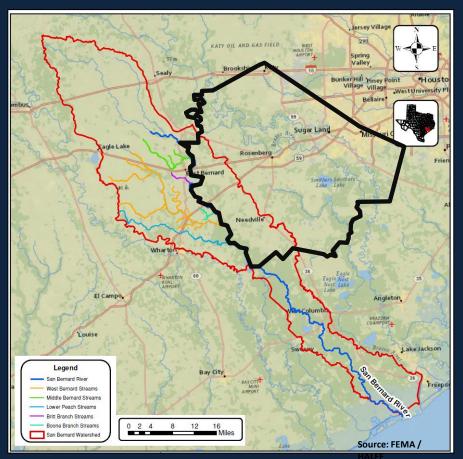
- Mustang Bayou
- Willow Fork of Buffalo Bayou
   Cane Island Branch

Little Prong Creek
Willow Fork Lateral V-A-3
Cinco Ranch Ditch

- Long Point Slough / Clodine Ditch
- Clear Creek
- Keegans Bayou
- Sims Bayou
   Cangelosi Ditch
- Brays Bayou



## **SAN BERNARD RIVER**





Headwaters located north of I-10 between Sealy & Columbus

Approximately 20% of Fort Bend County drains into the San Bernard River

Subject to overflows from the Colorado River near Wharton

Major Flood Events:
June 1960
November 1998
Hurricane Harvey (Aug. 2018)

On-Line Flood Gages: Chesterville at FM 3013 East Bernard at SH90A Boling at FM442

# BIG CREEK WATERSHED





Total Watershed = 144,000 acres (appx. 26% of FBC)

Headwaters near Orchard and enters the Brazos River at Brazos Bend State Park

Major Features: City of Rosenberg

Pleak, Fairchilds, Needville & Beasley

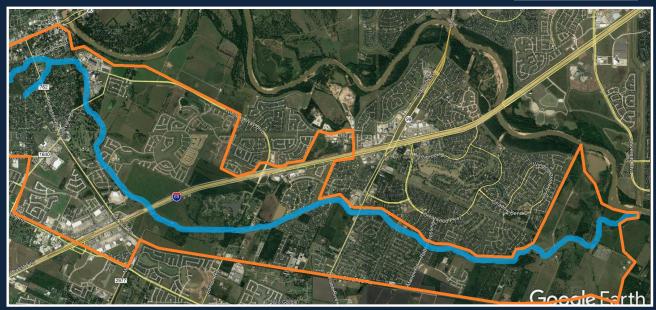
Smithers Lake / NRG Power Plant

Brazos Bend State Park

**Seabourne Creek Park** 

## **RABBS BAYOU**





Total Watershed = appx. 5,700 acres (appx 1% of FBC)

Headwaters is along
Lane Dr. near
Rosenberg/Richmond
city limits

Enters Brazos River South of Greatwood Major Developments:
Portions of Richmond,
Rosenberg, Veranda, Del
Webb, Rosenberg Town
Center



## **BESSIE'S CREEK**

Total Watershed = 67,584 acres (appx. 12% of FBC)

Headwaters is located within Waller County near Monaville

Brookshire Creek is a major contributing watershed

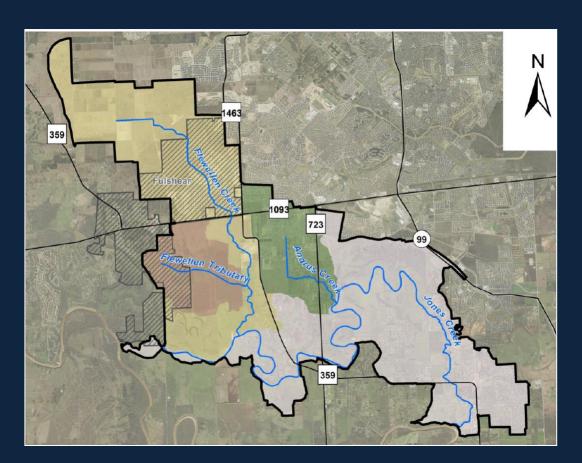
Total length of the main stem of Bessie's Creek is appx. 45 miles

FBCDD refers to lower end of Bessie's Creek as Fulshear Creek

Confluence with the Brazos River near Bois D'arc Ln & Winner Foster Rd.

