

**Hurricane Harvey Meteorological and Hydrological Data Within the  
Clear Creek Drainage Basin  
and  
Harris County Subsidence Data**

**Compiled by  
Mario Runco Jr.**

**President, Board of Directors**

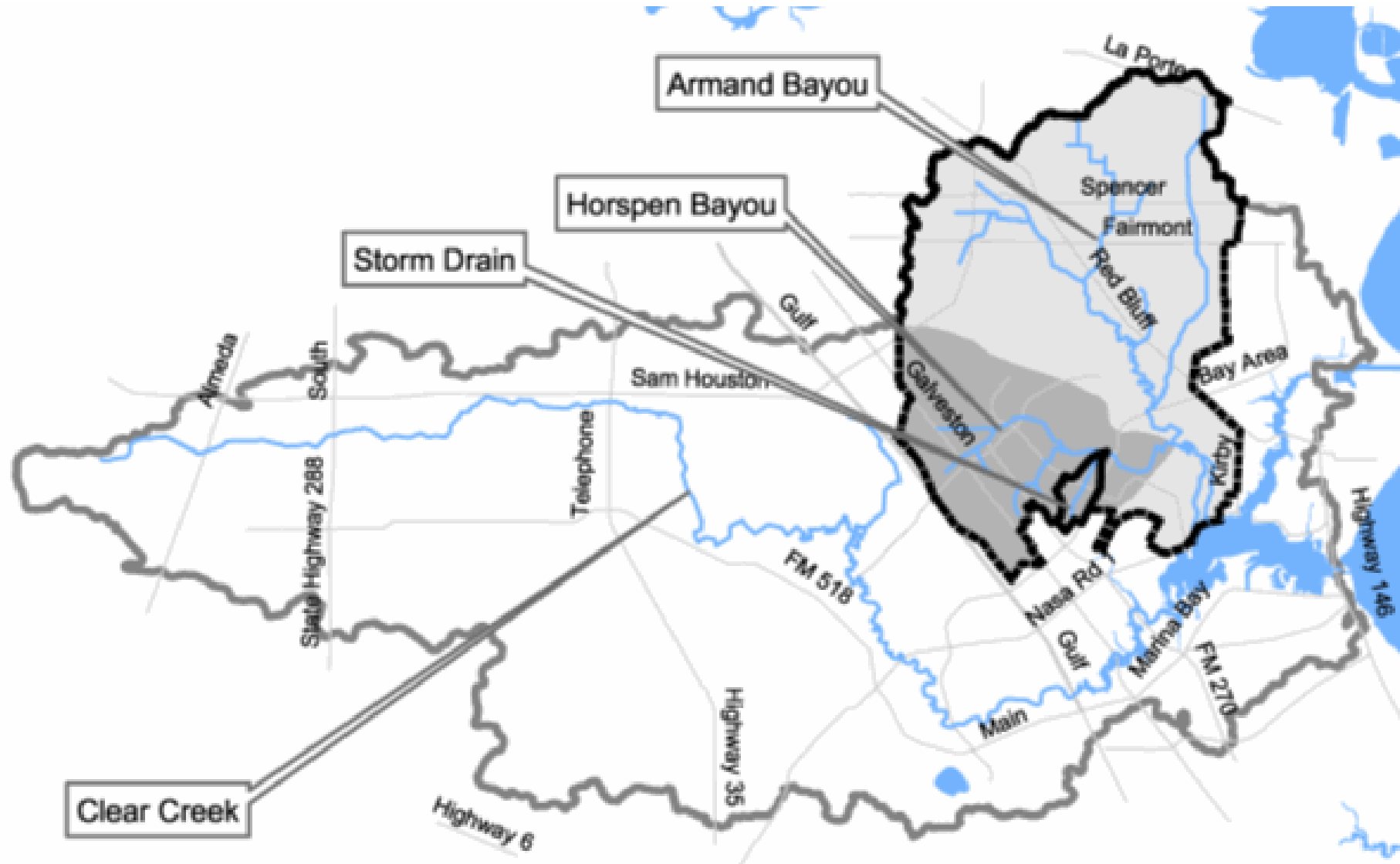
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Former USGS Hydrologist**

