



Hurricane Harvey Storm Event: Briefing Regarding Lake Conroe Operations

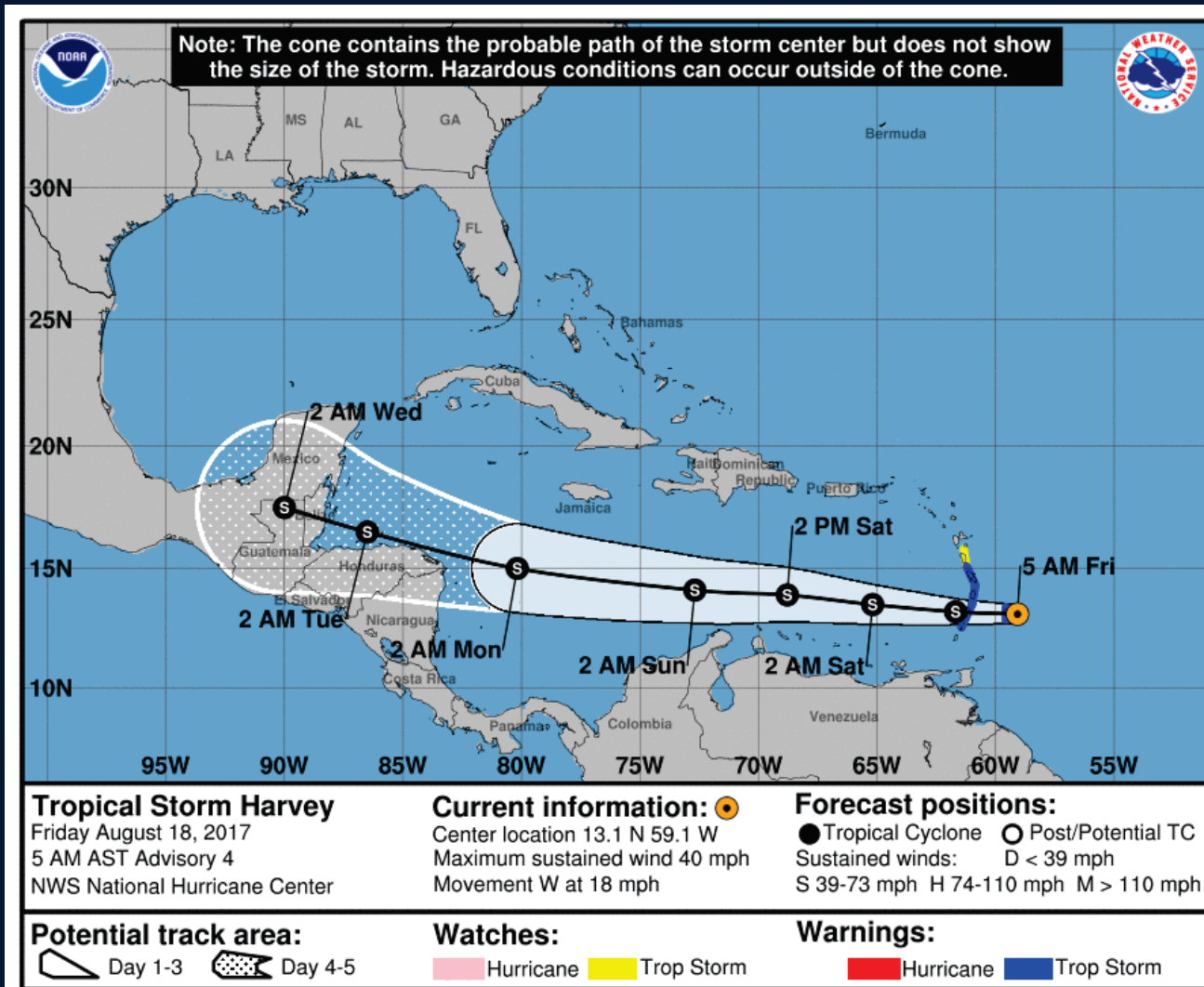
**SJRA Board Meeting
September 28, 2017**

Hurricane Harvey

Time Sequence

August 18 thru August 31, 2017

Friday, August 18, 2017 - Seven Days Prior to Landfall

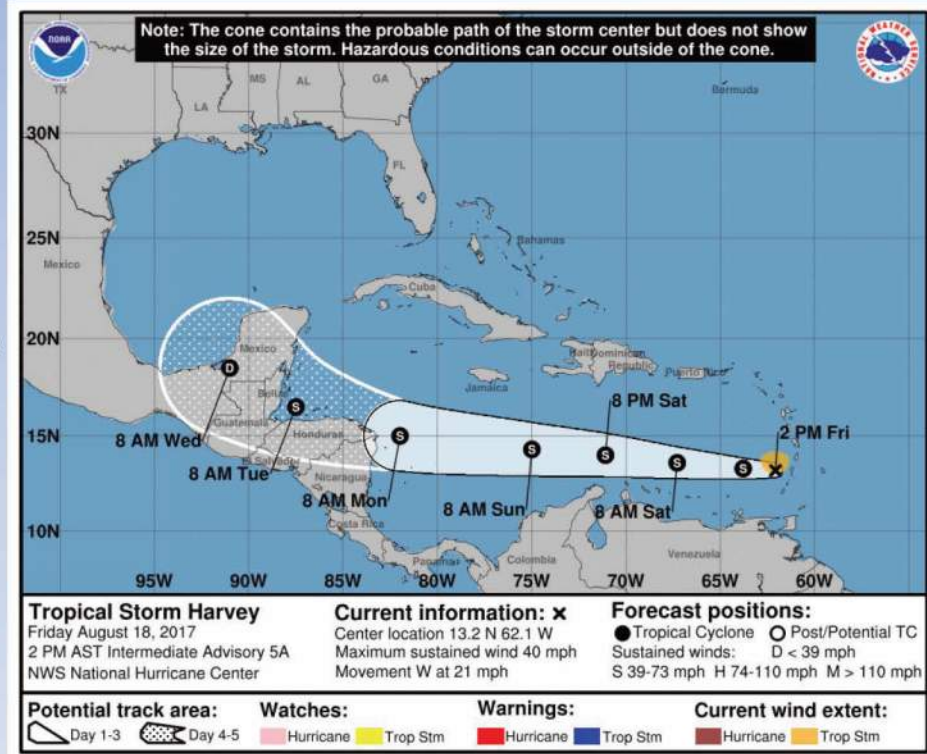




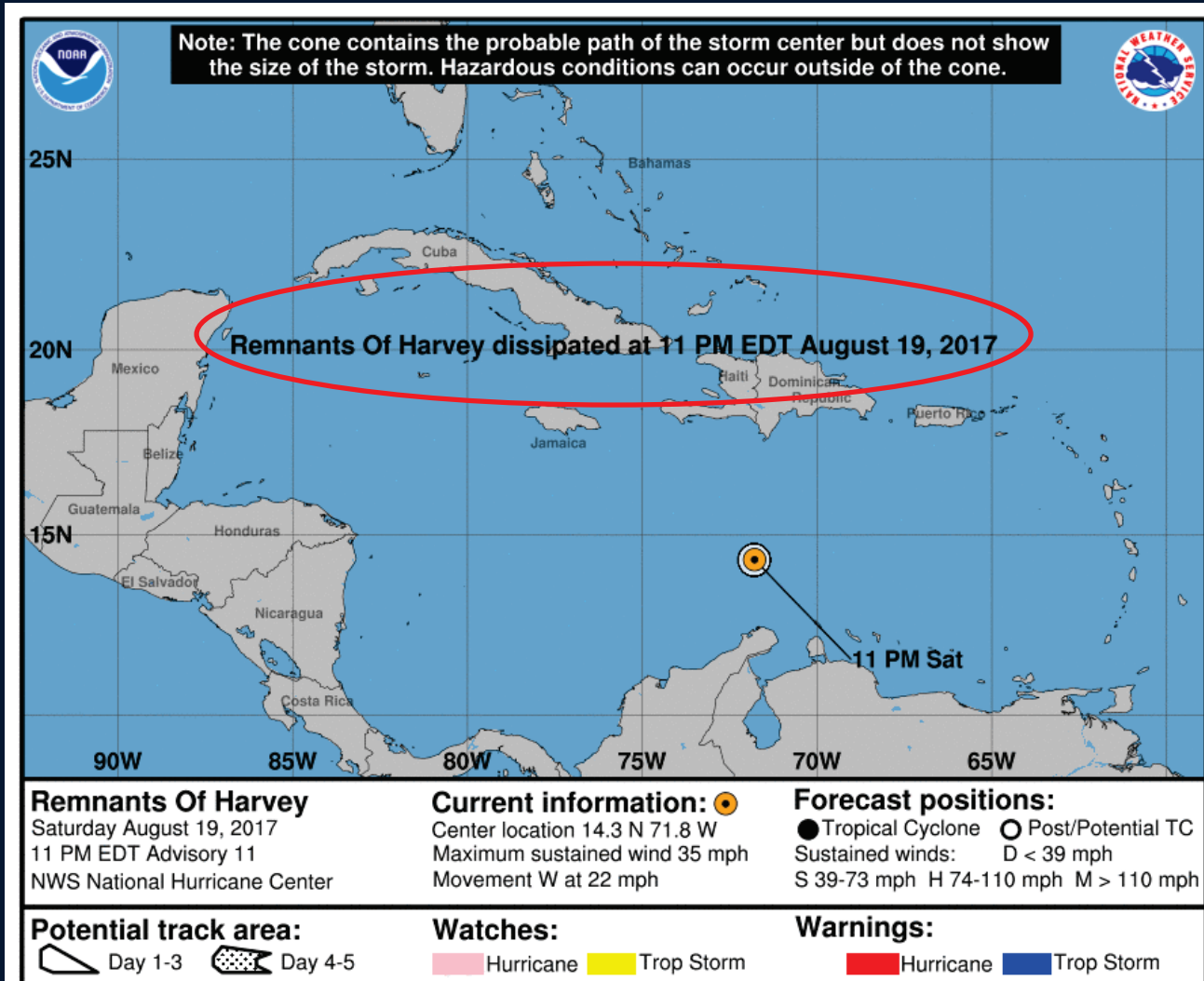
Tropical Storm Harvey

National Weather Service Houston/Galveston

- Tropical Storm Harvey is forecast to track westward across the Caribbean Sea over the next 5 days and into Central America or the Yucatan Peninsula as shown
- Beyond 5 days could continue westward over land or turn more northwestward and track into the Southern Gulf of Mexico
- Storm poses no immediate threat to Southeast Texas but will need to be monitored the next several days



Saturday, August 19, 2017 - Six Days Prior to Landfall



Tuesday, August 22, 2017
Three Days Prior to Landfall



Situation Overview

National Weather Service Houston/Galveston

- Circulation associated with remnants of Harvey centered over Yucatan
- Likely to redevelop into a tropical storm or hurricane as it emerges out over the warm waters of Bay of Campeche
- Track details still uncertain but landfall of a hurricane (Cat 1?) possible lower to mid TX coast around Friday
- Some solutions slow the storm after landfall and draw it up the coast → significant rainfall, flood potential

Two-Day Graphical Tropical Weather Outlook

National Hurricane Center Miami, Florida



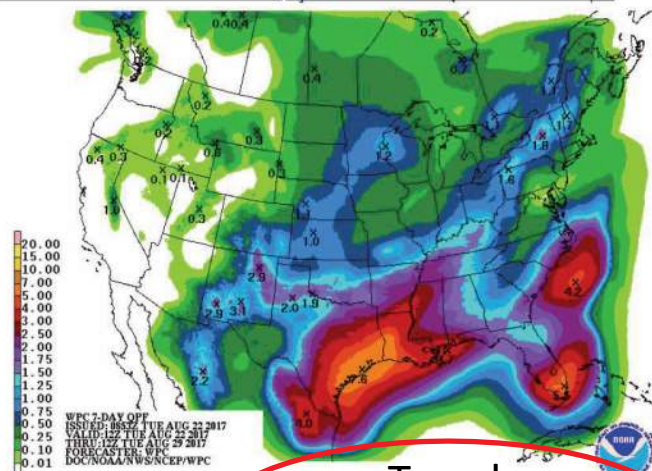
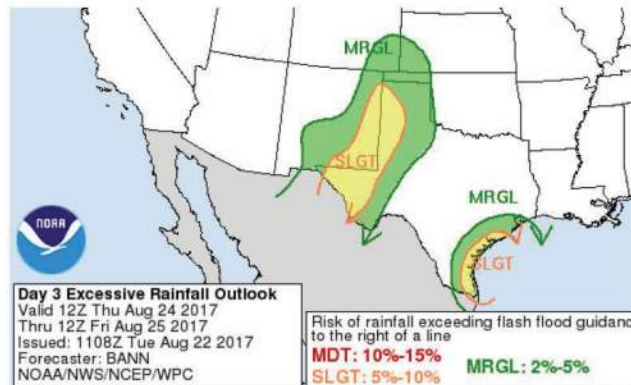
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Rainfall, Flood Threat

National Weather Service Houston/Galveston

- Landfall Friday accompanied by winds, surge, heavy rainfall
- Depending how storm then tracks periods of heavy rain could continue through the weekend
- Basin averages of 4 to 8 inches are likely but could well be double or higher if storm takes that slower track; will refine these amounts as we get closer
- Flash flood watches may be needed as we get closer to the event



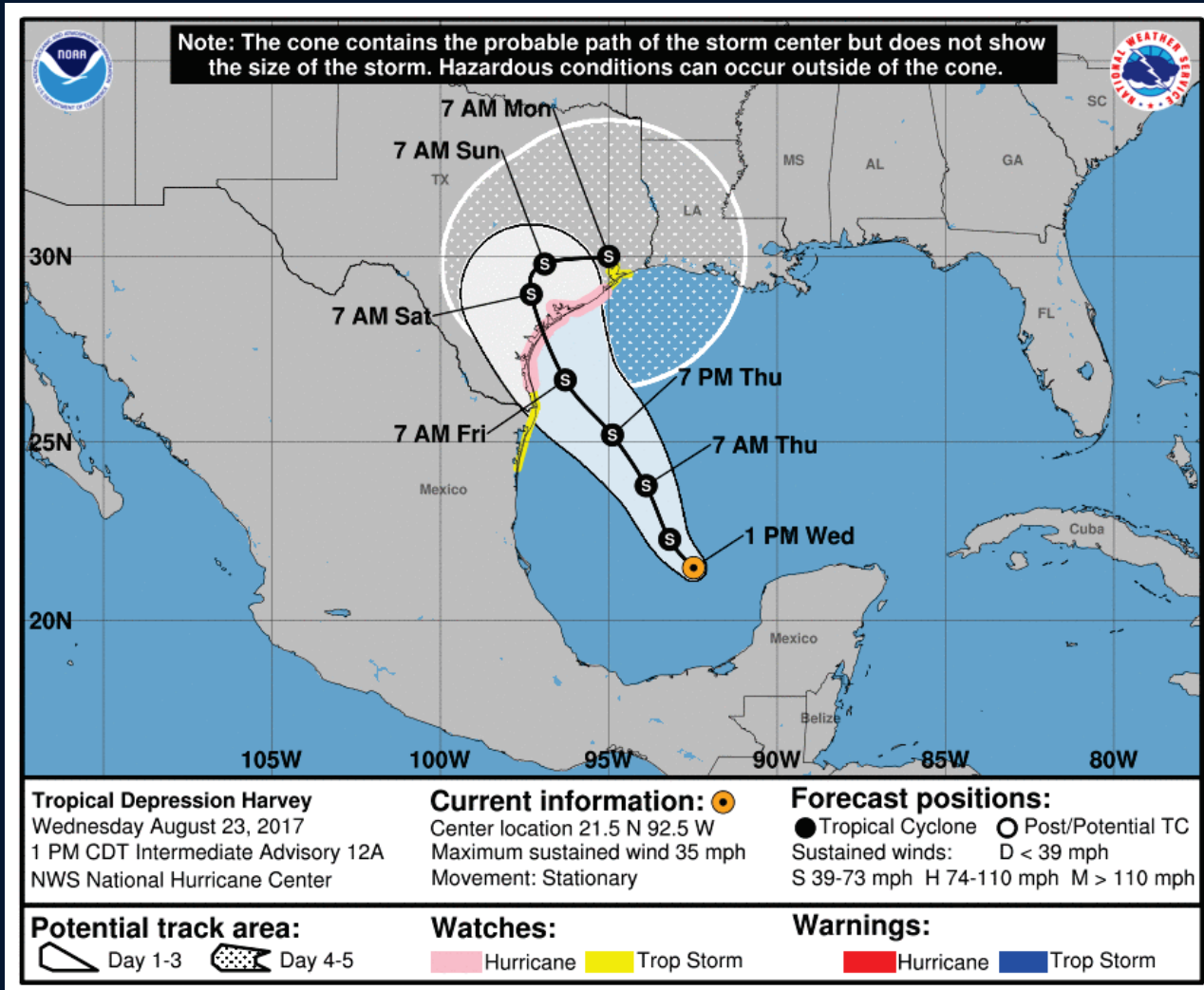
Tuesday

Image 8/22/2017
Created 1:32 PM



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Wednesday, August 23, 2017 - Two Days Prior to Landfall



Tropical Depression Harvey
 Wednesday August 23, 2017
 1 PM CDT Intermediate Advisory 12A
 NWS National Hurricane Center

Current information: ●
 Center location 21.5 N 92.5 W
 Maximum sustained wind 35 mph
 Movement: Stationary

Forecast positions:
 ● Tropical Cyclone ○ Post/Potential TC
 Sustained winds: D < 39 mph
 S 39-73 mph H 74-110 mph M > 110 mph

Potential track area:
 Day 1-3 Day 4-5

Watches:
 Hurricane Trop Storm

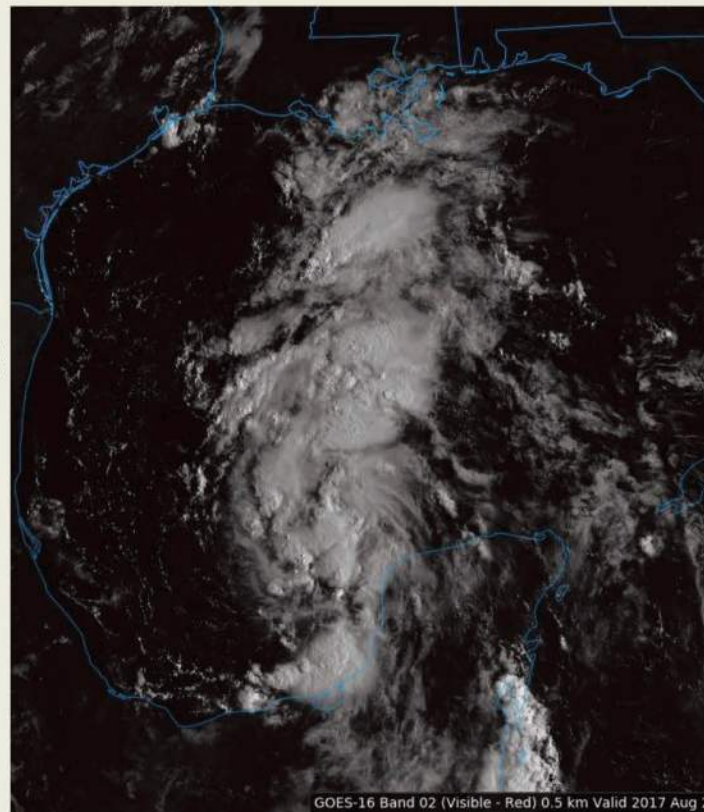
Warnings:
 Hurricane Trop Storm



Situation Overview

National Weather Service Houston/Galveston

- NHC beginning advisories on Tropical Depression; system forecast to become strong tropical storm or hurricane
- Hurricane/Tropical Storm/Storm Surge Watches posted for portions of the area
- Possible system will slow after landfall then move slowly east or northeast across the area
- Slow movement implies potential for heavy rainfall and flooding



Wednesday

Image 8/23/2017
Created 10:54 AM



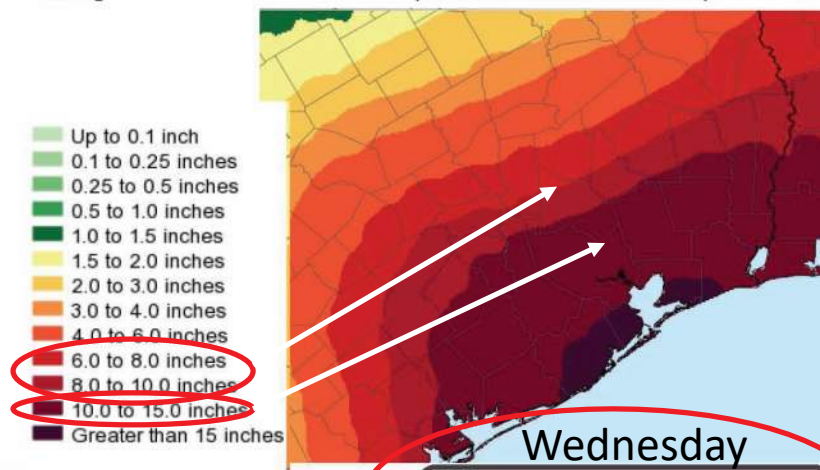
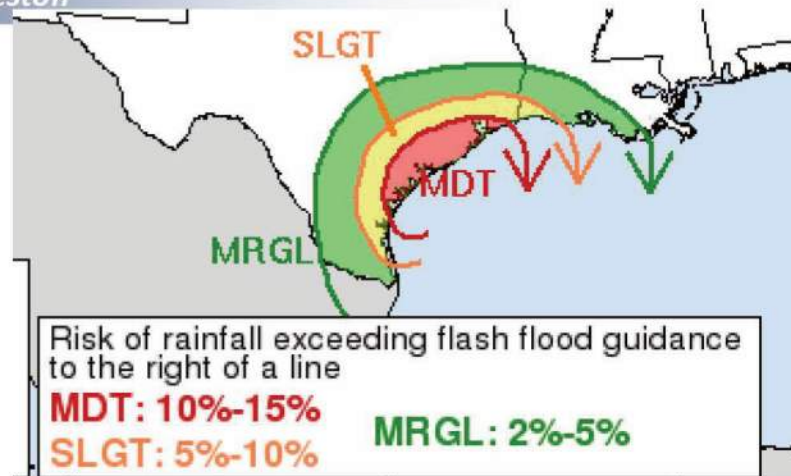
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Rainfall, Flood Threat

National Weather Service Houston/Galveston

- Landfall then a slow track over the area would mean periods of heavy rain from Friday through Monday
- Details of track still uncertain but graphic shows latest thinking on rainfall amounts over that period; will refine forecast going forward
- Thinking 10 to 15 inches near the coast with isolated 20; lesser amounts inland but again all dependent on the track
- Flash flood watches will likely be needed as we get closer to the event



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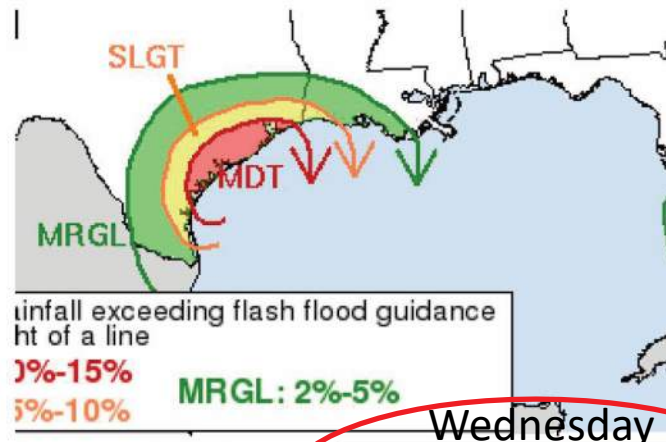
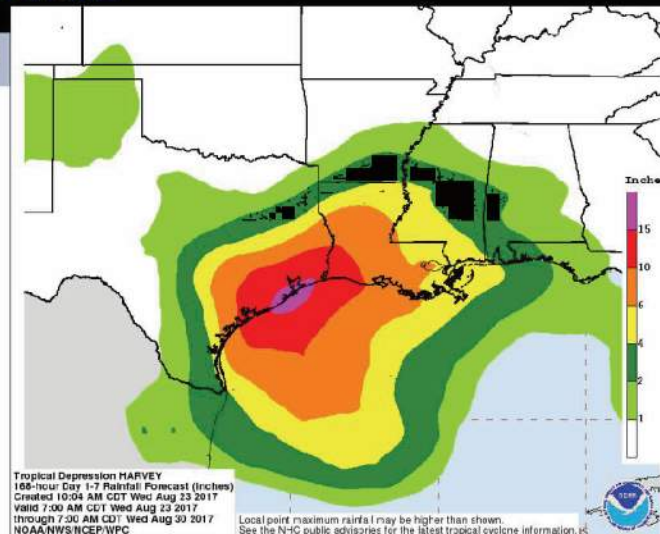
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Rainfall, Flood Threat