Major Fort Bend Developments:
Cities of Fulshear, Simonton,
& Weston Lakes
Fulbrook
Fulbrook on Fulshear Creek
Proposed Twinwood Development

## **JONES CREEK**





Total Watershed = 31,500 acres (appx. 6% of FBC)

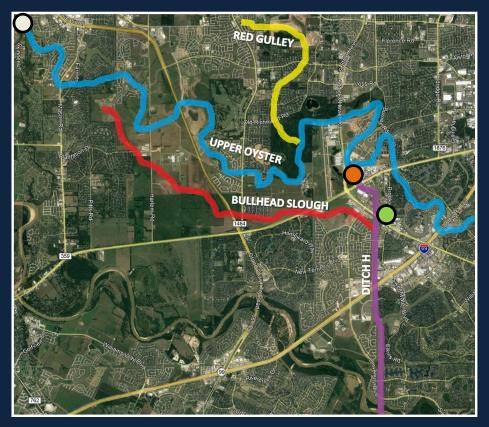
Flewellen Creek is a major lateral and contributes approximately half the drainage area

Jones Creek enters the Brazos just upstream of Richmond

Major
Developments:
Cross Creek Ranch
Tamarron
Briscoe Falls
Sendero
Creekside Ranch
Westheimer Lakes
Rolling Oaks
Woods Edge

## **UPPER OYSTER CREEK**

(Red Gulley, Bullhead Slough & Ditch H)





#### **Major Developments:**

Long Meadow Farms
Harvest Green
Waterside Estates
Aliana
Village of Oak Lake
FBCMUD No. 25
Imperial Sugar Land
Sugar Land Airport
Telfair
City of Sugar Land

Headwaters is at Skinner Rd. near Long Meadow Farms

Ditch H enters the Brazos River near LID 14/ Avalon south of University Blvd.

## **UPPER OYSTER CREEK**



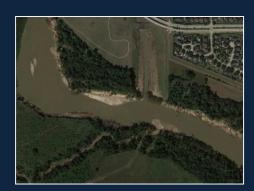
OYSTER CREEK HEADWATERS - SKINNER RD.



OYSTER CREEK / DITCH H
DIVERSION STRUCTURE

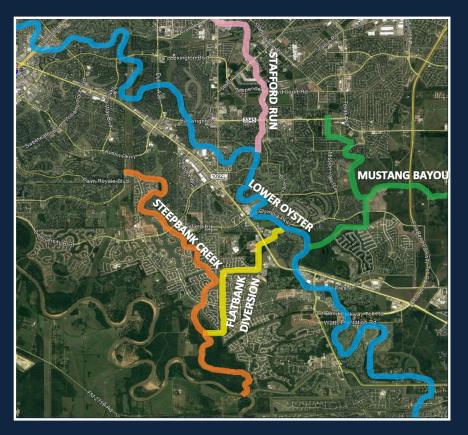


AMIL GATES REPLACEMENT STRUCTURE



DITCH H / BRAZOS RIVER CONFLUENCE

# ADDITIONAL SUGAR LAND / MISSOURI CITY / STAFFORD BRAZOS RIVER WATERSHEDS





**LOWER OYSTER CREEK** 

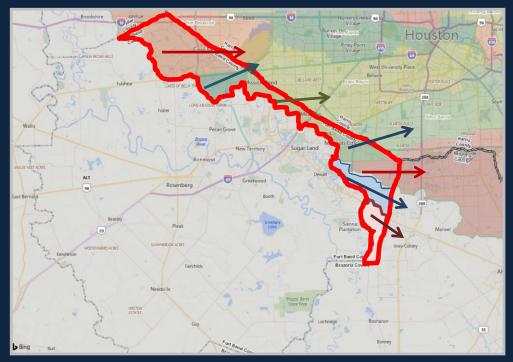
**STAFFORD RUN** 

**STEEPBANK CREEK** 

FLATBANK
DIVERSION CHANNEL

**MUSTANG BAYOU** 

## **UPPER HARRIS / BRAZORIA CO.**



Willow Fork of Buffalo Bayou/Barker Reservoir

**Long Point Slough/Clodine Ditch** 

**Brays Bayou** 

**Keegans Bayou** 

**Sims Bayou** 

**Clear Creek** 

**Chocolate Bayou** 

**Mustang Bayou** 

Approximately 15% of Fort Bend drains east into Harris and Brazoria County watersheds

