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San Jacinto  
River Authority

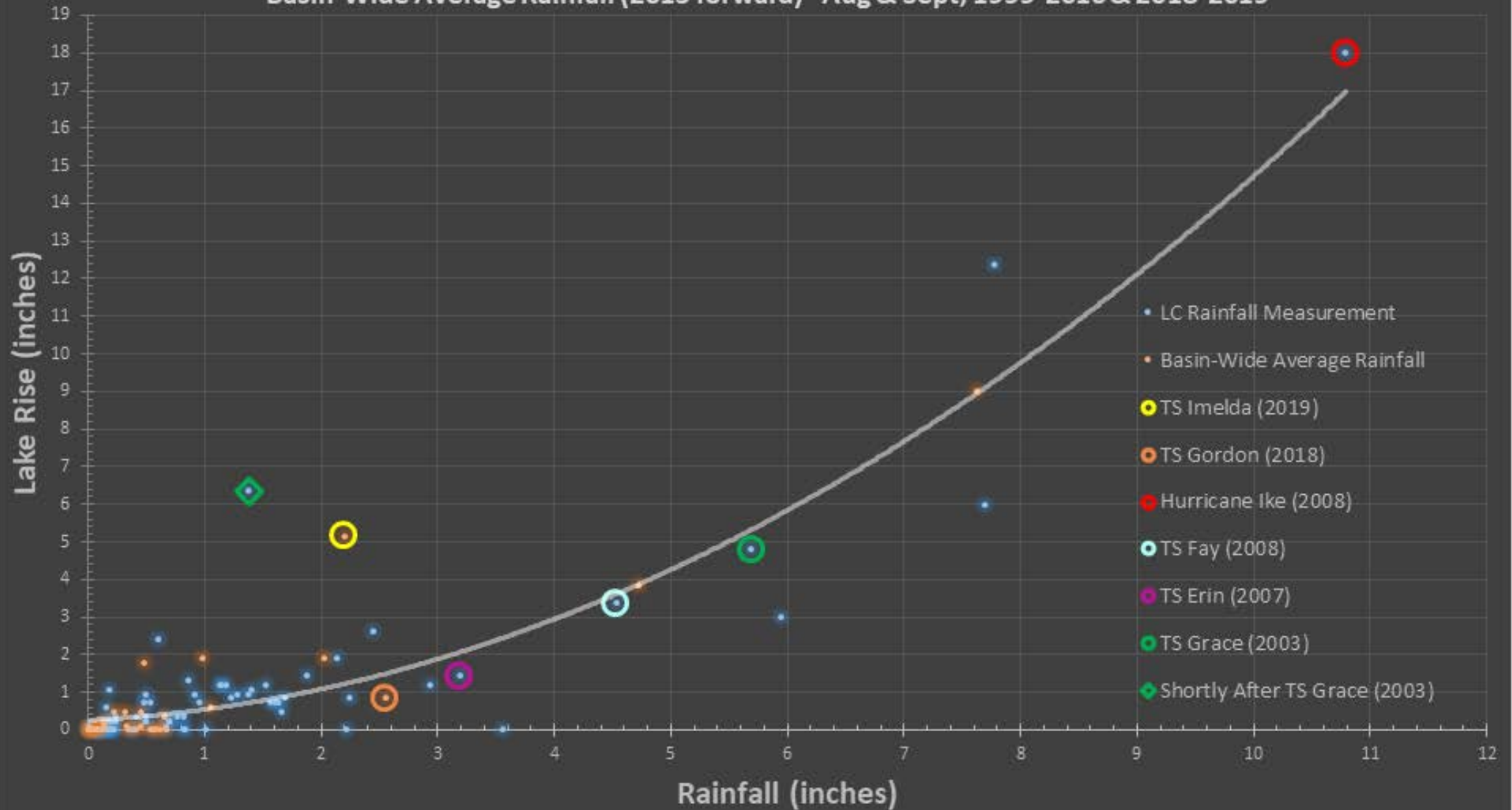


# Temporary Seasonal Lake Lowering

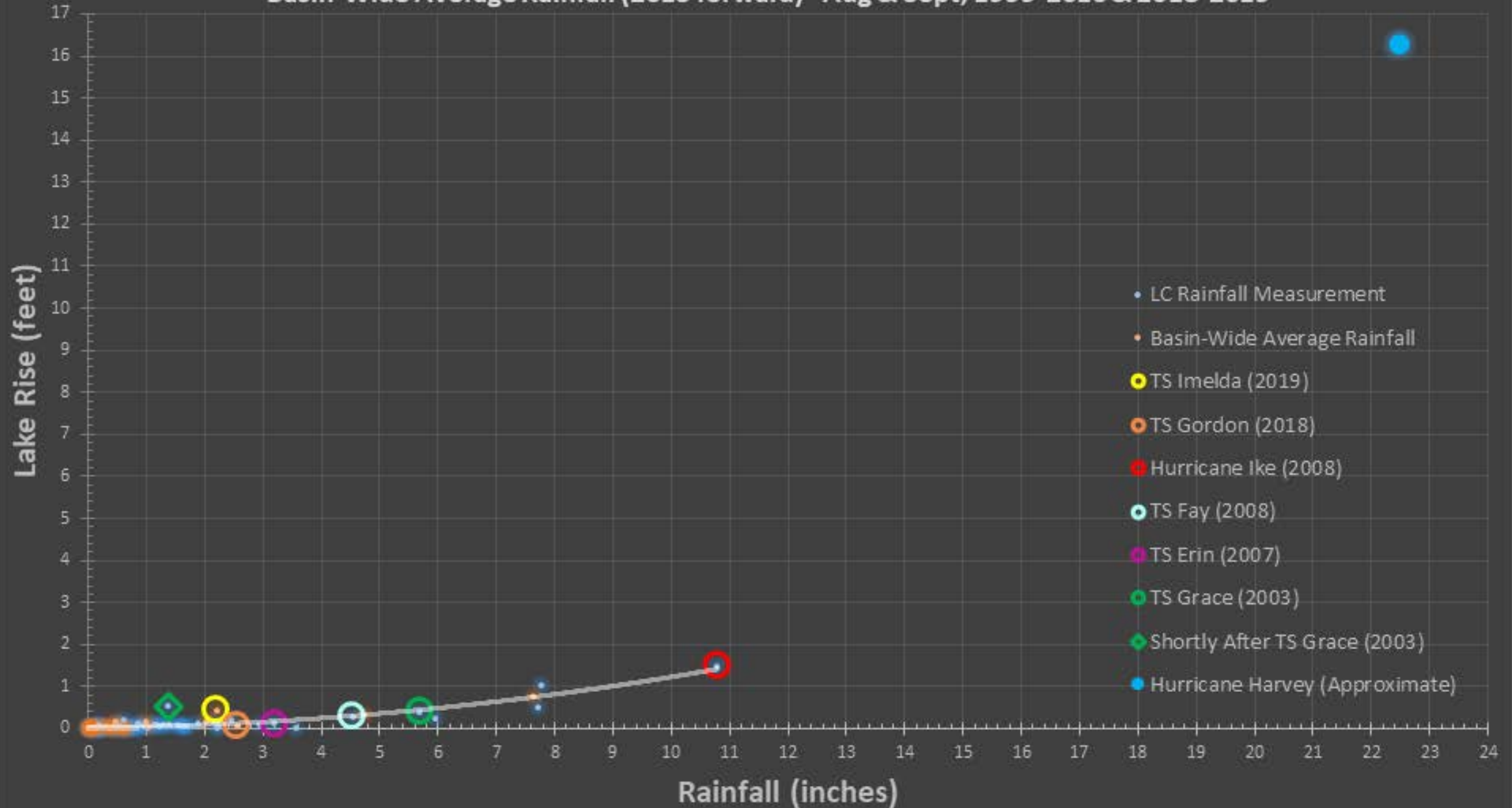
# Overview of the January Presentation

- Upper Watershed & Volumes
- Lake Conroe Facts/Gate Operations
- Current Initiative/Watershed Map
- Pre-release
- Lake Conroe/Lake Houston Distance
- Seasonal Lowering Initiative Engineering Studies
- Lake Conroe Data – Lake Level and Rainfall
- Fall 2018/Spring and Fall 2019 Summary
- Downstream Projects

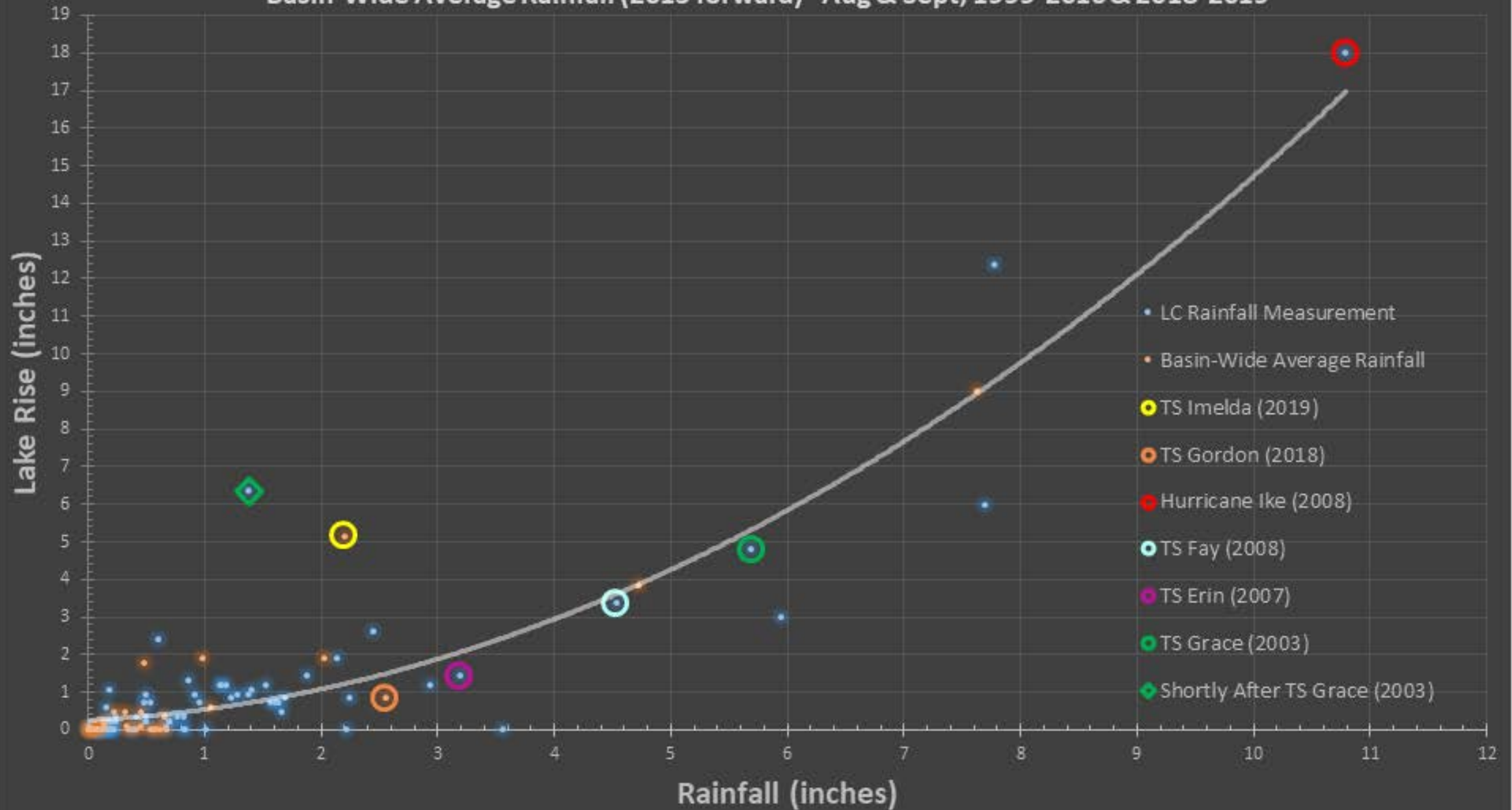
Lake Rise vs. Rainfall Measured at LC Maintenance (pre-2015) and  
Basin-Wide Average Rainfall (2015 forward) - Aug & Sept, 1999-2016 & 2018-2019