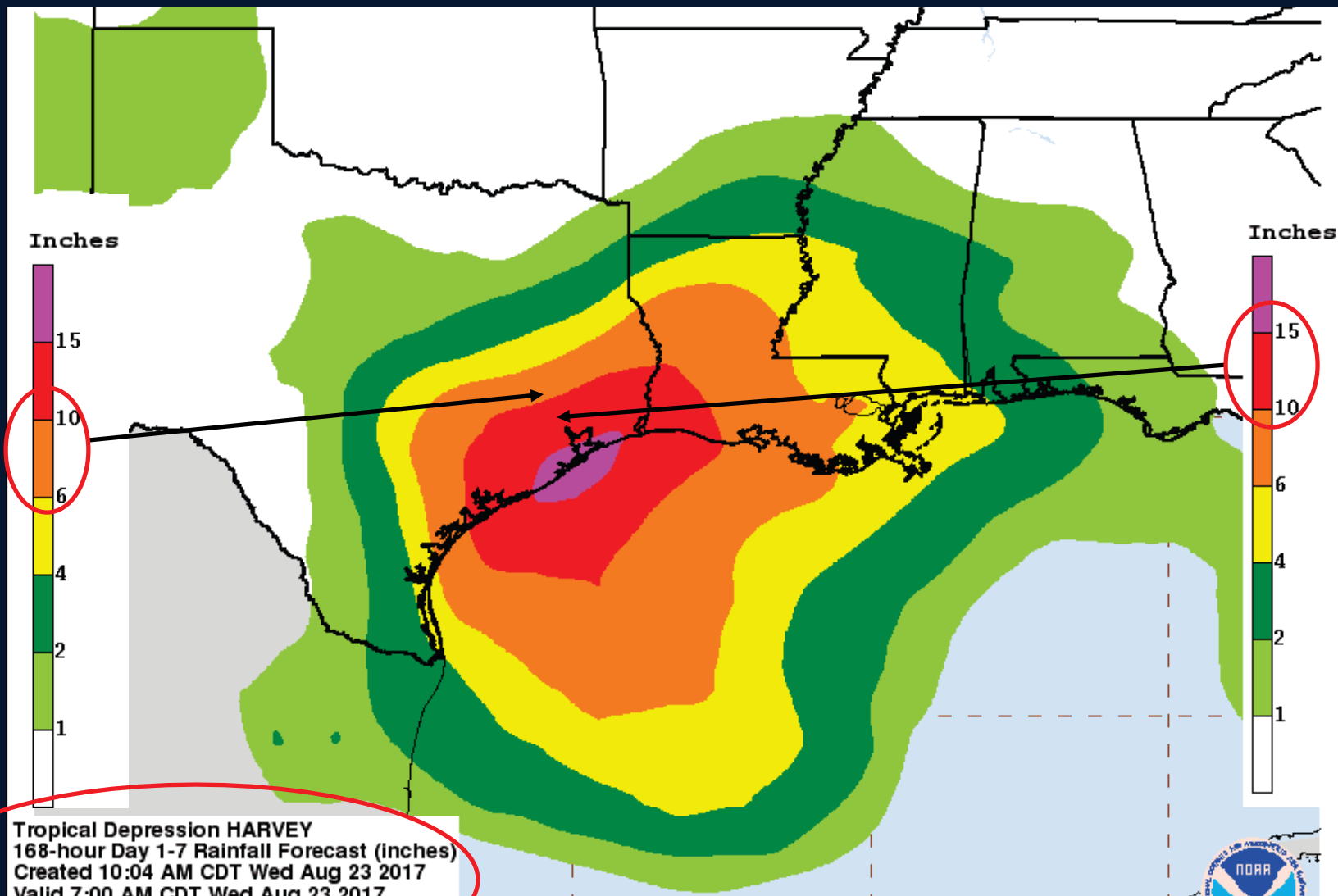
National Weather Service Houston/Galveston

- Landfall then a slow track over the area would mean periods of heavy rain from Friday through at least Monday
- Possibility of 10 to 15 inches with local amounts 20+ possible; greatest amounts coastal counties, lesser amounts well inland
- **Details of track still uncertain; timing and location of heaviest rainfall could still change!**
- Flash flood watches will likely be needed as we get closer and can better define area and timing



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Image 8/23/2017
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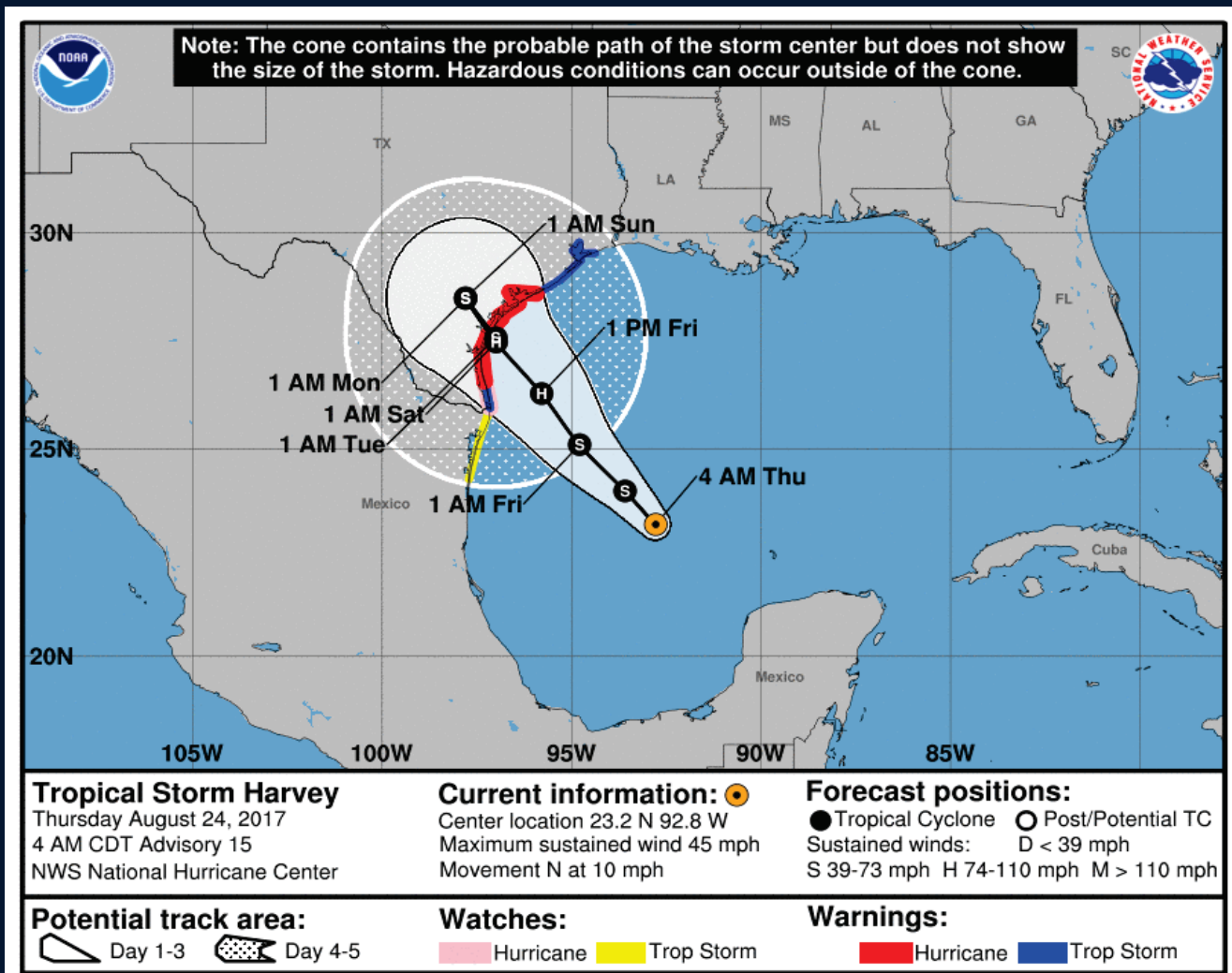


Tropical Depression HARVEY
 168-hour Day 1-7 Rainfall Forecast (Inches)
 Created 10:04 AM CDT Wed Aug 23 2017
 Valid 7:00 AM CDT Wed Aug 23 2017
 through 7:00 AM CDT Wed Aug 30 2017
 NOAA/NWS/NCEP/WPC

Local point maximum rainfall may be higher than shown.
 See the NHC public advisories for the latest tropical cyclone information. 35



Thursday, August 24, 2017 - One Day Prior to Landfall

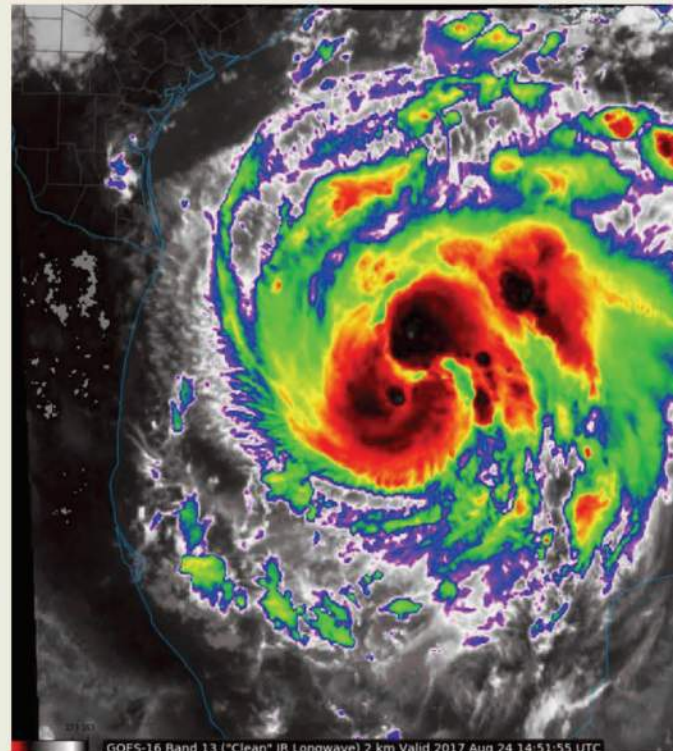




Situation Overview

National Weather Service Houston/Galveston

- Tropical Storm Harvey Intensifying, now forecast to be a category 3 hurricane at landfall
- Landfall, middle Texas coast Friday night
- Storm surge inundation 6 to 10 feet above ground level for Matagorda County up to Sargeant, 4 to 7 feet AGL Sargeant to San Luis Pass, 2 to 4 feet Galveston Bay
- Steering flow weakens considerably after landfall; slow movement means heavy rainfall & potentially life threatening flooding especially coastal counties



Satellite Image of Harvey, Thursday morning
Thursday

Image 8/24/2017
Created 10:57 AM



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Rainfall, Flood Threat

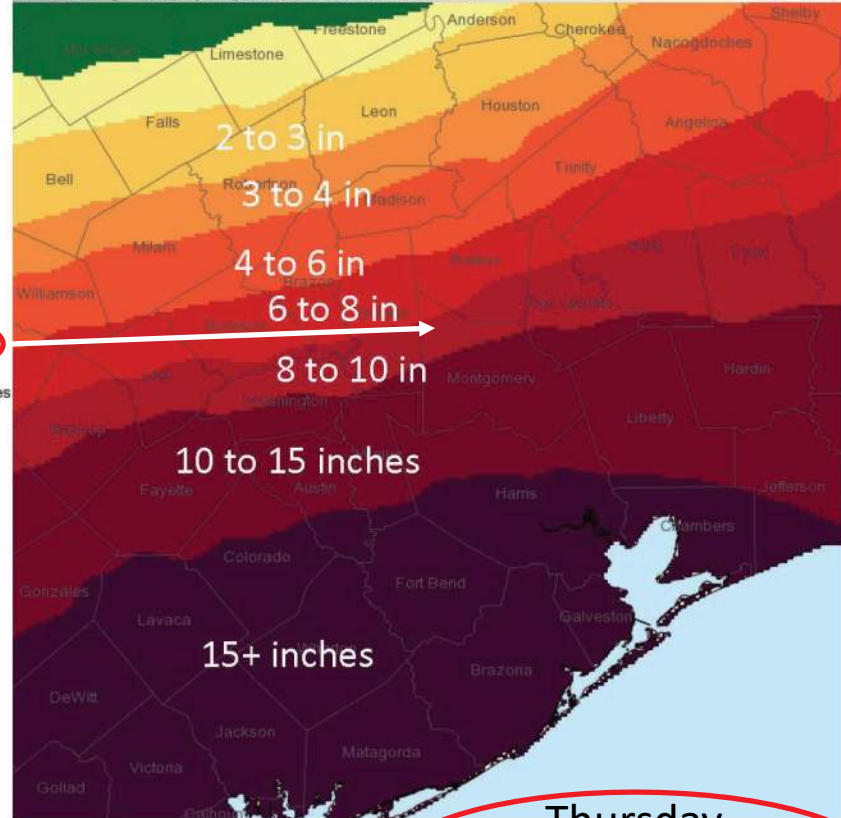
National Weather Service Houston/Galveston

- Timing of onset and end of heavier rains uncertain
- Most likely start Matagorda, Jackson Counties, closest to the hurricane, Friday/Friday night continuing
- Bands east of the center to set up into areas farther east Saturday and Sunday
- Could be sharp gradient north to south with coastal counties seeing most rain over the multiday period

Forecast Precipitation



Valid Ending Thursday August 31st, 2017 at 7 AM CDT



Graphic Created August 24th, 2017 10:05 AM CDT

Thursday

Image 8/24/2017 Created 10:57 AM



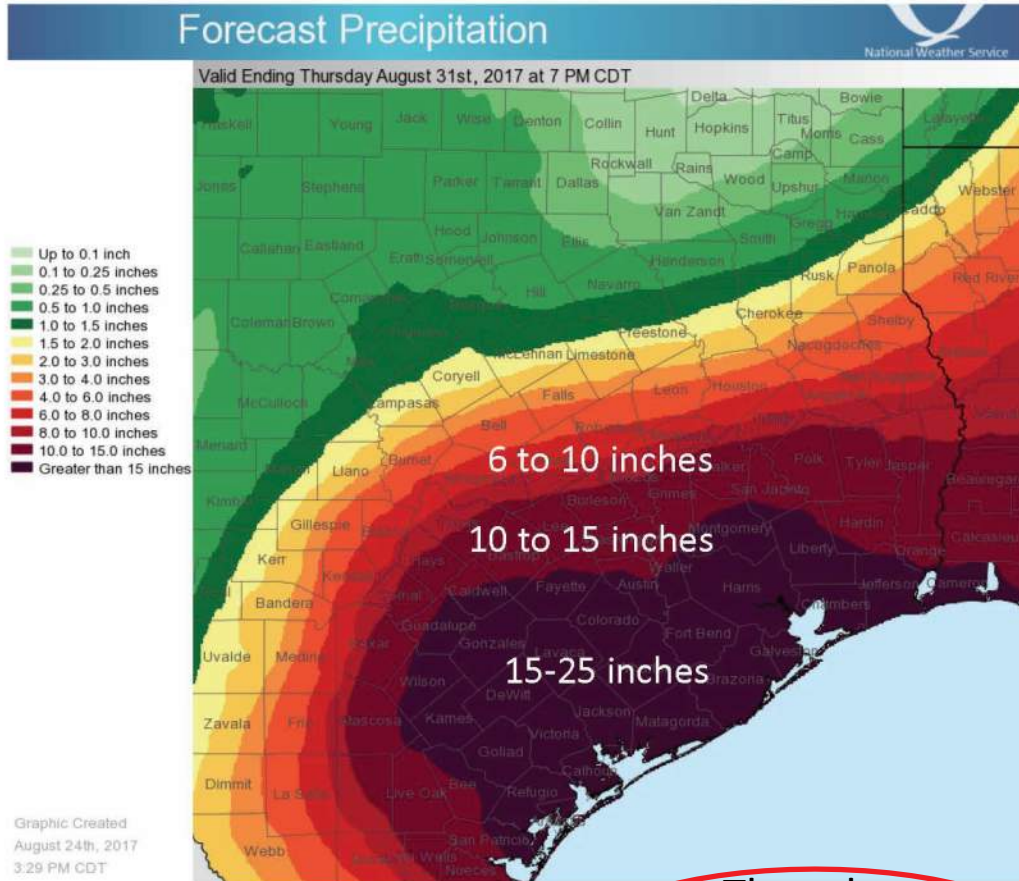
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Rainfall, Potentially Devastating Flood Threat

National Weather Service Houston/Galveston

- Extreme rainfall expected over multi-day period (Friday through at least Monday) with 15 to 25 inches southern half of forecast area, lesser amounts north with major potentially catastrophic flooding some areas
- Most likely start Matagorda, Jackson Counties, closest to the hurricane, Friday/Friday night continuing
- Bands east of the center to set up into areas farther east Saturday and Sunday



Thursday

Image 8/24/2017

Created 4:42 PM



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6 to 8 in 8 to 10 in

Montgomery

10-15 inches

Harris

15-25 inches

Thursday

8/24/2017

10:57 am

10-15 inches

Montgomery

15-25 inches

Harris

Thursday

8/24/2017

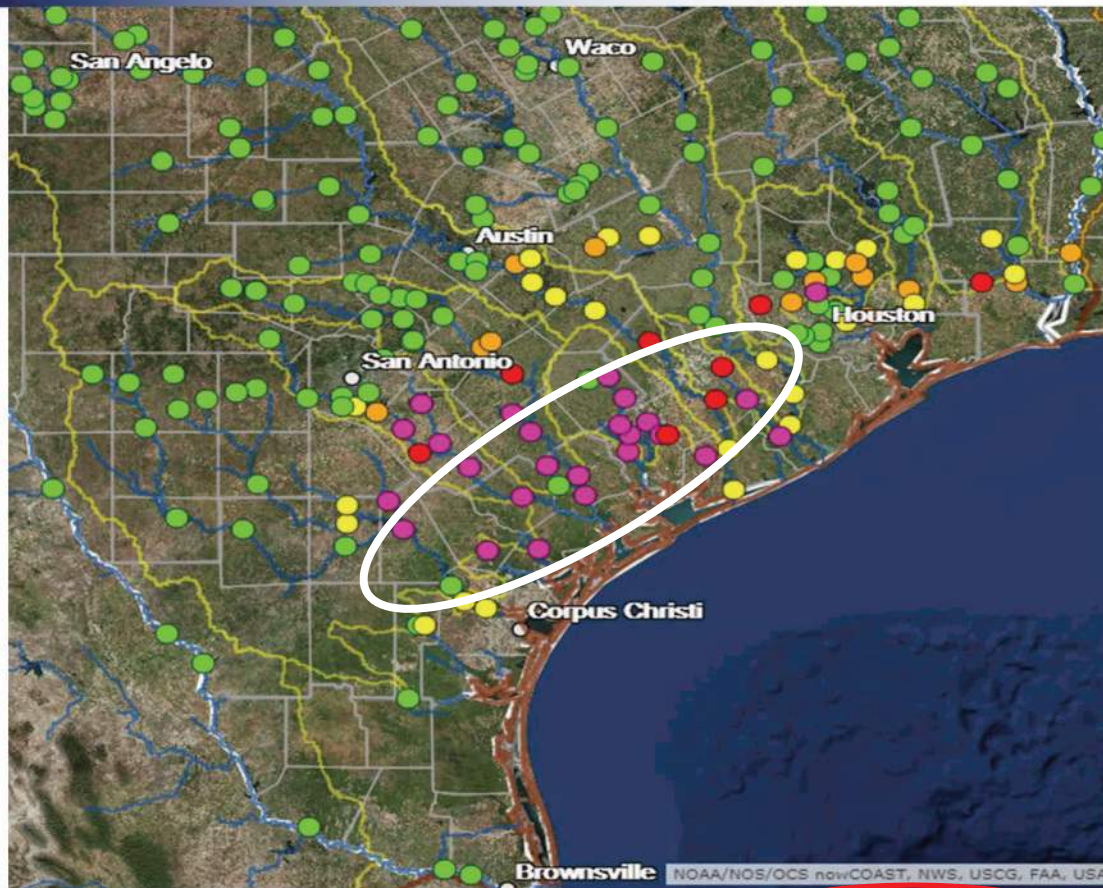
4:42 pm



River Concerns (WGRFC)

National Weather Service Houston/Galveston

- Purple Points represent points that with current rainfall will reach MAJOR or RECORD flooding
- Life threatening flood potential with this storm
- San Benard River, Colorado River below LaGrange, Lower end Lavaca below Lake Texana, Cypress, Greens, White Oak Bayous all areas of concern



Thursday

Image 8/24/2017
Created 4:42 PM



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Friday, August 25, 2017 - Landfall at Rockport, Texas 10 pm

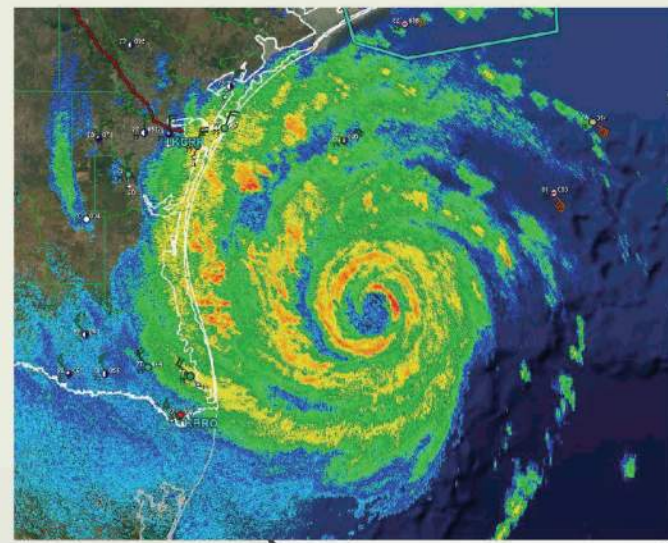
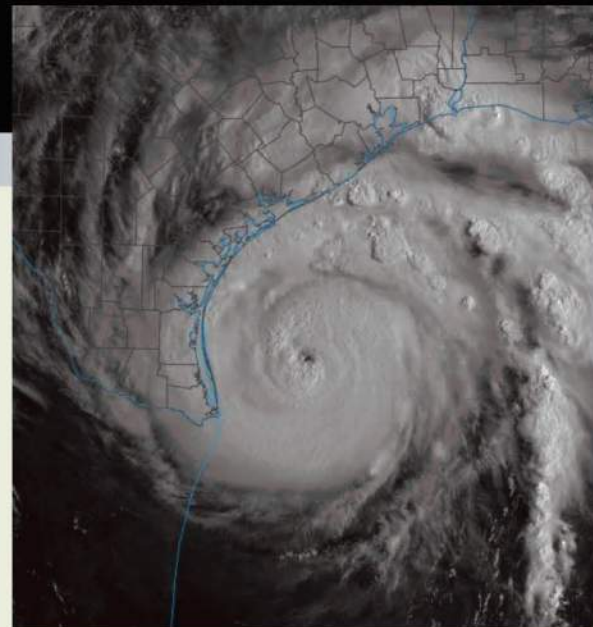




Situation Overview

National Weather Service Houston/Galveston

- No changes to warnings or general forecast
- Hurricane Harvey a category 2 hurricane (max winds 110 mph sustained) and is forecast to be a **category 3 hurricane at landfall**.
- Landfall is expected tonight along the middle Texas coast (Corpus Christi, Rockport).
- **Life threatening Storm Surge** inundation of 6 to 12 feet (above ground level) from N Entrance Padre Island Natl Seashore to Sargent, 5 to 8 feet Sargent to Jamaica Beach, and 2 to 4 feet from Jamaica Beach to High Island and around Galveston Bay.
- Steering flow weakens considerably after landfall; a slow drift will result this weekend and into early next week. This will result in heavy rainfall for a prolonged period of time with **catastrophic flooding possible** especially south of the I-10 corridor.



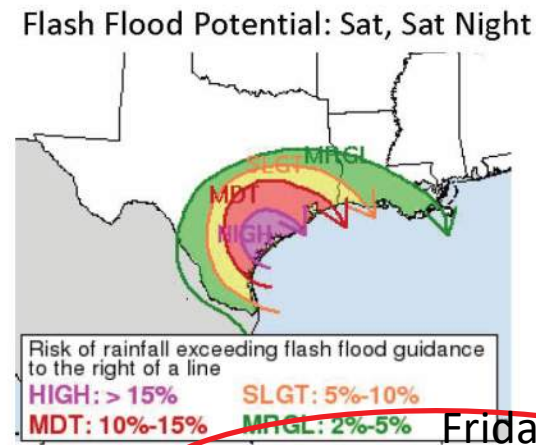
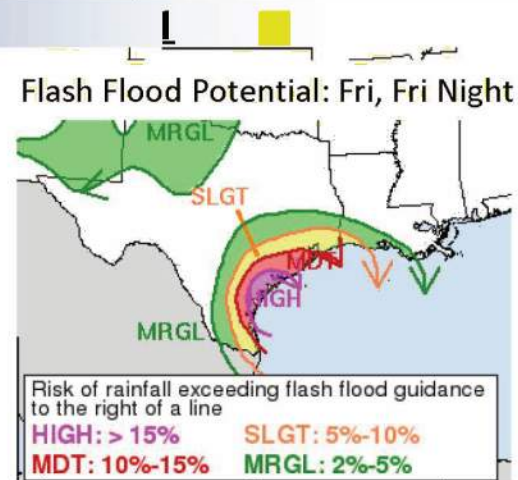
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Rainfall, Potentially Devastating Flood Threat

National Weather Service Houston/Galveston

- Landfall then a slow track over the area will mean periods of heavy rain from today into early next week.
- Potential Impacts: **Widespread flooding** with numerous road closures as rainfall amounts grow through the weekend. Major bayou and river flooding is expected. Structure flooding is possible.
- 15 to 25 inches with local amounts near 35 inches possible across southern portions, less further inland. There may be a tight gradient on northern edge of the rainfall pattern.
- Flash Flood Watches have been issued for most of the area (excluding far NE).



Friday



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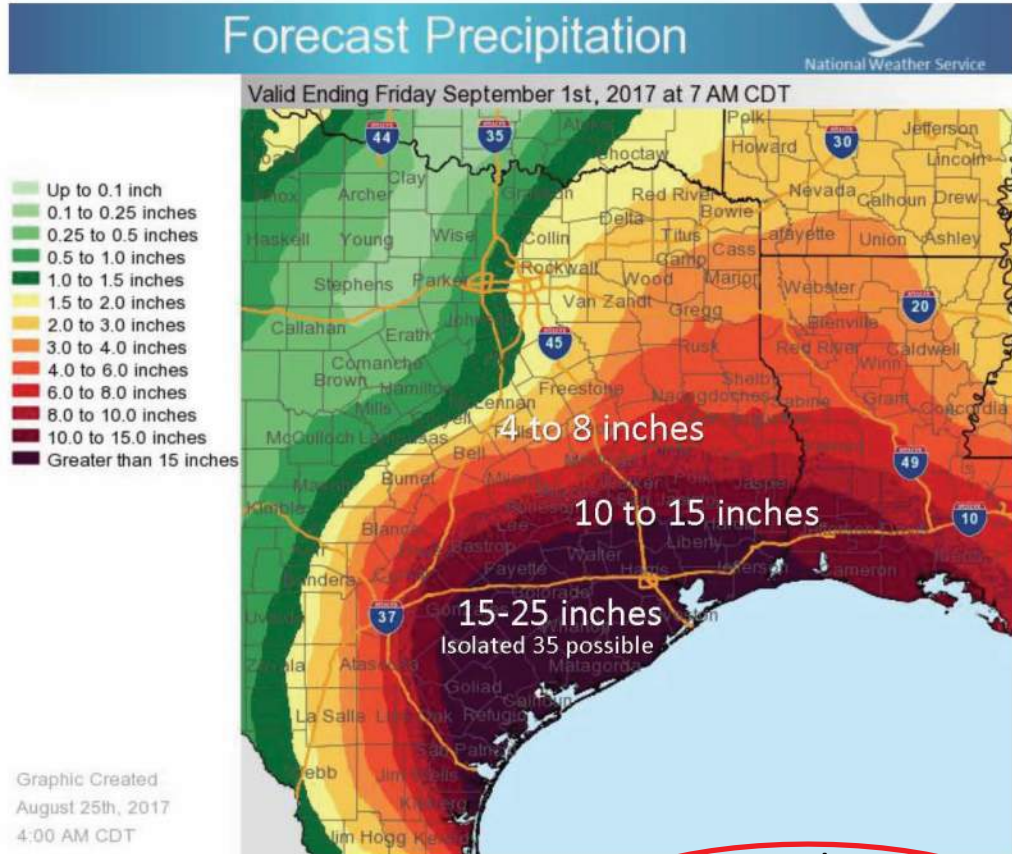
Image 8/25/2017
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Rainfall, Potentially Devastating Flood Threat

National Weather Service Houston/Galveston

- Extreme rainfall expected over a multi-day period (Today through at least Monday) **potentially devastating flooding** near and south of I-10 across southeast Texas.
- Most likely starting across Matagorda, Jackson counties, closest to the hurricane, Friday/Friday night and continuing into early next week.



