

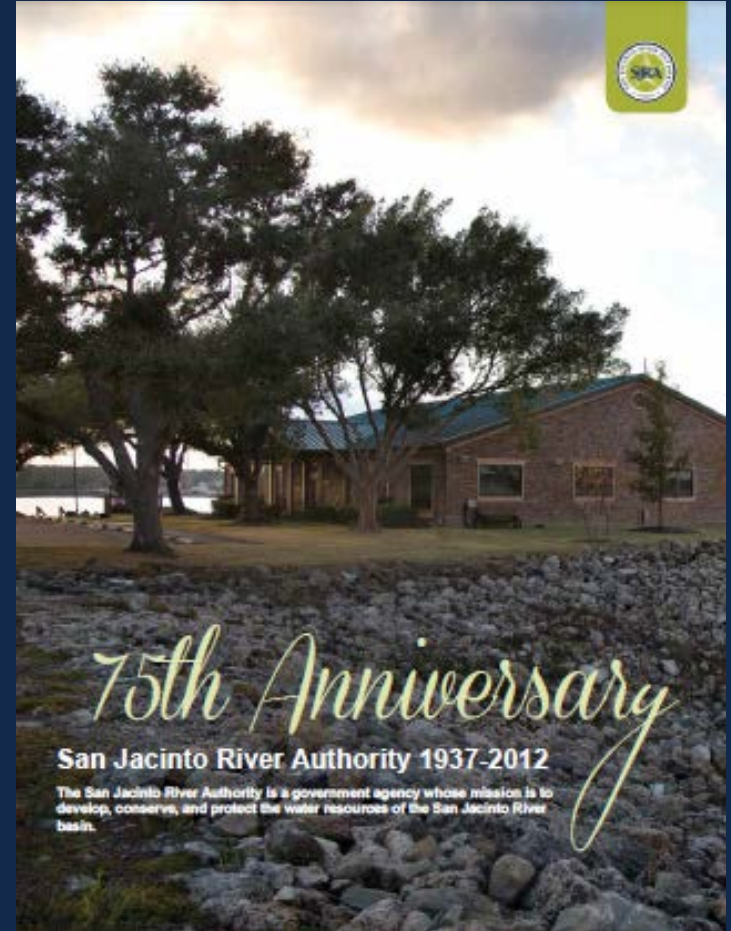


Hurricane Harvey Storm Event: Briefing Regarding Lake Conroe Operations

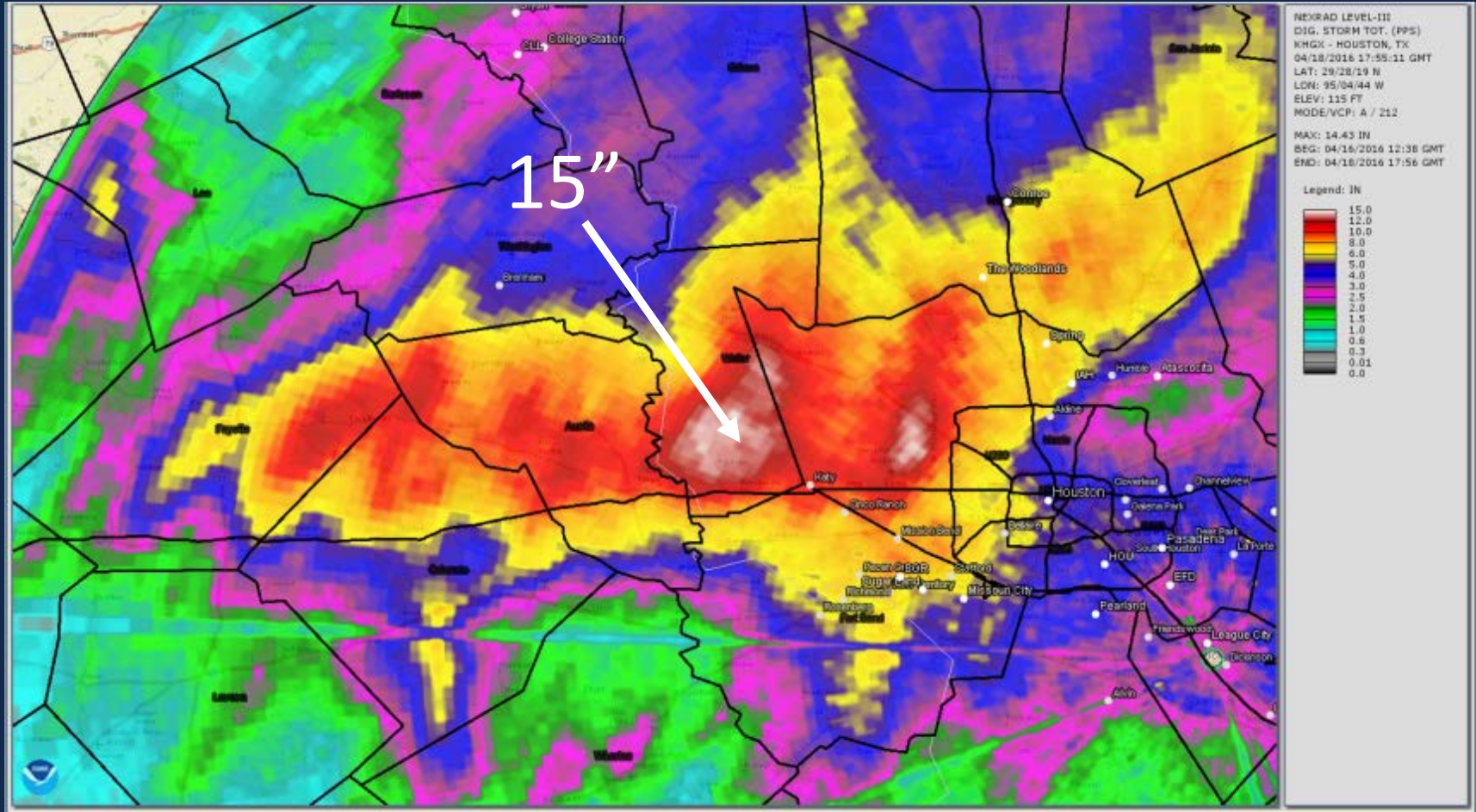
April 4, 2018

San Jacinto River Authority

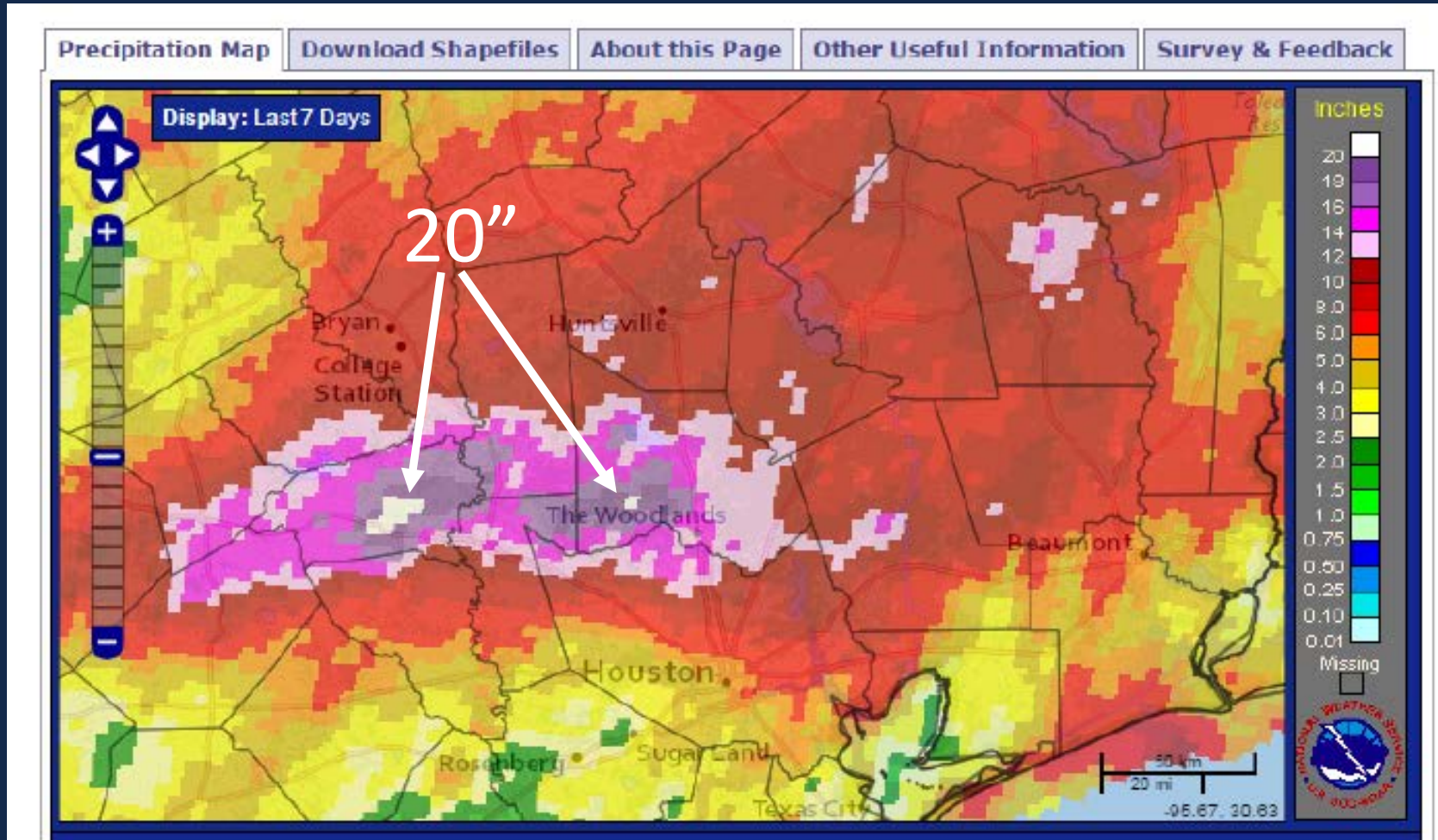
- Created in 1937
- Statutory purpose – Long-term, regional water resource planning and development
- One of about 12 major river authorities in Texas