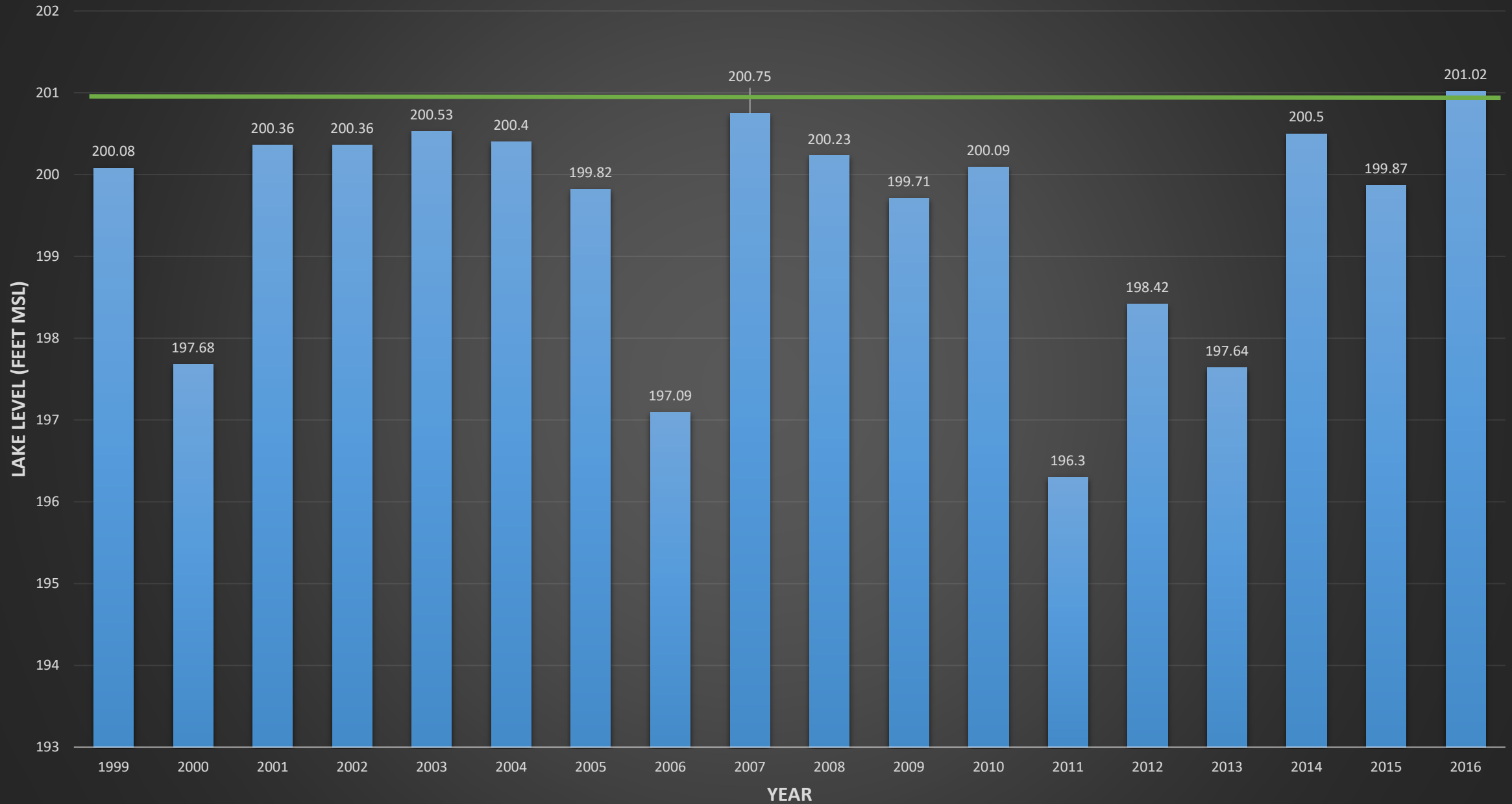
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Lake Rise vs. Rainfall Measured at LC Maintenance (pre-2015) and  
Basin-Wide Average Rainfall (2015 forward) - Aug & Sept, 1999-2016 & 2018-2019



## August 31st Historical Lake Conroe Lake Levels



# Important Considerations

- SJRA has coordinated with staff from the City of Houston and the Texas Division of Emergency Management in developing this recommendation.
- Recent legislation related to flood funding (SB 7 by Creighton) and flood planning (SB 8 by Perry) emphasize *and prioritize* regional cooperation. Coordination and cooperative effort will be absolutely critical for future flood mitigation efforts.



# Important Considerations

- All water released from Lake Conroe as part of this initiative is being accounted for from the City of Houston's 2/3 share and reported to TCEQ by the City of Houston.
- The action taken by the SJRA Board tonight will be a recommendation to the City of Houston. It is their water in Lake Conroe that is being diverted under this initiative; therefore, it is ultimately their decision.

# Primary Objective

Create a **modified seasonal lake lowering** initiative that **still benefits downstream communities** while achieving the following objectives:

1. Provide a more strategic location for flood mitigation storage
2. Acknowledge the mitigation projects accomplished to date
3. Consider additional data from actual rainfall events that occurred in the Fall seasonal lowering months
4. Reduce the negative impact to water supplies

# 1 - More Strategic Mitigation Storage

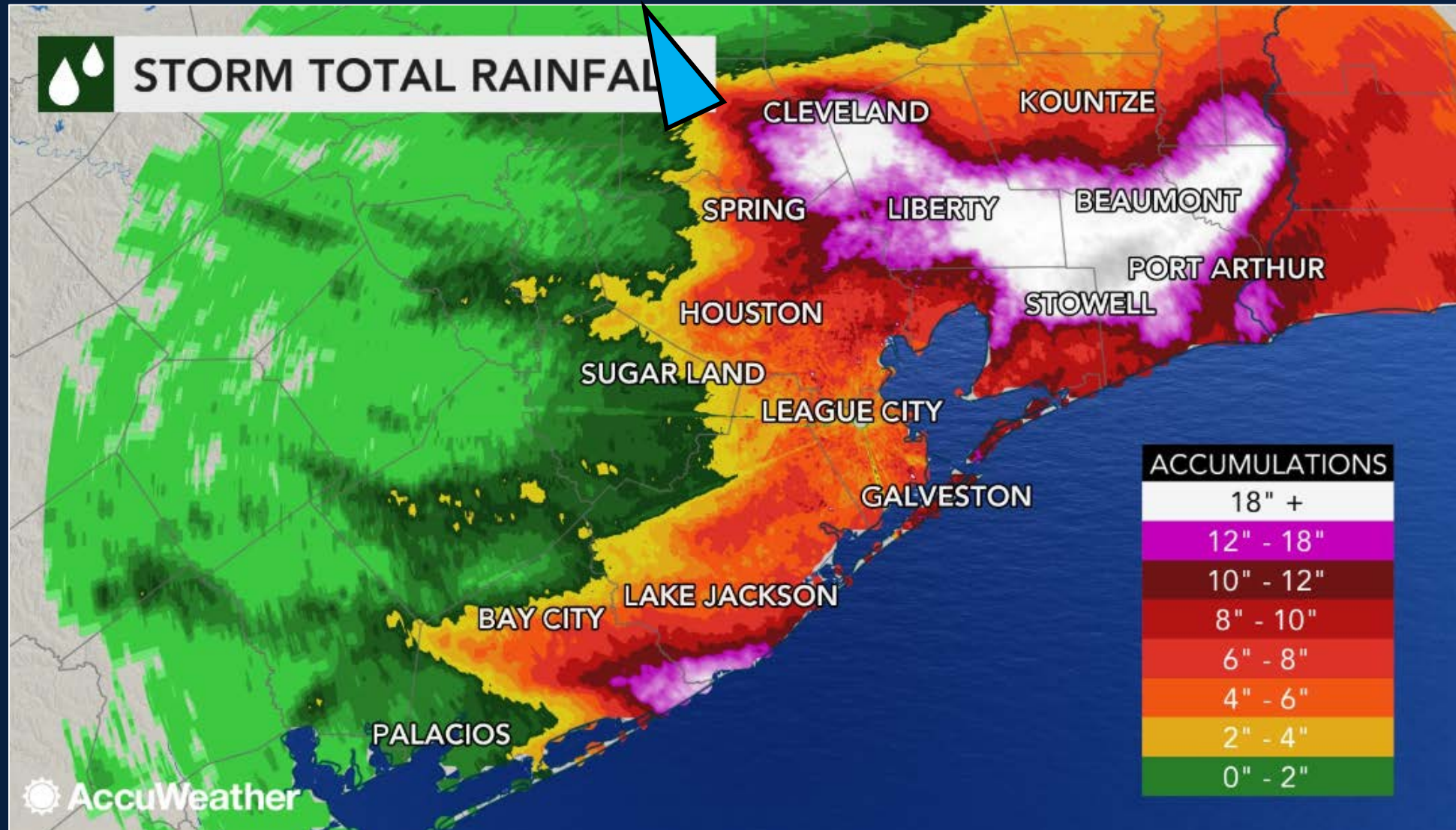
Seasonal storage in Lake Houston provides multiple benefits to reduce flood risks:

- Lake Houston is currently at 41.5' msl (one foot below conservation pool) to allow for repairs on the dam (creating approximately 11,000 acre-ft of storage capacity).
- Provides a risk reduction to the Lake Houston area for rainfall events that do not occur directly over the Lake Conroe Watershed.
- Additional capacity in Lake Houston creates space for nearby storm water infrastructure to drain some initial runoff.



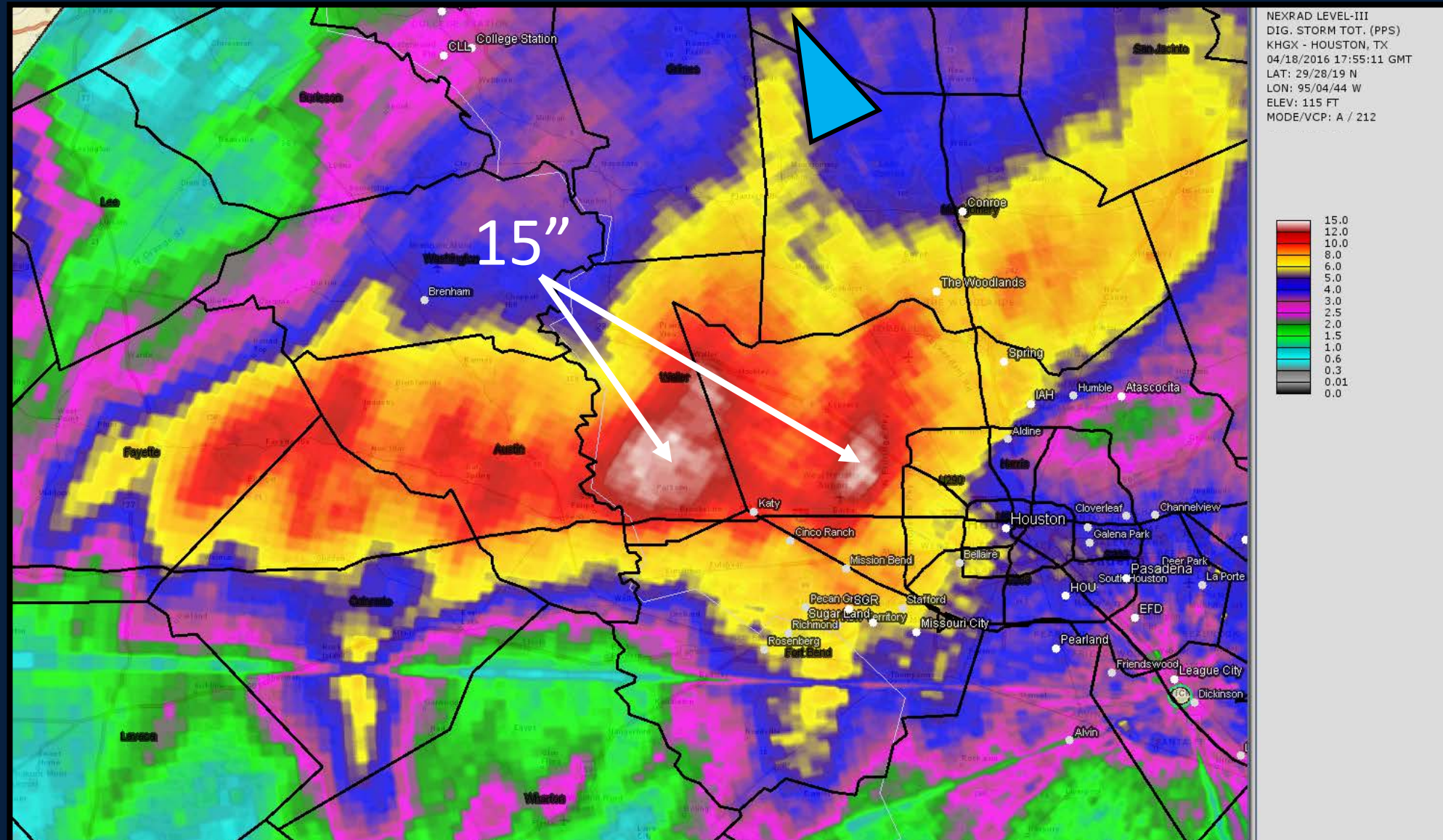


# Tropical Storm Imelda 2019





# Tax Day Event 2016



# 1 - More Strategic Mitigation Storage

Seasonal storage in Lake Houston provides multiple benefits to reduce flood risks:

- Lake Houston is currently at 41.5' msl (one foot below conservation pool) to allow for repairs on the dam (creating approximately 11,000 acre-ft of storage capacity).
- Provides a risk reduction to the Lake Houston area for rainfall events that do not occur directly over the Lake Conroe Watershed.
- Additional capacity in Lake Houston creates space for nearby storm water infrastructure to drain some initial runoff.