Friday

Image 8/25/2017
Created 11:00 AM



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Saturday, August 26, 2017 - First Day after Landfall

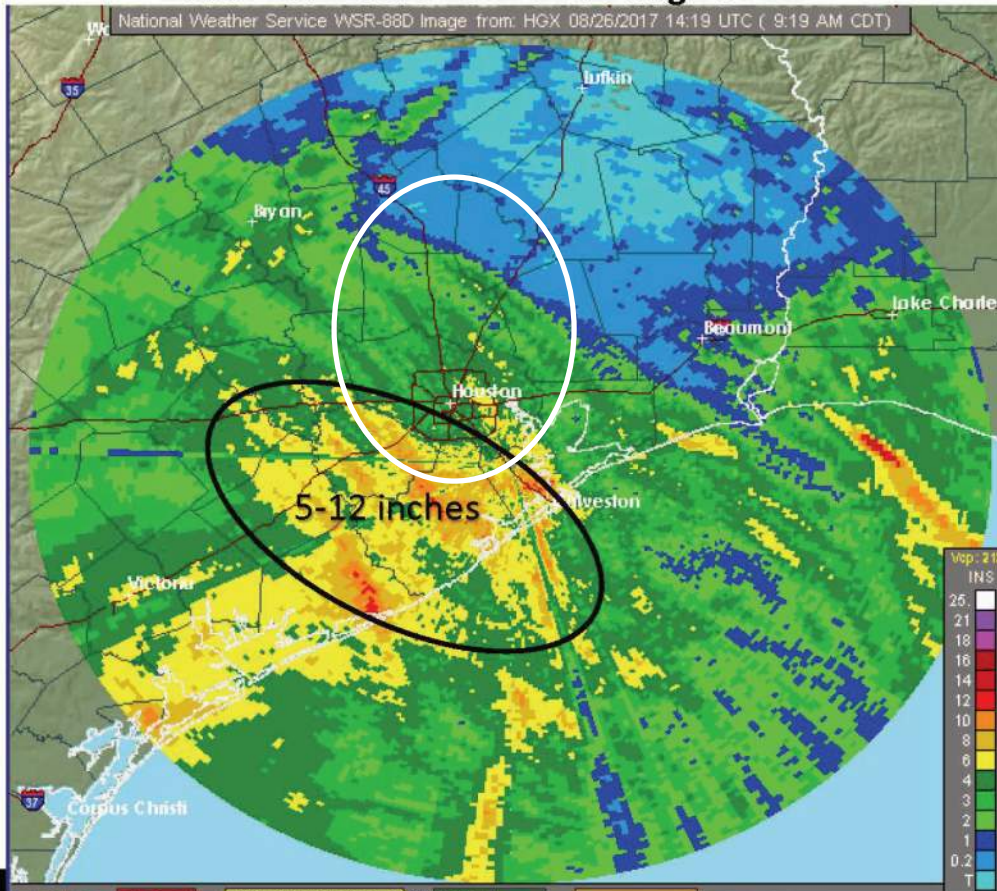




Observed Rainfall

National Weather Service Houston/Galveston

Radar Estimated Rainfall through 9 AM



Some area totals through 2-3 AM:

...Jackson County...

Edna	12.06 in
La Ward	7.06 in

...Matagorda County...

2 W Bay City	8.17 in
Palacios Airport	5.73
9 W Markham	4.96 in
1 WNW Bay City	5.40 in

...Wharton County...

East Bernard	8.08
8 WSW Boling-iago	7.92 in
1 NW El Campo	3.64 in
Wharton	6.99 in

Saturday

Image 8/26/2017
Created 10:52 AM



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Forecast Rainfall

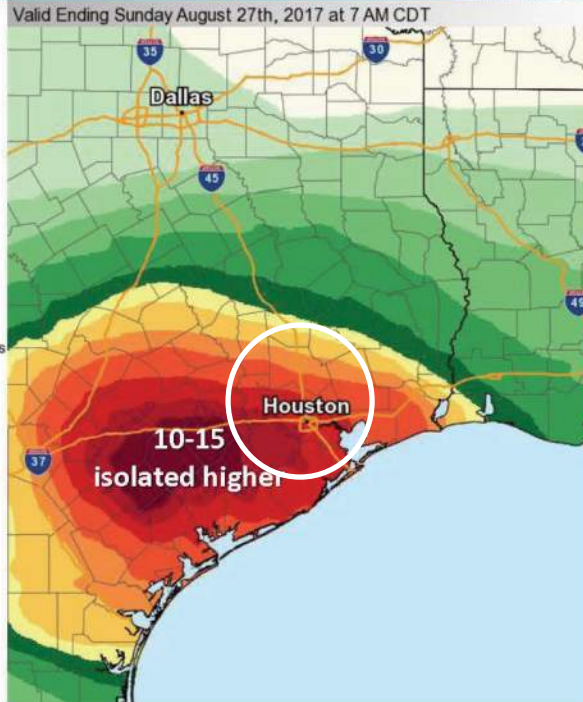
National Weather Service Houston/Galveston

Today and Tonight

Forecast Precipitation

Valid Ending Sunday August 27th, 2017 at 7 AM CDT

- Up to 0.1 inch
- 0.1 to 0.25 inches
- 0.25 to 0.5 inches
- 0.5 to 1.0 inches
- 1.0 to 1.5 inches
- 1.5 to 2.0 inches
- 2.0 to 3.0 inches
- 3.0 to 4.0 inches
- 4.0 to 6.0 inches
- 6.0 to 8.0 inches
- 8.0 to 10.0 inches
- 10.0 to 15.0 inches
- Greater than 15 inches



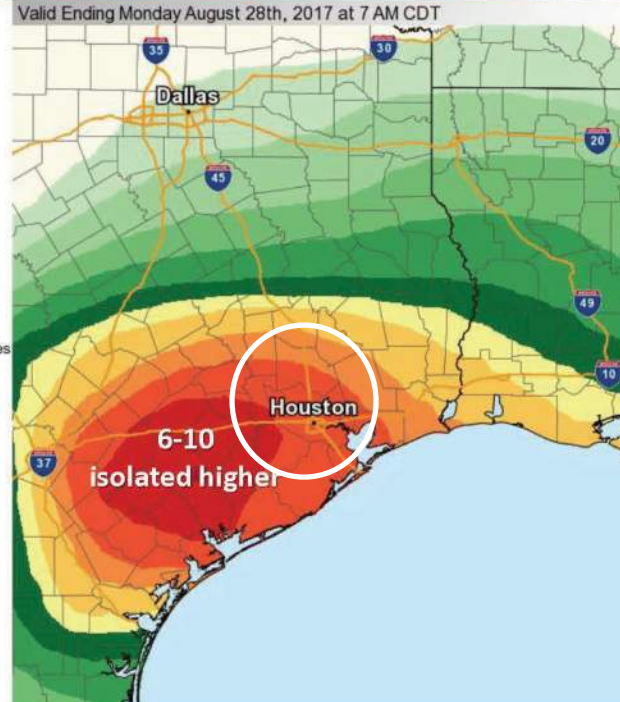
Graphic Created
August 26th, 2017
1:32 AM CDT

Sunday and Sunday night

Forecast Precipitation

Valid Ending Monday August 28th, 2017 at 7 AM CDT

- Up to 0.1 inch
- 0.1 to 0.25 inches
- 0.25 to 0.5 inches
- 0.5 to 1.0 inches
- 1.0 to 1.5 inches
- 1.5 to 2.0 inches
- 2.0 to 3.0 inches
- 3.0 to 4.0 inches
- 4.0 to 6.0 inches
- 6.0 to 8.0 inches
- 8.0 to 10.0 inches
- 10.0 to 15.0 inches
- Greater than 15 inches



Graphic Created
August 26th, 2017
1:35 AM CDT

Saturday

Image 8/26/2017
Created 10:52 AM



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Forecast Rainfall

National Weather Service Houston/Galveston

Monday and Monday night

5 Day Total (Saturday AM through Thursday AM)

Forecast Precipitation



Valid Ending Tuesday August 29th, 2017 at 7 AM CDT

- Up to 0.1 inch
- 0.1 to 0.25 inches
- 0.25 to 0.5 inches
- 0.5 to 1.0 inches
- 1.0 to 1.5 inches
- 1.5 to 2.0 inches
- 2.0 to 3.0 inches
- 3.0 to 4.0 inches
- 4.0 to 6.0 inches
- 6.0 to 8.0 inches
- 8.0 to 10.0 inches
- 10.0 to 15.0 inches
- Greater than 15 inches



Graphic Created
August 26th, 2017
1:43 AM CDT

Forecast Precipitation



Valid Ending Thursday August 31st, 2017 at 7 AM CDT

- Up to 0.1 inch
- 0.1 to 0.25 inches
- 0.25 to 0.5 inches
- 0.5 to 1.0 inches
- 1.0 to 1.5 inches
- 1.5 to 2.0 inches
- 2.0 to 3.0 inches
- 3.0 to 4.0 inches
- 4.0 to 6.0 inches
- 6.0 to 8.0 inches
- 8.0 to 10.0 inches
- 10.0 to 15.0 inches
- Greater than 15 inches



Graphic Created
August 26th, 2017
1:58 AM CDT

Saturday

Image 8/26/2017

Created 10:52 AM



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8-10

10-15

Saturday
8/26/2017
10:52 am

Montgomery

Houston

15-30 inches
Isolated 40





Forecast Rainfall

National Weather Service Houston/Galveston

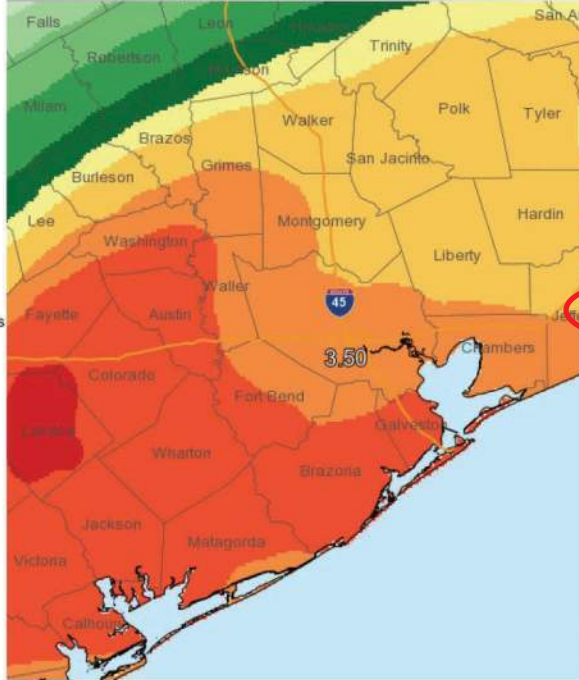
Monday and Monday night

5 Day Total (Saturday PM through Thursday AM)

Forecast Precipitation

Valid Ending Tuesday August 29th, 2017 at 7 AM CDT

- Up to 0.1 inch
- 0.1 to 0.25 inches
- 0.25 to 0.5 inches
- 0.5 to 1.0 inches
- 1.0 to 1.5 inches
- 1.5 to 2.0 inches
- 2.0 to 3.0 inches
- 3.0 to 4.0 inches
- 4.0 to 6.0 inches
- 6.0 to 8.0 inches
- 8.0 to 10.0 inches
- 10.0 to 15.0 inches
- Greater than 15 inches

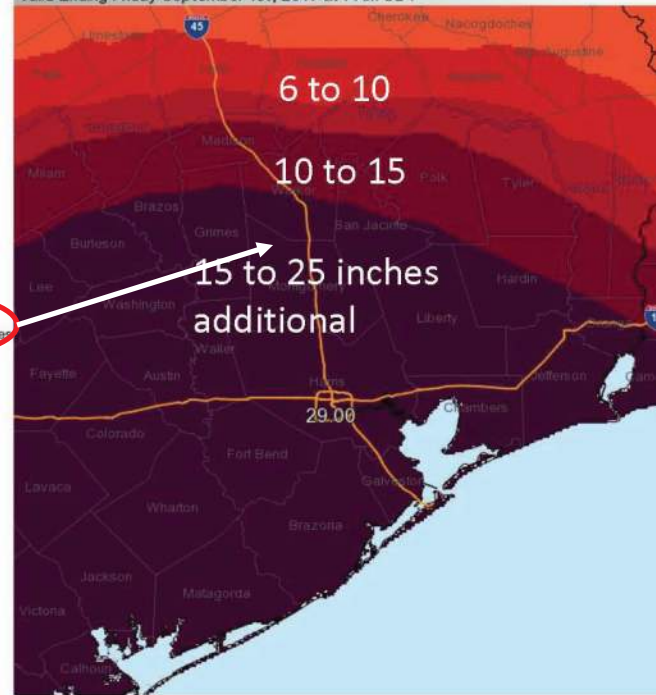


Graphic Created August 26th, 2017 3:46 PM CDT

Forecast Precipitation

Valid Ending Friday September 1st, 2017 at 7 AM CDT

- Up to 0.1 inch
- 0.1 to 0.25 inches
- 0.25 to 0.5 inches
- 0.5 to 1.0 inches
- 1.0 to 1.5 inches
- 1.5 to 2.0 inches
- 2.0 to 3.0 inches
- 3.0 to 4.0 inches
- 4.0 to 6.0 inches
- 6.0 to 8.0 inches
- 8.0 to 10.0 inches
- 10.0 to 15.0 inches
- Greater than 15 inches



Graphic Created August 26th, 2017 3:51 PM CDT

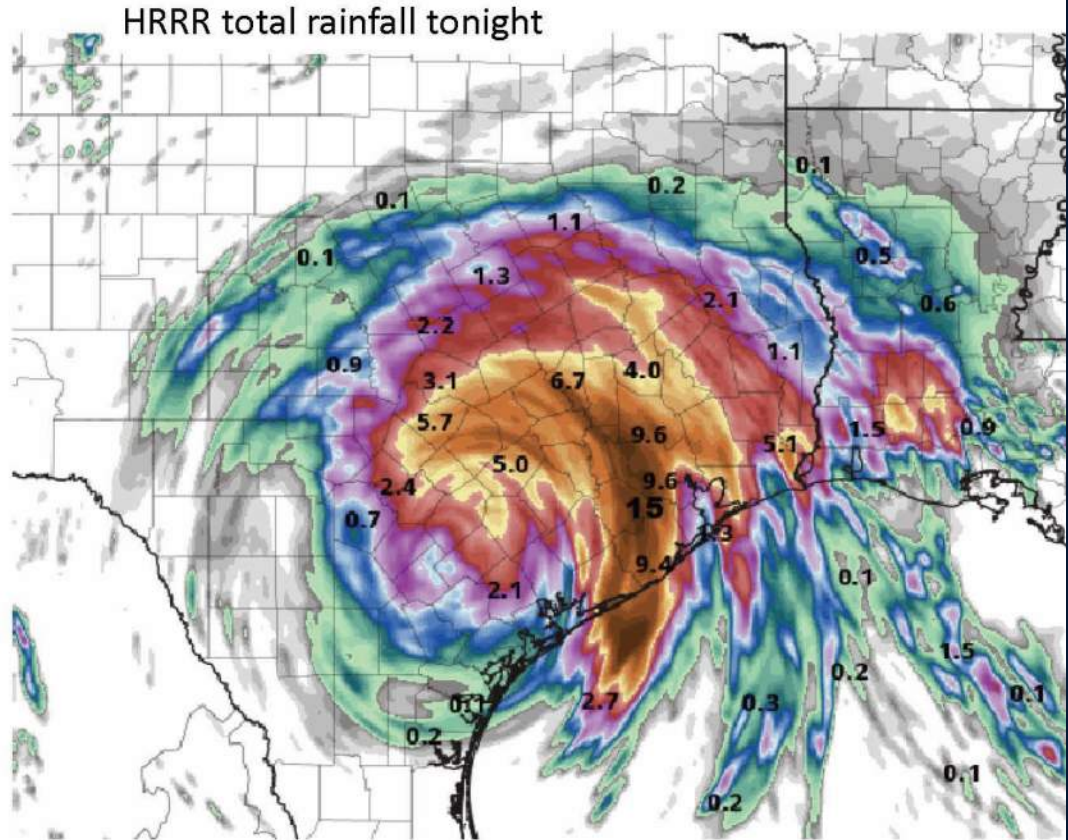
Saturday

Image 8/26/2017

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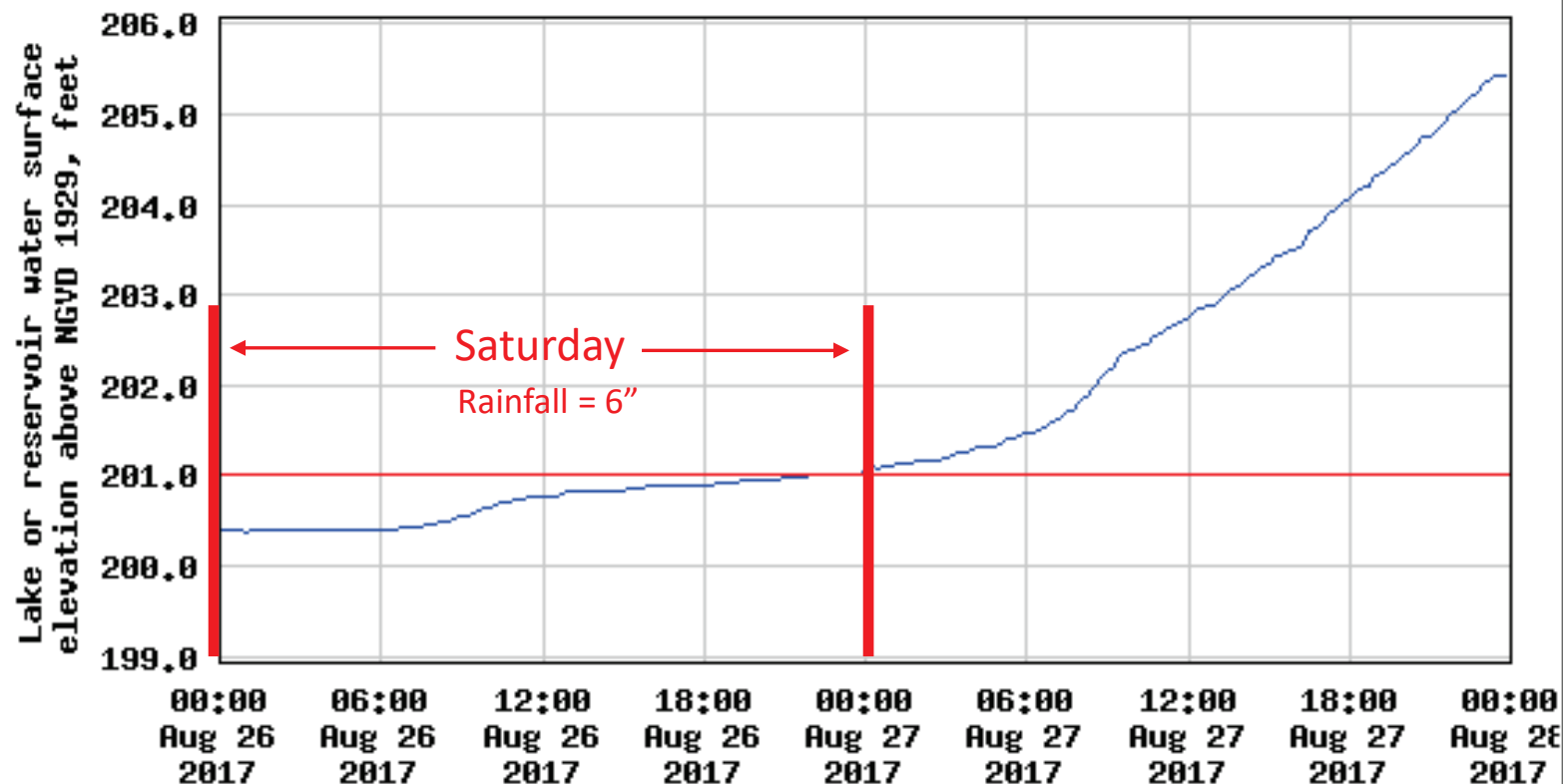


Saturday

Image 8/26/2017
Created 4:18 PM



USGS 08067600 Lk Conroe nr Conroe, TX



----- Provisional Data Subject to Revision -----

- Lake or reservoir water surface elevation above ngvd 1929
- Conservation Pool Elevation

Sunday, August 27, 2017 - Second day after Landfall



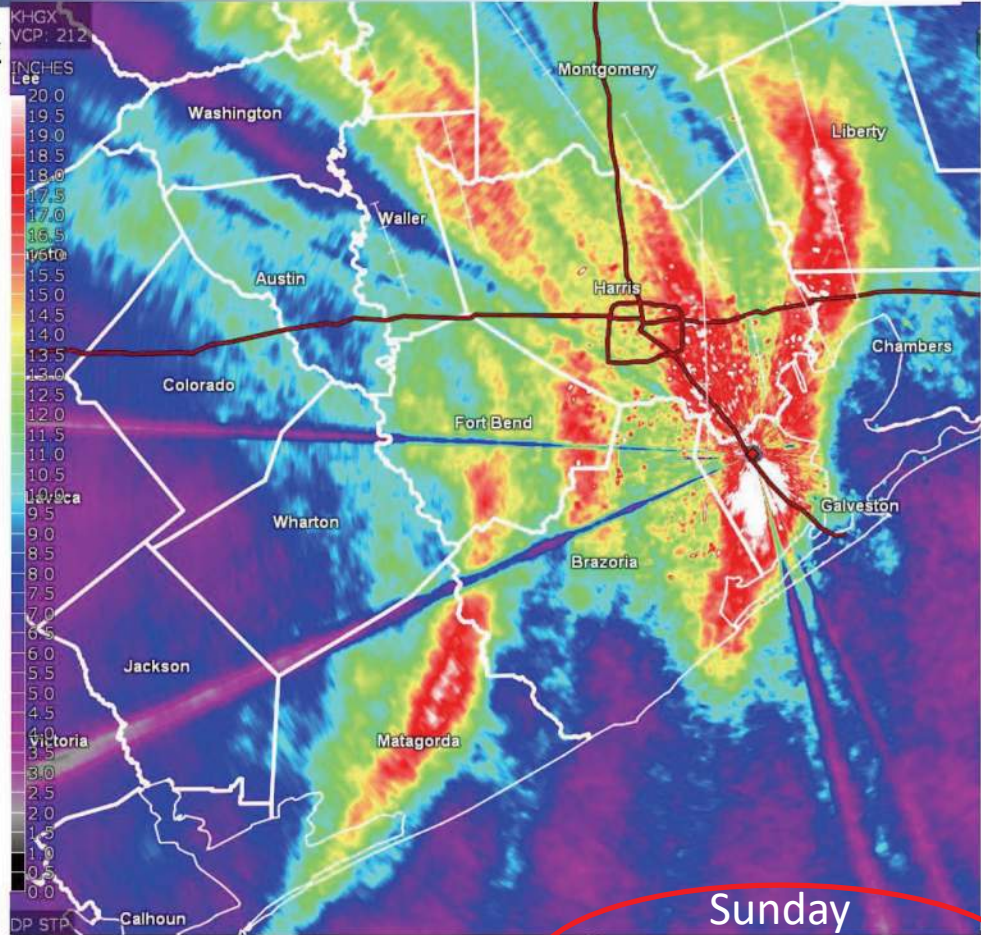


Radar Estimated Storm Total Rainfall

National Weather Service Houston/Galveston

48 hour measured rainfall max in each county

Austin County, Eagle Lake	15 inches
Brazoria County...Dixie Farm Road	26.76
Chambers...Mt Belvieu	16.27
Colorado...Ellinger	18.74
Fort Bend County...First Colony	24.83
Galveston County...Santa Fe	24.50
Harris County...Pearland	24.44
Liberty County...Dayton	27.45
Matagorda County...2W Bay City	12.89*
(likely 20+ in parts of county)	
Montgomery County...Magnolia	17.80
San Jacinto...Coldspring	14.69
Walker...Shiro	12.72
Waller...3 W Katy	13.70
Washington...Carmin	16.95
Wharton...East Bernard	13.5