Barker Reservoir owned and operated by US Army Corps of Engineers

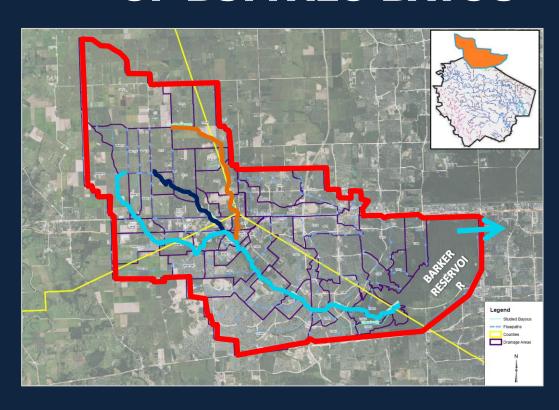
Developed/urban
watersheds
within Houston, Stafford,
Missouri City,
Arcola city limits

On-Line Flood Gages available at HCFCD Flood Warning Website:

www.harriscountyfws.or

8

# WILLOW FORK OF BUFFALO BAYOU



Total Watershed = 82,432 acres

Appx. 1/3<sup>rd</sup> of total watershed (27,520 acres) lies within FBC

3 Major Laterals come together at the upper end of Fort Bend (WFBB, Snake Creek, & Cane Island Branch)

> All flows routed through Barker Reservoir

#### **Major Developments:**

City of Katy Firethorne Pine Mill Ranch Grayson Lakes Seven Meadows Grand Lakes Cinco Ranch Kelliwood Canyon Gate

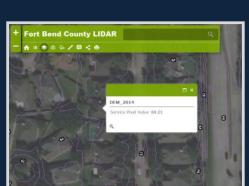
## **LOCAL RESOURCES:**

## www.fortbendcountytx.gov

/government/departments/county-services/drainage-district



**Floodplain Maps** 



LiDAR Topographic Data



Stream / Channel Maps



**Search Levee Contacts** 

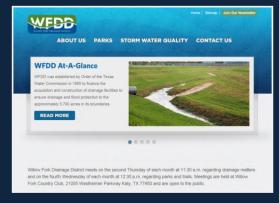
Links to Flood Gages

River Level Gauges

**Fort Bend County** 

## **LOCAL RESOURCES:**





**City Resources** 

**LID/MUD Resources** 



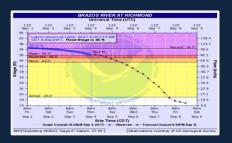
## In closing...



Countywide "Watershed Study"



US Army Corps of Engineers Brazos River FRM Study & Bathymetric Data Collection



**New Flood Gages** 



JEFFREY T. JANECEK, P.E.
FORT BEND COUNTY DRAINAGE DISTRICT
jeffrey.janecek@fortbendcountytx.gov
(281) 342-2863

## **Hydrology in Harris County**

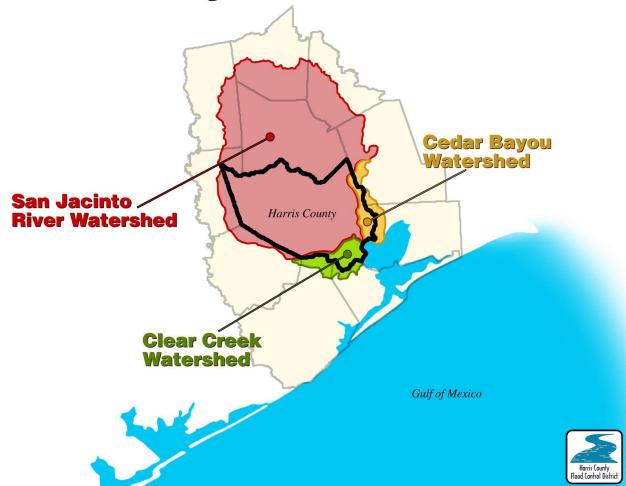
Mark Moore
Lead Hydrologic Technician
Harris County Flood Control District