**M.S. (Meteorology) – Rutgers University 1976**

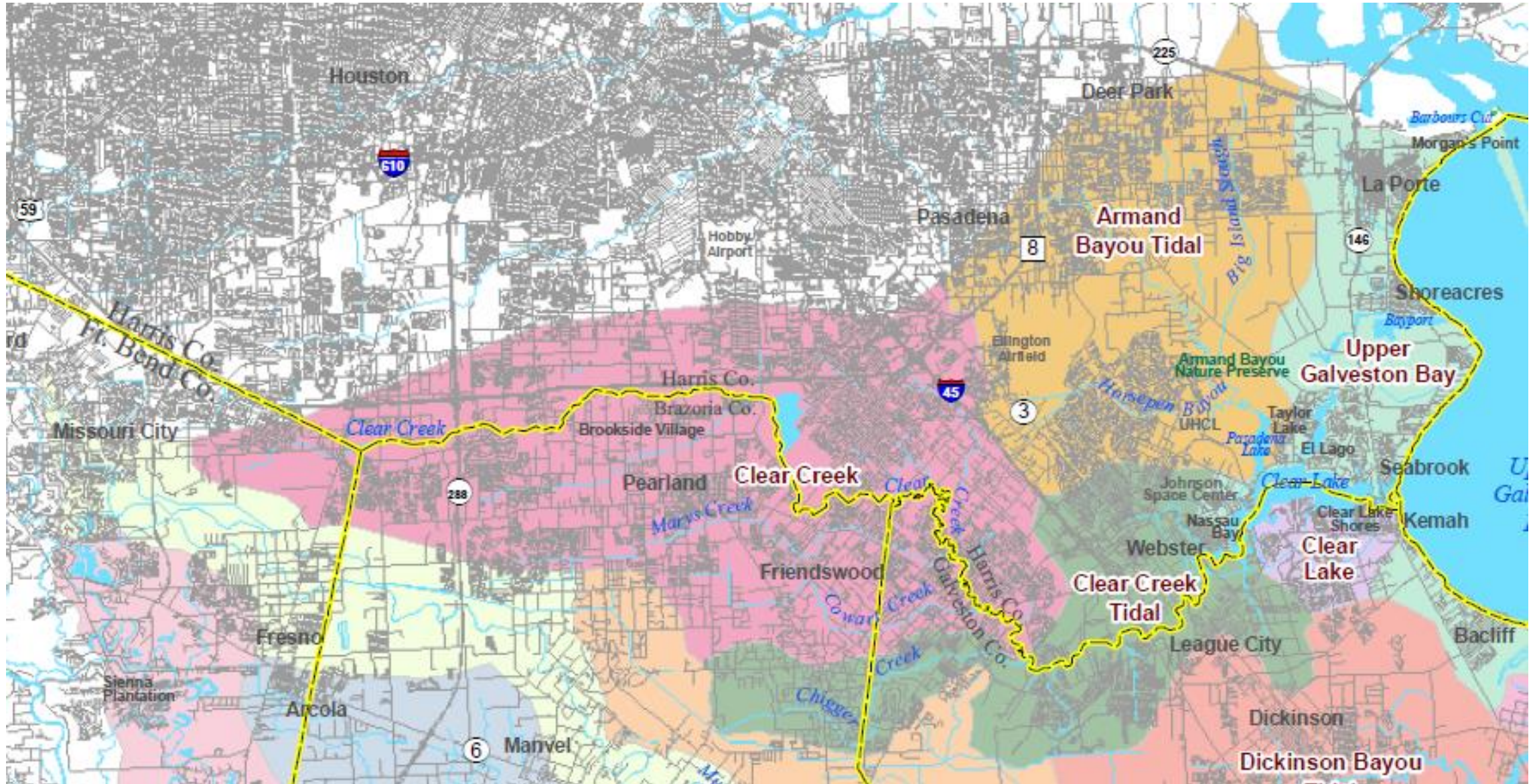
**B.S. (Meteorology & Physical Oceanography) – C.C.N.Y. 1974**

**September 11, 2017  
(Patriot Day)**

# Clear Creek and Tributaries Drainage Basin



# Clear Creek and Tributaries Drainage Basin



# Clear Creek and Tributaries Drainage Basin (Harris County FCD)

## Watershed Overview

The Clear Creek watershed is located in southern Harris County drains portions of Harris, Galveston, Brazoria and Fort Bend counties; 16 cities including Houston, Brookside Village, Pearland, Friendswood, League City, Pasadena, the Clear Lake Area communities and 5 drainage/flood control districts.

| Drainage Area | Watershed Population                 | Open Stream Miles   | Streams   |
|---------------|--------------------------------------|---------------------|---|
| 197 Sq. Miles | 164,172 (Harris County portion only) | 154 Miles (Primary) | Primary: Clear Creek, Mud Gully, & Turkey Creek |

## Land Use

Development activity has historically been concentrated in the lower end of the watershed around Clear Lake and several smaller cities in the mid and upper portions of the watershed; however, in recent decades development activity has increased throughout the watershed and is expected to continue. This development has channeled more water falling within the basin into the streams and bayous more quickly than ever before causing downstream water levels to rise higher and more quickly than in the past.