Sunday

Image 8/27/2017
Created 4:48 PM



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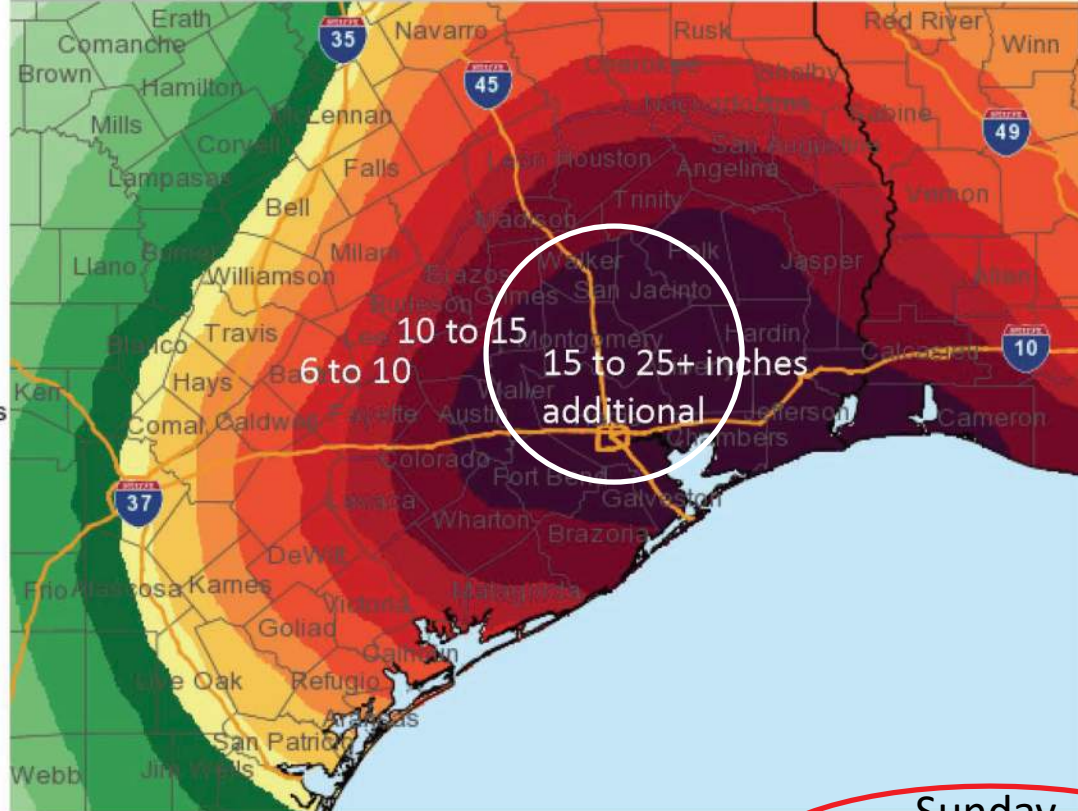
Forecast Additional Rainfall (5 Day)

Forecast Precipitation

National Weather Service

Valid Ending Friday September 1st, 2017 at 1 PM CDT

- Up to 0.1 inch
- 0.1 to 0.25 inches
- 0.25 to 0.5 inches
- 0.5 to 1.0 inches
- 1.0 to 1.5 inches
- 1.5 to 2.0 inches
- 2.0 to 3.0 inches
- 3.0 to 4.0 inches
- 4.0 to 6.0 inches
- 6.0 to 8.0 inches
- 8.0 to 10.0 inches
- 10.0 to 15.0 inches
- Greater than 15 inches



Graphic Created
August 27th, 2017
4:09 PM CDT

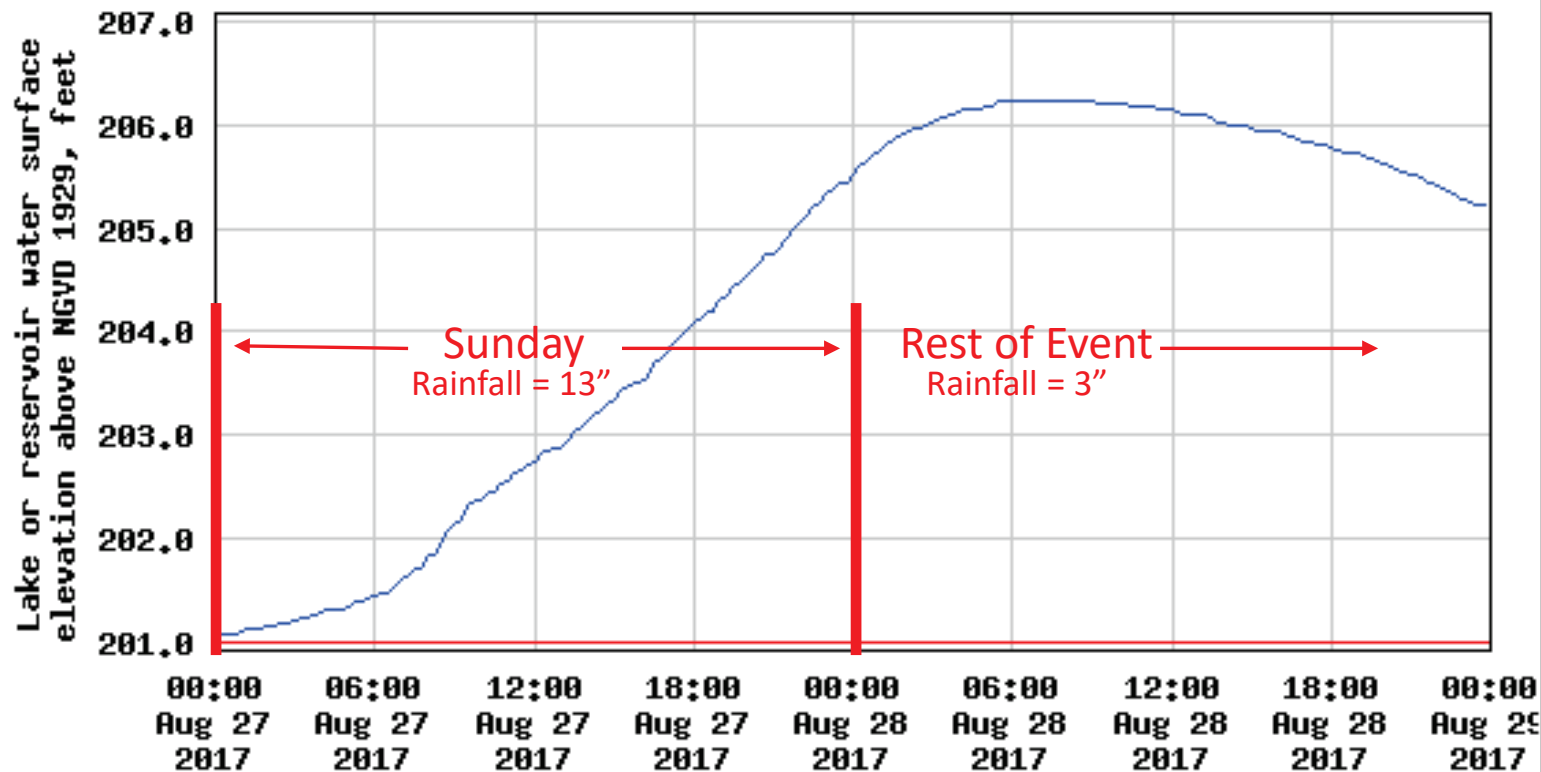
Sunday



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Image 8/27/2017
Created 4:48 PM

USGS 08067600 Lk Conroe nr Conroe, TX



----- Provisional Data Subject to Revision -----

- Lake or reservoir water surface elevation above ngvd 1929
- Conservation Pool Elevation

Monday, August 28, 2017 - Third Day after Landfall

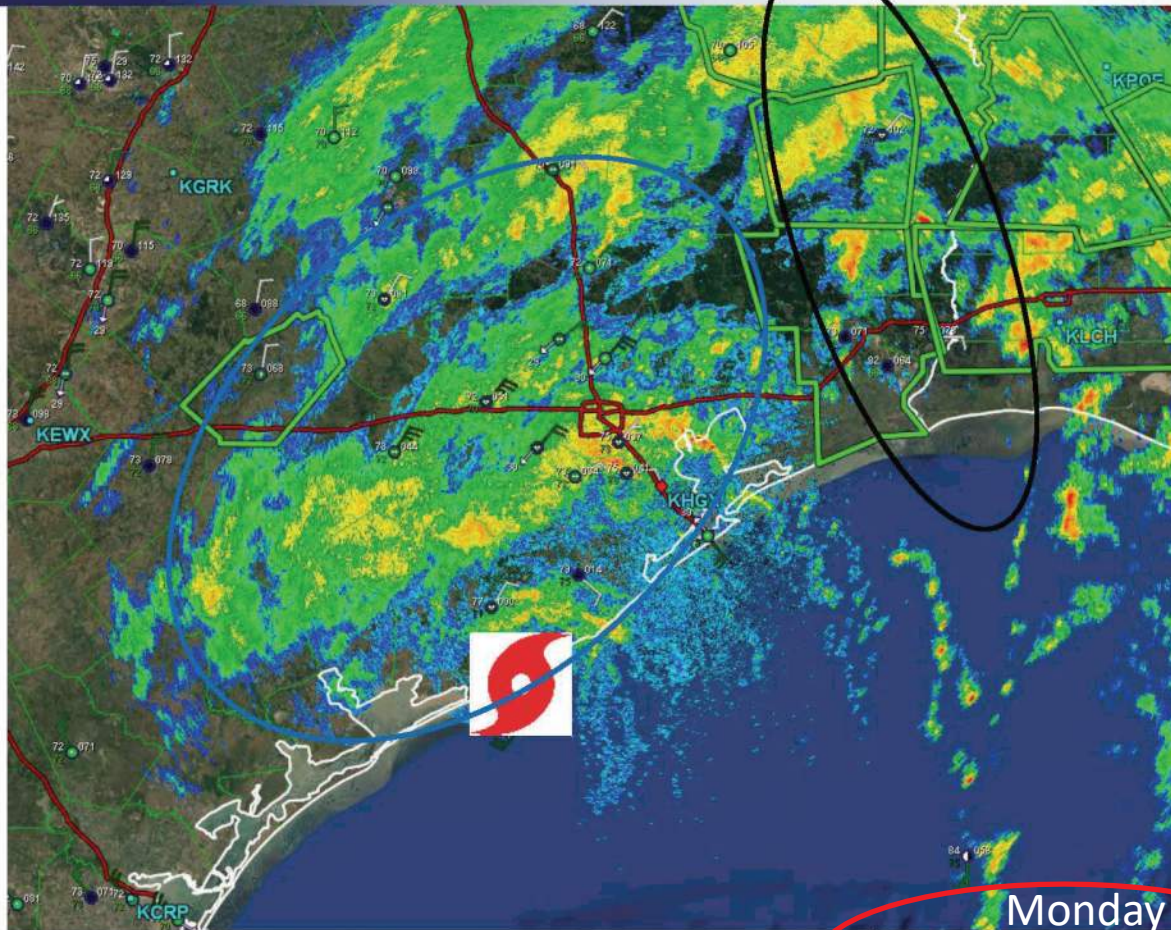




5 AM Radar Update

National Weather Service Houston/Galveston

- The band of heaviest rainfall has shifted east into Louisiana
- Areas of light to moderate with brief heavy rainfall (Blue oval) will continue today



Monday



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Image 8/28/2017
Created 10:41 AM



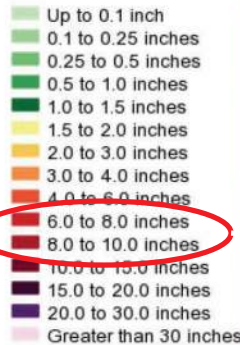
Forecast Additional Rainfall (3 Day Totals)

National Weather Service Houston/Galveston

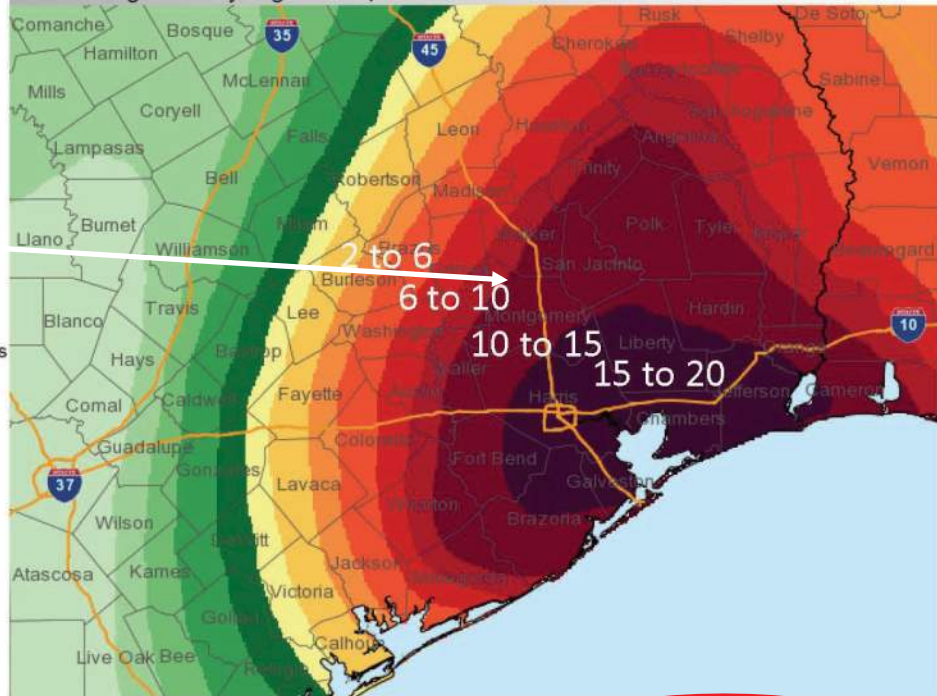
- Latest forecast for total additional rainfall through Thursday

This Afternoon-Thurs Morning

Forecast Precipitation



Valid Ending Thursday August 31st, 2017 at 7 PM CDT



Graphic Created August 28th, 2017 9:59 AM CDT

Monday

Image 8/28/2017
Created 10:41 AM



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4:14 PM Radar Update

National Weather Service Houston/Galveston

SW to NE oriented band of moderate to locally heavy rain just on N flank of Tropical Storm Harvey;

Rainfall amounts in this band will be 4 to 8 inches this afternoon and evening



Monday

Image 8/28/2017
Created 4:34 PM



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Additional Forecast Rainfall Amounts – Tonight and Tuesday

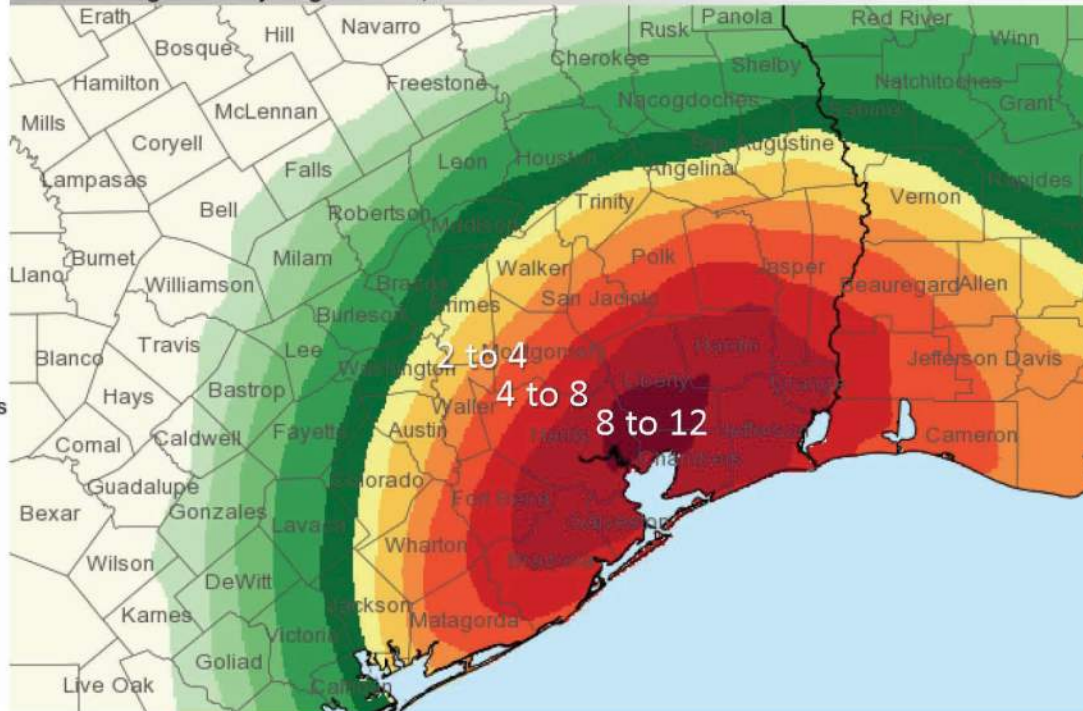
National Weather Service Houston/Galveston

Forecast Precipitation



Valid Ending Tuesday August 29th, 2017 at 7 PM CDT

- Up to 0.1 inch
- 0.1 to 0.25 inches
- 0.25 to 0.5 inches
- 0.5 to 1.0 inches
- 1.0 to 1.5 inches
- 1.5 to 2.0 inches
- 2.0 to 3.0 inches
- 3.0 to 4.0 inches
- 4.0 to 6.0 inches
- 6.0 to 8.0 inches
- 8.0 to 10.0 inches
- 10.0 to 15.0 inches
- 15.0 to 20.0 inches
- 20.0 to 30.0 inches
- Greater than 30 inches



Graphic Created
August 28th, 2017
3:45 PM CDT

Monday

Image 8/28/2017
Created 4:34 PM



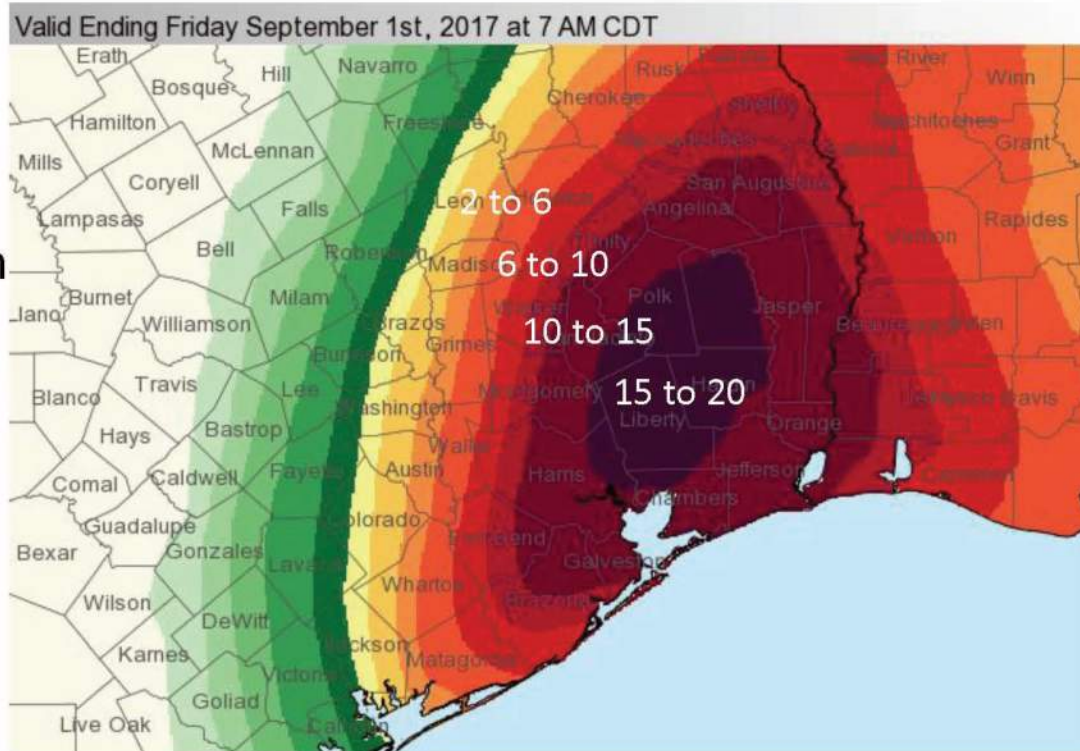
@NWSHouston
weather.gov/houston



Forecast Additional Rainfall (3 Day Totals)

National Weather Service Houston/Galveston

- Latest forecast for total additional rainfall through Thursday



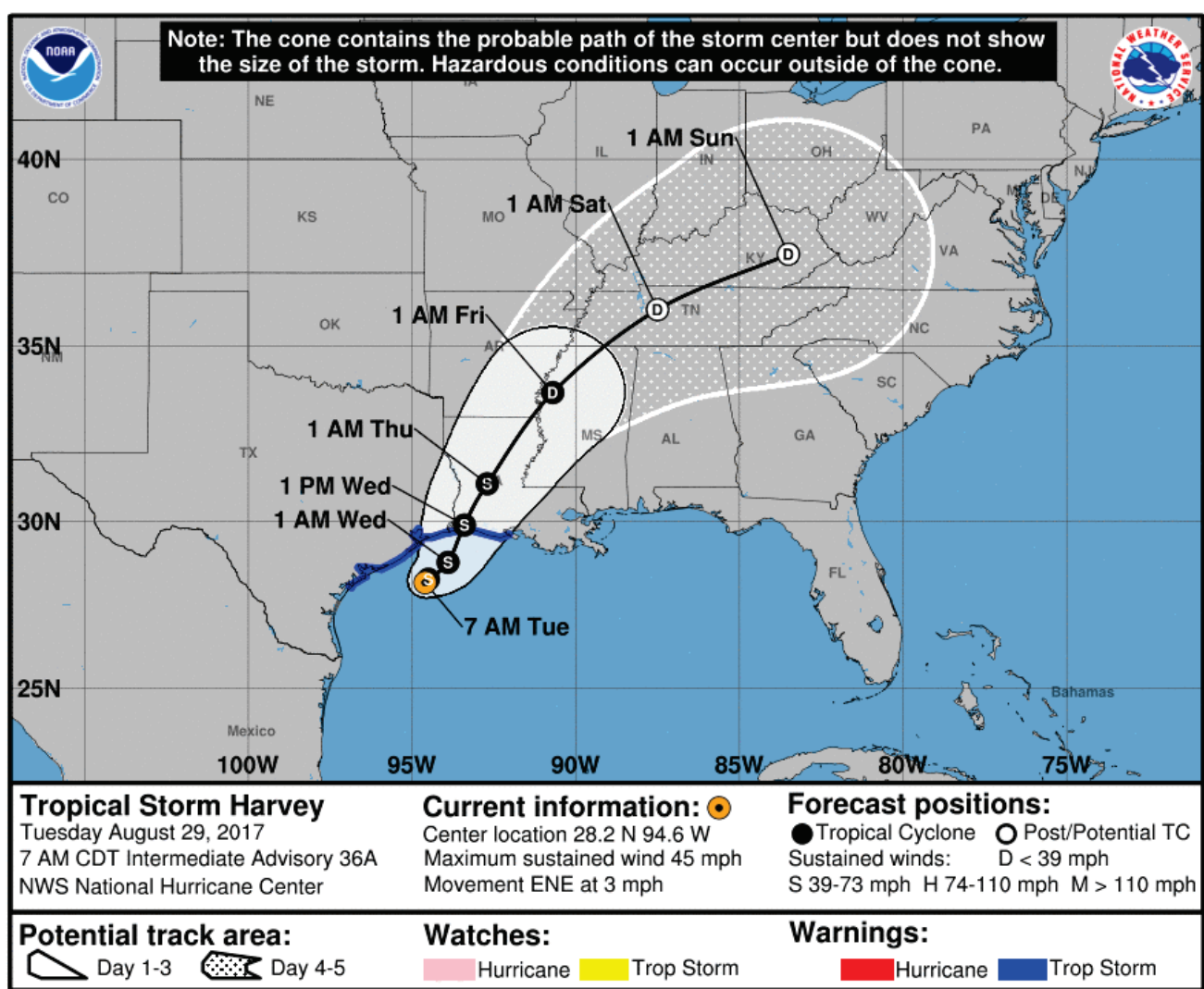
Monday



@NWSHouston
weather.gov/houston

Image 8/28/2017
Created 4:34 PM

Tuesday, August 29, 2017 - Fourth Day after Landfall



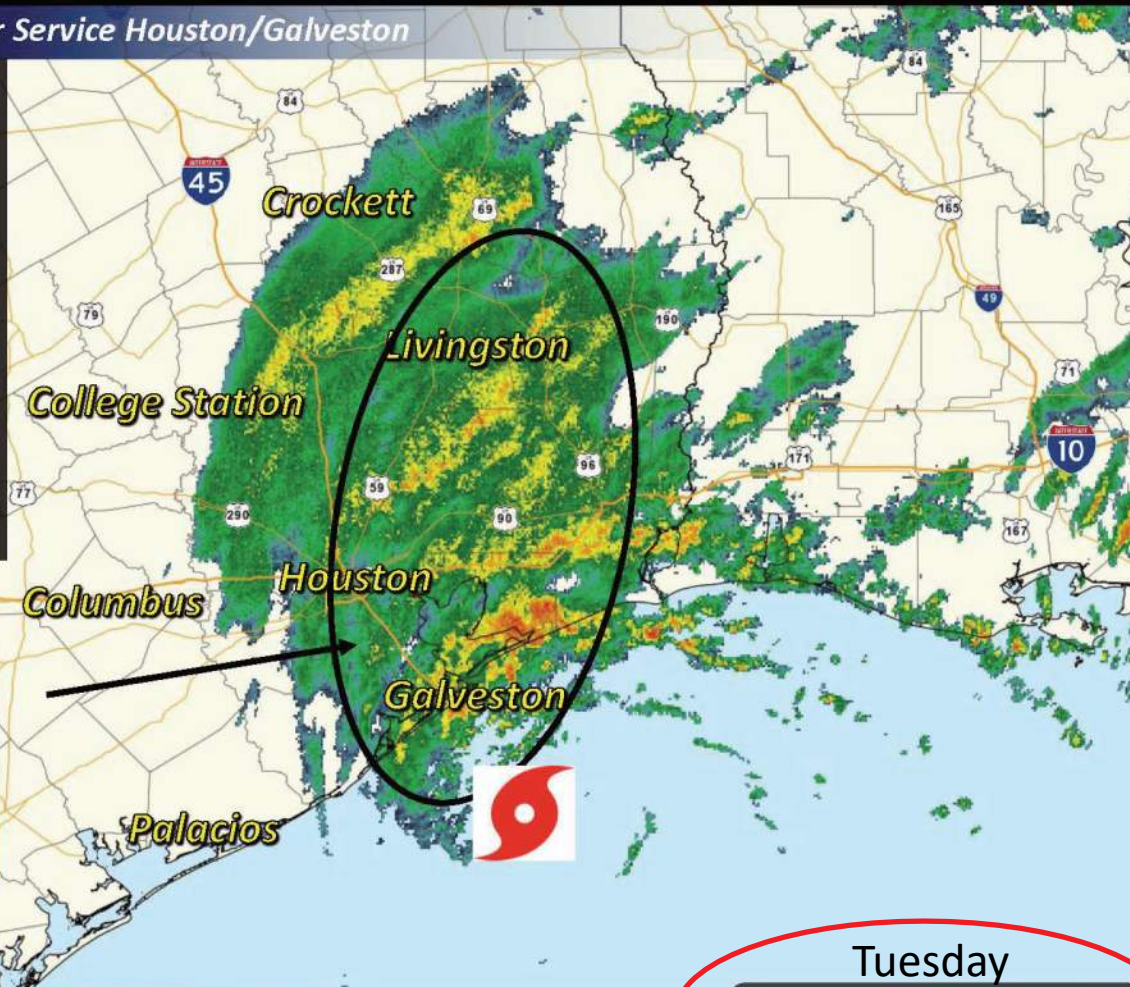


11:00 AM Radar Update

National Weather Service Houston/Galveston

Area of moderate to occasionally heavy rain in a band north of the center of circulation

Very slowly shifting east next 24 hours



Tropical Storm Harvey

Tuesday

Image	8/29/2017
Created	11:03 AM



@NWSHouston
weather.gov/houston



River Flow Impacts

National Weather Service Houston/Galveston

- Increased flow on waterways from inland flood waters will make for challenging navigation, possibly for weeks
 - [River observations and forecasts](#)
 - Flow on area waterways exceed flow seen in the October 1994 flood when pipelines ruptured and “water burned”

Example: San Jacinto River at Sheldon

October 1994 record: 27.09 feet // 300,000 cfs

August 28 – 6:30 PM: 28.5 feet // 395,000 cfs

Lake Houston discharge

- If a rupture happens, vessels break loose, have a spill, etc, NWS can provide localized current and forecast weather conditions for event support.