- Four operating divisions – Highlands, Woodlands, Lake Conroe, and GRP



Tax Day 2016 Event



Memorial Day 2016 Event

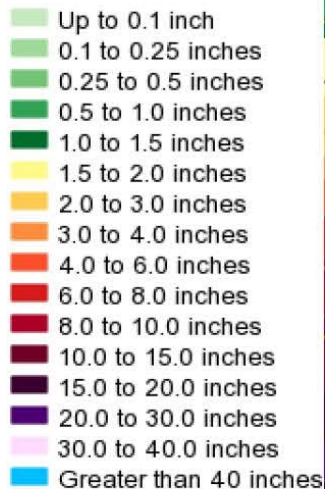


5 Day Rainfall Totals

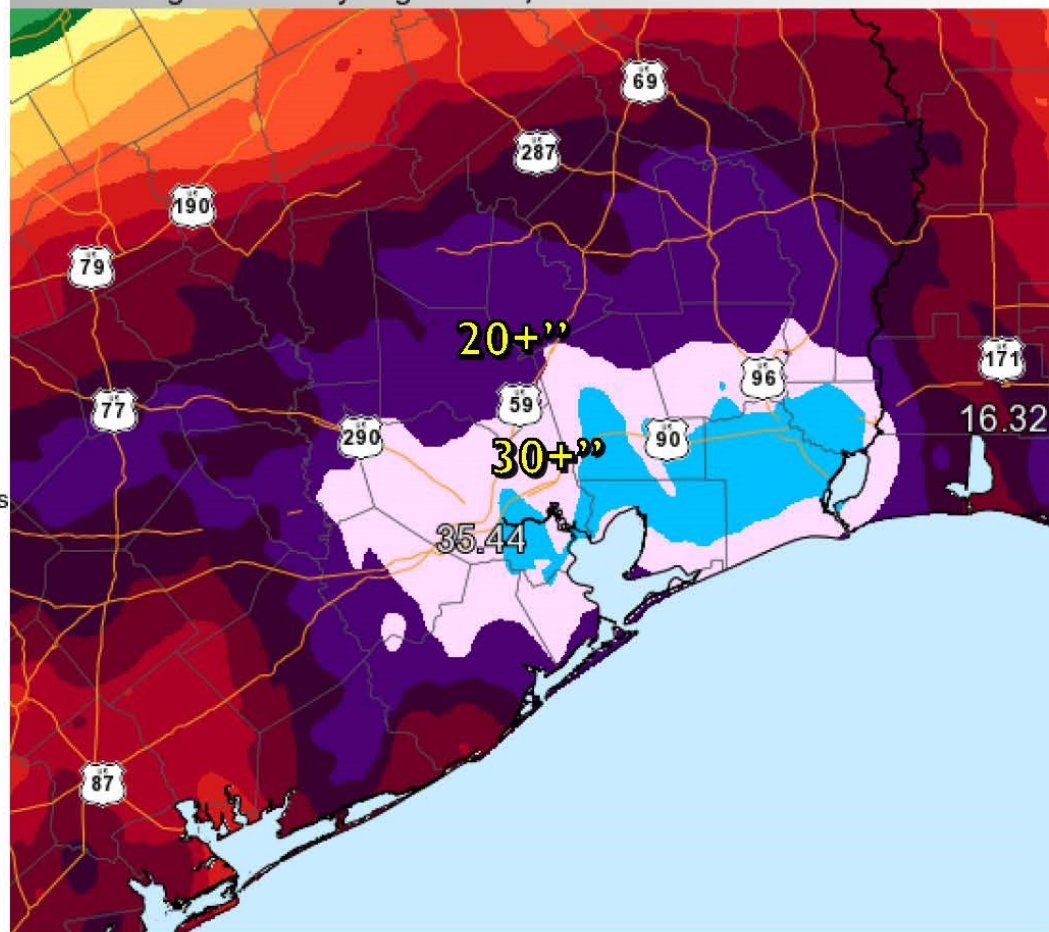
Observed Precipitation

National Weather Service

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



Rainfall in
Inches



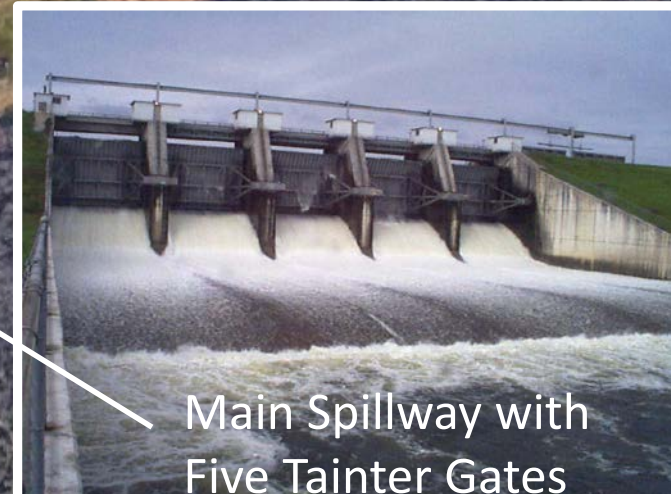
Graphic Created
August 30th, 2017
9:00 AM CDT