Secondary: Taylor Lake/Taylor's Bayou, Boggy Bayou, Cow Bayou, Camp Meeting Gully, Indian Trails Channel, Savel Gully, Cedar Gully

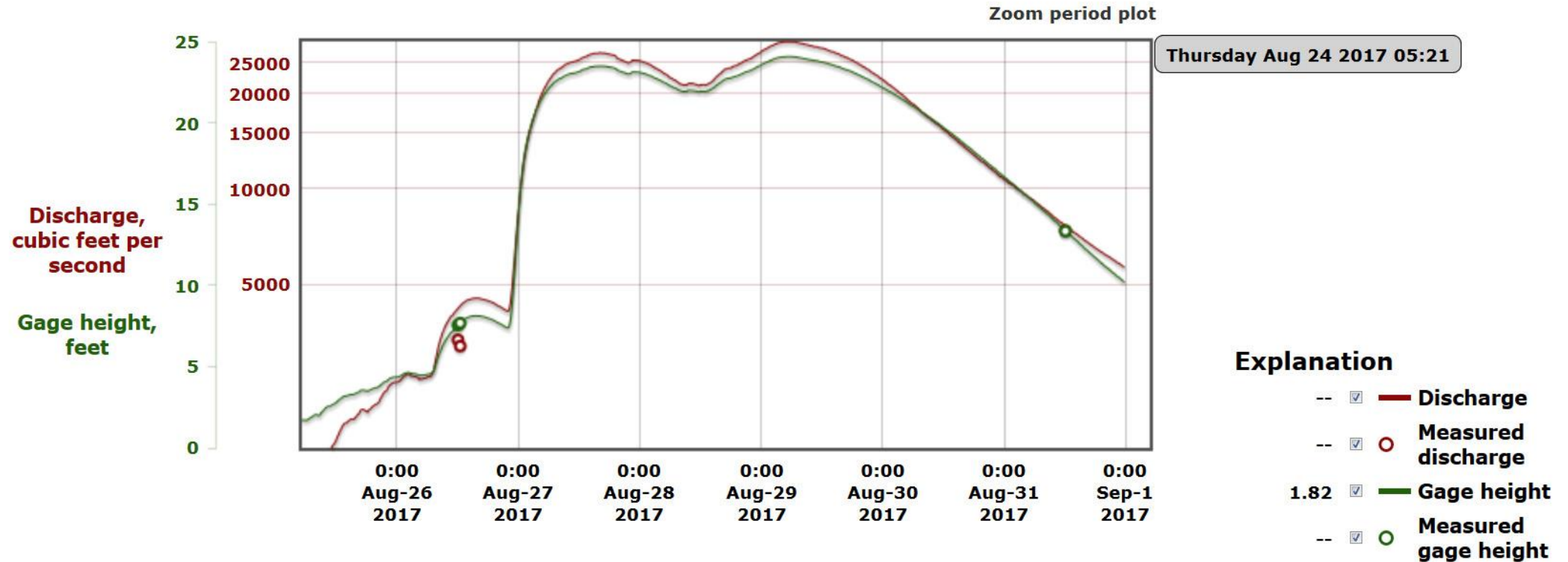
## Environment

Clear Creek between Clear Lake and the City of Friendswood is in a natural state. Its bottom elevations are below sea level and subject to tidal influences.