Tuesday

Image 8/29/2017
Created 11:03 AM



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weather.gov/houston



Forecast Rainfall Amounts – This Afternoon and Tonight

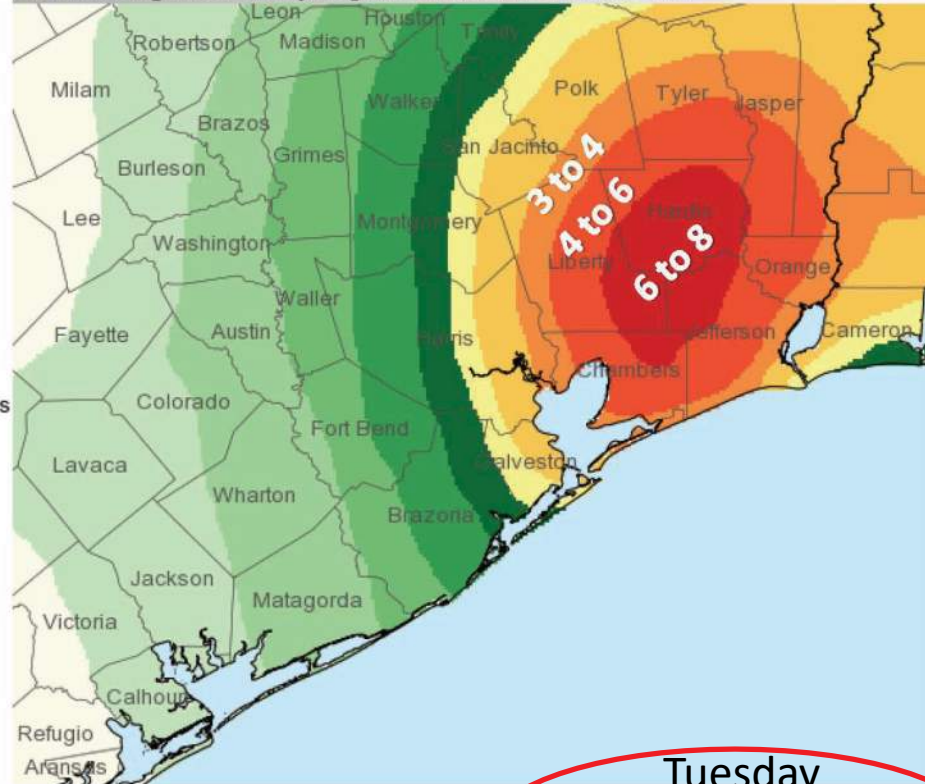
National Weather Service Houston/Galveston

- Latest forecast for total additional rainfall through 7 AM Wednesday.
- The greatest heavy rainfall threat is across eastern Harris, Galveston, and Chambers and Liberty counties.

Forecast Precipitation



Valid Ending Wednesday August 30th, 2017 at 7 AM CDT



Graphic Created August 29th, 2017 9:32 AM CDT

Tuesday

Image 8/29/2017 Created 11:03 AM



@NWSHouston weather.gov/houston



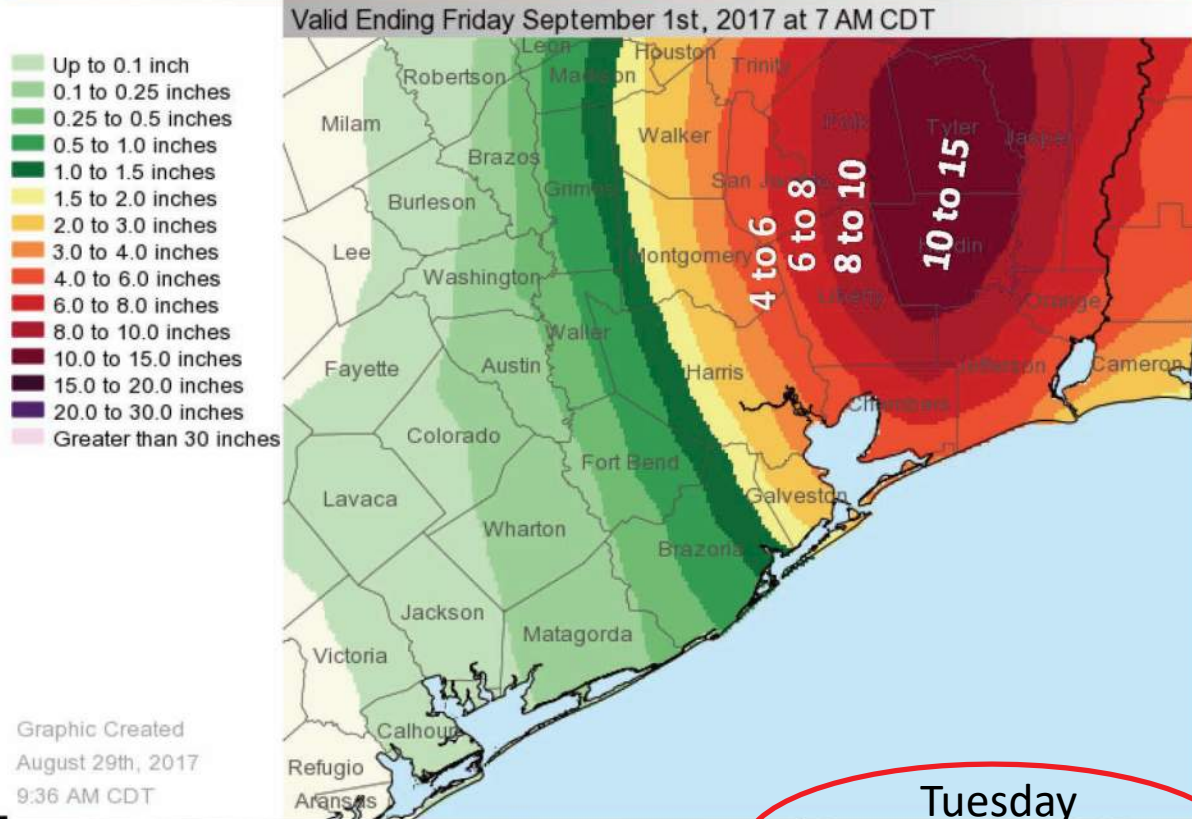
Forecast Additional Rainfall (2 Day Totals)

National Weather Service Houston/Galveston

Forecast Precipitation



- Latest forecast for total additional rainfall through Thursday morning.

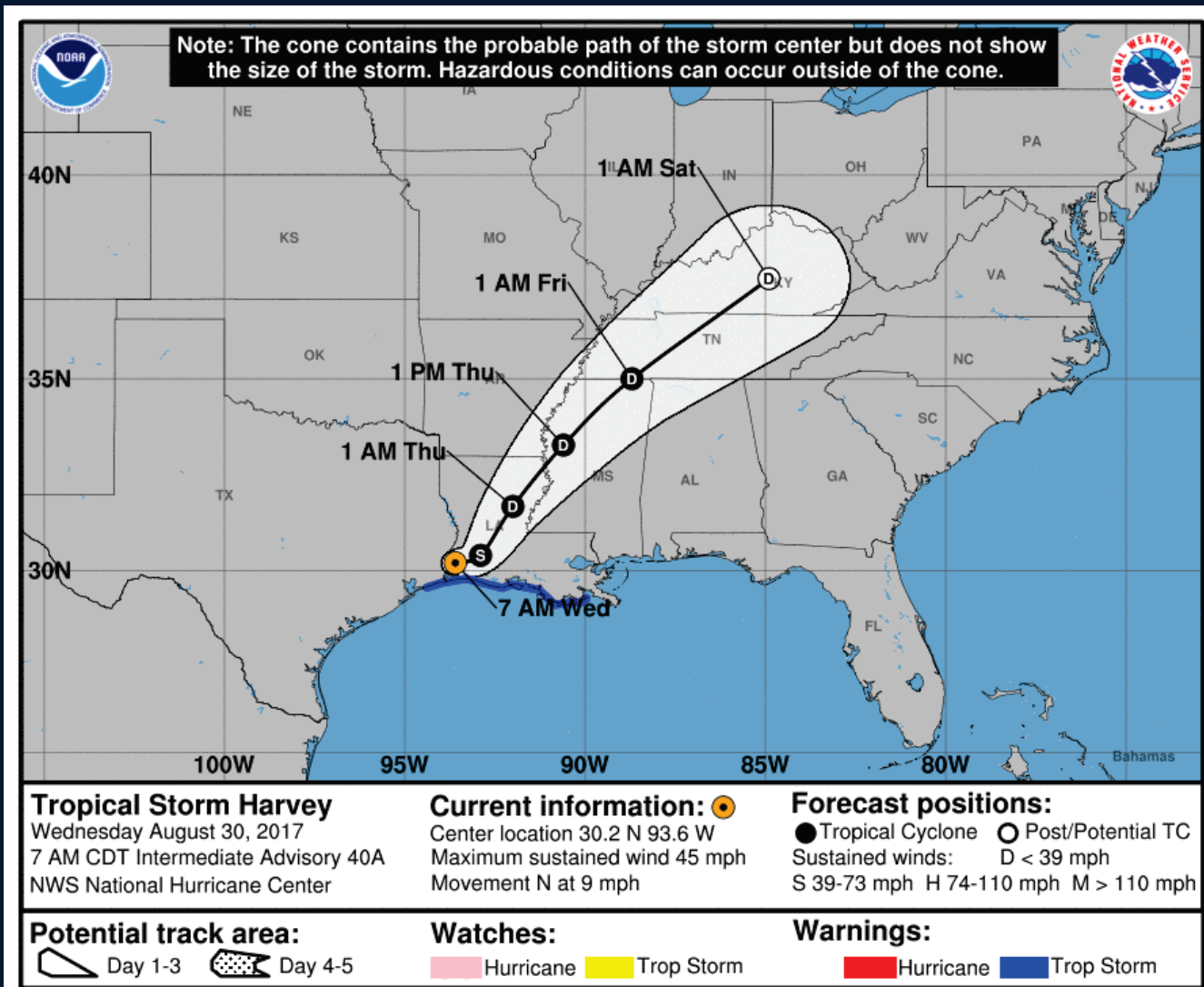


Tuesday
Image 8/29/2017
Created 11:03 AM



@NWSHouston
 weather.gov/houston

Wednesday, August 30, 2017 - Fifth Day after Landfall





Significant River Flooding Continues

National Weather Service Houston/Galveston

5 Day Rainfall Totals

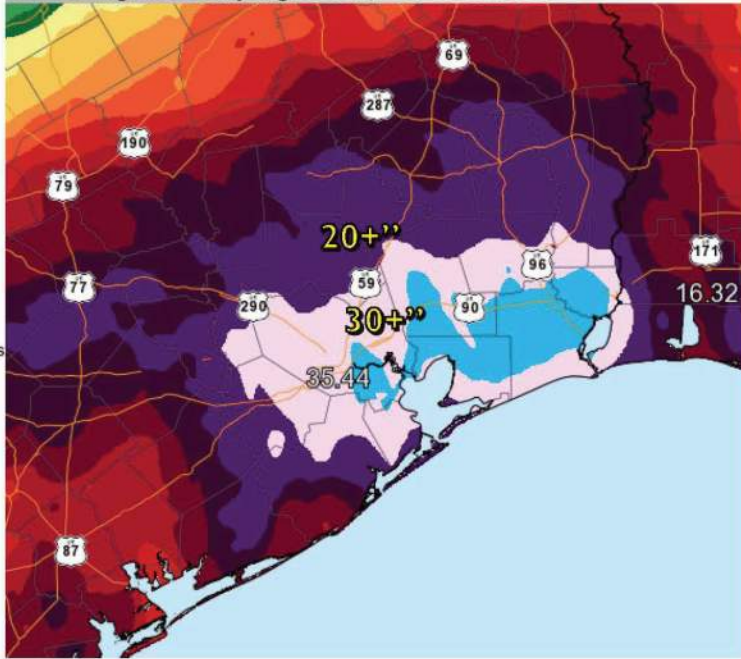
Observed Precipitation



Valid Ending Wednesday August 30th, 2017 at 8 AM CDT

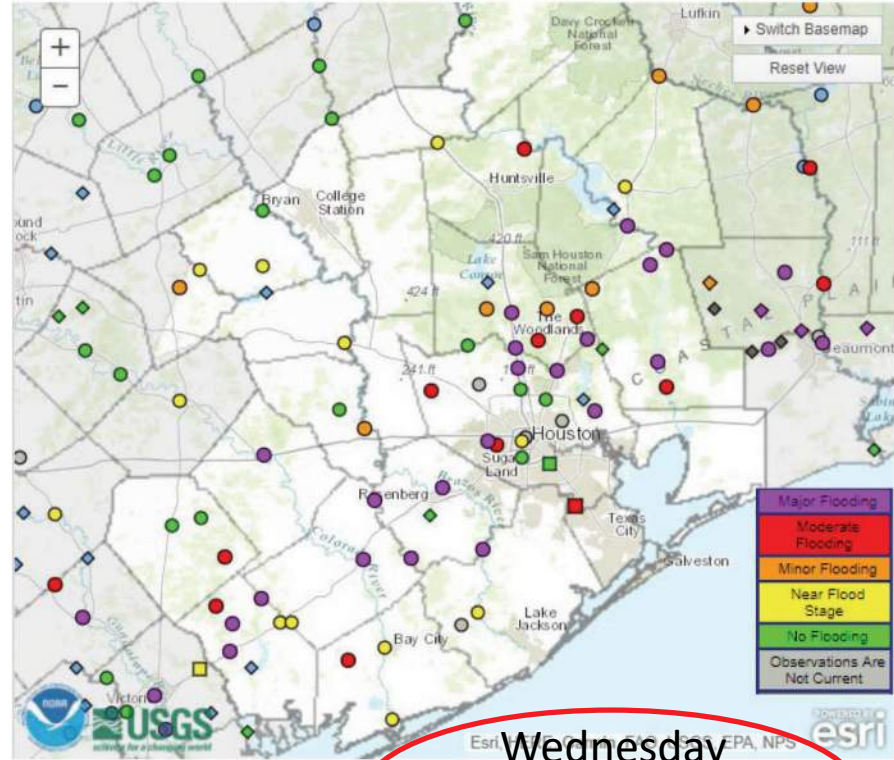
- Up to 0.1 inch
- 0.1 to 0.25 inches
- 0.25 to 0.5 inches
- 0.5 to 1.0 inches
- 1.0 to 1.5 inches
- 1.5 to 2.0 inches
- 2.0 to 3.0 inches
- 3.0 to 4.0 inches
- 4.0 to 6.0 inches
- 6.0 to 8.0 inches
- 8.0 to 10.0 inches
- 10.0 to 15.0 inches
- 15.0 to 20.0 inches
- 20.0 to 30.0 inches
- 30.0 to 40.0 inches
- Greater than 40 inches

Rainfall in Inches



Graphic Created August 30th, 2017 9:00 AM CDT

Latest River Observations as of 12:00 PM



Wednesday

Image Created 8/30/2017 2:39 PM



@NWSHouston weather.gov/houston

5 Day Rainfall Totals

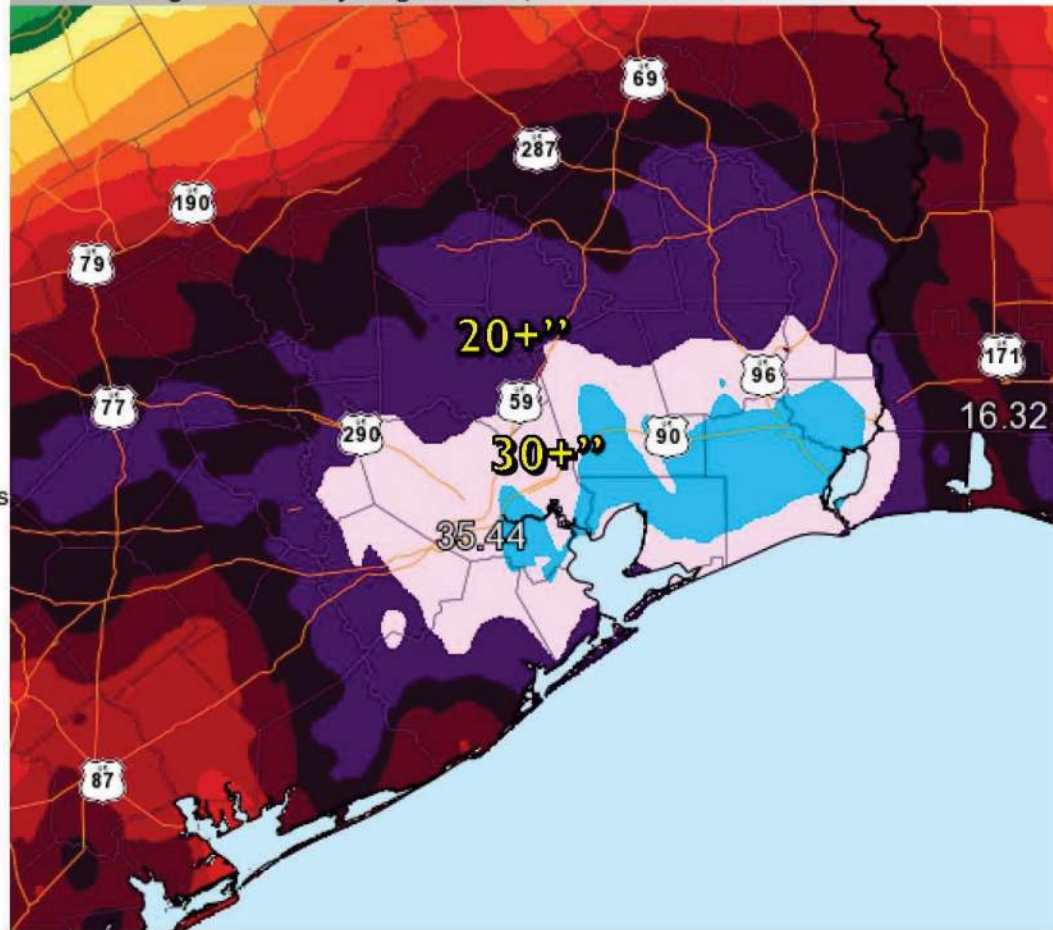
Observed Precipitation



Valid Ending Wednesday August 30th, 2017 at 8 AM CDT

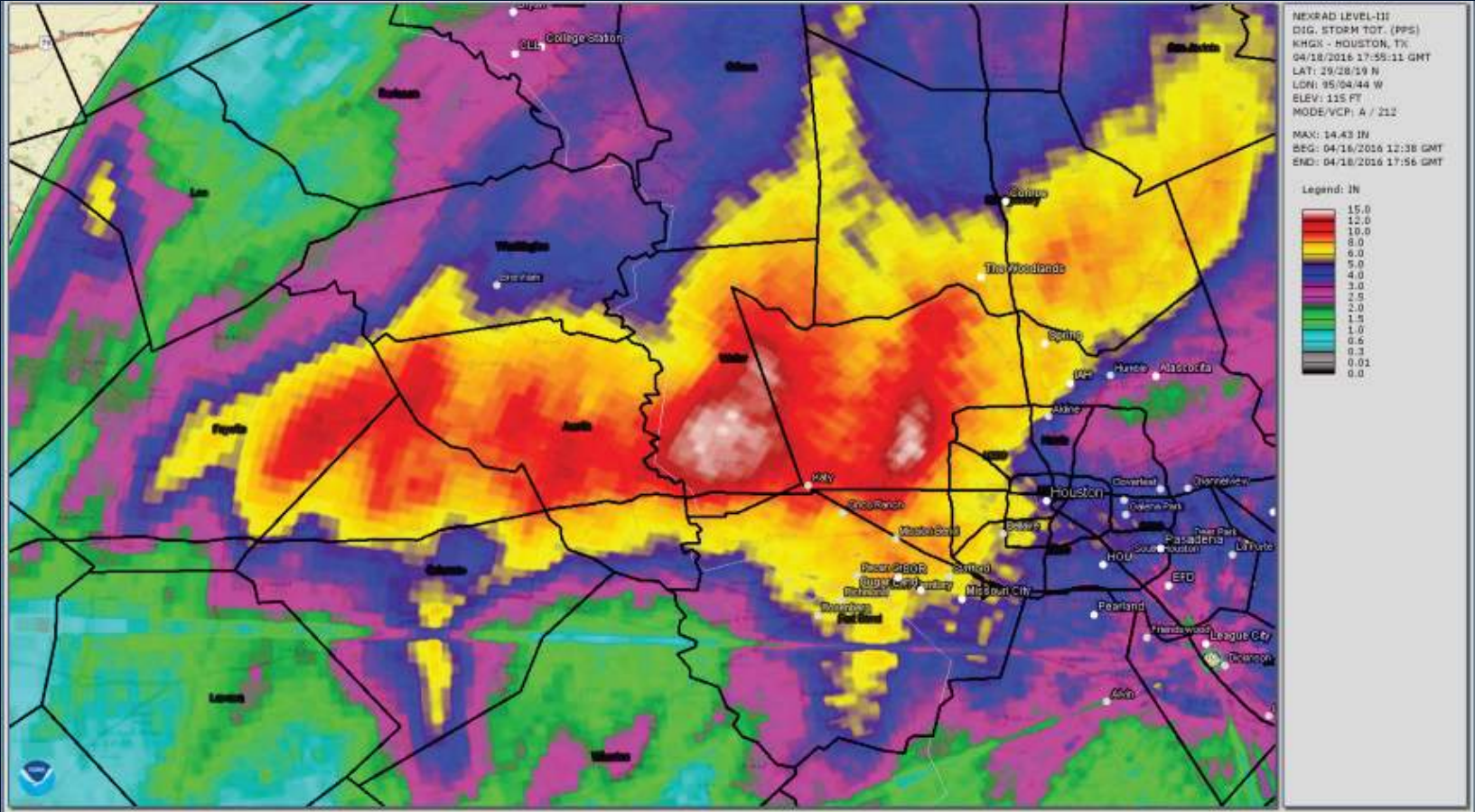
- Up to 0.1 inch
- 0.1 to 0.25 inches
- 0.25 to 0.5 inches
- 0.5 to 1.0 inches
- 1.0 to 1.5 inches
- 1.5 to 2.0 inches
- 2.0 to 3.0 inches
- 3.0 to 4.0 inches
- 4.0 to 6.0 inches
- 6.0 to 8.0 inches
- 8.0 to 10.0 inches
- 10.0 to 15.0 inches
- 15.0 to 20.0 inches
- 20.0 to 30.0 inches
- 30.0 to 40.0 inches
- Greater than 40 inches

Rainfall in
Inches



Graphic Created
August 30th, 2017
9:00 AM CDT

Tax Day 2016 Event



Memorial Day 2016 Event

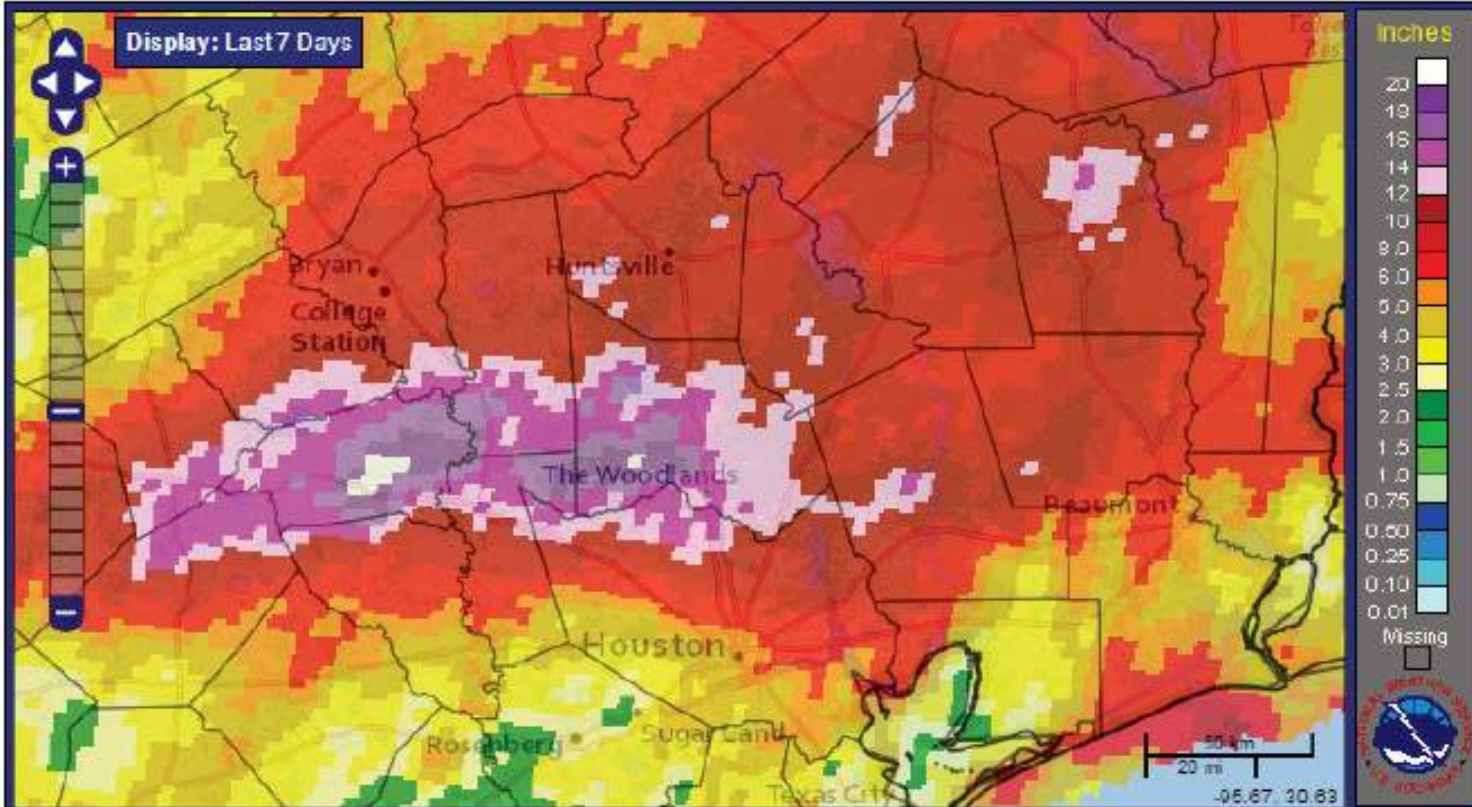
Precipitation Map

[Download Shapefiles](#)