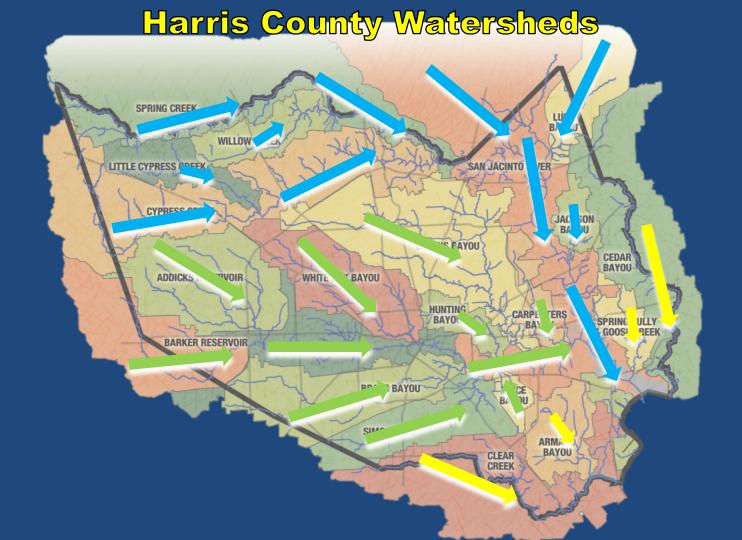
## **Southeast Texas Watersheds**





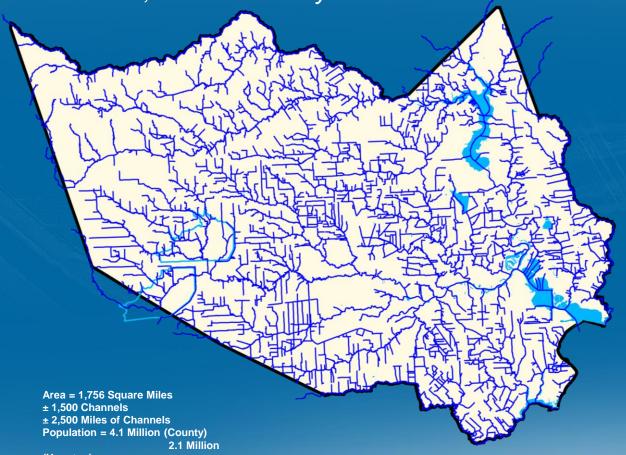
## **Harris County Local Watersheds**





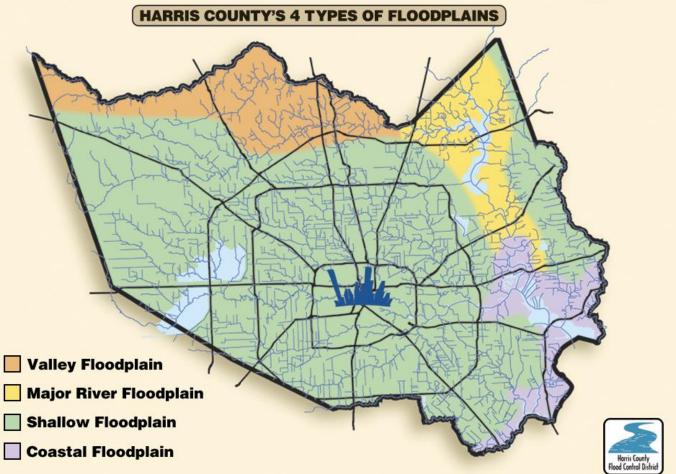
#### **Harris County Open Channel Network**