## 2 - Acknowledge Completed Mitigation Projects

Completed projects have restored some downstream conveyance capacity in the San Jacinto River.

- 2.3 million cubic yards of sand has been removed from the mouth of the San Jacinto River. Enough sand to fill the Astrodome 1.5 times.
- Additional dredging is in progress and will continue throughout 2020.

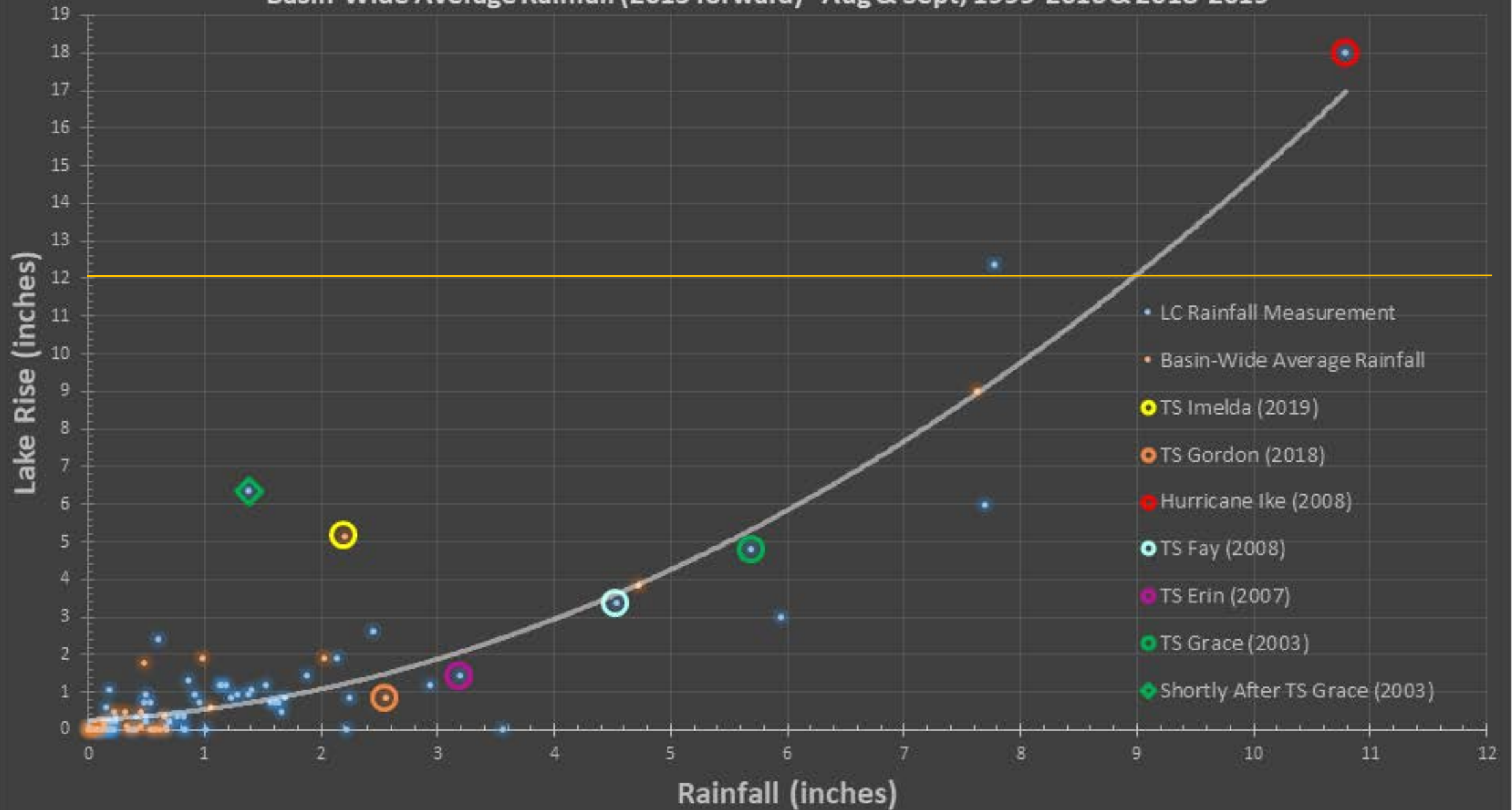


# 3 - Data From Actual Rainfall Events

A review of historic rainfall data and corresponding lake rise suggests less than 2-feet of storage is adequate to catch most storm events at Lake Conroe that occur in the fall.

- Only two rainfall events that occurred in the months of August and September since 1999 (excluding 2017) resulted in more than one-foot of rise in Lake Conroe.
  - More than 90% of these events resulted in less than 3-inches of rise in Lake Conroe.
- Five named tropical storms in this same period resulted in less than 12-inches of rise.

Lake Rise vs. Rainfall Measured at LC Maintenance (pre-2015) and  
Basin-Wide Average Rainfall (2015 forward) - Aug & Sept, 1999-2016 & 2018-2019



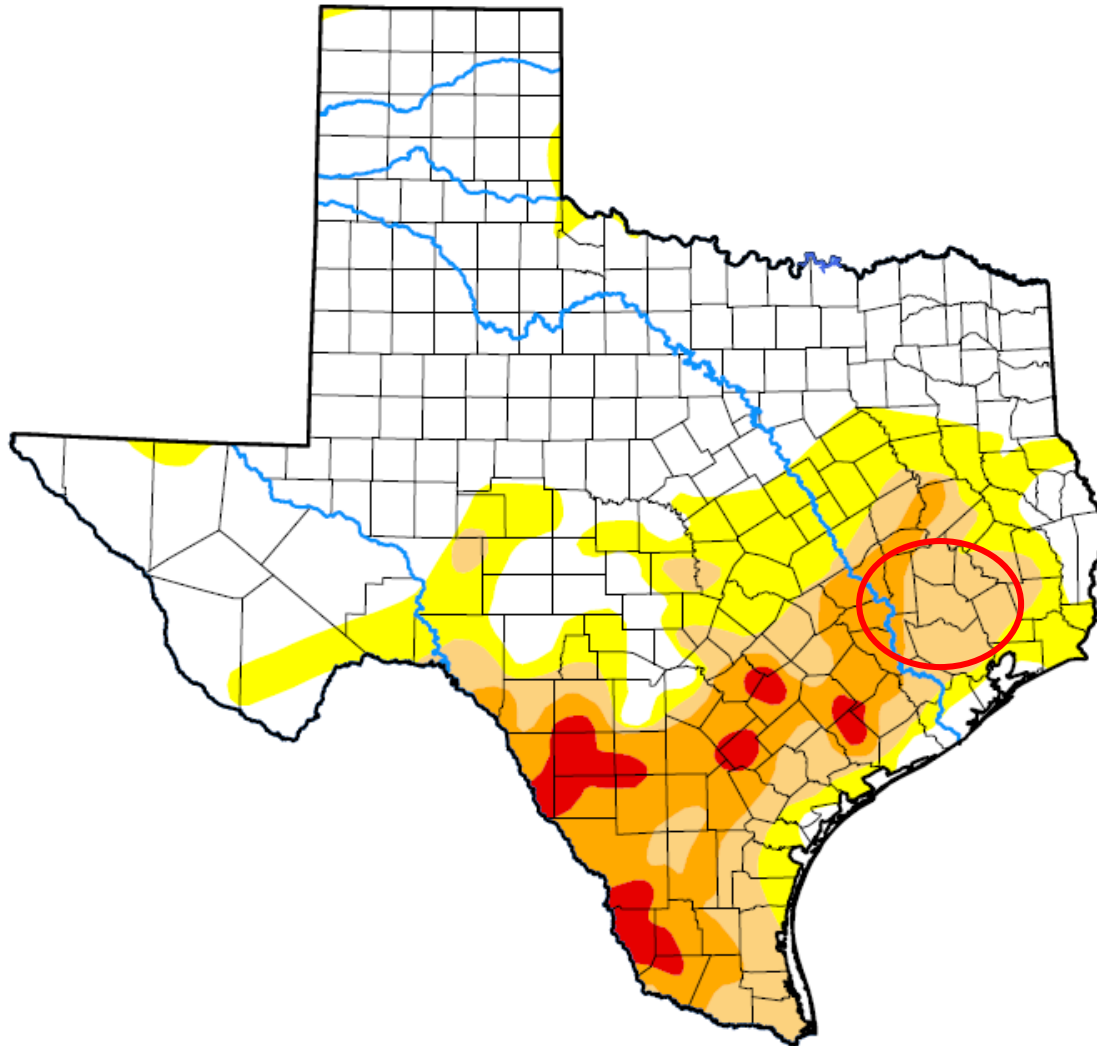
## 4 - Reduce Negative Impact to Water Supplies

Minimizing the amount of stored water that is released from Lake Conroe will benefit regional water supplies.







- Best practice is to store water supplies as high as possible in the basin.
- With a drainage basin that covers approximately 3,000 square miles, it is easy for Lake Houston to recover after seasonal lowering or pre-releasing with even a small rainfall event.
- The Upper San Jacinto River Basin is currently in Moderate Drought (<https://droughtmonitor.unl.edu/>).

# U.S. Drought Monitor Texas

February 18, 2020  
(Released Thursday, Feb. 20, 2020)  
Valid 7 a.m. EST



## Intensity:

-  None
-  D0 Abnormally Dry
-  D1 Moderate Drought
-  D2 Severe Drought
-  D3 Extreme Drought
-  D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

## Author:

David Miskus  
NOAA/NWS/NCEP/CPC



[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

# Recommended Regional Mitigation Strategy (Spring)

- Lake Houston:
  - Lake Houston is currently at 41.5' msl (one foot below conservation pool) creating approximately 11,000 acre-ft of storage capacity
  - SJRA coordinate with Houston on potential for additional release of water from Lake Houston when a significant storm is in the forecast
  - **Increase in mitigation benefit as compared to 2019 Spring strategy**
- Lake Conroe:
  - Seasonally lower to 200' msl (approx. 20,000 acre-ft of storage)
  - Begin seasonal lowering on April 1<sup>st</sup>
  - Begin recapturing flows on June 1<sup>st</sup>
  - **No change from the 2019 Spring strategy**

# Recommended Regional Mitigation Strategy (Fall)

- Lake Houston:
  - Lake Houston is currently at 41.5' msl (one foot below conservation pool) creating approximately 11,000 acre-ft of storage capacity
  - SJRA coordinate with Houston on potential for additional release of water from Lake Houston when a significant storm is in the forecast
  - **Increase in mitigation benefit as compared to 2019 Fall strategy**
- Lake Conroe:
  - Seasonally lower to 200' msl (approx. 20,000 acre-ft of storage)
  - Begin seasonal lowering on August 1<sup>st</sup>
  - Begin recapturing flows October 1<sup>st</sup>
  - **One-foot reduction from 2019 Fall strategy**

# City of Houston Recommendation

- Spring:
  - Seasonally lower Lake Conroe to 200' msl
  - Begin seasonal lowering on April 1<sup>st</sup>
  - Begin Recapturing flows on June 1<sup>st</sup>
  - **No change from the 2019 Spring strategy**
- Fall:
  - Seasonally lower Lake Conroe to 199.5' msl
  - Begin seasonal lowering on August 1<sup>st</sup>
  - Begin recapturing flows on October 1<sup>st</sup>
  - Additional lowering to 199' msl if named storm within five-day forecast
  - Continue until completion of Lake Houston gate expansion project