Key Points Regarding Lake Conroe Operations

Lake Conroe Dam

GRP Intake and
Pump Station

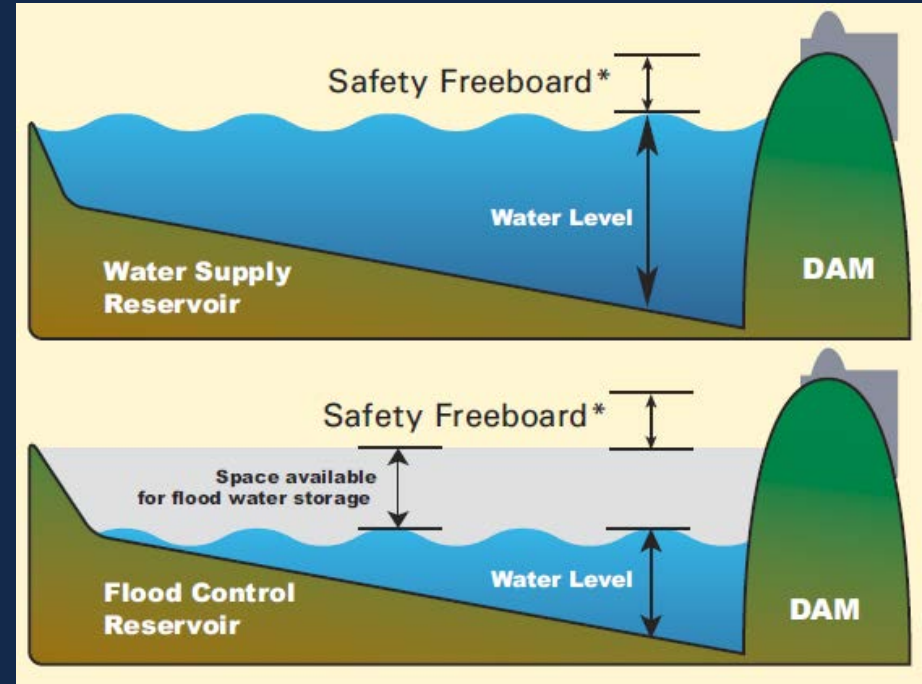
Service Outlet
Structure

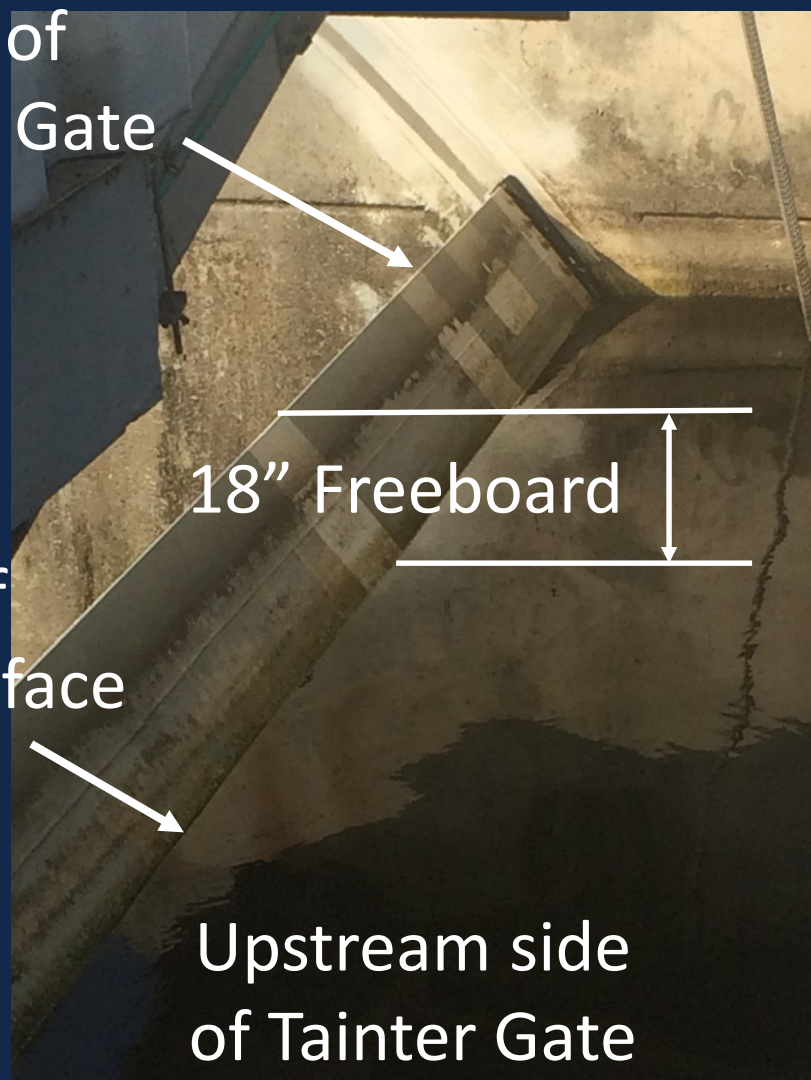


Main Spillway with
Five Tainter Gates

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



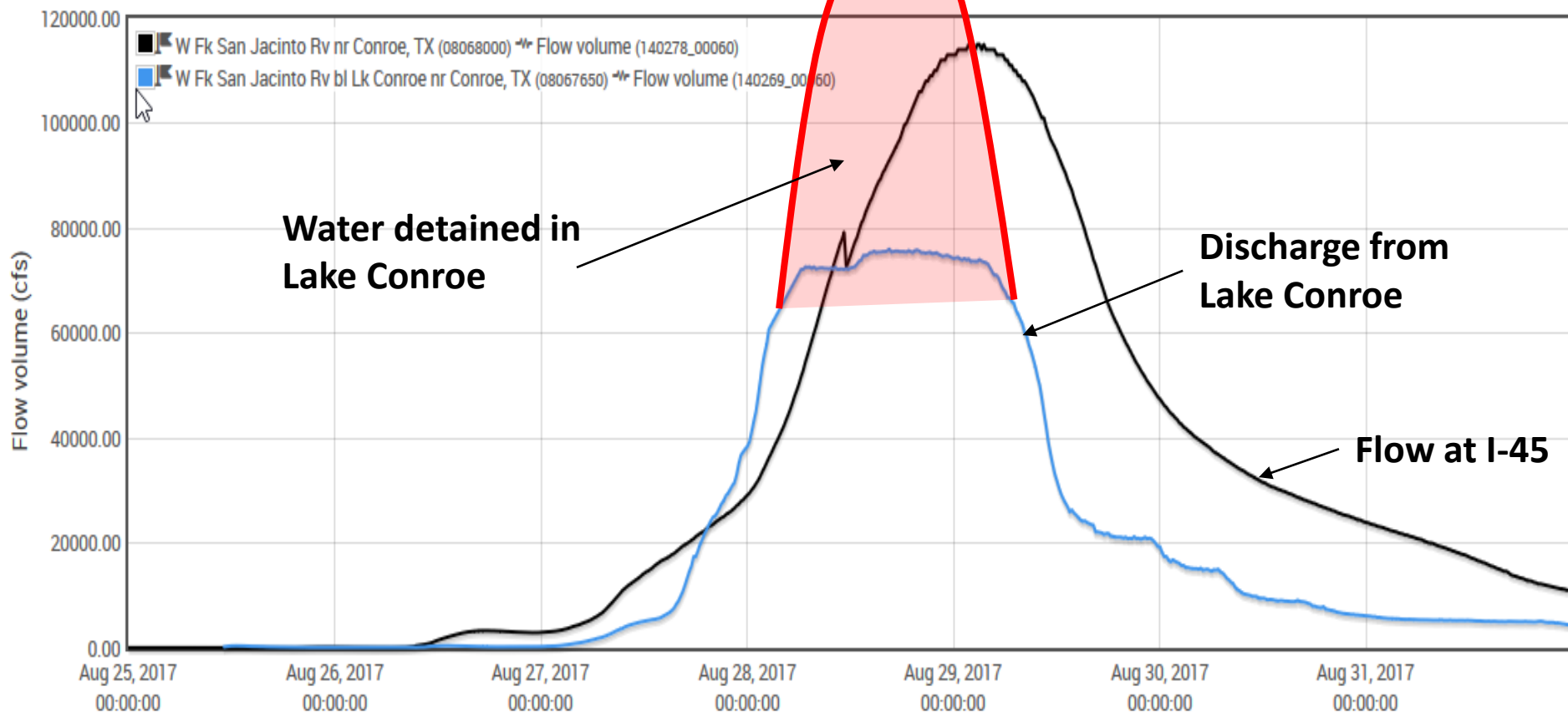


Key Point #2 – Lake Conroe REDUCES downstream flooding