2,500 Miles of Bayous and Creeks

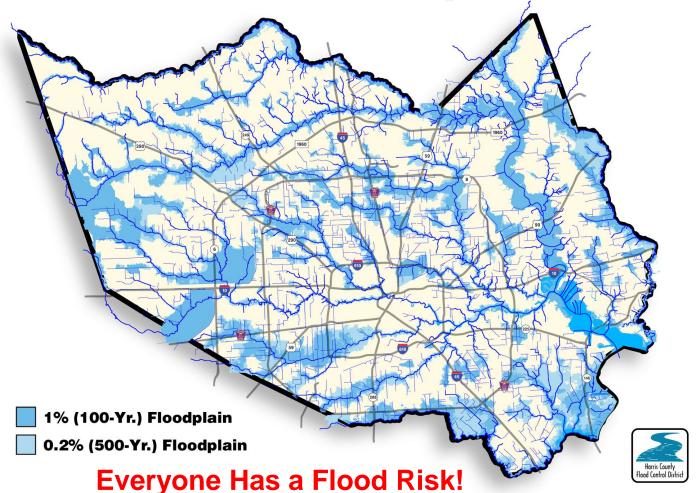




## **Understanding Our Flooding**

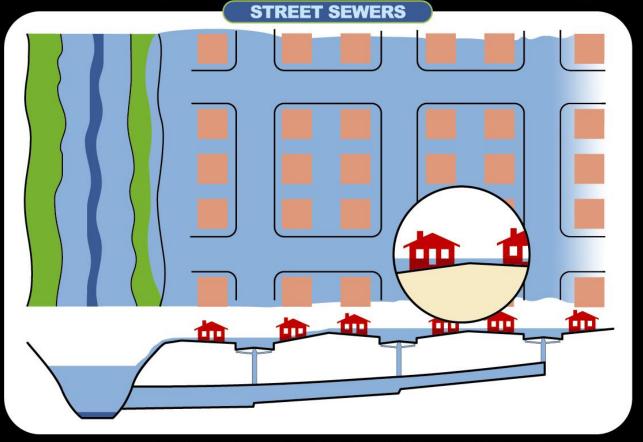


## 2007 FEMA Floodplains





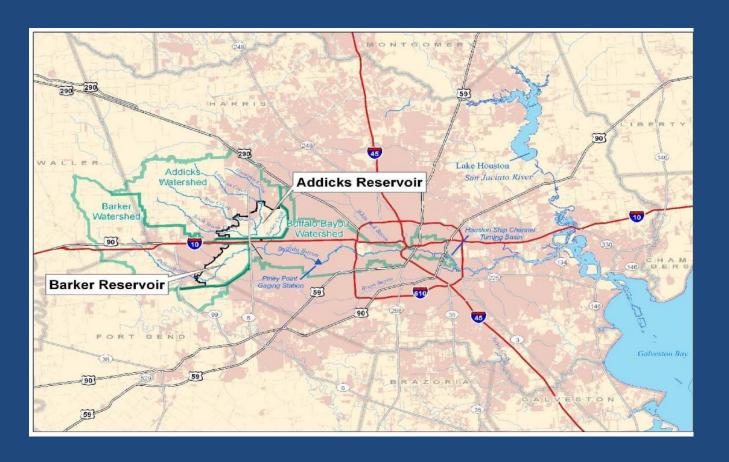
## **Ponding & Sheet Flow Flooding**



FLOODING FROM INTENSE LOCAL RAINFALL (Longer Duration)