# Clear Creek Friendswood Water Levels & Discharge Data (USGS) August 25 – 31, 2017

## USGS 08077600 Clear Ck nr Friendswood, TX



# Clear Creek at I-45 Water Levels & Rainfall Data (Harris County FWS)

## August 25 – 31, 2017



### Cross Section

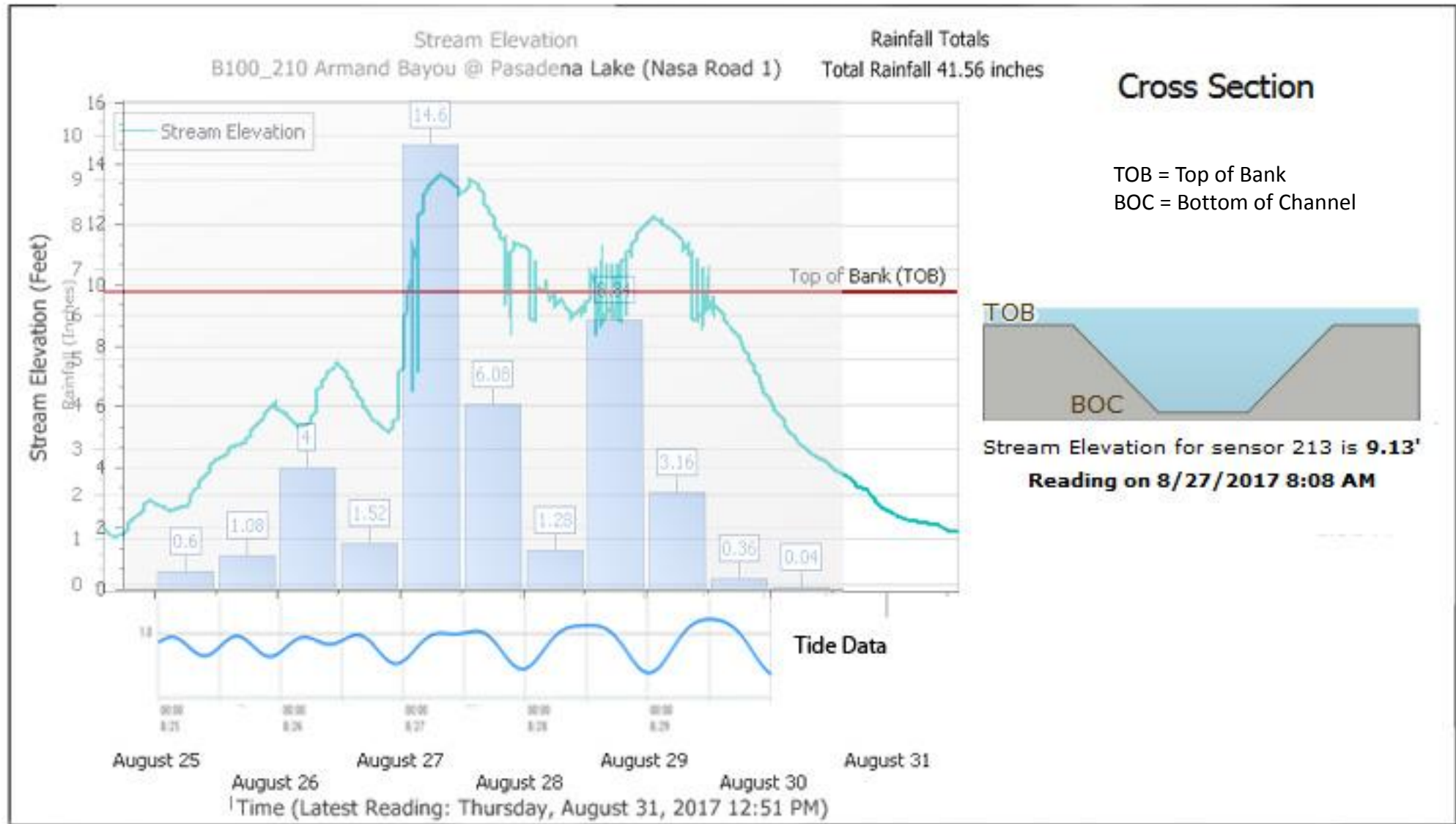
TOB = Top of Bank  
BOC = Bottom of Channel



Stream Elevation for sensor 109 is **16.07'**  
**Reading on 8/29/2017 10:47 AM**