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# Board Action Requested

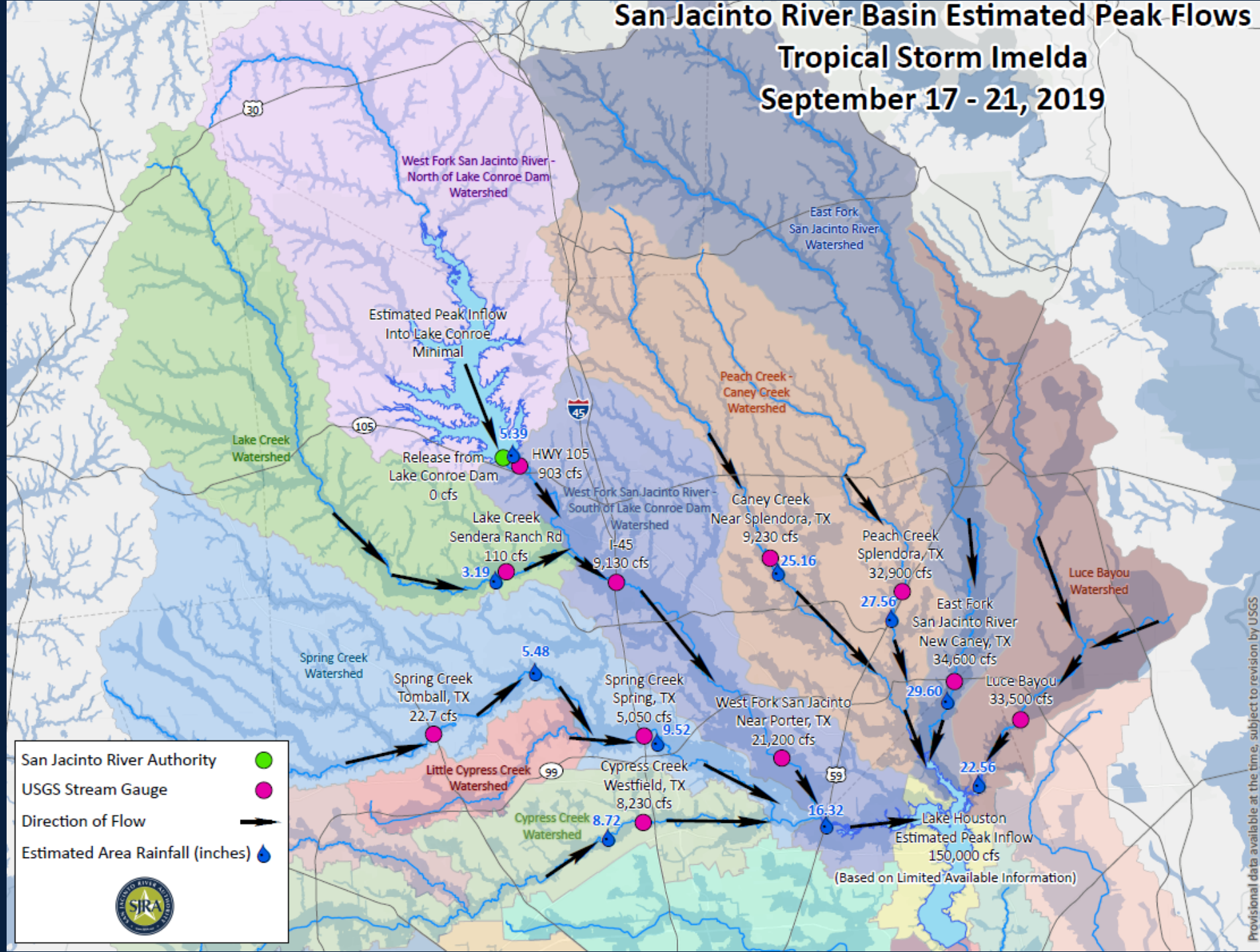
Direct staff regarding recommendation to City of Houston

- Acknowledge that water released for seasonal lowering belongs to City, and diversions are ultimately their decision
- Acknowledge that City can call for diversions, including prior to a named storm (SJRA does not recommend releasing water prior to a storm)
- Require City to notify SJRA in writing when to make diversions of City water and the desired quantity

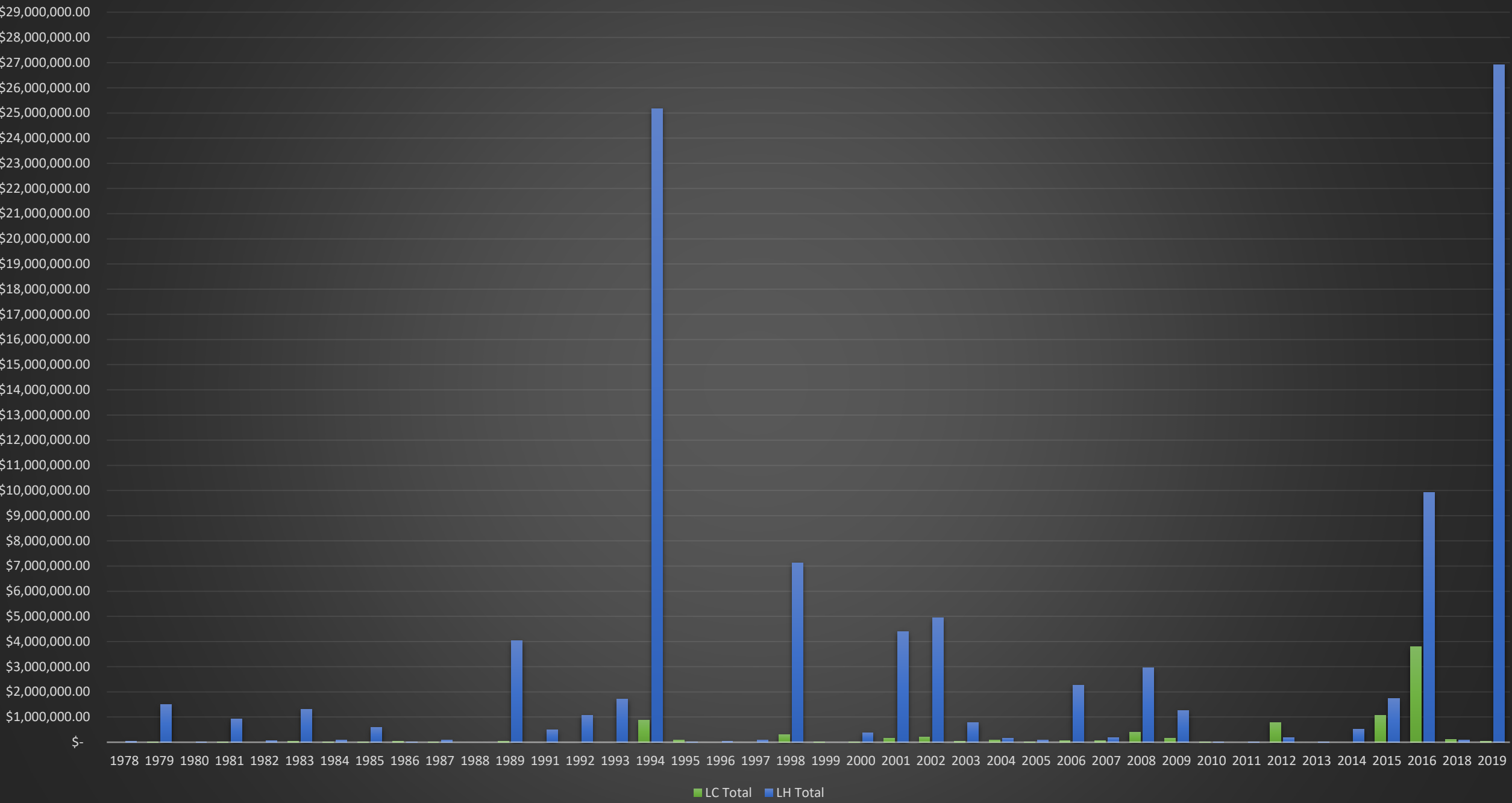
# San Jacinto River Basin Estimated Peak Flows