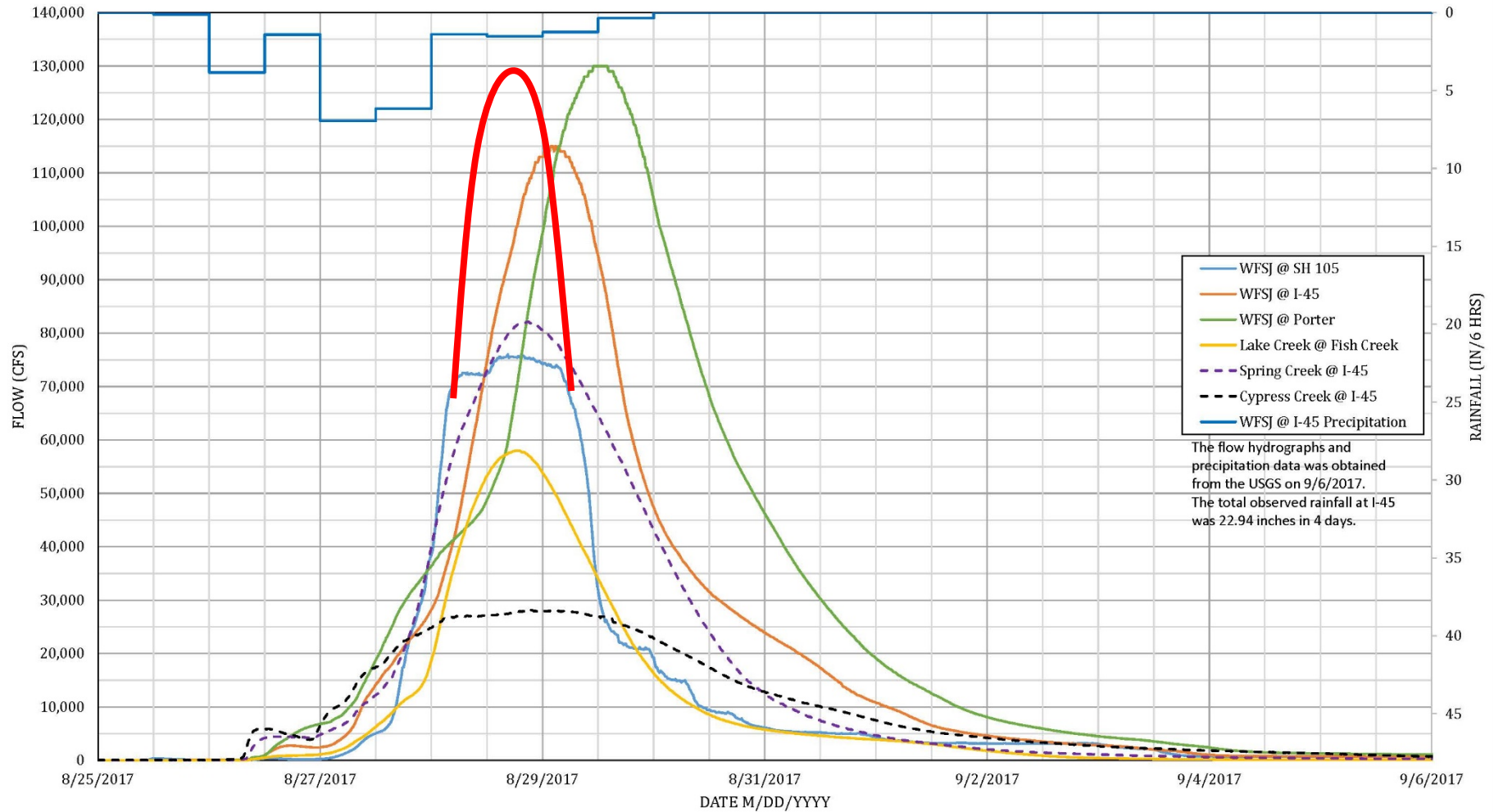
- Even though a water supply reservoir, Lake Conroe reduces peak flow through lake
- Possible due to six-foot flowage easement or inundation zone
- Operating protocol balances inflow reduction and lake level rise

~130,000 cfs

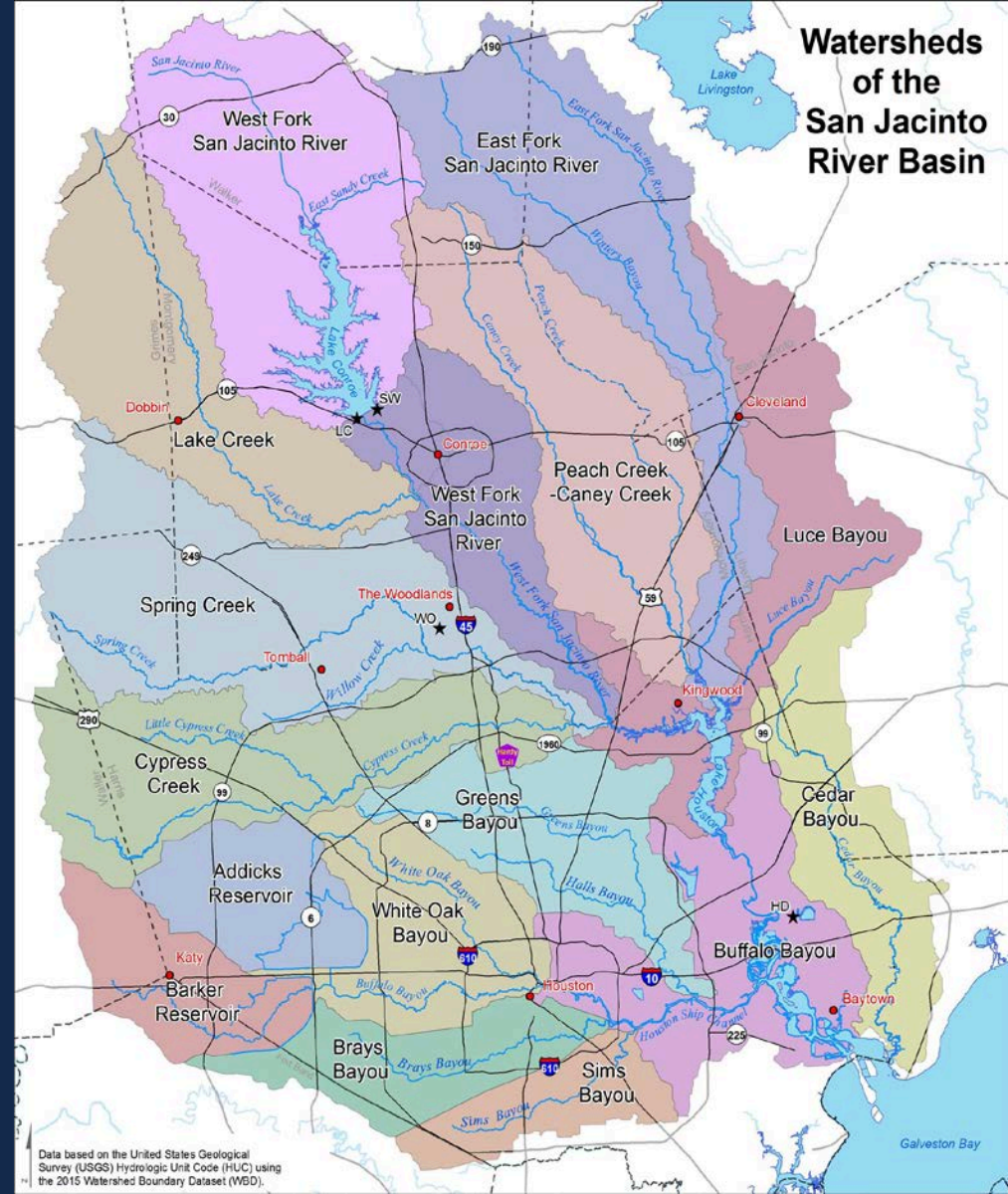
Peak Flow Into
Lake Conroe



USGS OBSERVED DATA (HURRICANE HARVEY EVENT)