# Pasadena (Mud) Lake Water Levels, Rainfall, and Tide Data (Harris County FWS)

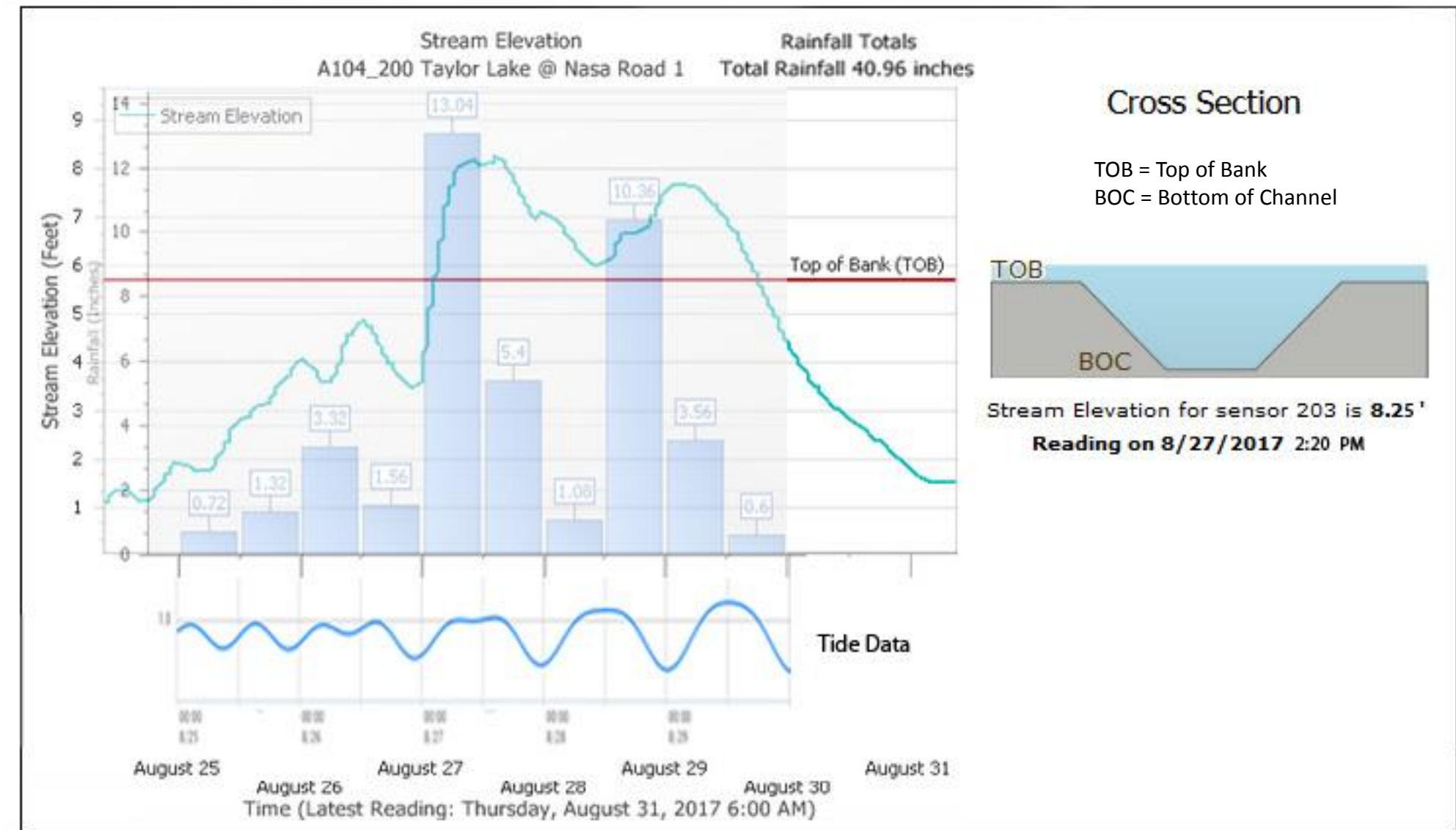
## August 25 – 31, 2017



Time (Latest Reading: Thursday, August 31, 2017 12:51 PM)