[About this Page](#)

[Other Useful Information](#)

[Survey & Feedback](#)



San Jacinto River Basin Estimated Peak Flows Hurricane Harvey August 25-30, 2017

Estimated Peak Inflow
into Lake Conroe
130,000 cfs

Release from
Lake Conroe Dam
79,141 cfs

Lake Creek
Sendera Ranch Rd
58,000 cfs

21.1

22.4

HWY 105
76,000 cfs

343 ft

1-45
15,000 cfs

18.5

Caney Creek
Near Splendora, TX
20,900 cfs

Feach Creek
Splendora, TX
31,300 cfs

19.7

East Fork
San Jacinto River
New Caney, TX
119,000 cfs

Spring Creek
Tomball, TX
48,800 cfs

27.0

Spring Creek
Spring, TX
82,100 cfs

29.5

West Fork San Jacinto
Near Porter, TX
130,000 cfs

27.4

Luce Bayou

Cypress Creek
Westfield, TX
28,100 cfs

31.2

35.2

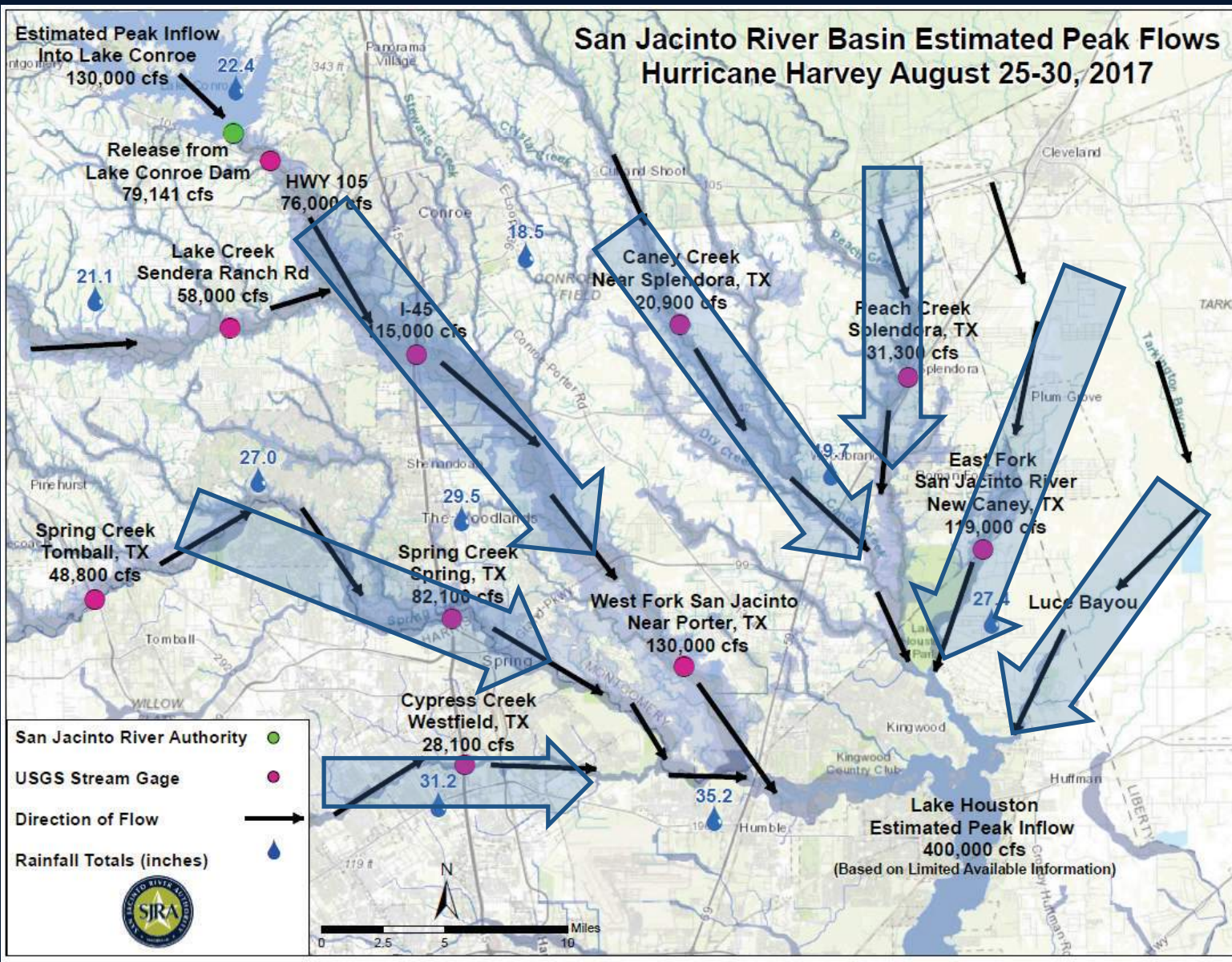
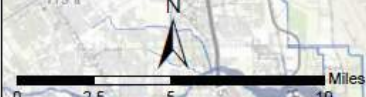
Lake Houston
Estimated Peak Inflow
400,000 cfs
(Based on Limited Available Information)

San Jacinto River Authority

USGS Stream Gage

Direction of Flow

Rainfall Totals (inches)



Hurricane Harvey

Storm Event	Peak Lake Level*	Peak Release	Rainfall (rate & duration varies)
August 2017 (Harvey)	206.2' msl	79,141 cfs	Over 22" (13" on Sunday)
October 1994	205.6' msl	33,300 cfs	13-15"
May 1983	204.6' msl	8,500 cfs	8"
May 2016 (Memorial Day)	204.5' msl	22,200 cfs	9.5"
November 1998	204.2' msl	27,400 cfs	11"
November 2002	203.8' msl	21,700 cfs	6.5"
June 2001	203.8' msl	9,800 cfs	9.3"
March 2016	203.1' msl	7,600 cfs	7"
April 2016 (Tax Day)	202.3' msl	7,000 cfs	7.5"

Key Points Regarding Lake Conroe Operations



Lake Conroe Dam

GRP Intake and Pump Station

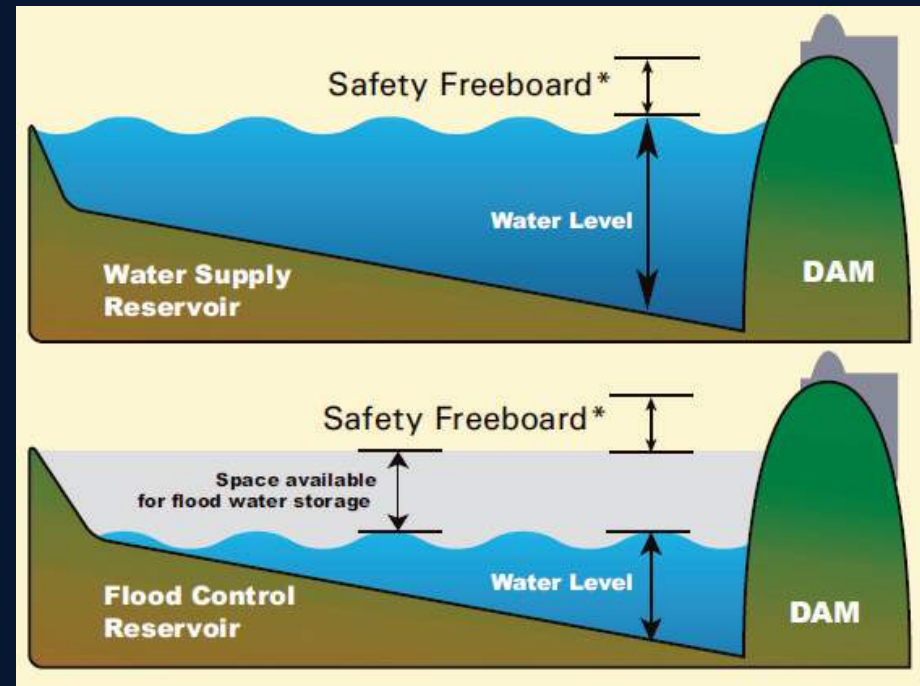
Service Outlet Structure

Main Spillway with Five Tainter Gates

Magnaolia Lake

Key Point #1 – There's No Option to Simply Hold Water and Not Release

- Lake Conroe is a water supply reservoir
- Designed to stay near full
- Designed to pass inflows from storms
- Very limited freeboard to capture inflows
- Structurally, the gates must open as lake rises

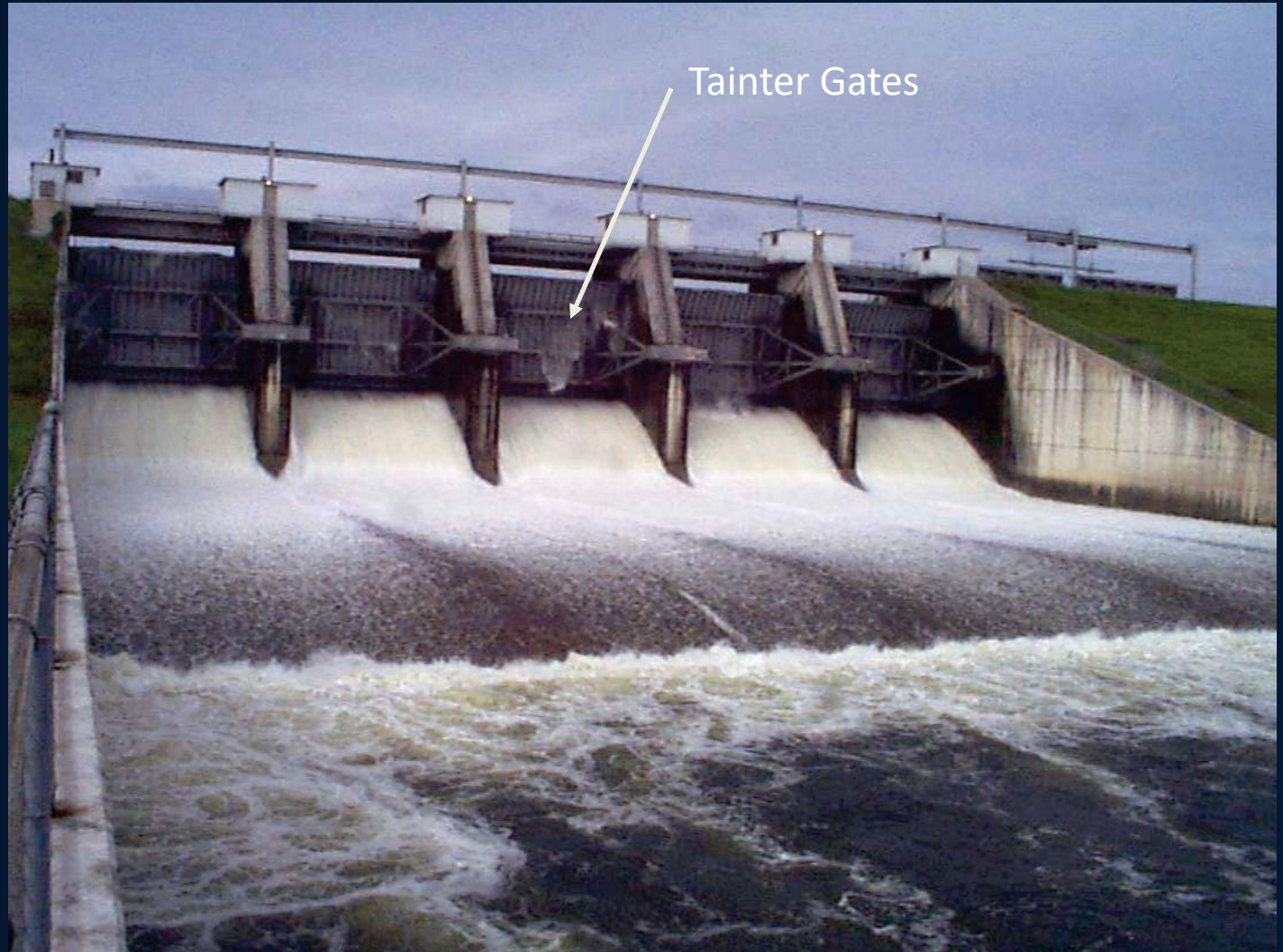


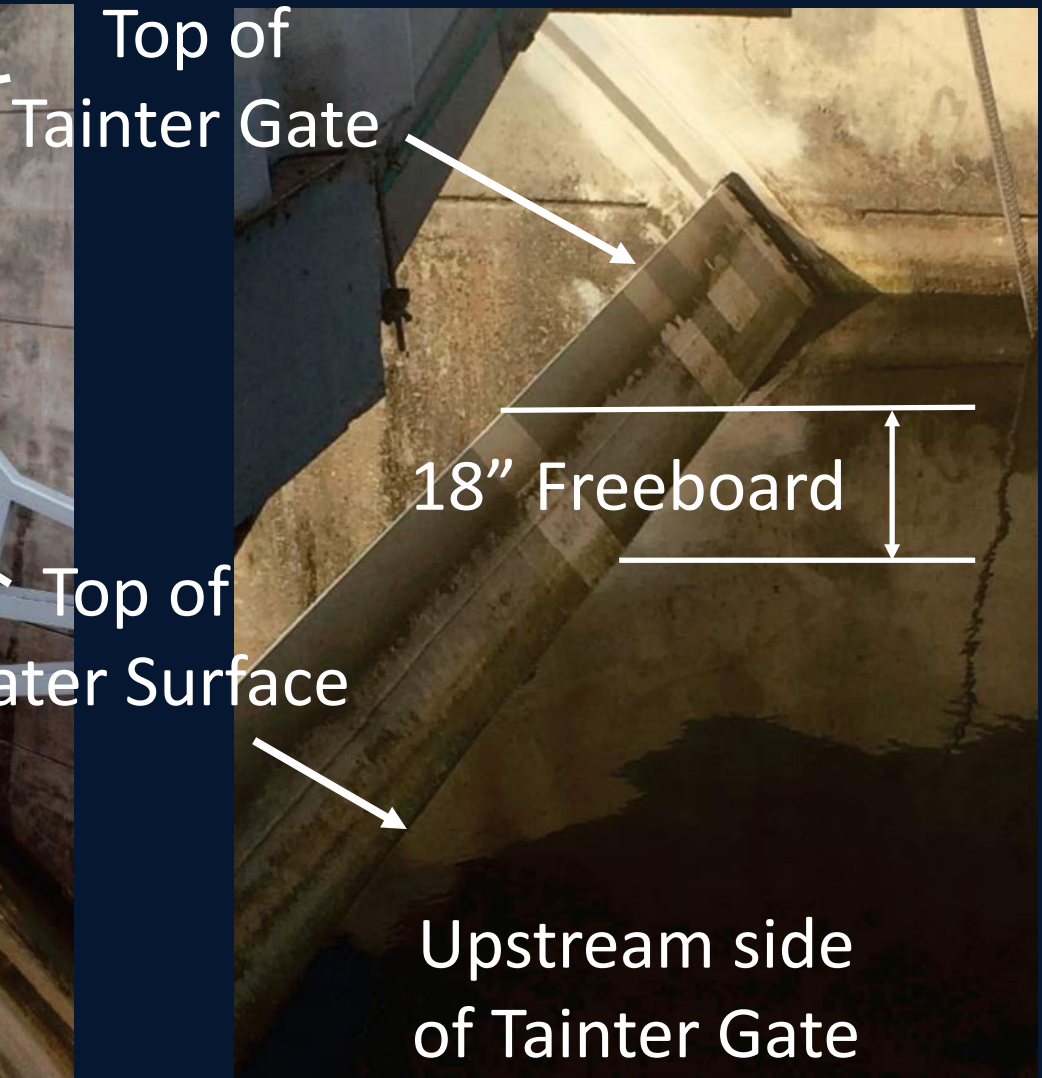
Dam:

- 2.2 mi long
- 82' peak ht

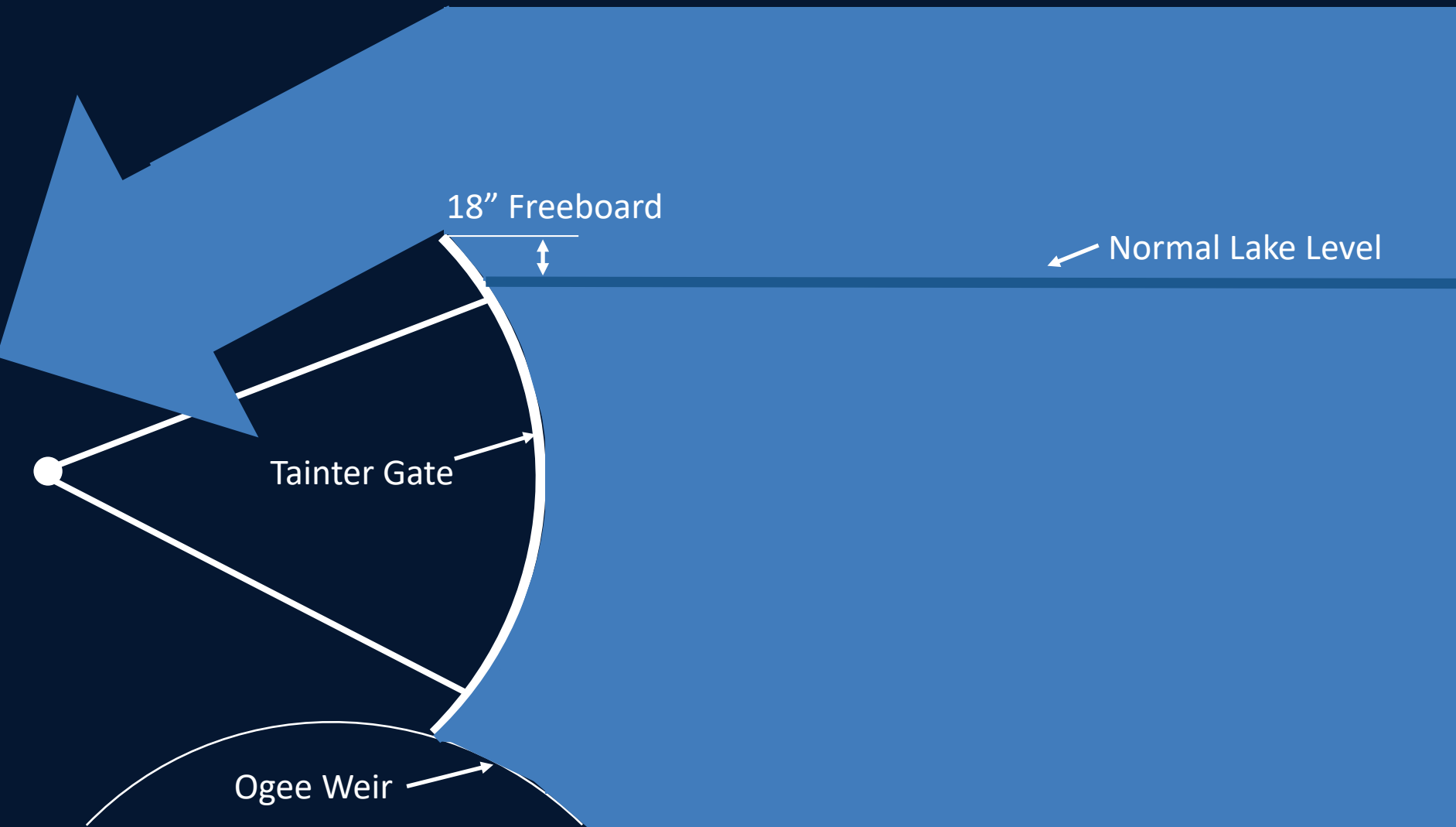
Tainter Gates:

- 40' wide
- 30' high

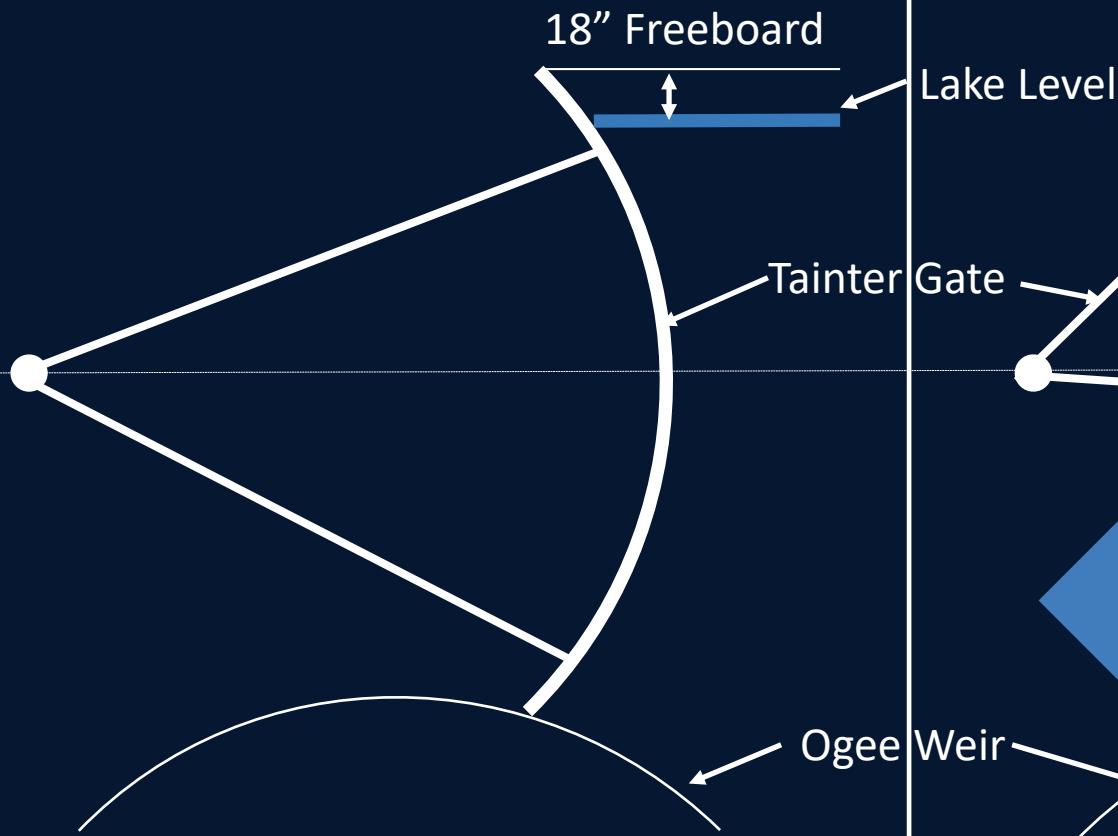




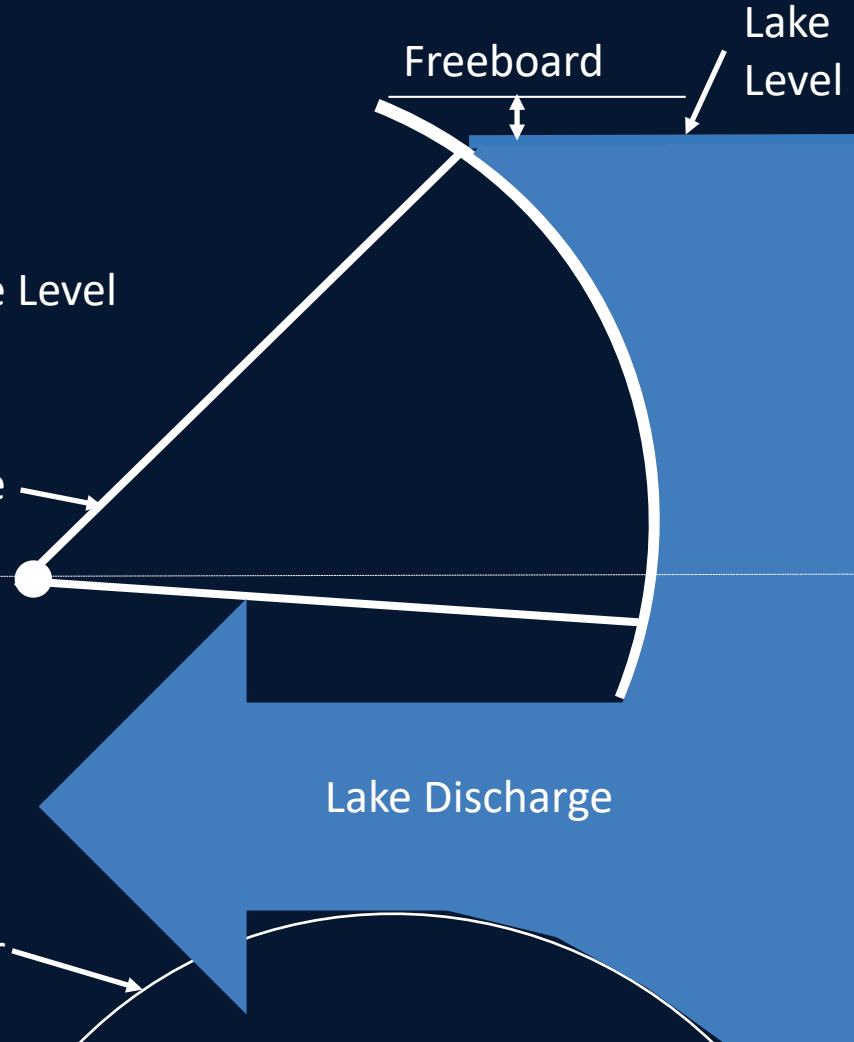
Normal Pool, Closed Gates



Normal Pool, Closed Gates



Rising Water, Open Gates

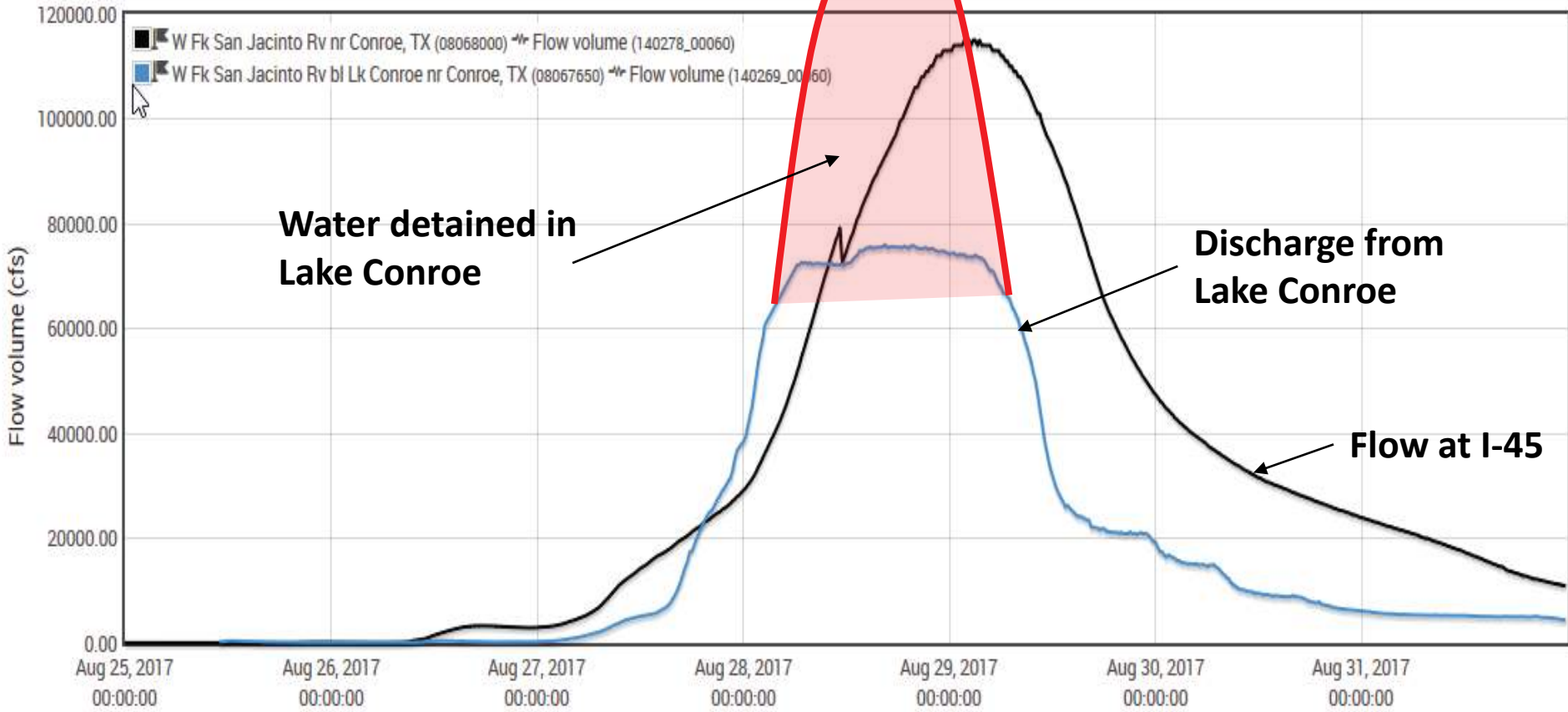


Key Point #2 – Lake Conroe REDUCES downstream flooding

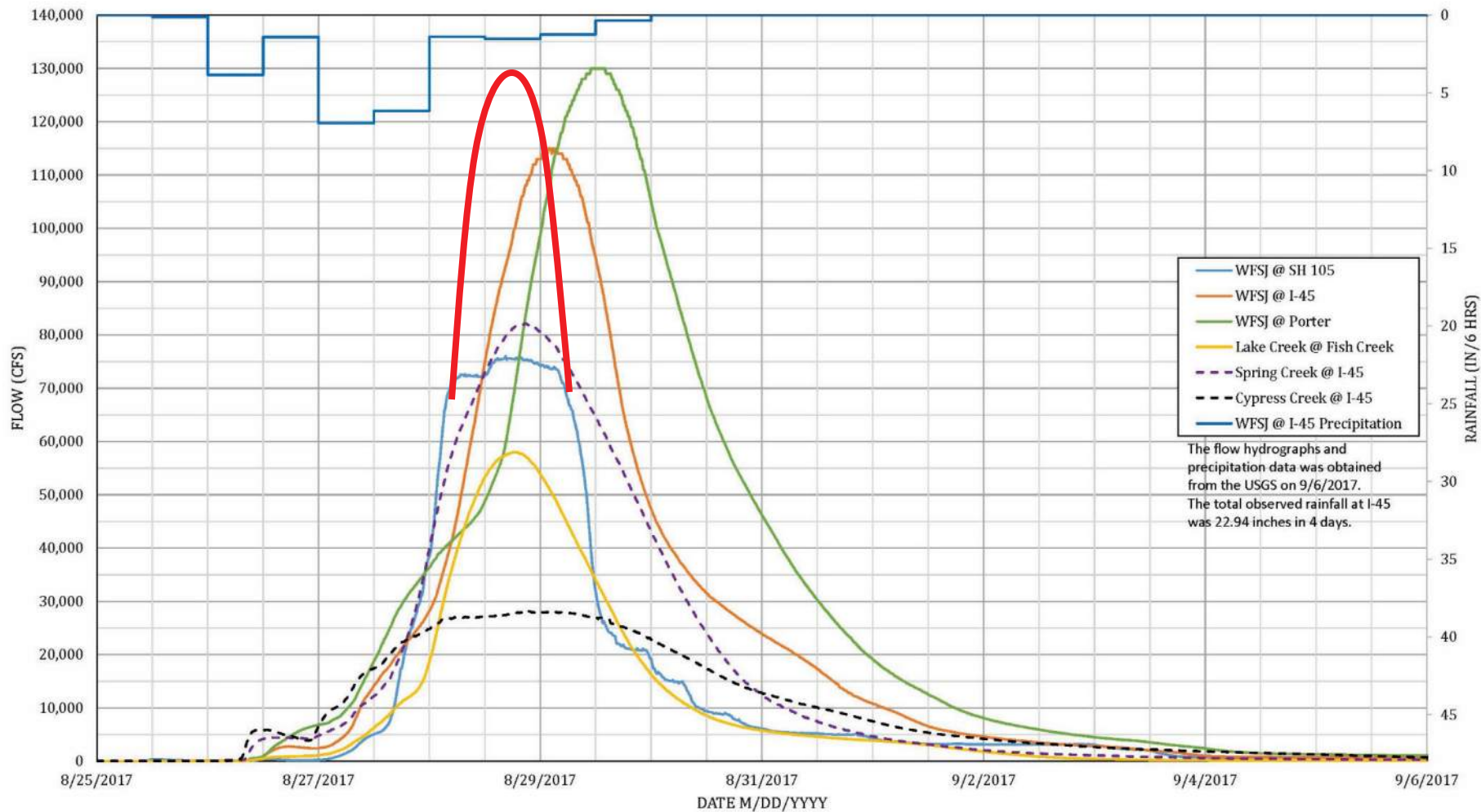
- Even though a water supply reservoir, Lake Conroe reduces peak flow through lake
- Possible due to six-foot flowage easement or inundation zone
- Operating protocol balances inflow reduction and lake level rise

~130,000 cfs

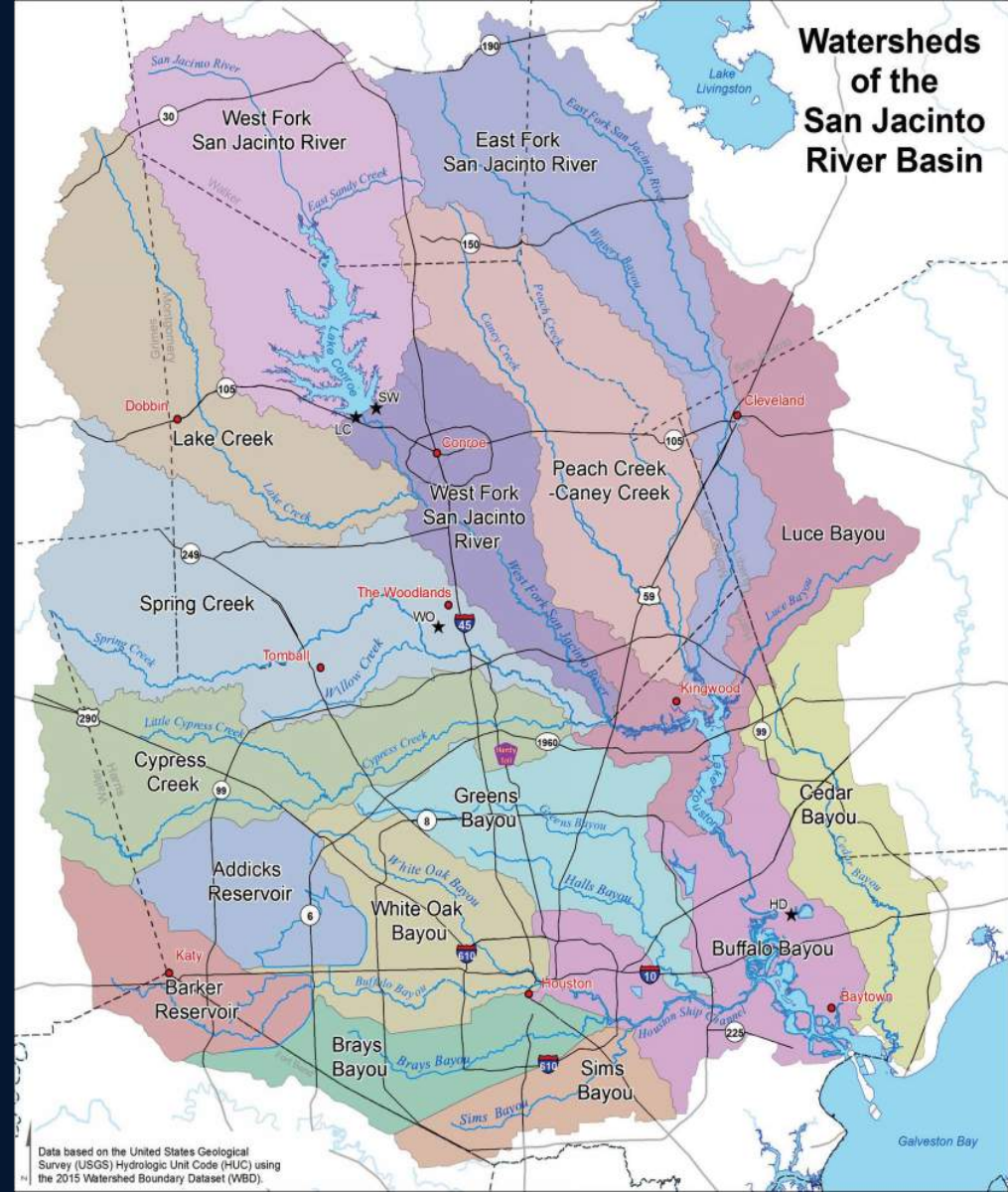
Peak Flow Into
Lake Conroe



USGS OBSERVED DATA (HURRICANE HARVEY EVENT)



Key Point #3 –
Lake Conroe
makes up roughly
10 to 20 percent
of the flows into
Lake Houston

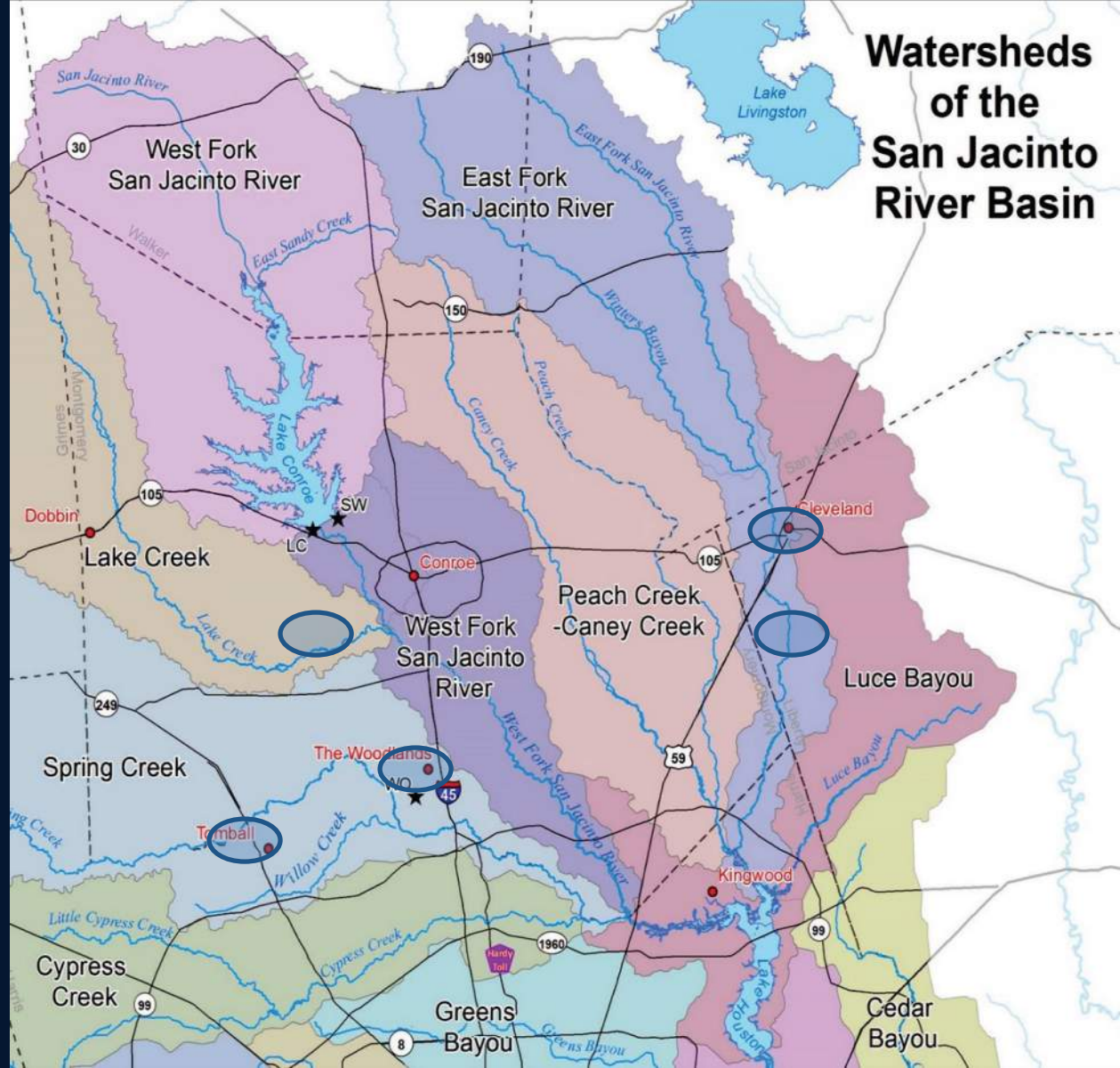


Impact from Lake Conroe watershed:

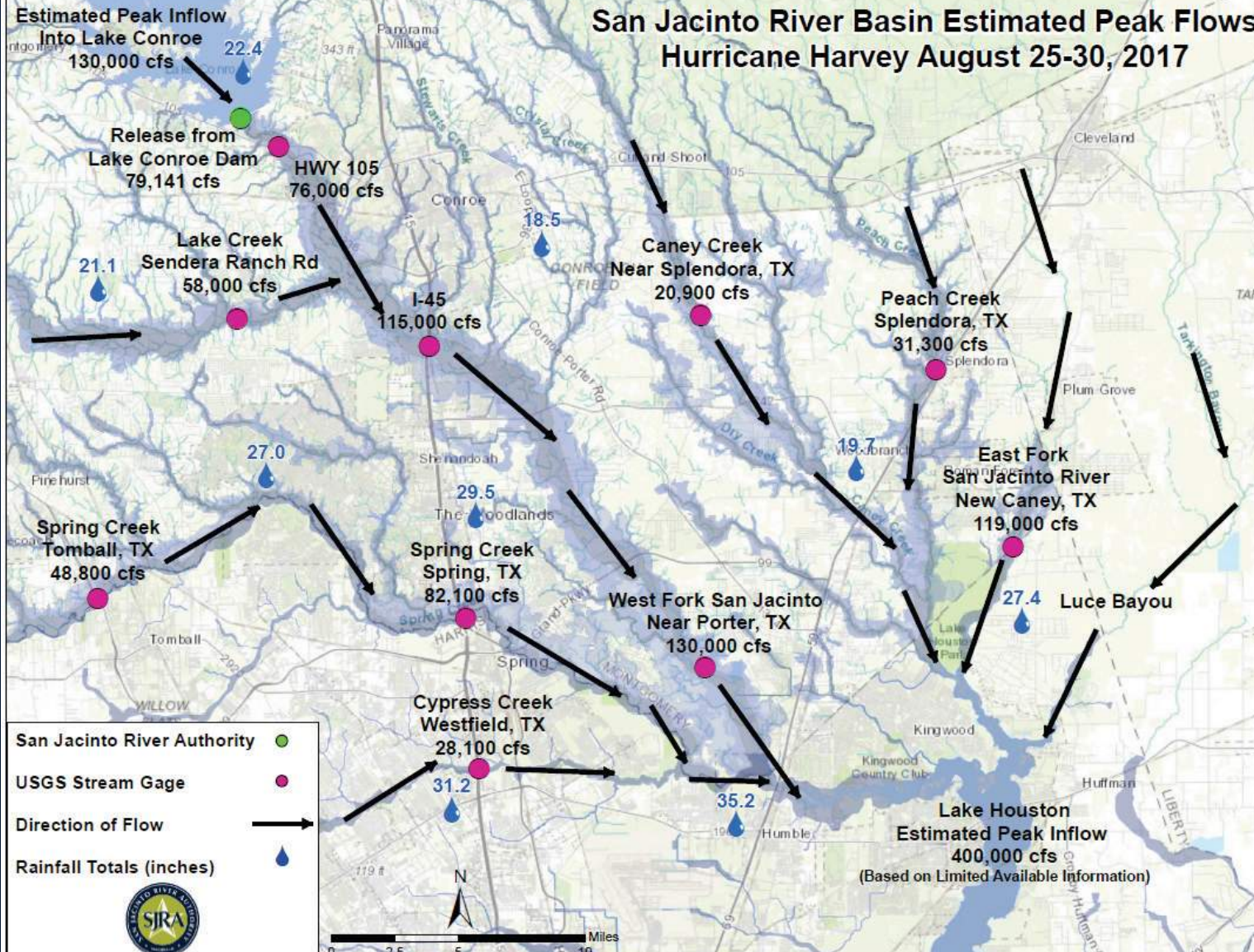
- Lake Houston = 10-20%
- The Woodlands
W of I-45 = 0%
- Tomball = 0%
- Woodforest = 0%
- Cleveland = 0%
- Plum Grove = 0%





Jeff Lindner, HCFCD


<https://www.youtube.com/watch?v=SowuKOT41Rc>



San Jacinto River Basin Estimated Peak Flows Hurricane Harvey August 25-30, 2017

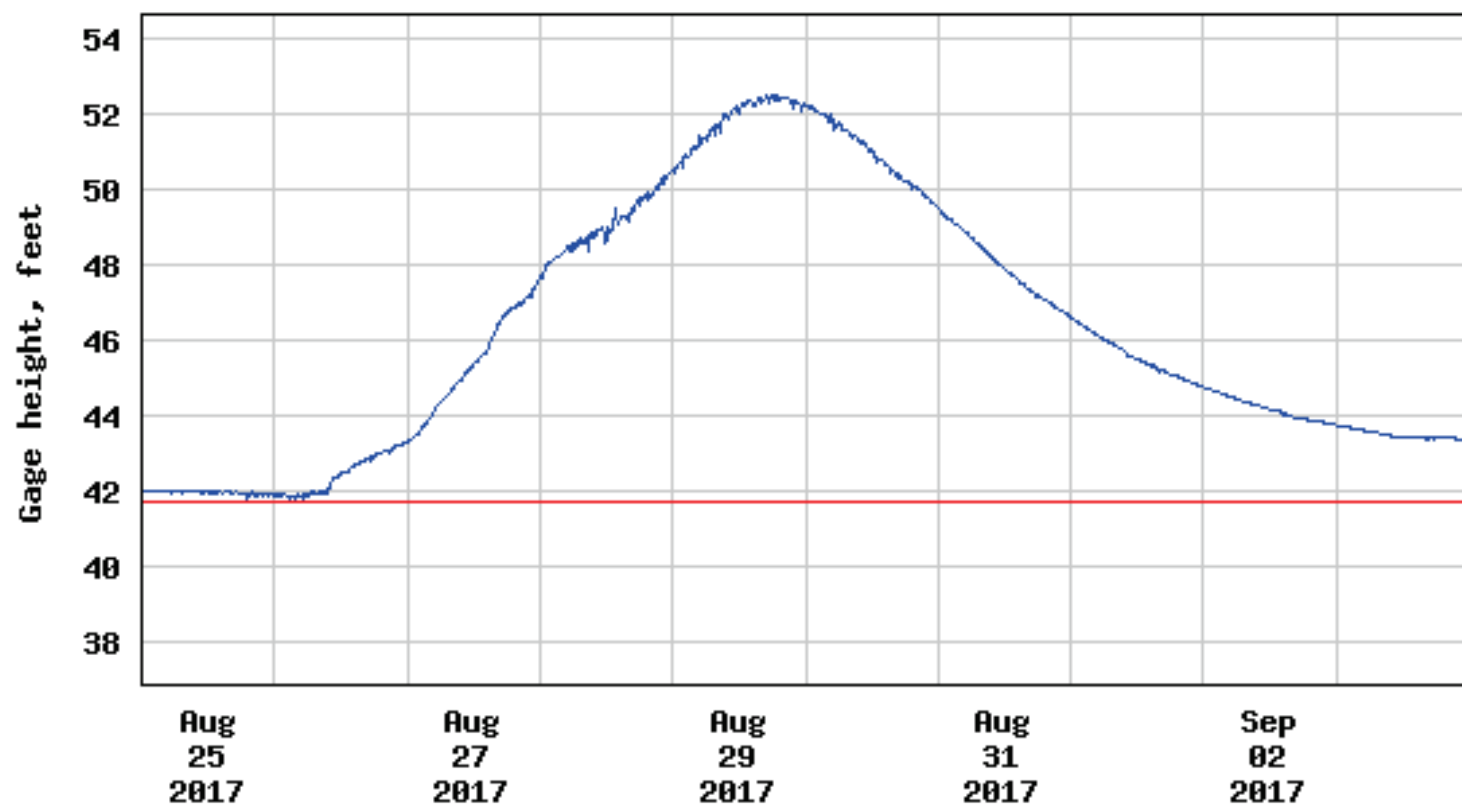


San Jacinto River Authority 
USGS Stream Gage 
Direction of Flow 
Rainfall Totals (inches) 




Lake Houston
Estimated Peak Inflow
400,000 cfs
 (Based on Limited Available Information)