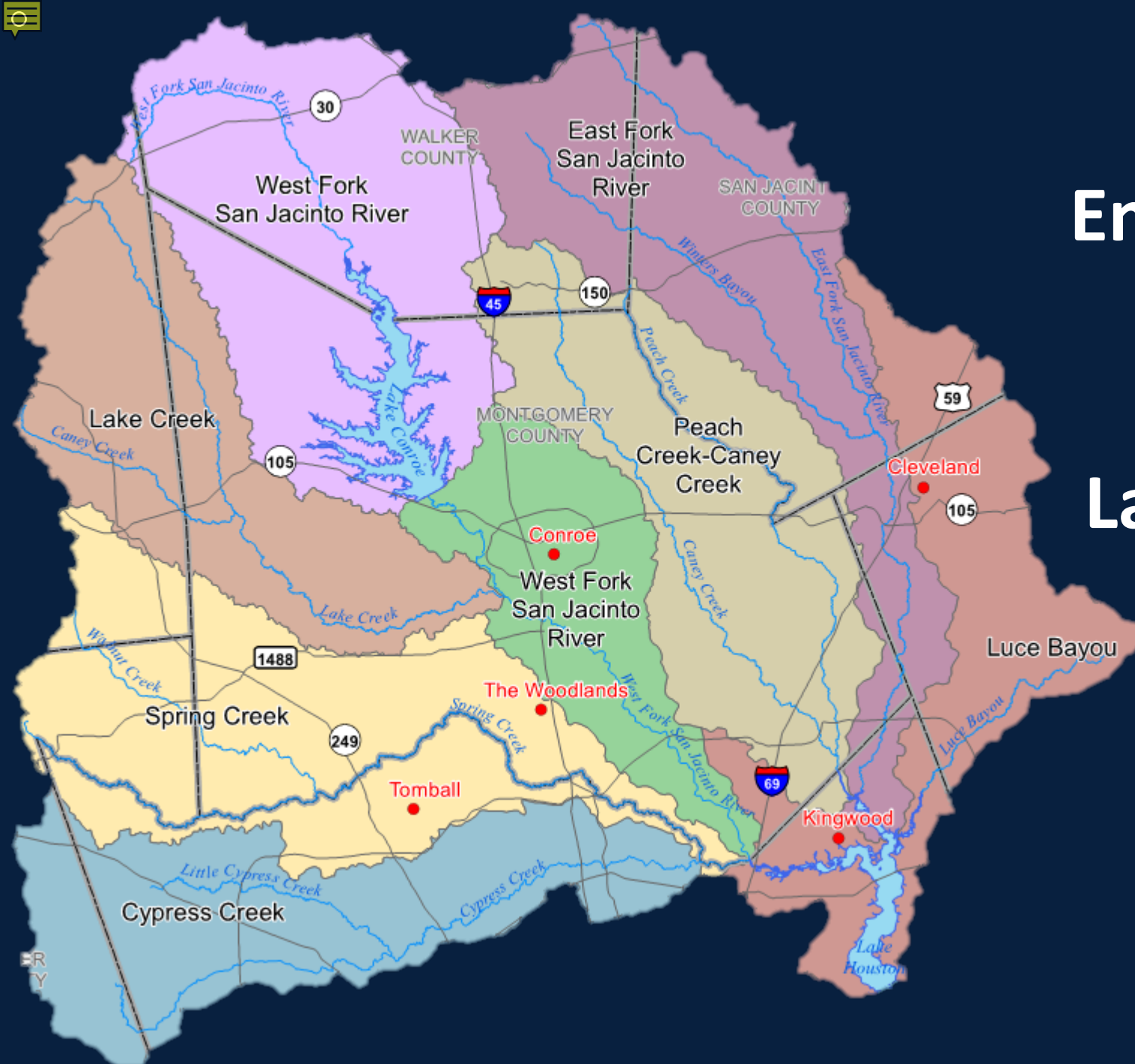
## Tropical Storm Imelda

September 17 - 21, 2019



# Total Payouts for Lake Conroe Area & Lake Houston/Kingwood Area (Without 2017)





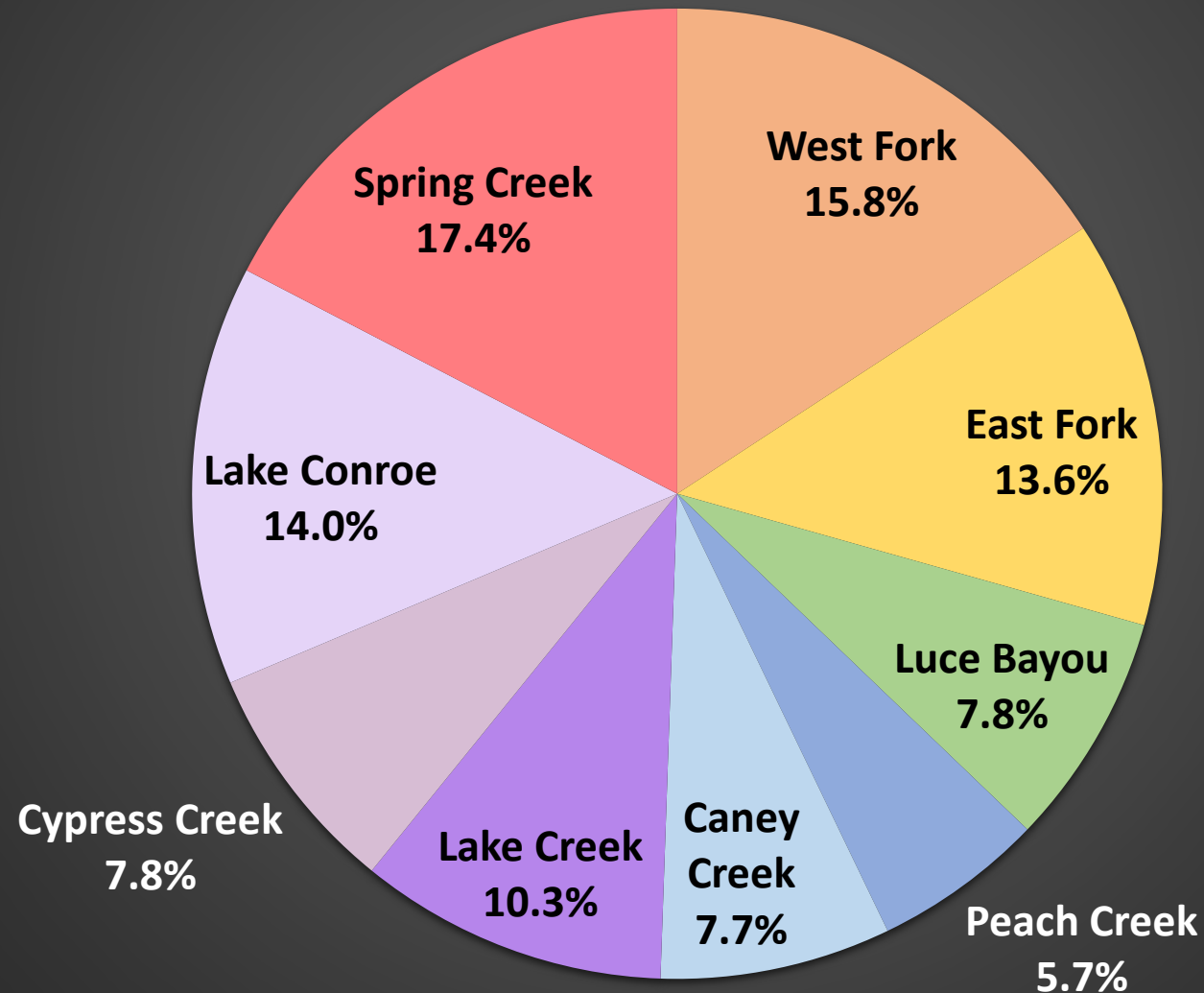
**Entire Upper Watershed:  
2,800 square miles**

**Lake Conroe Watershed:  
450 square miles**



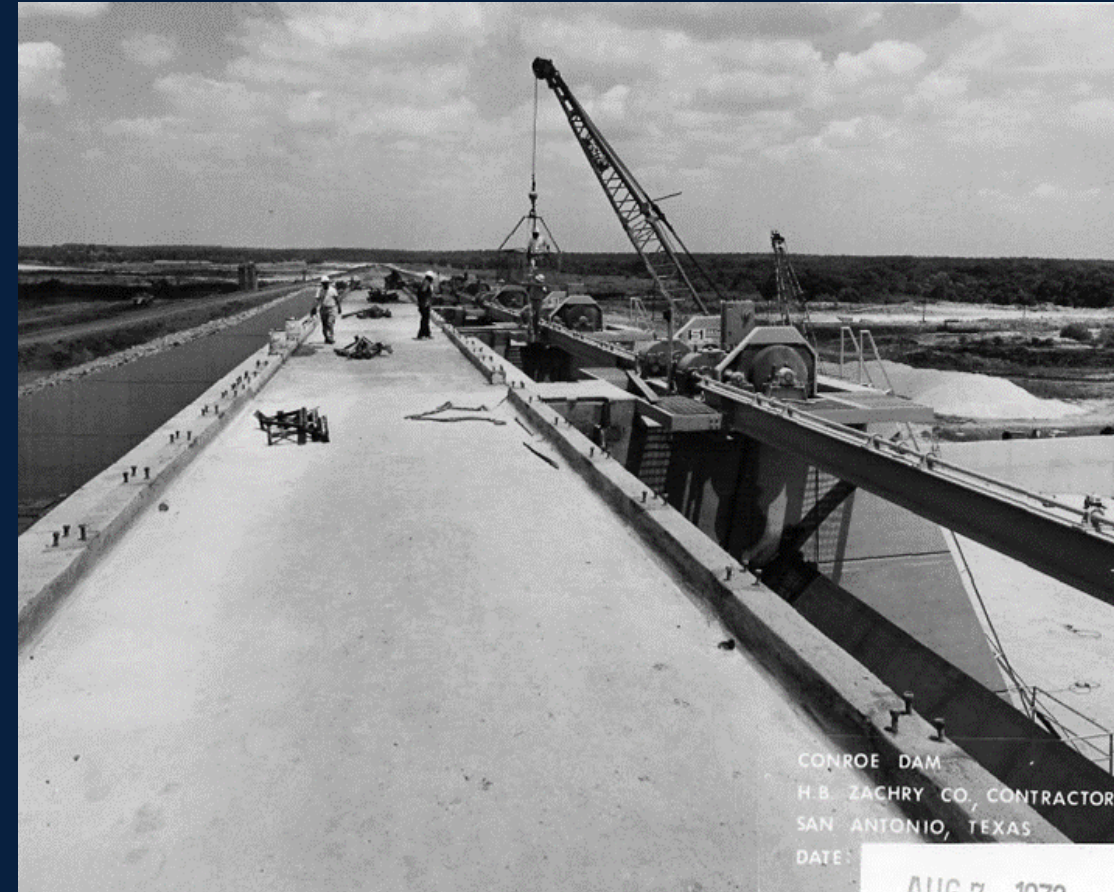
# 100-YR (ATLAS 14) Volume Percentages

Lake Houston Inflow Volume= 2.0 Million ac-ft



# Facts about Lake Conroe

- Surface acres: 19,640
- Capacity: Not to exceed 430,260 acre-feet
- Permitted water: 100,000 acre-feet
- Conservation pool elevation: 201 ft msl
- Main spillway: five gates, 40 ft by 30 ft
- SJRA obtained a flowage easement around the reservoir up to elevation 207 ft msl
- All water stored above elevation 201 ft msl must be released



# Facts about Lake Conroe

- Constructed as a water supply reservoir – not intended to be a “constant level lake”
- 1/3<sup>rd</sup> of permitted water belongs to SJRA
- 2/3<sup>rd</sup> of permitted water belongs to City of Houston
- City of Houston pays 2/3<sup>rd</sup> of the operating cost of Lake Conroe
- City of Houston has the ability to call for the release of their permitted water at any time, regardless of the water surface elevation of Lake Conroe







# Key Points regarding Gate Operations

- Tainter gates must be raised as lake rises
- Cannot allow over-topping as it compromises the structure.



Downstream side of Gate



Upstream side of Gate



# Seasonal Lake Lowering Initiative

- Conservation pool level is 201' msl
- Seasonal lowering will occur:
  - Spring: *April 1-May 31* to 200' msl
    - Gradual reduction starts *April 1<sup>st</sup>*
    - Recapturing starts on *June 1<sup>st</sup>*
  - Fall: *August 1-September 30* to 199' msl
    - Gradual reduction starts *August 1<sup>st</sup>*
    - Recapturing starts on *October 1<sup>st</sup>*





# Joint Reservoir Operations Strategy with CoH

- Temporary Seasonal Lowering of Lake Conroe
- City of Houston lowers Lake Houston prior to major rainfall events:
  - Conservation Pool Elevation is 42.5' msl
  - Lake Level reduced to 41.5' msl when 3 inches or more of rainfall is forecasted
  - Lake Houston was lowered to elevation 41.5' msl or lower nine times in 2019