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

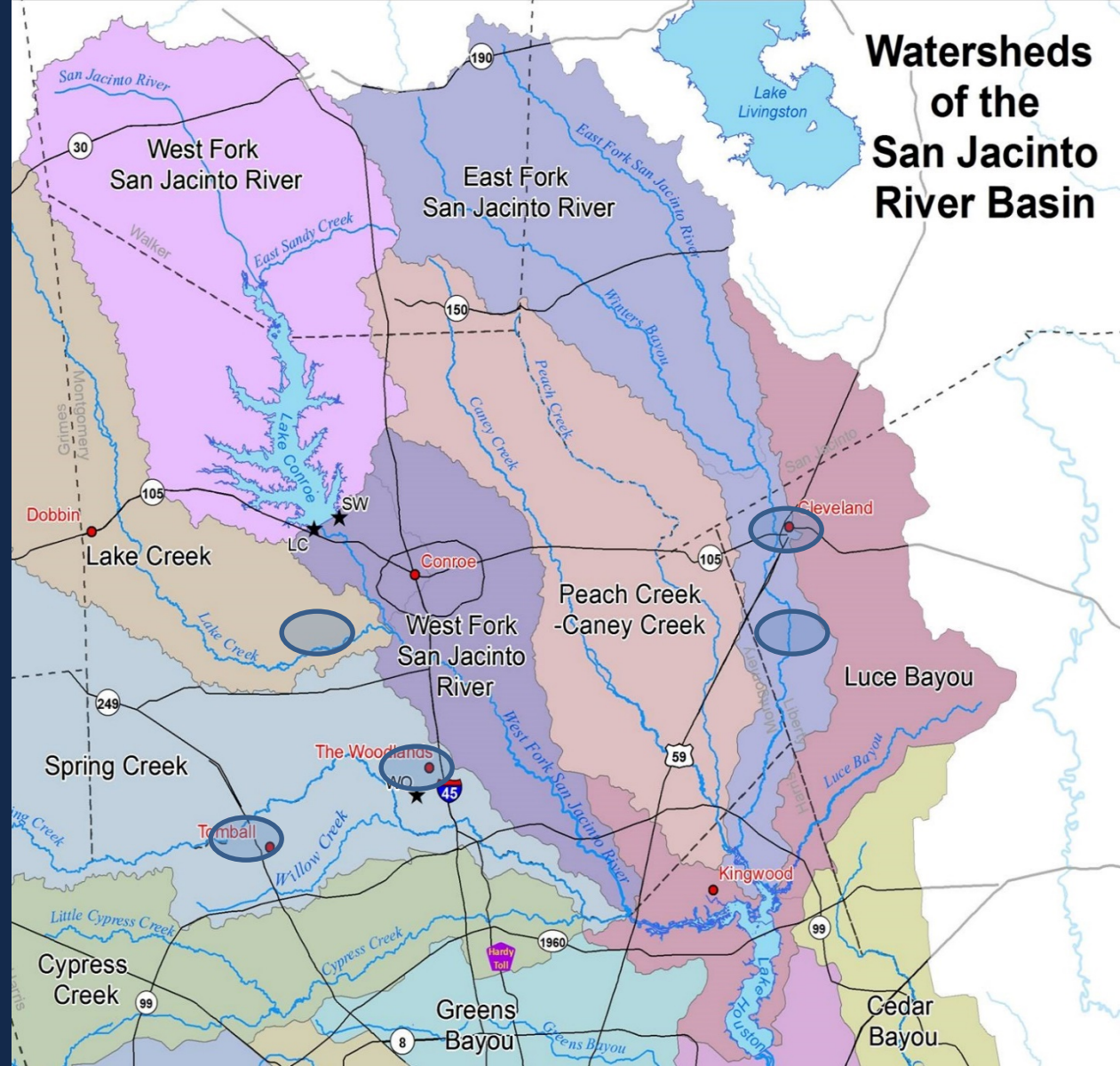


Impact from Lake Conroe watershed:

- 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

Estimated Peak Inflow
into Lake Conroe
130,000 cfs

Release from
Lake Conroe Dam
79,141 cfs

HWY 105
76,000 cfs

Lake Creek
Sendera Ranch Rd
58,000 cfs

I-45
115,000 cfs

Caney Creek
Near Splendora, TX
20,900 cfs

Peach Creek
Splendora, TX
31,300 cfs

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

Spring Creek
Tomball, TX
48,800 cfs

Spring Creek
Spring, TX
82,100 cfs

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

Luce Bayou

Cypress Creek
Westfield, TX
28,100 cfs

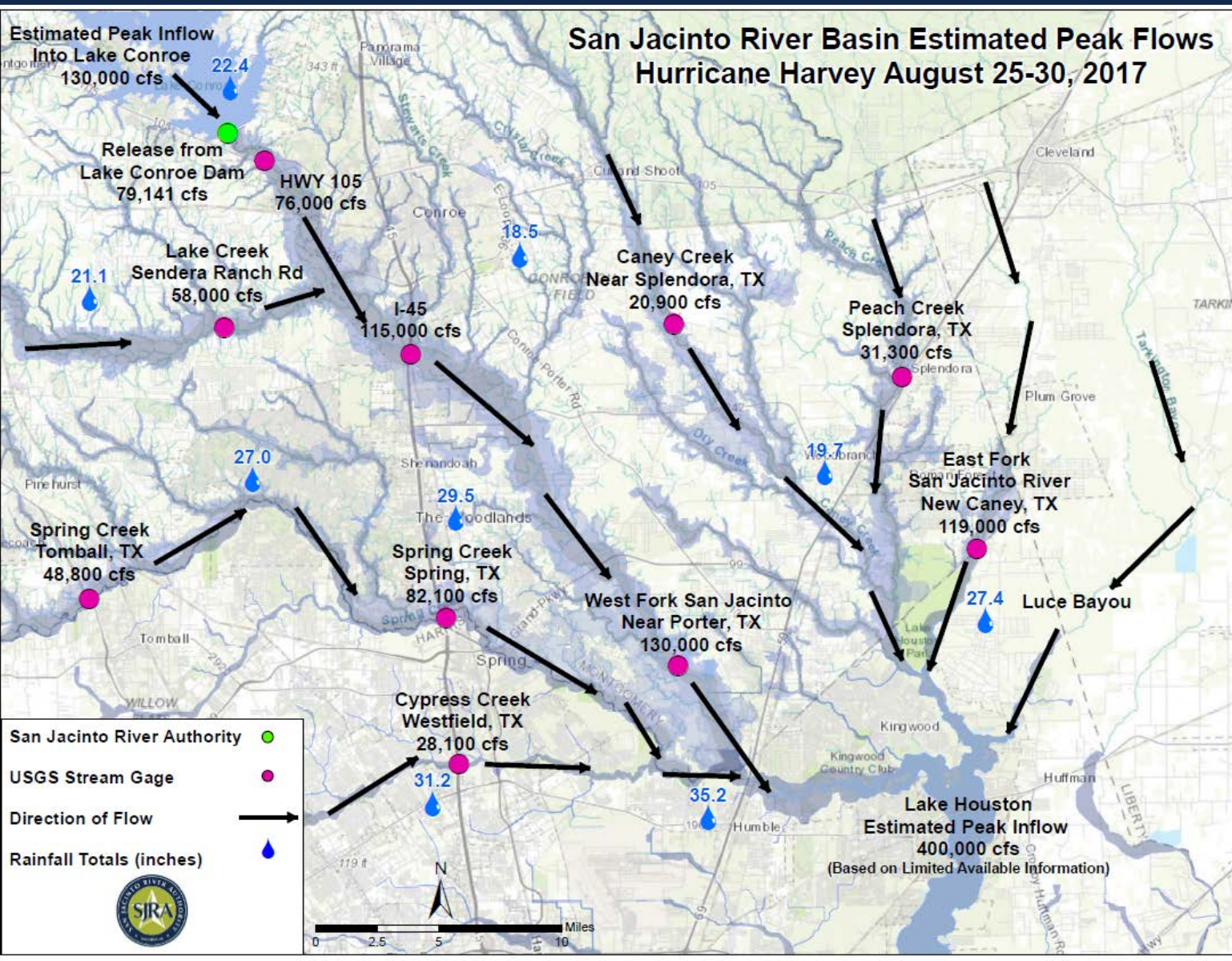
Lake Houston
Estimated Peak Inflow
400,000 cfs
(Based on Limited Available Information)