#### **Addicks and Barker Watersheds**

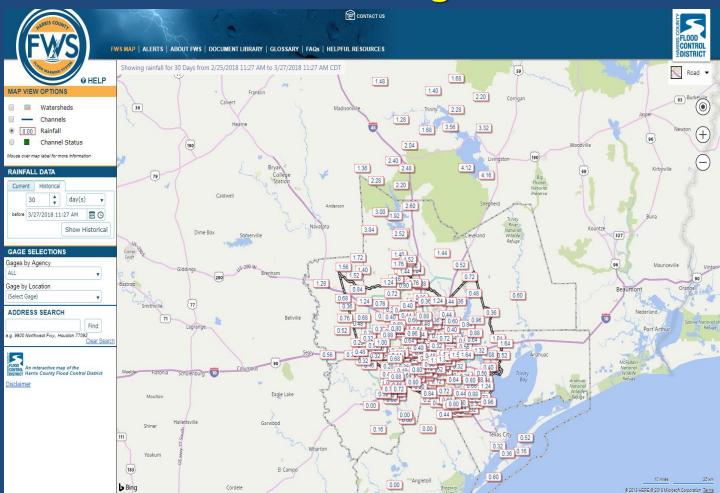


## **Flood Warning System**

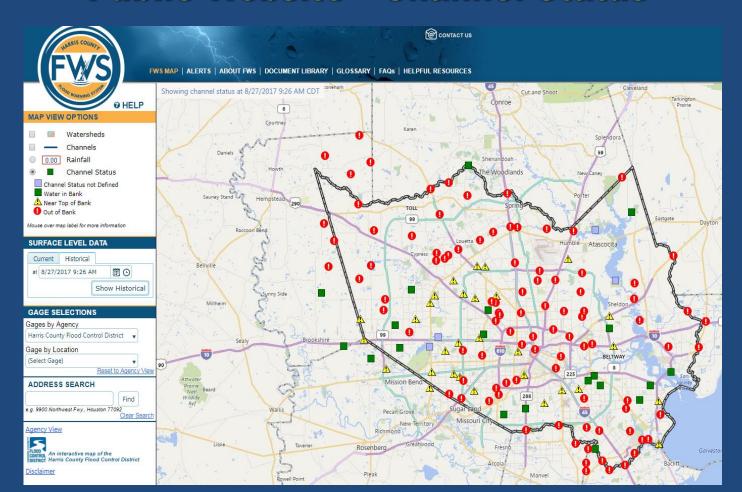




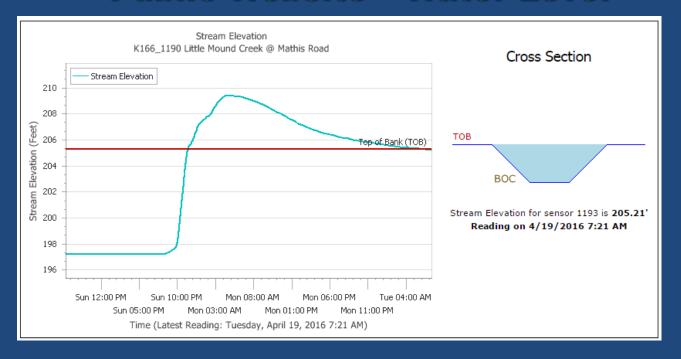
## **All FWS Gages**



#### **Public Website - Channel Status**



#### **Public Website - Water Level**



Flood Frequency	Elevation
10% (10-year)	208.80'
2% (50-year)	209.70'
1% (100-year)	210.10'
.2% (500-year)	211.10'

Historical Storm				
Date	Event	Elevation		
7/12/2012		207.90'		
4/18/2016		209.30'		
5/27/2016		208.05'		
8/27/2017	Harvey	208.90'		
High water mark elevations are approximate.				

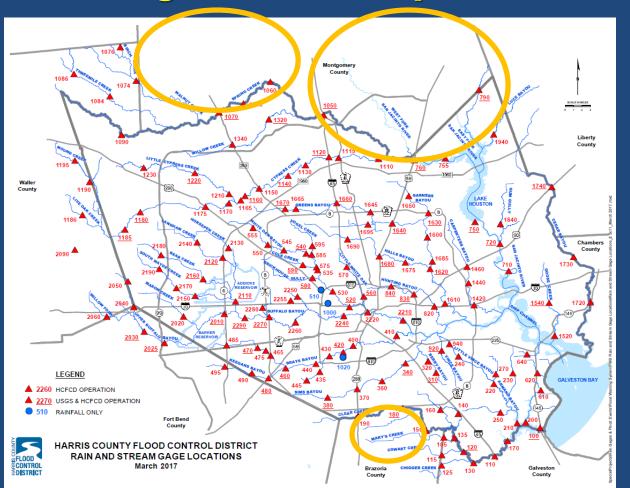
#### **Future Enhancements**

- Near real time inundation mapping
- Public customizable alarms
   Rainfall and stage
   Text or e-mail
- Expansion of FWS gages (Regional)
- Add roadway flooding (TranStar)

## **Inundation Mapping**



**Gage Network Expansion** 



### **Important Information Sources**

- Harris County Flood Control District
- City of Houston
- Harris County Office of Emergency Management
- Fort Bend County Office of Emergency Management
- Fort Bend County Drainage District
- National Weather Service
- U.S. Army Corps of Engineers

#### **Important Twitter Handles**

- @hcfcd
- @readyharris
- @houstonOEM
- @nwshouston
- @jefflindner1

# **Flood Safety**

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

## Safety Before a Flood



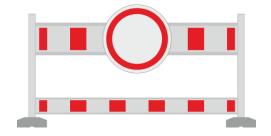


- Prepare a family disaster plan.
- Check if your insurance covers flood damages. If not, get flood insurance.
- Keep insurance and other important documents, such as copies of driver's licenses and credit cards, and other valuable items, in a safe place.
- Assemble a disaster supplies kit. Be sure to 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 Flood

- Monitor warnings and be prepared to take action.
- Have multiple ways to receive weather information.
- Turn around, don't drown!
- Stay away or be swept away. Flood waters will be moving swiftly and river banks/culverts can become unstable.
- Barricades are for your protection; do <u>not</u> drive around them!
- Do not sightsee!
- If evacuations are ongoing, don't get in the way of first responders.
- Stay out of the flood waters!