USGS 08072000 Lk Houston nr Sheldon, TX



----- Provisional Data Subject to Revision -----

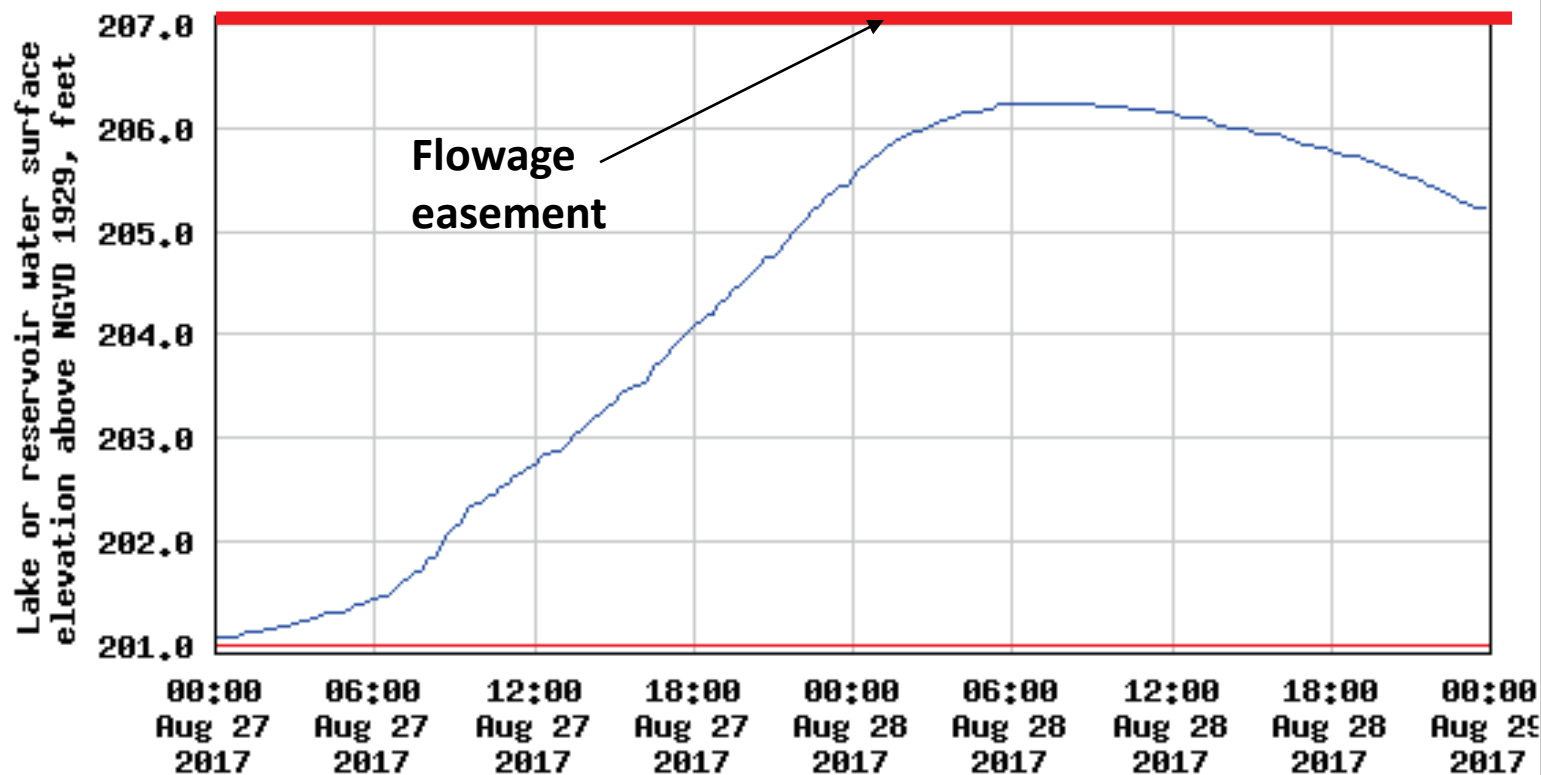
— Gage height

— Conservation Pool Storage

Key Point #4 – Lake Conroe level remained within authorized flowage easement

- Six-foot flowage easement acquired when lake was constructed
- Recorded in deed records
- Authorizes inundation up to 207' msl
- During Harvey, peak elevation was 206.24' msl

USGS 08067600 Lk Conroe nr Conroe, TX



---- Provisional Data Subject to Revision ----

- Lake or reservoir water surface elevation above ngvd 1929
- Conservation Pool Elevation



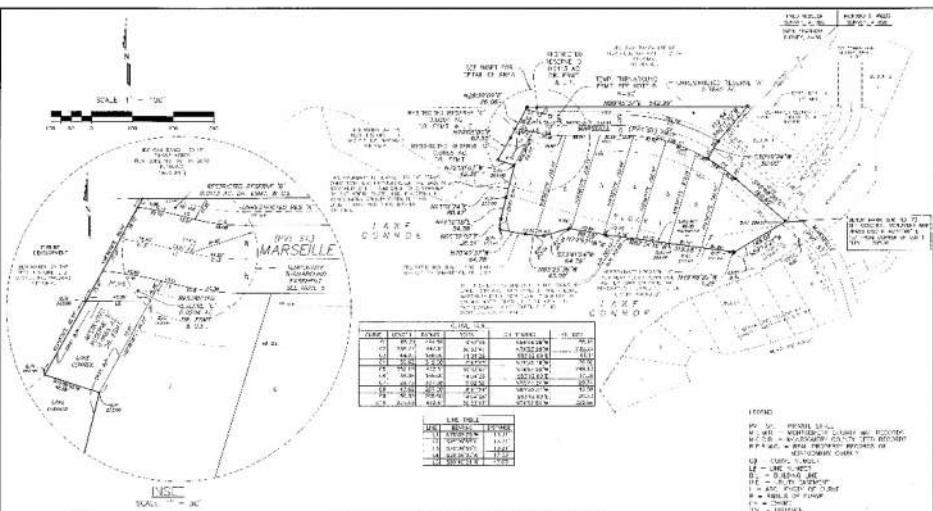
Permanent Flowage
Easement Elev = 207.00

Normal Water
Surface Elev = 201.00

It is understood and agreed by GRANTOR and GRANTEE that, whether specifically described above or not, this conveyance covers all land below elevation 207.00 feet, mean sea level, and all of the land on any island or islands created by the inundation, by water, of the land owned by GRANTOR in the survey or surveys above referred to, and no further claim shall be made for payment for land situated below said elevation 207.00 feet, mean sea level contour, and such islands as may be created.

The permanent easement rights herein granted are for the following uses and purposes, to-wit:

(a) The right to overflow, flood or cover such land, at any time or times hereafter, with floodwater, slack water or backwater created by the construction, maintenance and operation by GRANTEE of a dam, and the reservoir for the storage of water created by the construction of such dam with all appurtenant works, across the San Jacinto River in Montgomery County, Texas;



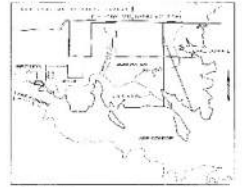
TRACT	ACRES	OWNER	REMARKS
1	1.00	BL EYL & ASSOCIATES	
2	1.00	BL EYL & ASSOCIATES	
3	1.00	BL EYL & ASSOCIATES	
4	1.00	BL EYL & ASSOCIATES	
5	1.00	BL EYL & ASSOCIATES	
6	1.00	BL EYL & ASSOCIATES	
7	1.00	BL EYL & ASSOCIATES	

BENTWATER SECTION SEVENTY THREE

BEING A SUBDIVISION OF 42969 ACRES IN THE OWEN SHANNON SURVEY, A-36 MONTGOMERY COUNTY, TEXAS 7 LOTS 1 BLOCK 4 RESERVES

OWNER: BLEYL AND ASSOCIATES
 2700 N. DOWNEY W. SUITE 101, DALLAS, TX 75206

BY ORDER OF: STEPHENSON SURVEYING CO.
 2401 SHILOH ROAD, SUITE 100, DALLAS, TX 75228



NOTES:

1. ALL LOTS ARE TO BE CONVEYED BY DEED.
2. ALL LOTS ARE TO BE CONVEYED BY DEED TO THE BUYER AND NOT BY CONTRACT.
3. ALL LOTS ARE TO BE CONVEYED BY DEED TO THE BUYER AND NOT BY CONTRACT.
4. ALL LOTS ARE TO BE CONVEYED BY DEED TO THE BUYER AND NOT BY CONTRACT.
5. ALL LOTS ARE TO BE CONVEYED BY DEED TO THE BUYER AND NOT BY CONTRACT.

DATE: 10/15/2014
 SHEET 1 OF 2

ONE OF THESE THREE CONDITIONS WAS PURCHASED FOR ADJACENT LANDS DURING LAND ACQUISITIONS FOR THE LAKE.

PORTIONS OF THE PROPERTY IN THIS SUBDIVISION ARE SUBJECT TO ONE OF THE FOLLOWING: AS PER SAN JACINTO RIVER AUTHORITY EASEMENT RECORDED IN VOL. 657, PG. 788, M.C.D.R.

- (1) A FLOWAGE AND INUNDATION EASEMENT UP TO 207 M.S.L. IN FAVOR OF THE SAN JACINTO RIVER AUTHORITY (SJRA).
- (2) A WAIVER OF DAMAGES CAUSED BY FLOODING OR INUNDATION IN FAVOR OF SJRA ABOVE 201 M.S.L.
- (3) A WAIVER OF DAMAGES CAUSED BY FLOODING OR INUNDATION IN FAVOR OF SJRA BETWEEN 201 M.S.L. AND 207 M.S.L.

WARRANTY

THE SURVEYOR WARRANTS THAT THE SURVEY WAS MADE IN ACCORDANCE WITH THE PROFESSIONAL STANDARDS OF THE SURVEYING AND MAPPING BOARD OF TEXAS AND THAT THE SURVEY IS A TRUE AND CORRECT REPRESENTATION OF THE FACTS AS KNOWN TO THE SURVEYOR AT THE TIME THE SURVEY WAS MADE.

DATE: 10/15/2014
 SHEET 2 OF 2

WARRANTY

THE SURVEYOR WARRANTS THAT THE SURVEY WAS MADE IN ACCORDANCE WITH THE PROFESSIONAL STANDARDS OF THE SURVEYING AND MAPPING BOARD OF TEXAS AND THAT THE SURVEY IS A TRUE AND CORRECT REPRESENTATION OF THE FACTS AS KNOWN TO THE SURVEYOR AT THE TIME THE SURVEY WAS MADE.

DATE: 10/15/2014
 SHEET 2 OF 2

BENTWATER SECTION SEVENTY THREE

BEING A SUBDIVISION OF 40256 ACRES IN THE OWEN SHANNON SURVEY, A-36 MONTGOMERY COUNTY, TEXAS 7 LOTS 1 BLOCK 4 RESERVES

OWNER: BLEYL AND ASSOCIATES
 2700 N. DOWNEY W. SUITE 101, DALLAS, TX 75206

BY ORDER OF: STEPHENSON SURVEYING CO.
 2401 SHILOH ROAD, SUITE 100, DALLAS, TX 75228

DATE: 10/15/2014
 SHEET 2 OF 2

Key Point #5 – SJRA does not pre-release prior to storm events

- Primary reason – high risk of making downstream flooding problems worse
- It would take weeks to safely lower Lake Conroe any significant amount
- Small increase in storage makes no difference in large storm event like Harvey
- Weather predictions not accurate enough

Time required to safely lower Lake Conroe

Release Rate (cfs)	Daily Volume Released (acre-feet)	Daily Reduction in Lake Level (inches)	Retained daily rainfall for entire watershed assuming 50% infiltration (inches)
625	1,250	0.75	0.1
1,250	2,500	1.5	0.2
2,500	5,000	3	0.4

Forecast



Storm dissipated from forecasts six days from ultimate landfall.

August 22 (three days from landfall), NWS announced:

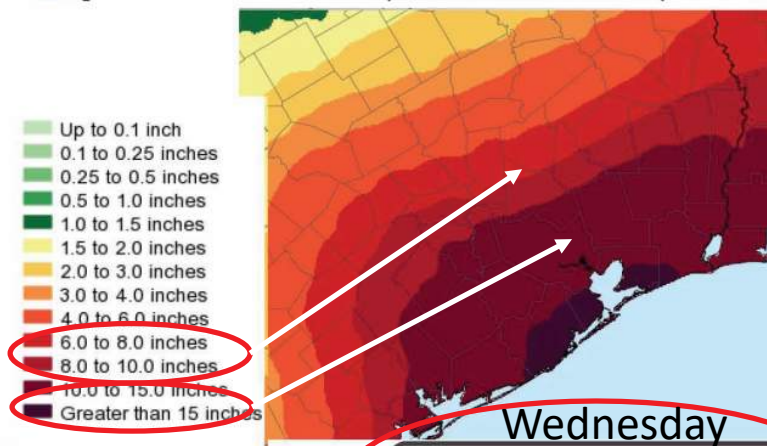
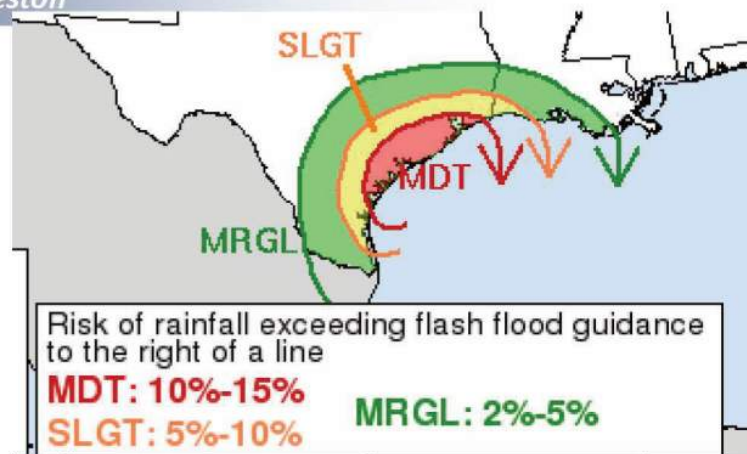
- “remnants of Harvey centered over Yucatan.”
- “likely to redevelop into a tropical storm or hurricane over the warm waters of the Bay of Campeche.”



Rainfall, Flood Threat

National Weather Service Houston/Galveston

- Landfall then a slow track over the area would mean periods of heavy rain from Friday through Monday
- Details of track still uncertain but graphic shows latest thinking on rainfall amounts over that period; will refine forecast going forward
- Thinking 10 to 15 inches near the coast with isolated 20; lesser amounts inland but again all dependent on the track
- Flash flood watches will likely be needed as we get closer to the event



Wednesday
Image 8/23/2017
Created 10:54 AM

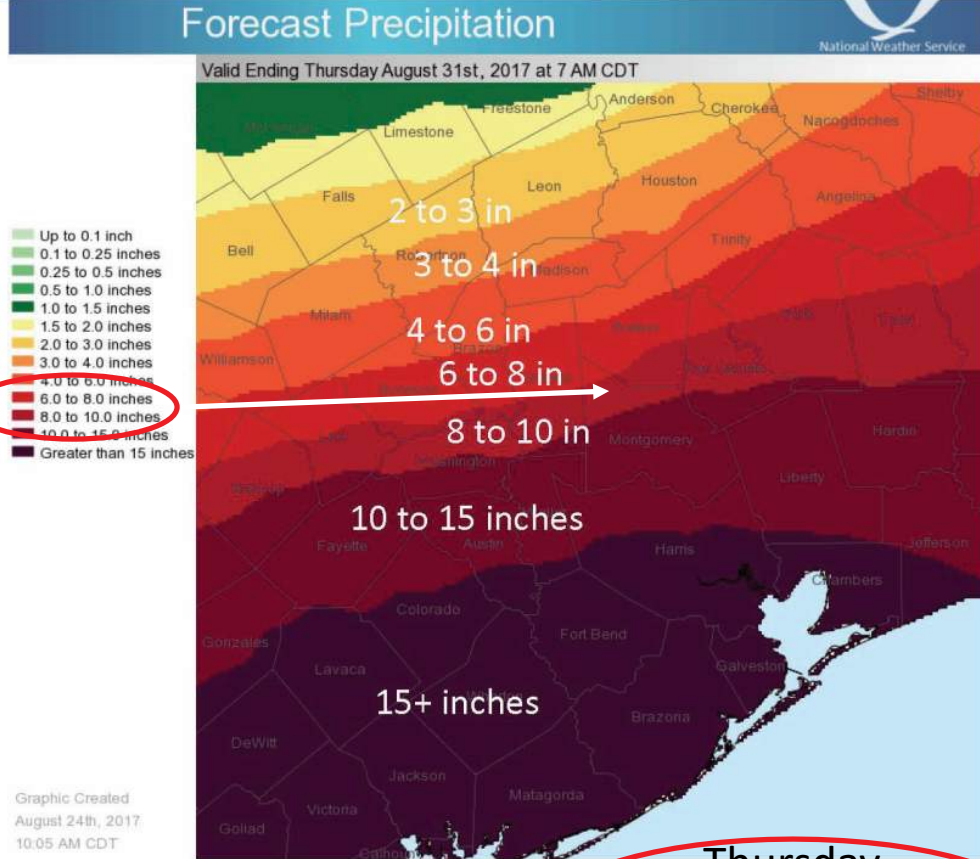
Two days from landfall, heavier rainfall projected downstream of Lake Conroe



Rainfall, Flood Threat

National Weather Service Houston/Galveston

- Timing of onset and end of heavier rains uncertain
- Most likely start Matagorda, Jackson Counties, closest to the hurricane, Friday/Friday night continuing
- Bands east of the center to set up into areas farther east Saturday and Sunday
- Could be sharp gradient north to south with coastal counties seeing most rain over the multiday period

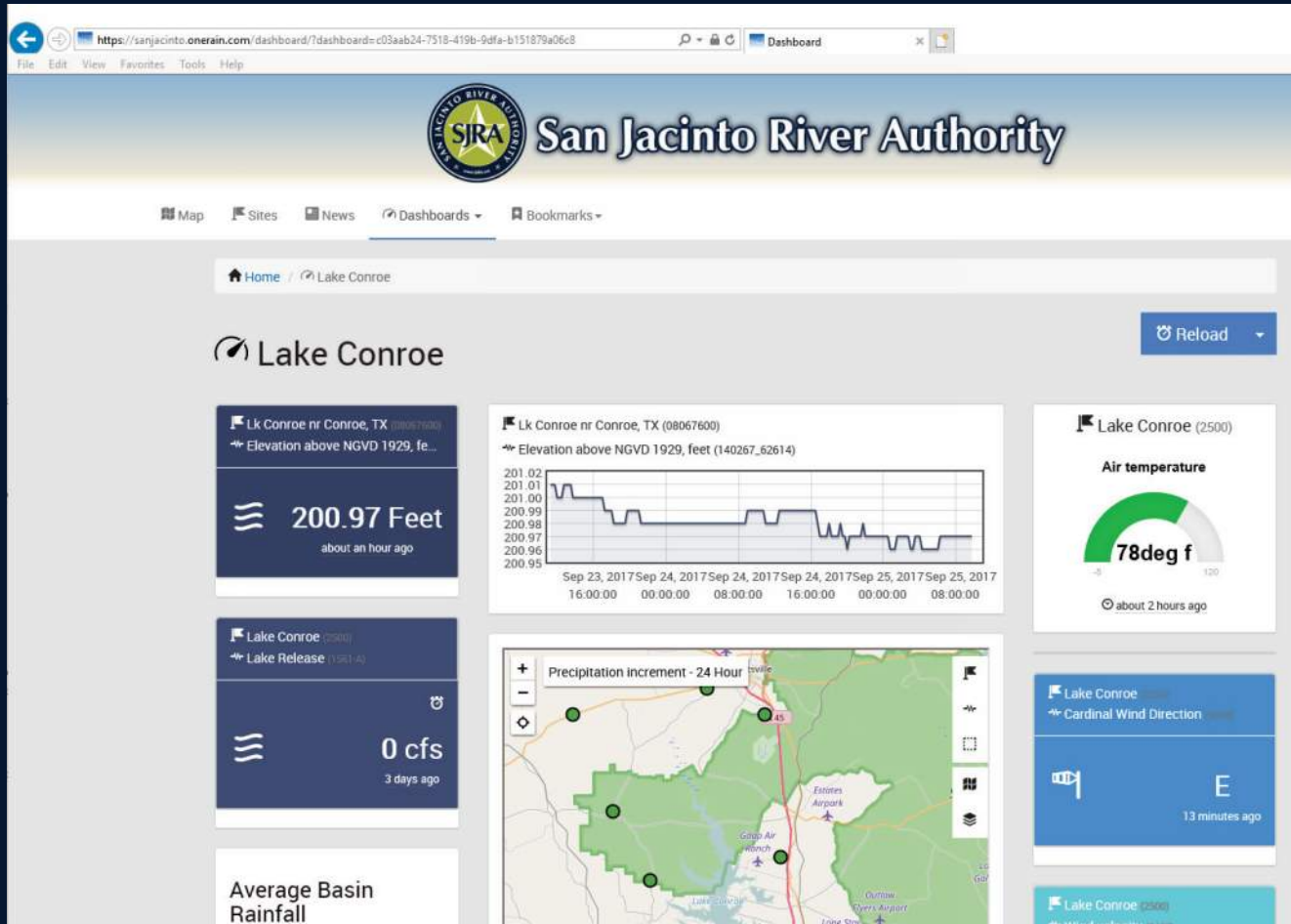


One day before landfall, heavier rainfall projected downstream of Lake Conroe

Key Point #6 – SJRA follows pre-planned emergency communications protocols

- Partners with emergency response agencies in both Montgomery and Harris counties
- SJRA has no ability to order or control evacuations or to serve as emergency response
- SJRA's role is to operate the dam and notify appropriate emergency officials
- SJRA conducts periodic table top exercises with these agencies

SJRA provides real-time data throughout storm events



FOR IMMEDIATE RELEASE
August 24, 2017



CONTACT: Ronda Trow
(936) 588-3111

SJRA Making Preparations for Heavy Rainfall at Lake Conroe

With current forecasts predicting anywhere from 10 to 15 inches of rainfall in the Lake Conroe watershed, SJRA employees are implementing their standard procedures for a heavy rain event, which includes establishing 24-hour work schedules, testing all equipment, positioning

FOR IMMEDIATE RELEASE
12:30 AM, August 27, 2017



CONTACT: Ronda Trow
(936) 588-3111

Lake Conroe Exceeds Full Level; SJRA Beginning Controlled Releases

With approximately six inches of rainfall across the watershed over the past 24 hours, the Lake Conroe water level has risen over seven inches and exceeded normal pool elevation. SJRA operations personnel at the Lake Conroe dam are now beginning controlled releases to slowly pass a portion of the inflow coming into the lake.

Fortunately, Lake Conroe was over six inches low when the event started and was able to absorb a significant amount of rainfall without any release. Releases from the lake will begin gradually, and the lake will continue to be allowed to slowly rise, which means the operation of the dam will buffer the amount of flow that would otherwise enter the river.

The operational guidelines for Lake Conroe take many factors into consideration and the dam operators will continue to monitor the dam itself and to ensure that the peak rate of flow released from the dam

FOR IMMEDIATE RELEASE
August 27, 2017



CONTACT: Ronda Trow
(936) 828-0285

Lake Conroe Temporarily Closed Due to High Levels, Submerged Objects, and Floating Debris

Effective immediately, the San Jacinto River Authority is temporarily closing Lake Conroe due to high lake levels, the presence of submerged objects, floating debris, and other hazards that could put people's safety at risk.

The lake level has risen to over 20' above mean sea level, which is two feet over the lake's normal pool level. The last time the lake reached this level was in May of last year.

At this level, many docks, bulkheads, small islands, and other structures are fully submerged and create a very dangerous situation for boaters. In addition, high winds and rapidly-flowing water from local streams have resulted in a large amount of floating debris on the reservoir. With bulkheads becoming submerged, lake area residents should also be cautious of electrical outlets and equipment coming into contact with water.

Over the past 24 hours, the Lake Conroe watershed has experienced rainfall totals over eight inches. This has resulted in a rapid rise in lake level.

SJRA is currently releasing water from the dam in accordance with its operating procedures for the reservoir. The rate of release is currently 8,120 cubic feet per second.

For anyone interested in monitoring the current conditions of the reservoir, SJRA provides continuous data regarding lake level and release rate on its home-page (www.sjra.net) along with numerous other data points. In addition, live gauge data can be accessed by clicking the link labeled "Lake & River Conditions."

For additional information visit our website at www.sjra.net or like SJRA on Facebook @SanJacintoRiverAuthority

FOR IMMEDIATE RELEASE
11:30 PM, August 27, 2017



CONTACT: Ronda Trow
(936) 588-3111

New Record Release Rate for Lake Conroe Dam

Approximately 72 hours into the current rainfall event, the Lake Conroe watershed has received an average of 18 inches of rainfall. As a result, the Lake Conroe water level has

FOR IMMEDIATE RELEASE
1:30 AM, August 28, 2017



CONTACT: Ronda Trow
(936) 588-3111

New Record Release and Water Level for Lake Conroe

The Lake Conroe water level has now risen to 205.88 feet above mean sea level (MSL). The previous record water level for the lake was 205.60 in 1994.

The current release rate from Lake Conroe is 73,201 cubic feet per second (cfs). The previous record set in 1994 was 33,360 cfs.

Hurricane Harvey has created an extreme weather event for the entire Houston region, and SJRA personnel are working around the clock to deal with the tremendous amounts of rainfall that are impacting the watershed.

FOR IMMEDIATE RELEASE
10:00 PM, August 28, 2017



CONTACT: Ronda Trow
(936) 588-3111

Update on Lake Conroe Water Levels and Releases

The Lake Conroe water level has now crested and is beginning to slowly decline. The current water level is 205.5 feet above mean sea level (MSL), which is 4.5' over the normal pool elevation of 201' MSL. The peak water level during this storm event was 206.24' MSL. The previous record water level for the lake was 205.6' MSL, set in October of 1994.

The current release rate from the Lake Conroe dam is 79,100 cubic feet per second (cfs). The previous record set in 1994 was 33,360 cfs.

One of the most amazing statistics of this event (so far) was the amount of water flowing into Lake Conroe. The peak inflow into the lake was approximately 130,000 cfs. The peak release rate from Lake Conroe was 79,100 cfs. This means that the operation of the dam buffered the peak flow that would otherwise have continued down the river causing additional flooding.

SJRA reservoir operators are continuing to monitor forecasted rainfall amounts to determine when the release rate can be lowered.

Anyone interested in monitoring Lake Conroe levels, releases, rainfall totals, or stream flows can visit www.sjra.net and click on the link for "Lake and River Conditions." This link can be found near the top right corner of the home page where current lake conditions are listed. We will also post press releases and other updates on our home page.

For additional information visit our website at www.sjra.net or like SJRA on Facebook @SanJacintoRiverAuthority

FOR IMMEDIATE RELEASE
9:00 PM, August 28, 2017



CONTACT: Ronda Trow
(936) 588-3111

Lake Conroe Lake Level and Releases Declining

The Lake Conroe water level is continuing to slowly decline. The current water level is 203.7 feet above mean sea level (MSL), which is only 2.7' over the normal pool elevation of 201' MSL.

Most docks and bulkheads will become visible once the lake drops another 0.7 feet to 203' MSL; however, the lake will remain closed to public access due to floating debris. An announcement will be made once the lake is reopened to boat traffic.

The release rate from the Lake Conroe dam is currently 8,120 cubic feet per second.

FOR IMMEDIATE RELEASE
7:00 PM, August 29, 2017



CONTACT: Ronda Trow
(936) 588-3111

Lake Conroe and Lake Conroe Park to Remain Closed through Labor Day Weekend

FOR IMMEDIATE RELEASE
10:00 AM, September 5, 2017



CONTACT: Ronda Trow
(936) 588-3111

Lake Conroe to Open for Limited Boat Traffic; Extreme Caution Urged

Beginning today, Lake Conroe will be open for boat traffic; however, boaters are urged to exercise extreme caution due to hazardous debris on the reservoir. All vessels are encouraged to not exceed MINIMUM PLANING SPEED in all areas of the reservoir.

For additional information and further announcements, visit our website at www.sjra.net or like SJRA on Facebook @SanJacintoRiverAuthority