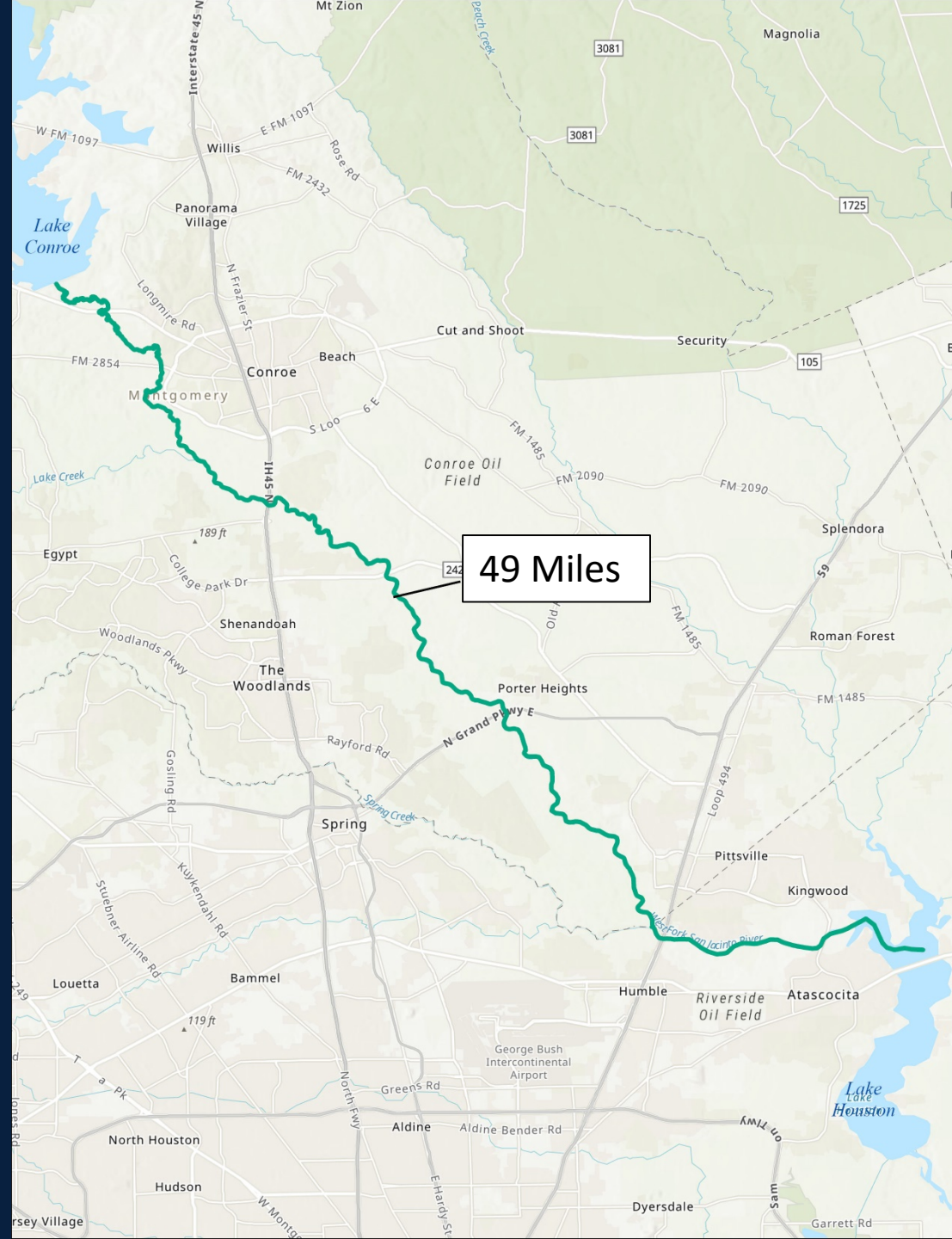


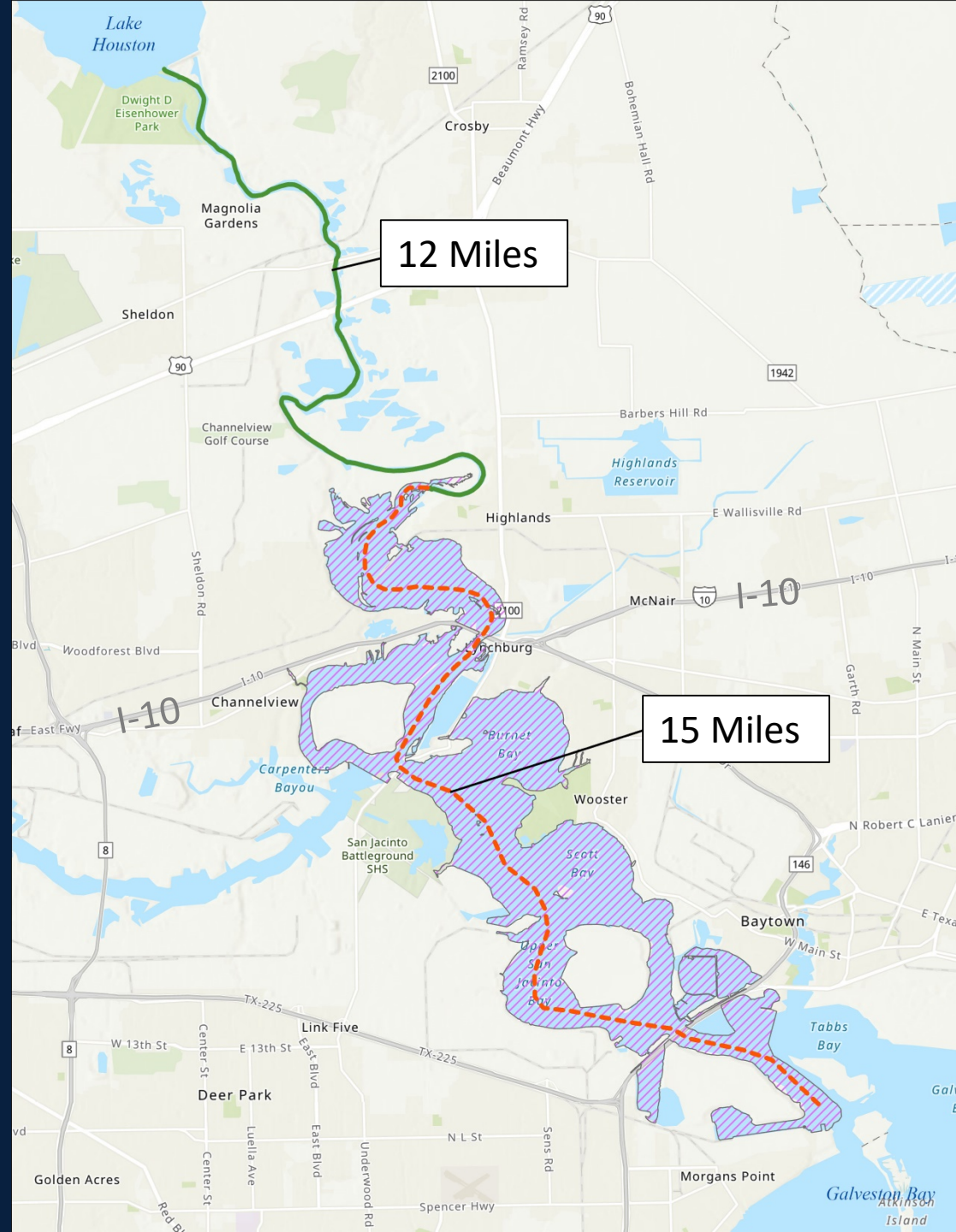


# Why Not Pre-Release from Lake Conroe?

- Weather predictions not accurate enough
- Risk of making downstream conditions worse
- Downstream partners want empty rivers prior to a storm
- Potentially impacts properties immediately downstream of the dam









# Decision Based on Engineering Studies

Two engineering studies were completed prior to the SJRA Board taking action on the seasonal lake lowering initiative.

1. Analysis of potential impacts of lowering Lake Conroe conservation pool elevation on lake storage and elevation, available diversions from the lake (average and firm), and downstream water rights.
2. Analysis of potential impacts on lake levels and downstream maximum water surface elevation of a two-foot and three-foot reduction in the conservation pool level of Lake Conroe.

# Engineering Study: Water Supply

Scenario	Firm Yield (ac-ft/yr)	Change from Baseline (ac-ft/yr)
Conservation Pool	80,200	0
200' (temp)	80,200	0
199' (temp)	78,800	-1,400

\*Models were developed based on an assumption that reductions of conservation storage for seasonal lake lowering were limited to August and September

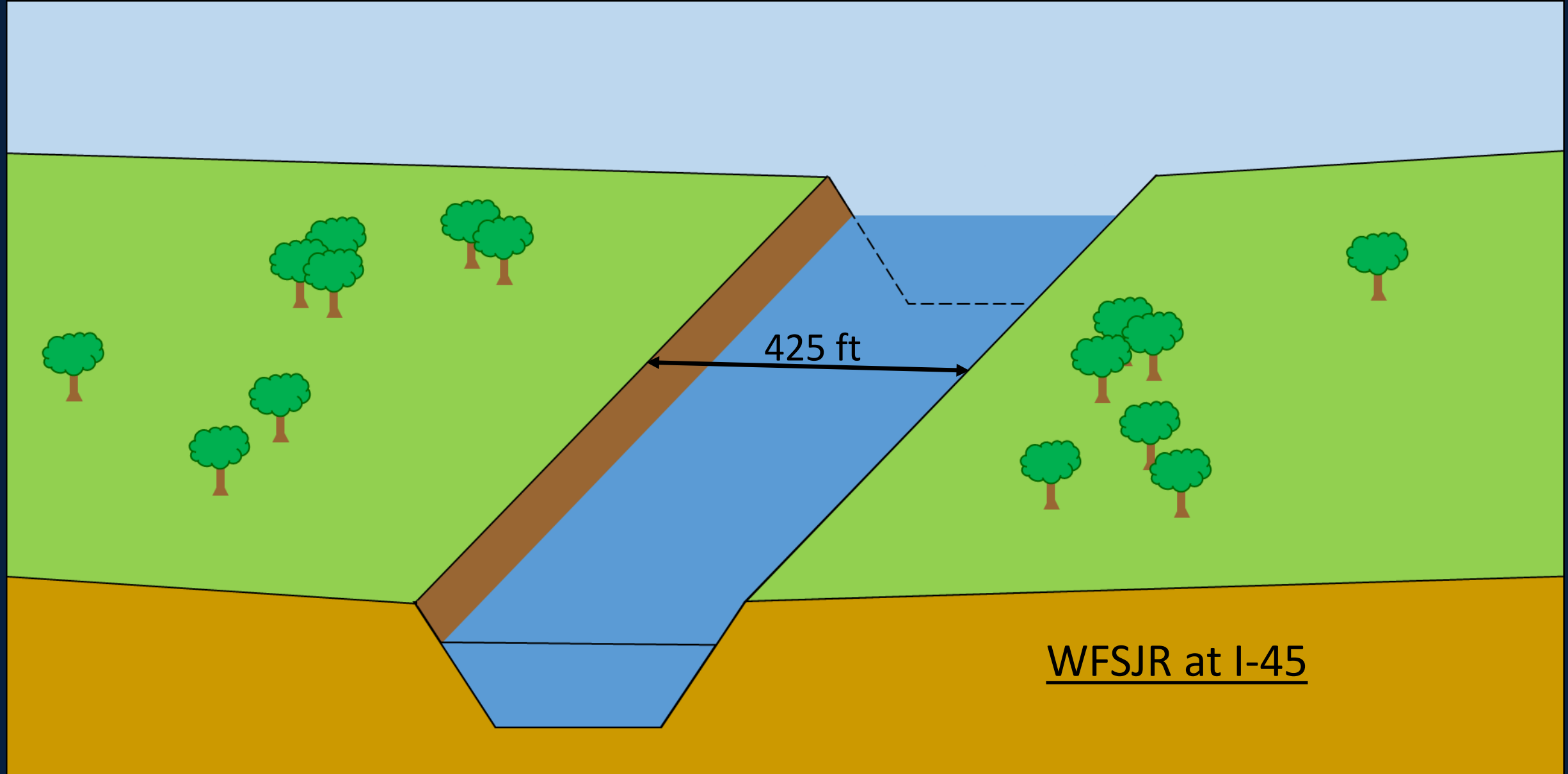




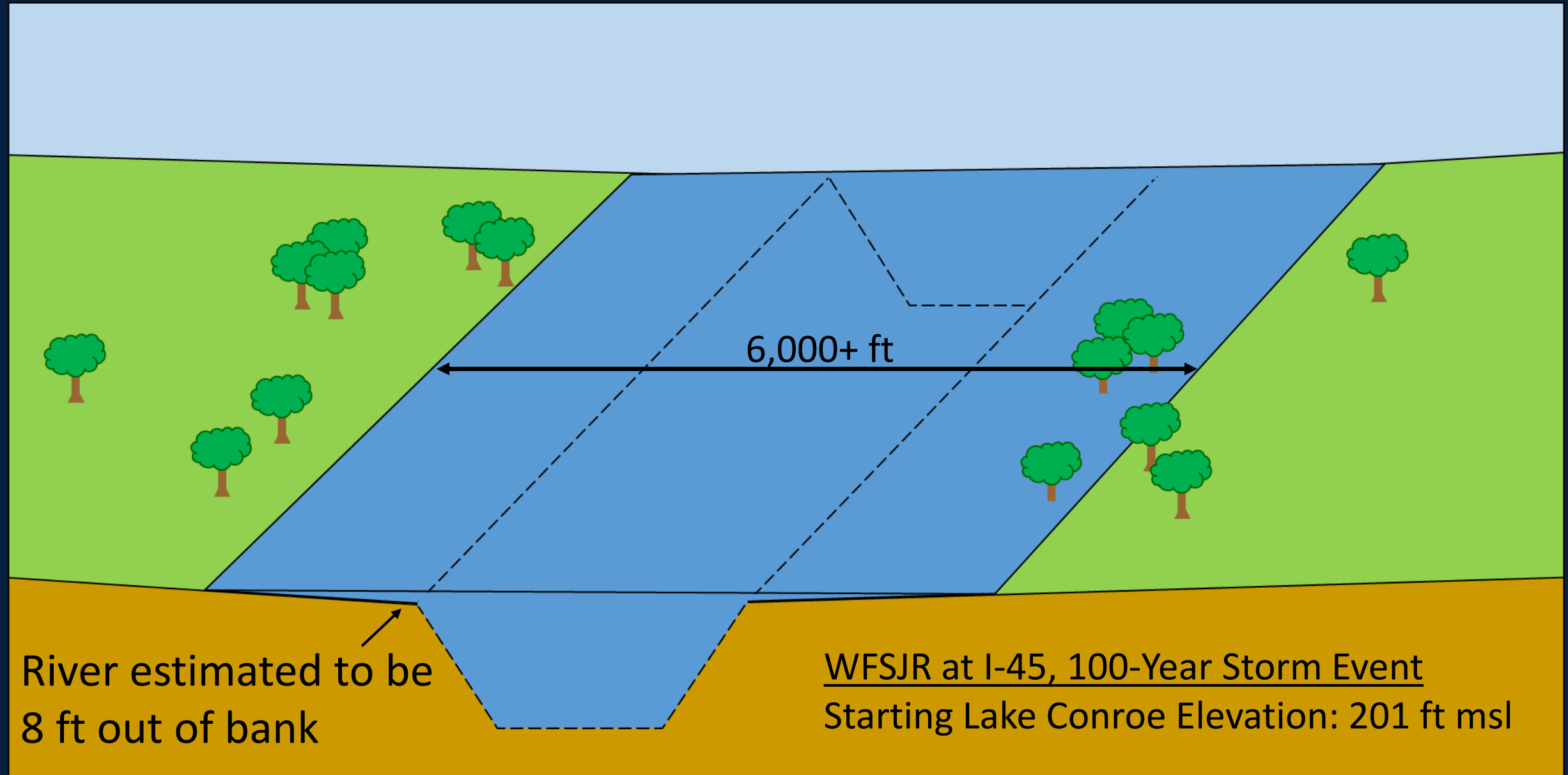
# Engineering Study: Maximum Downstream WSEL