San Jacinto River Authority

USGS Stream Gage

Direction of Flow

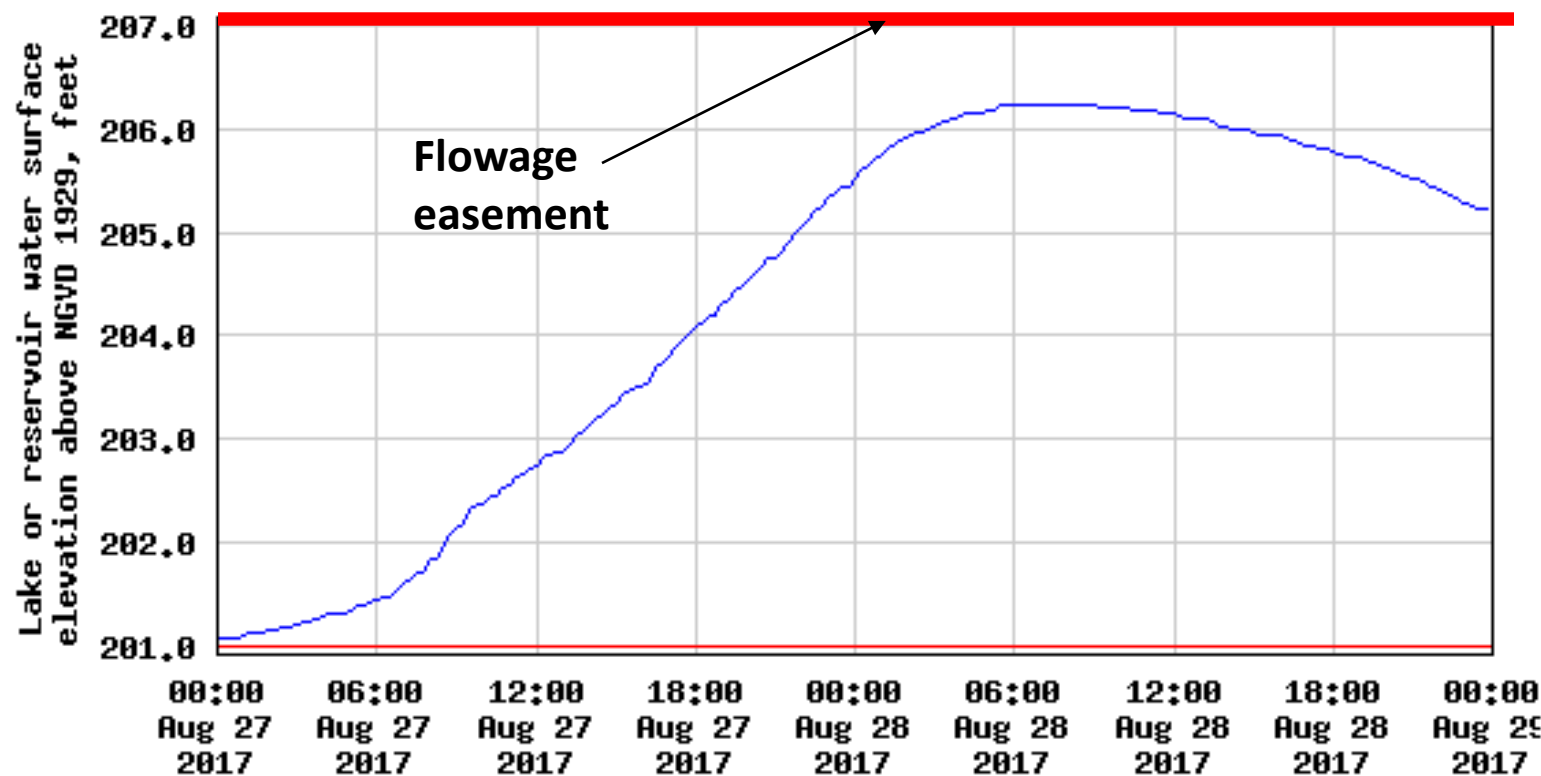
Rainfall Totals (inches)



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

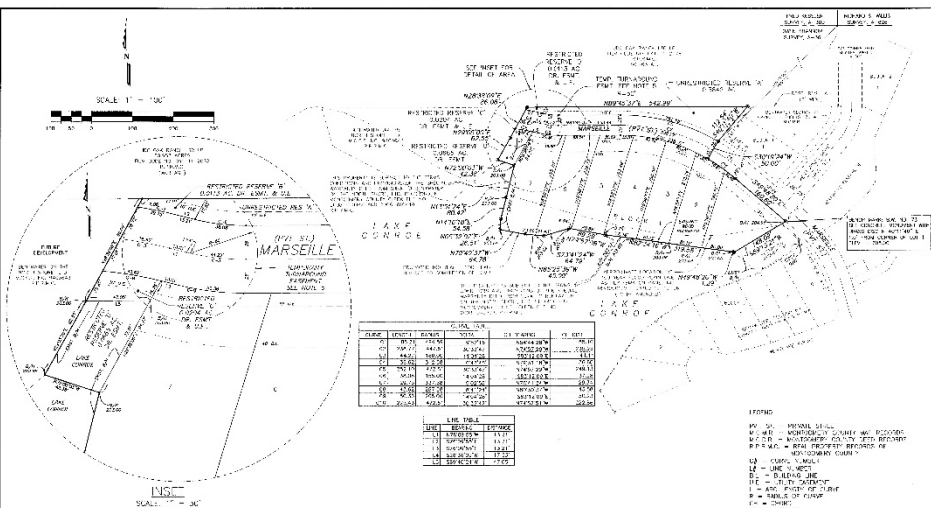
- Six-foot flowage easement acquired when lake was constructed
- Recorded in deed records
- Authorizes inundation up to 207' msl
- During Harvey, peak elevation was 206.24' msl