# Taylor Lake Water Levels, Rainfall, and Tide Data (Harris County FWS)

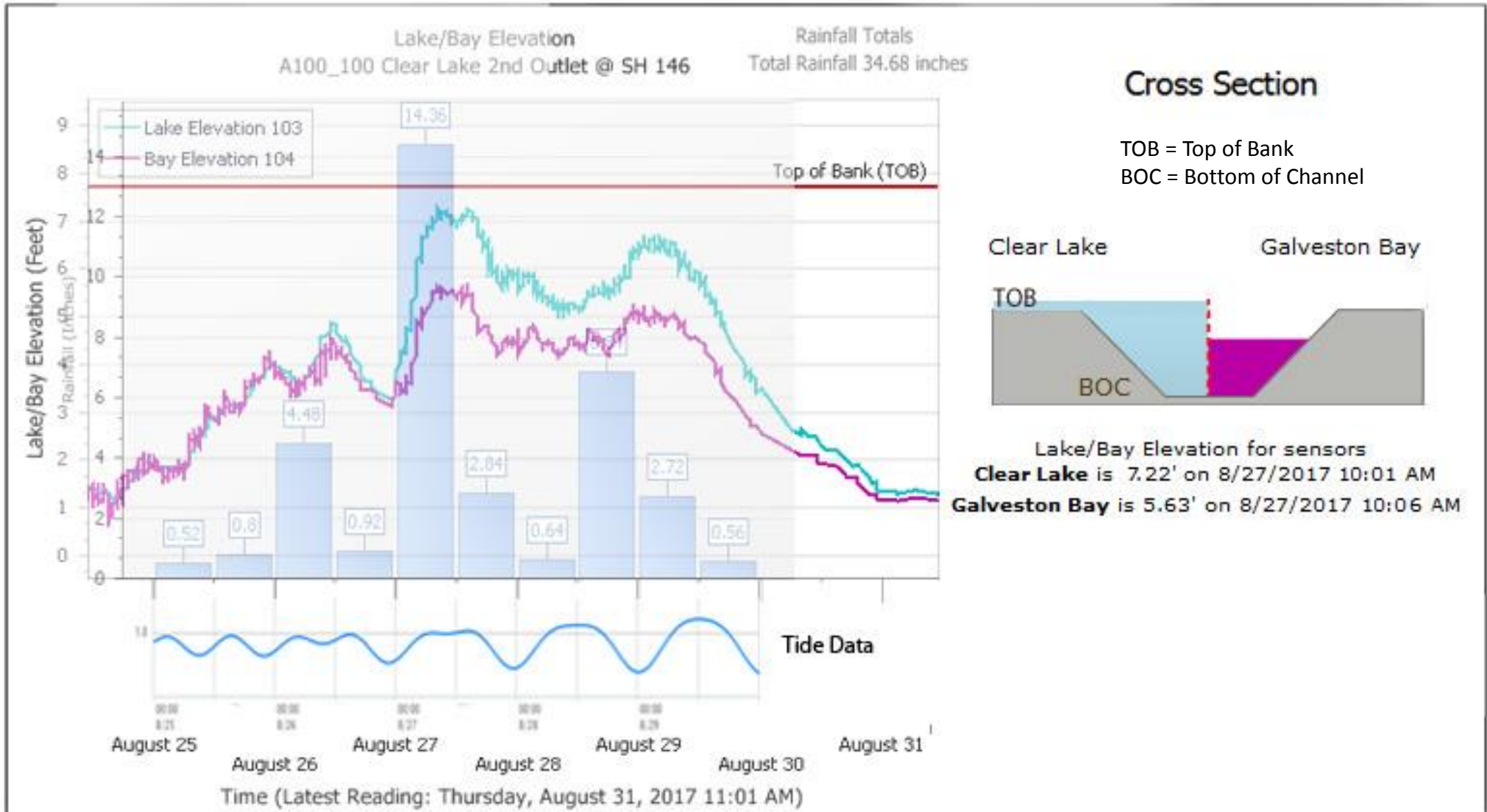
## August 25 – 31, 2017





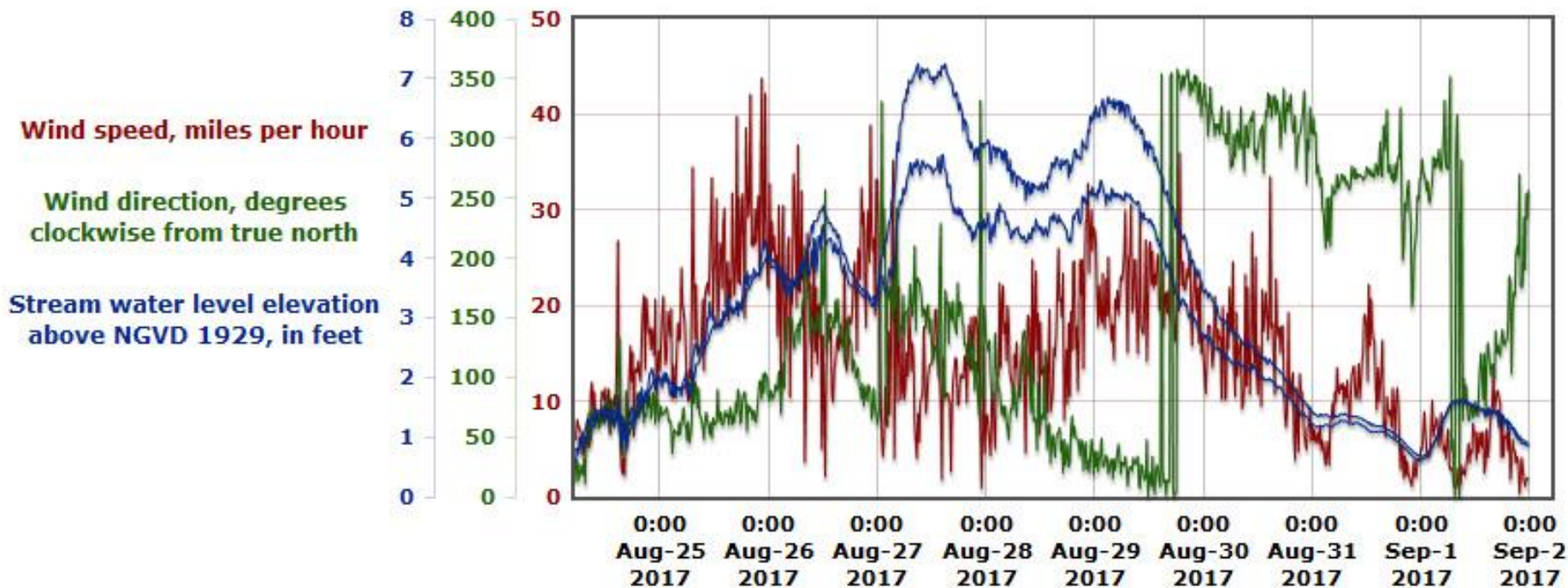
# Clear Lake Water Levels, Rainfall, and Tide Data (Harris County FWS)

## August 25 – 31, 2017



# Clear Lake Water Levels & Wind Data (USGS) August 25 – 31, 2017

## USGS 08077637 Clear Lk Second Outflow Channel at Kemah, TX



**Wind speed, miles per hour**

**Wind direction, degrees clockwise from true north**

**Stream water level elevation above NGVD 1929, in feet**

**Legend:** — Wind speed    — Wind direction    — Stream water level elevation above ngvd 1929 MSL Clear Lake, Clear Lake    — Stream water level elevation above ngvd 1929 MSL Seaward, Seaward



Views of Clear Lake's 2nd Outfall during Hurricane Harvey showing floodgates open with the bottom of the raised floodgates submerged and water rushing beneath.





# Observations and Conclusions

1. The data show that the cause of most of the flooding within the Clear Creek and tributaries drainage basin during Hurricane Harvey, which occurred on Sunday morning, August 27<sup>th</sup>, 2017, was a peak rainfall amount occurring during a rising tide in a basin with already previously elevated water levels and unable to drain into Galveston Bay fast enough during which time the water level of Clear Lake at its peak was 1.6 feet higher than that of Galveston Bay.
2. The data also show that the rainfall let up considerably on Monday August 28<sup>th</sup>, 2017, which allowed basin water levels to fall somewhat before a second sustained heavy rainfall occurred on Tuesday, August 29<sup>th</sup>, 2017. This fact along with an ebbing tide during that rainfall prevented water levels from again reaching the levels they did on Sunday.
3. Rapid development and concomitant widespread installation of drainage infrastructure upstream and across the 197 square mile drainage basin that has channeled ever greater amounts of runoff more rapidly into the drainage basin has caused downstream littoral areas to be more susceptible to flooding due to confluence/bottlenecking of all upstream drainage systems, channels, and tributaries to Clear Lake and only two outflow channels (the case for retention ponds, parks, green areas, and/or managed regional development).
4. Otherwise normally effective drainage systems have reduced efficacy when water levels in the drainage basin rise well above outfalls to the point where significant lengths of upslope portions of those drainage systems are also submerged preventing locally collected water from draining as rapidly as needed.
5. Sinking land elevations over time has caused the effects of a Hurricane Harvey to be significantly worse than they would have otherwise been in the past.