	201 (ft msl)	199 (ft msl)	Difference (ft)
100-year Water Surface Elevation at Cross Section, ft msl			
DS Lake Conroe	153.94	152.47	-1.47
US SH 105	149.57	148.10	-1.47
Lake Creek	136.88	136.36	-0.52
IH-45	124.44	123.70	-0.74
500-year Water Surface Elevation at Cross Section, ft msl			
DS Lake Conroe	159.31	157.74	-1.57
US SH 105	154.33	153.00	-1.33
Lake Creek	141.02	140.37	-0.65
IH-45	129.69	128.89	-0.80

# Engineering Study: Maximum Downstream WSEL

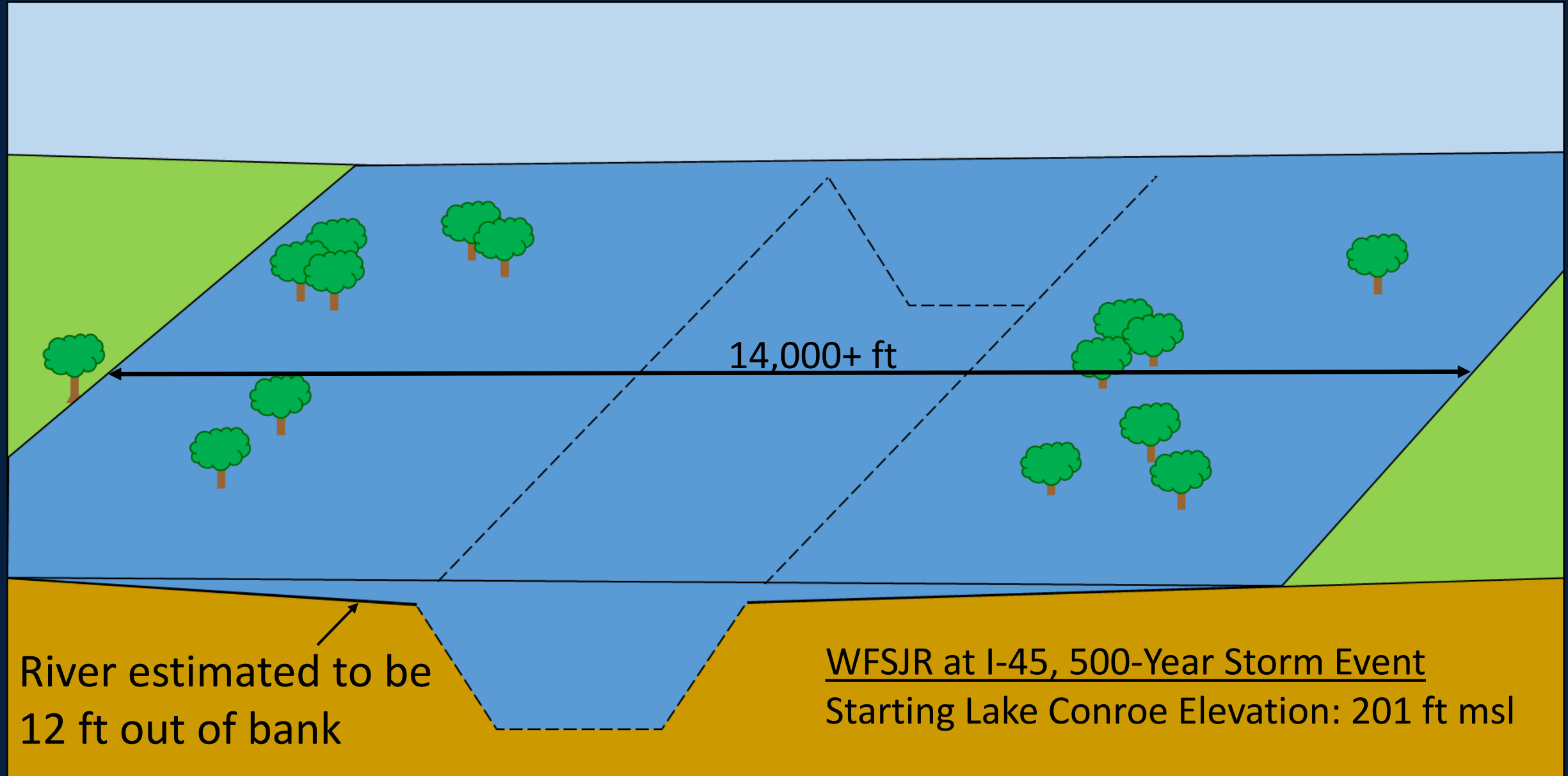


# Engineering Study: Maximum Downstream WSEL



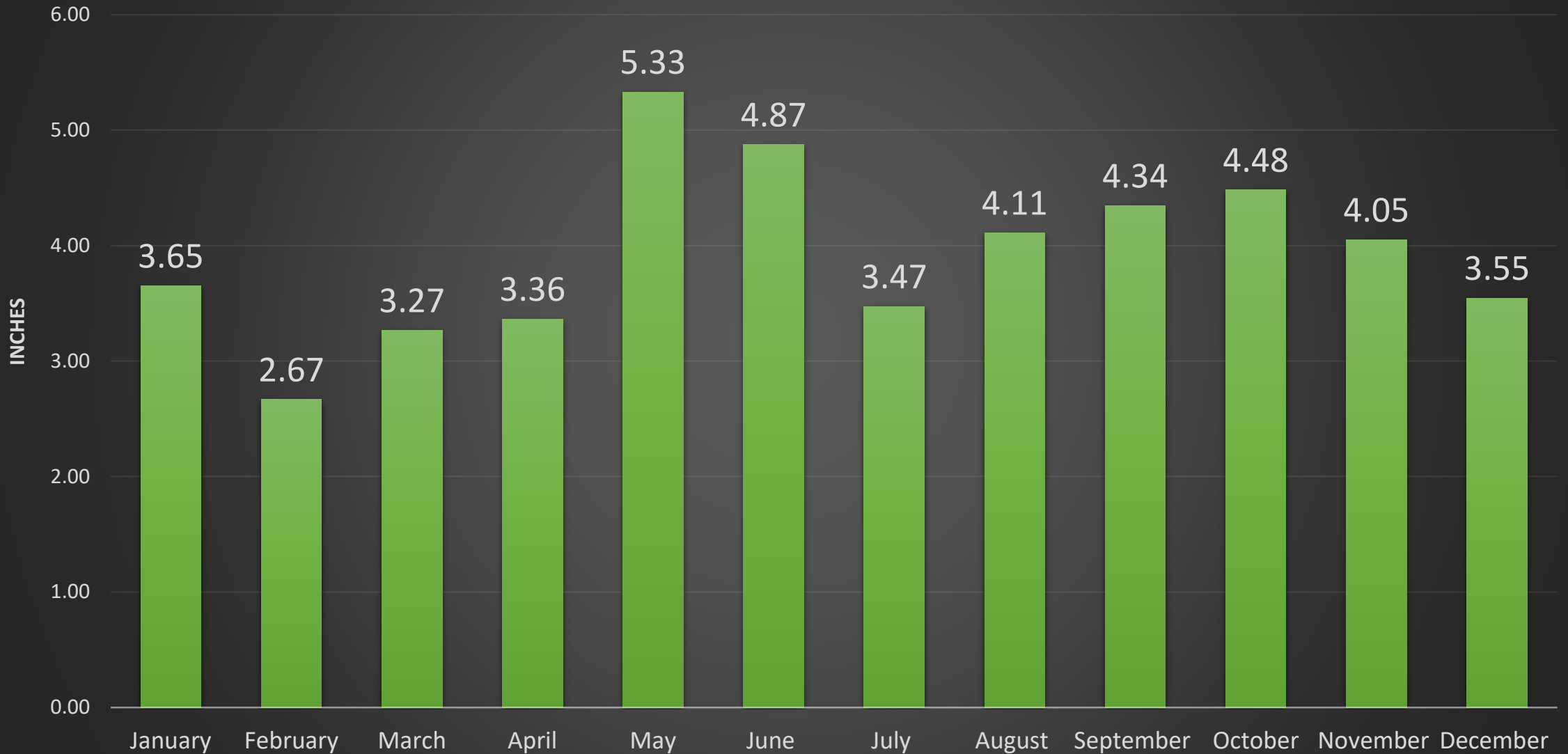


# Engineering Study: Maximum Downstream WSEL

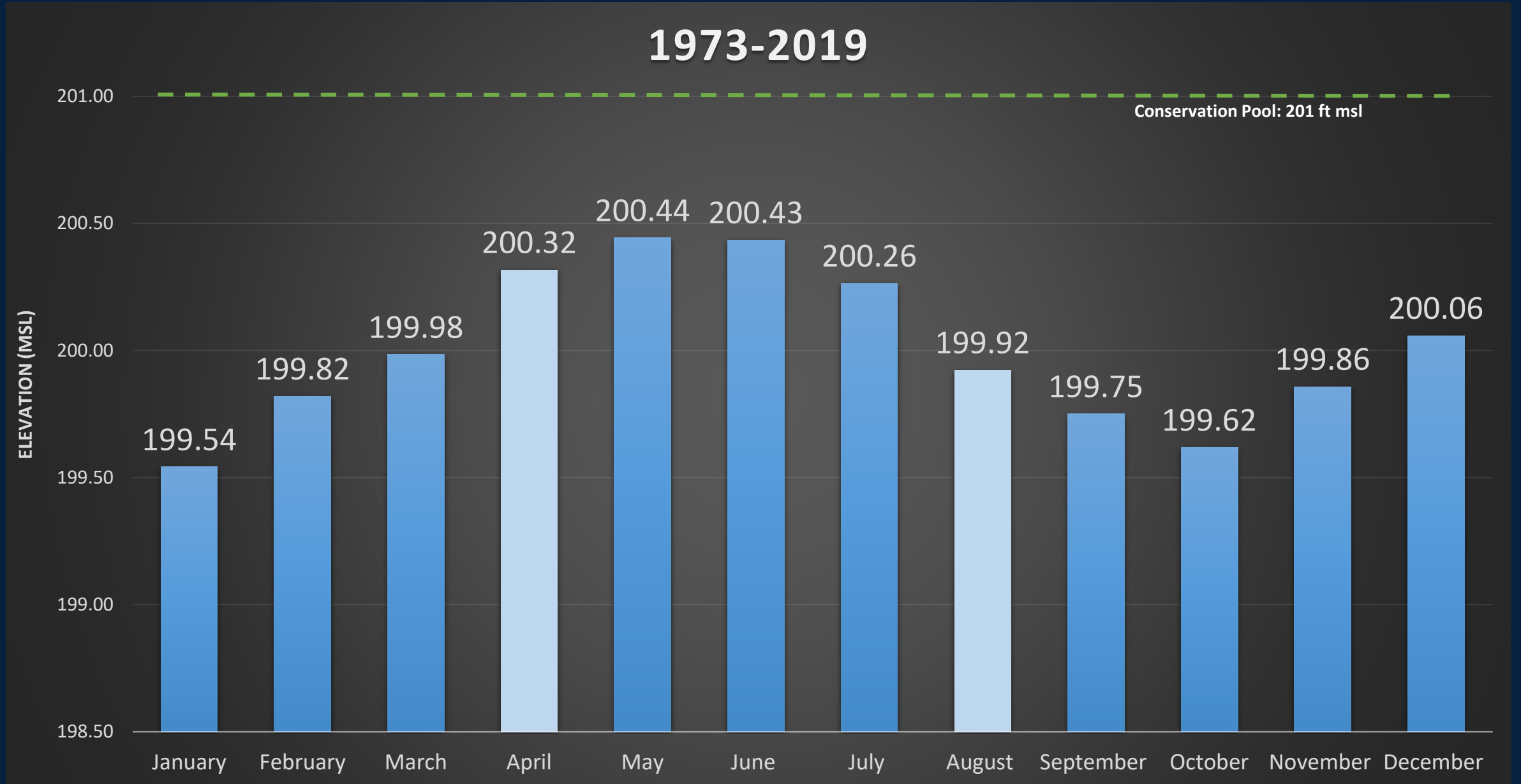


# Rainfall Averages for Lake Conroe

1973-2019



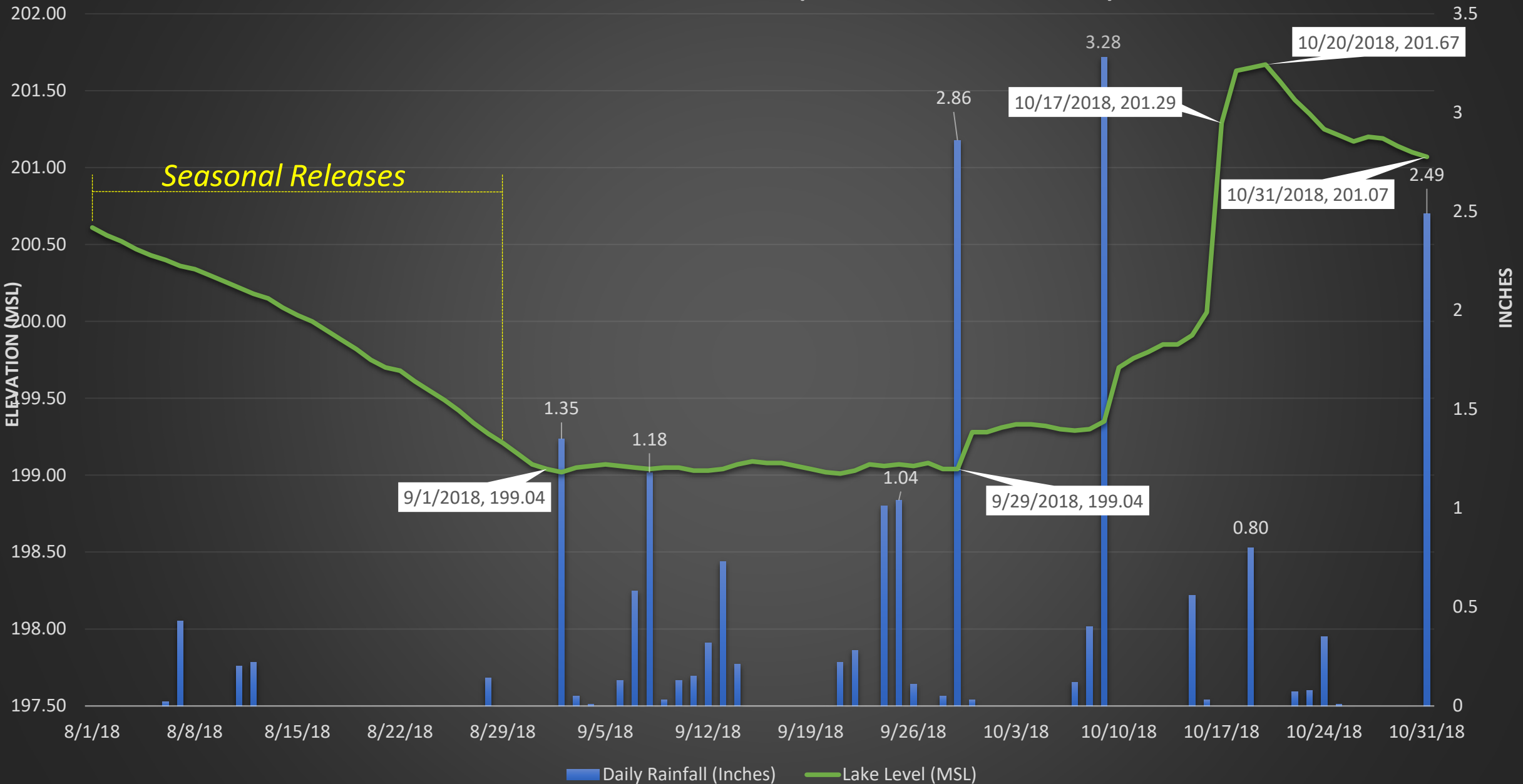
# Lake Level Averages for Lake Conroe





# FALL 2018 SEASONAL LAKE RELEASE

## DAILY RAINFALL AND LAKE LEVEL (AUGUST-OCTOBER 2018)

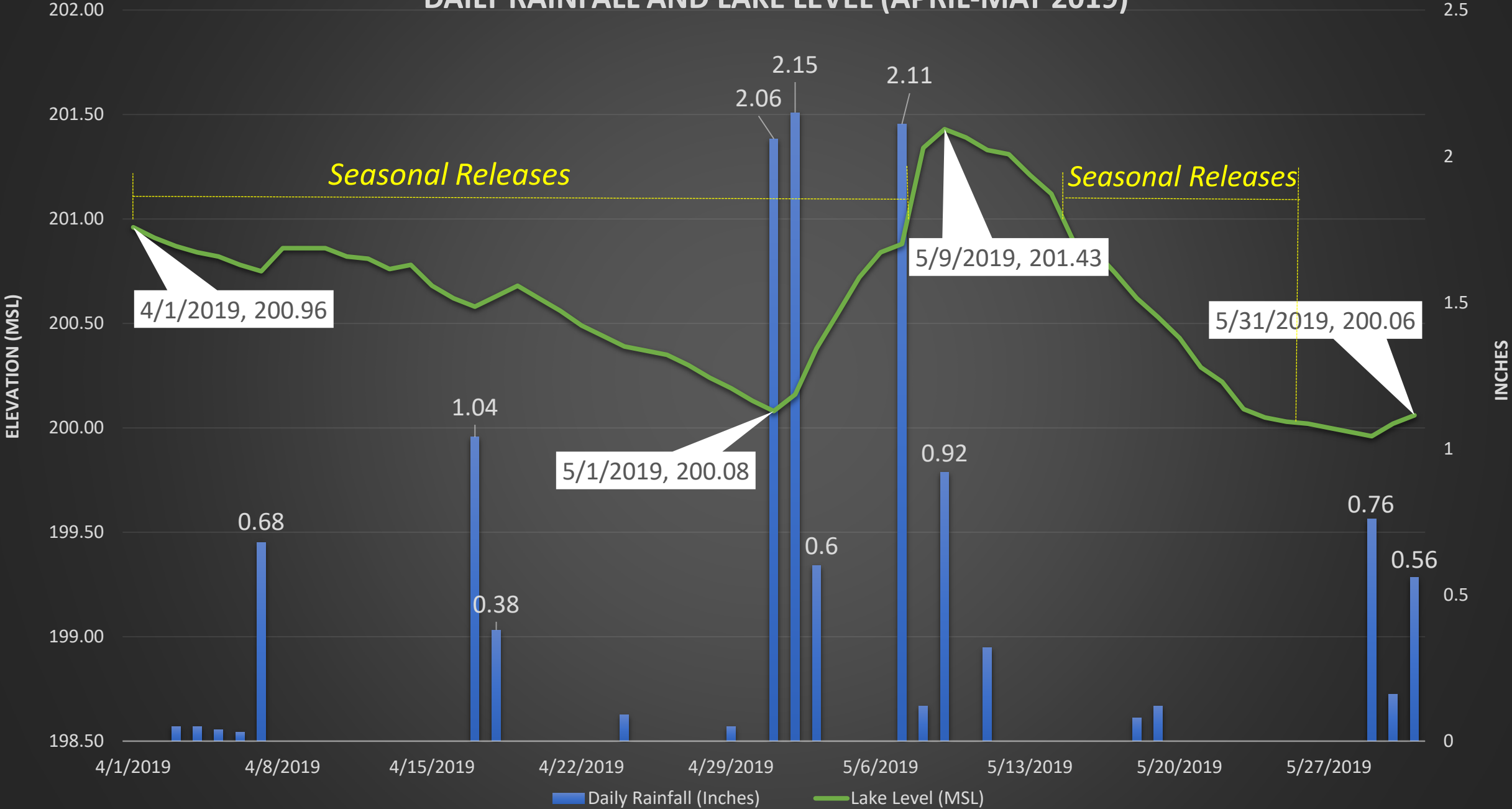