## 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!
- Flooded roads may have hidden dangers, such as washed out road beds or underwater obstructions.
- Be especially cautious when traveling at night.
- 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 After a Flood

- Stay away from damaged areas unless your assistance has been specifically requested by police, fire, or a relief organization.
- Return home only when authorities indicate it is safe.
- Use extreme caution when entering buildings; there may be hidden damage, particularly in foundations.
- Cut power to flooded areas of your home
- Only use generators in well-ventilated areas—never in a closed garage!



weather.gov/flood

# 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

Any Coastal 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

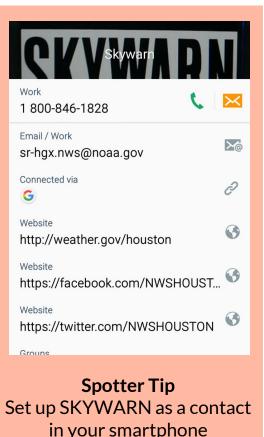
Call sign WX5HGX

**Email** 

sr-hgx.nws@noaa.gov

Social Media

Twitter: @NWSHouston Facebook: NWSHouston



in your smartphone

## Flood Risk

### Flood Risk?



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





#### **Insurance Misconception**

#### • Misconception:

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

#### Fact:

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

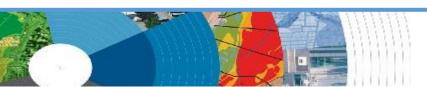
Renters and Business owners should also consider flood insurance for contents.

#### 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.

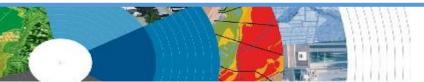




## **Cost of Flood Damage?**

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





## Flood Insurance/Group Flood Insurance

#### **Everyone is at risk for flooding**

- Brief definition of flooding is any forms of rising water in which 2 properties are affected-one being yours
- Structure Coverage
  - 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
- Wait Period
  - Typically 30-days from purchase until effective.
- Average NFIP pay out for Harvey was \$112K (March 2018)

#### Group Flood Insurance

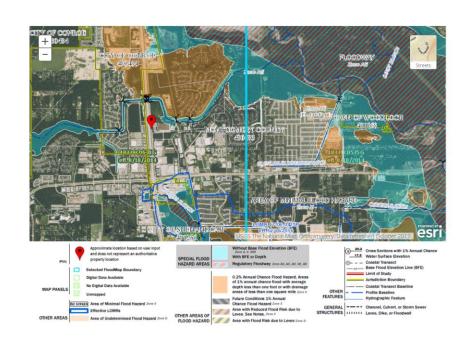
- Available during a Presidential Declared event
- If qualified for a IA grant a GFIP will be purchased in the amount of \$600
- Policy is good for 3 years
- Must maintain insurance on the property forever
- Max amount on the policy is 33,500 this includes structure and dwelling
- Average pay out for Harvey for IA was \$6000



#### What is a FIRM?

#### Flood Insurance Rate Map

- Identifies the flood zones
- SFHA (high risk)
  - A, AE, AO, AH, VE, V etc. (Aqua)
    - 1% annual chance flood
- 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
    - o Even the non-shaded is a flood zone a minimal risk.
- Used for rating flood insurance policies
- Are subdivided by panels to cover jurisdictional boundary.
- Shows what the BFE within the zones
- FIRM's only show Costal and Riverine flood risk





### **Structure Elevation Impact Insurance Rates**



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.

## **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.
- Flood insurance allows individual property owners to manage their risk.
  - Buy policies that cover the structure **AND** contents.



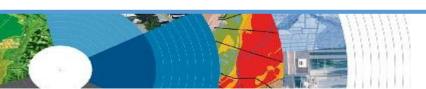
#### **Contact Information**

Angela Harrison, Insurance
Cell 470-557-2794 | Angela.Harrison@fema.dhs.gov

Yho-Meka Conway, Insurance Cell 470-572-0803 | Yho-Meka.Conway@fema.dhs.gov

NFIP Hotline 1-800-427-4661 www.fema.gov/nfip Lauren Schmied, PE, Floodplain Management Cell 202-812-6164 | <u>Lauren.Schmied@fema.dhs.gov</u>

Larry Fordham ANFI, CFM, ACA
Acting Senior Regional Insurance Specialist, FEMA Region 6
Phone: 940-383-7253 | Cell: 202-394-4483
| Larry.Fordham@fema.dhs.gov





## Questions

National Weather Service Brazos River Authority Fort Bend County Drainage District Harris County Flood Control District FEMA