USGS 08067600 Lk Conroe nr Conroe, TX



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

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



BENTWATER

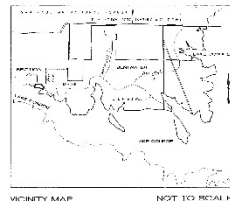
SECTION SEVENTY THREE

BEING A SUBDIVISION OF 4.2989 ACRES
IN THE OWEN SHANNON SURVEY, A-36
MONTGOMERY COUNTY, TEXAS
7 LOTS 1 BLOCK 4 RESERVES

BLEYL AND ASSOCIATES
2521 N. LOOP WEST W., SUITE 12, CORPUS CHRISTI, TX 78401
SURVEYOR

STEPHENSON SURVEYING CO.
14212 GLADWIN WAY DR., WILLOU, TX 77380

BENTWATER, ON THE NORTH SHORE, LTD.
2438 WINDMILL DRIVE, HOUSTON, TEXAS 77069-1206
HOUSTON, TEXAS 77069-1206



VICINITY MAP NOT TO SCALE

SHEET 1 OF 2

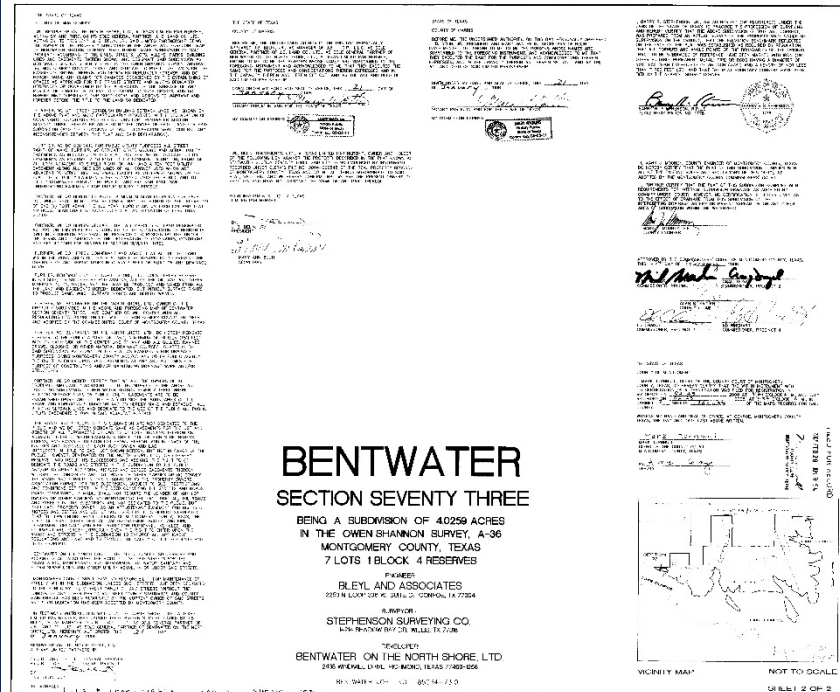
ONE OF THESE THREE CONDITIONS WAS PURCHASED FOR ADJACENT LANDS DURING LAND ACQUISITIONS FOR THE LAKE.

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.



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

Saturday, August 19, 2017 - 6 Days Prior to Landfall



Storm dissipated from forecasts six days from ultimate landfall.

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

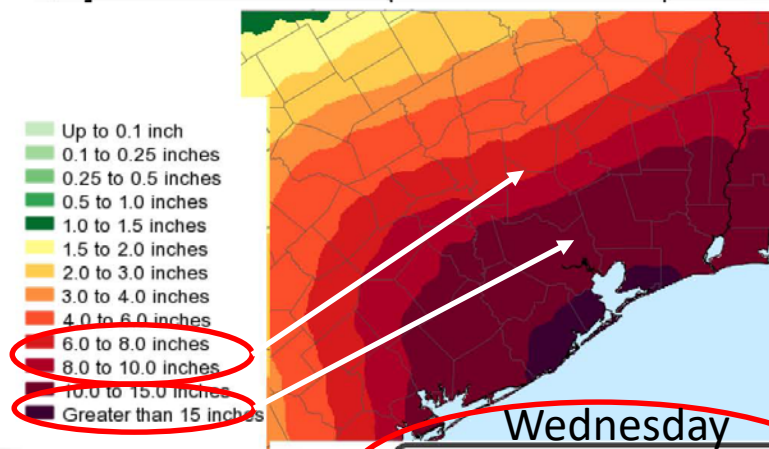
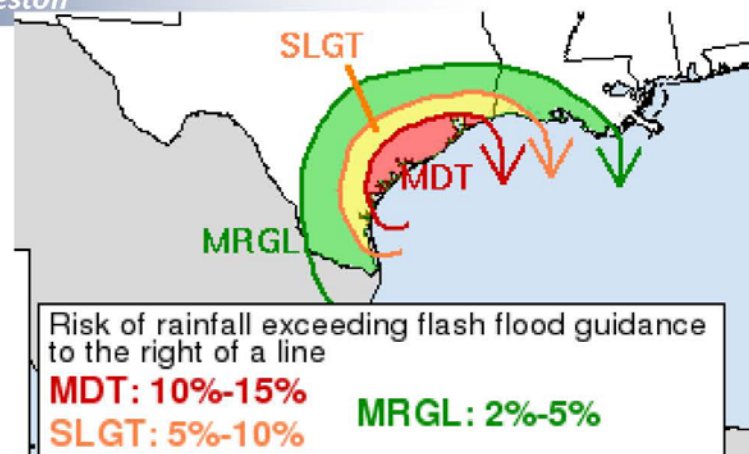
- “remnants of Harvey centered over Yucatan.”
- “likely to redevelop into a tropical storm or hurricane over the warm waters of the Bay of Campeche.”



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



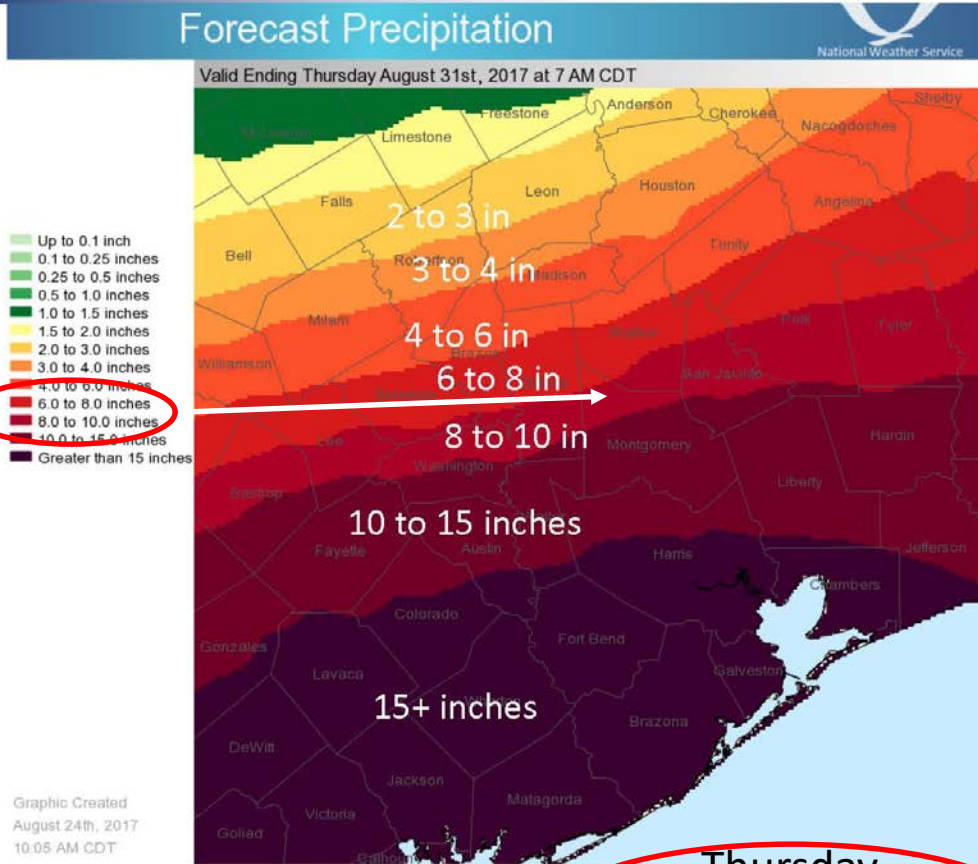
Two days from landfall, heavier rainfall projected downstream of Lake Conroe



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



@NWSHouston
weather.gov/houston

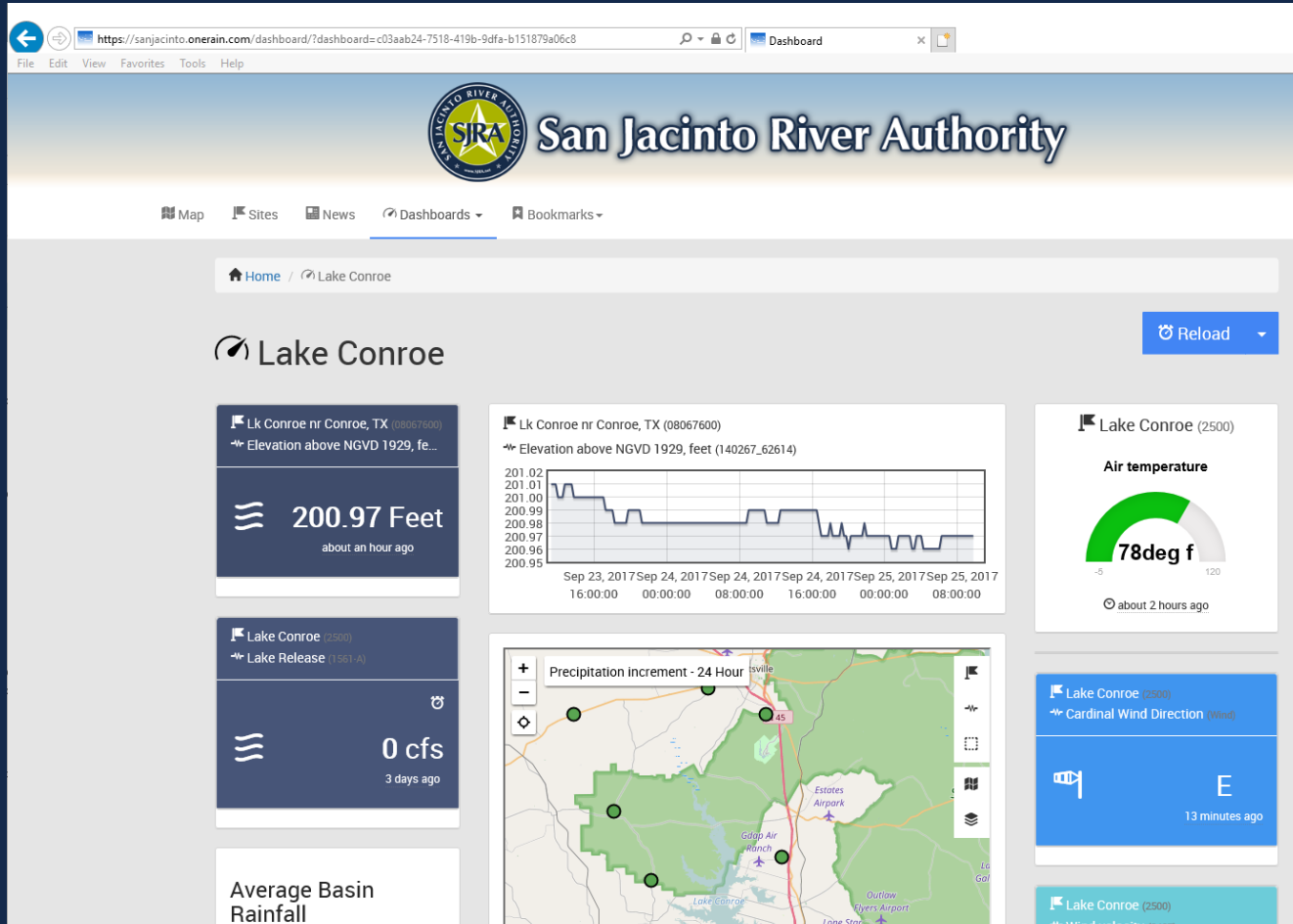
Thursday

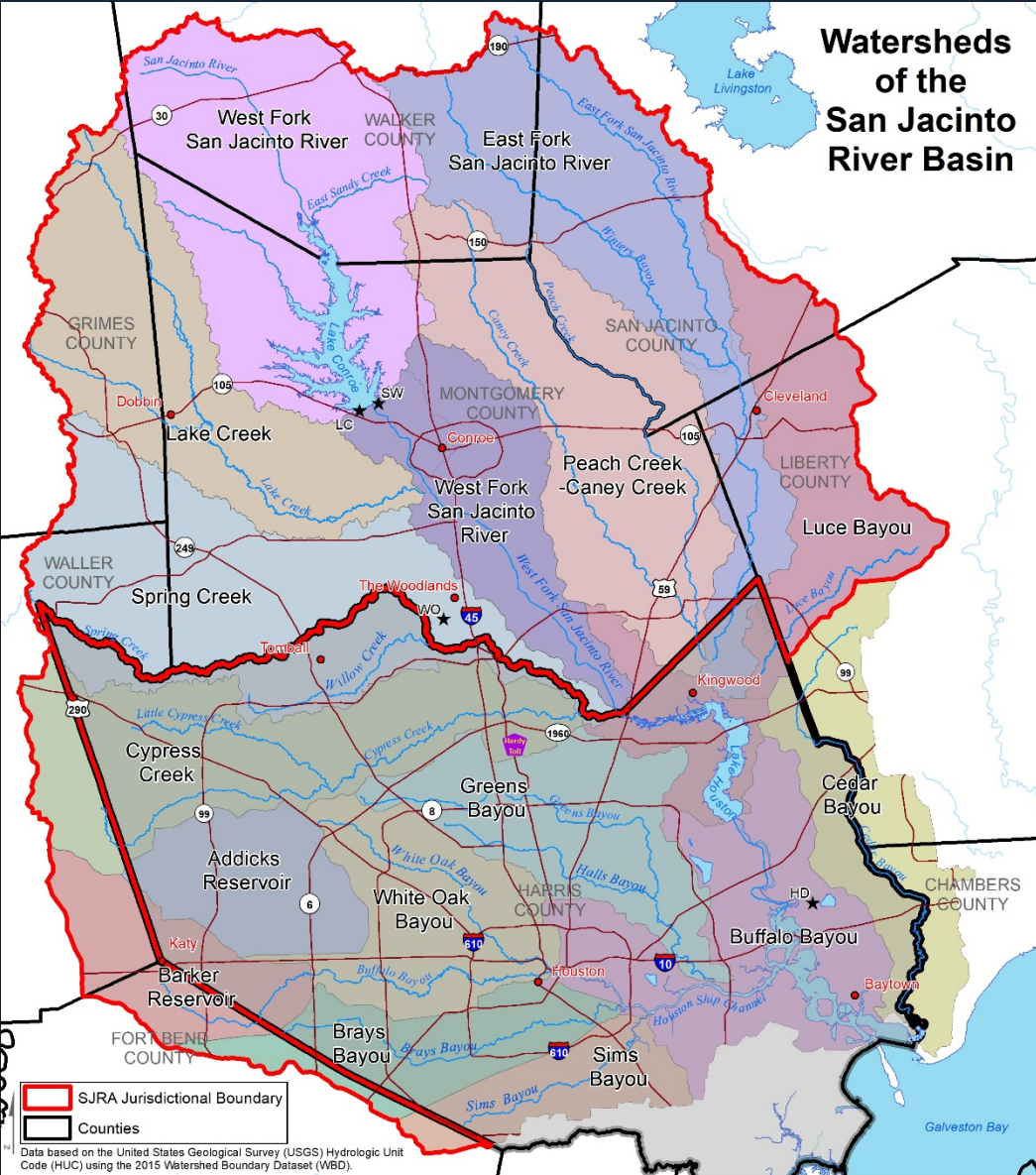
Image 8/24/2017
Created 10:57 AM

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





Regional Flood Management Initiative

- Taking leadership role regarding flood management.
- Regional partner with HCFCD.
- Modelling, studies, communications, mitigation strategies, and project implementation.
- Limited by funding.