# Fall 2018 Summary

- Lake Conroe conservation pool elevation = 201.00 ft msl
- The lake level was 0.40 feet below conservation pool elevation prior to August 1<sup>st</sup> due to external losses (i.e. evaporation, customer sales)
- Seasonal releases ended on August 31, 2018
- 18,265 acre-feet of Houston's water was released
- Reached conservation pool elevation October 17, 2018

# SPRING 2019 SEASONAL LAKE RELEASE

## DAILY RAINFALL AND LAKE LEVEL (APRIL-MAY 2019)

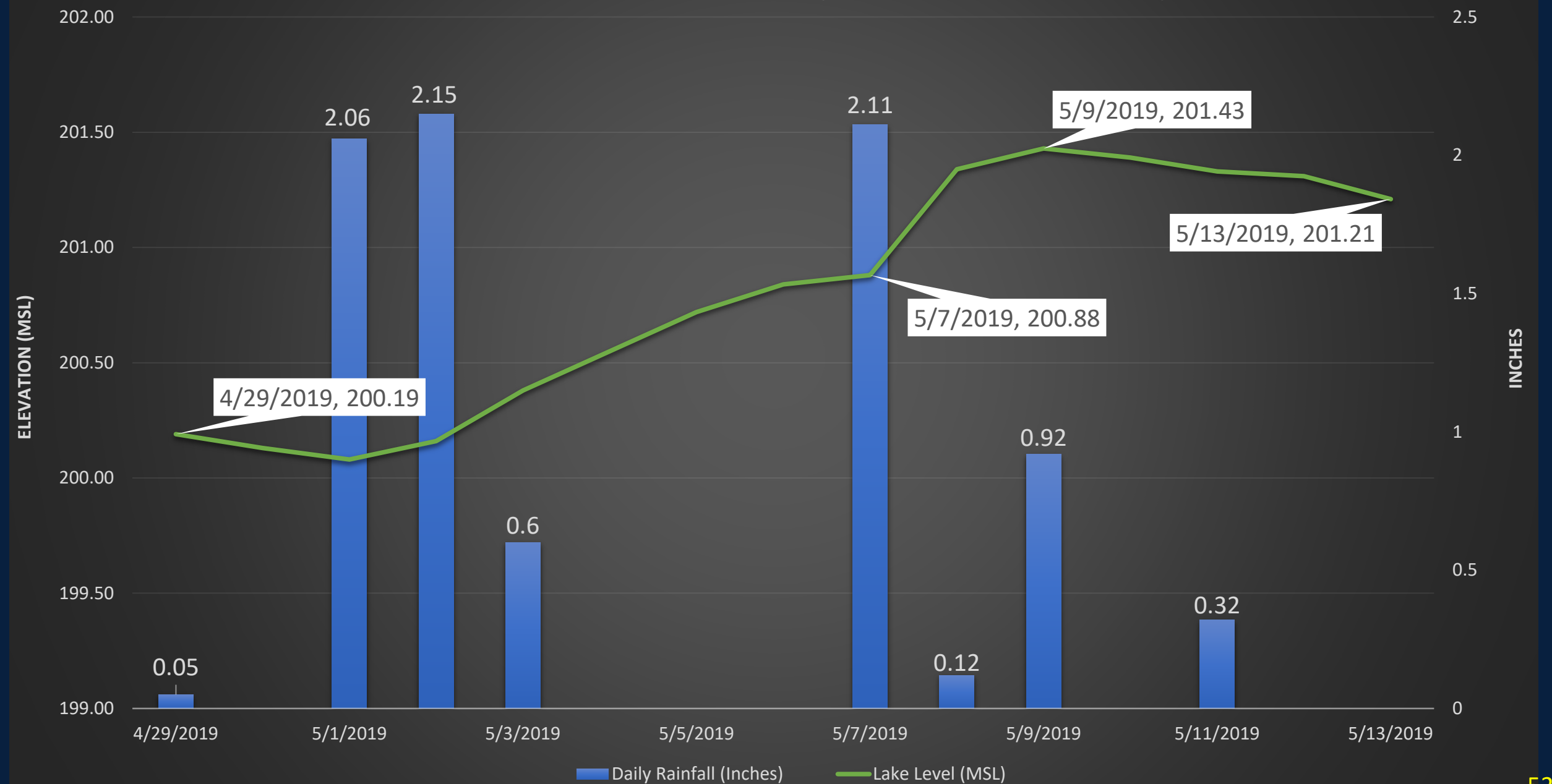


# Spring 2019 Summary

- The lake level was at conservation pool elevation prior to April 1<sup>st</sup>
- Seasonal releases ended on May 24, 2019
- 49,069 acre-feet of Houston's water was released
- Did not return to conservation pool between end of May and August 1<sup>st</sup>

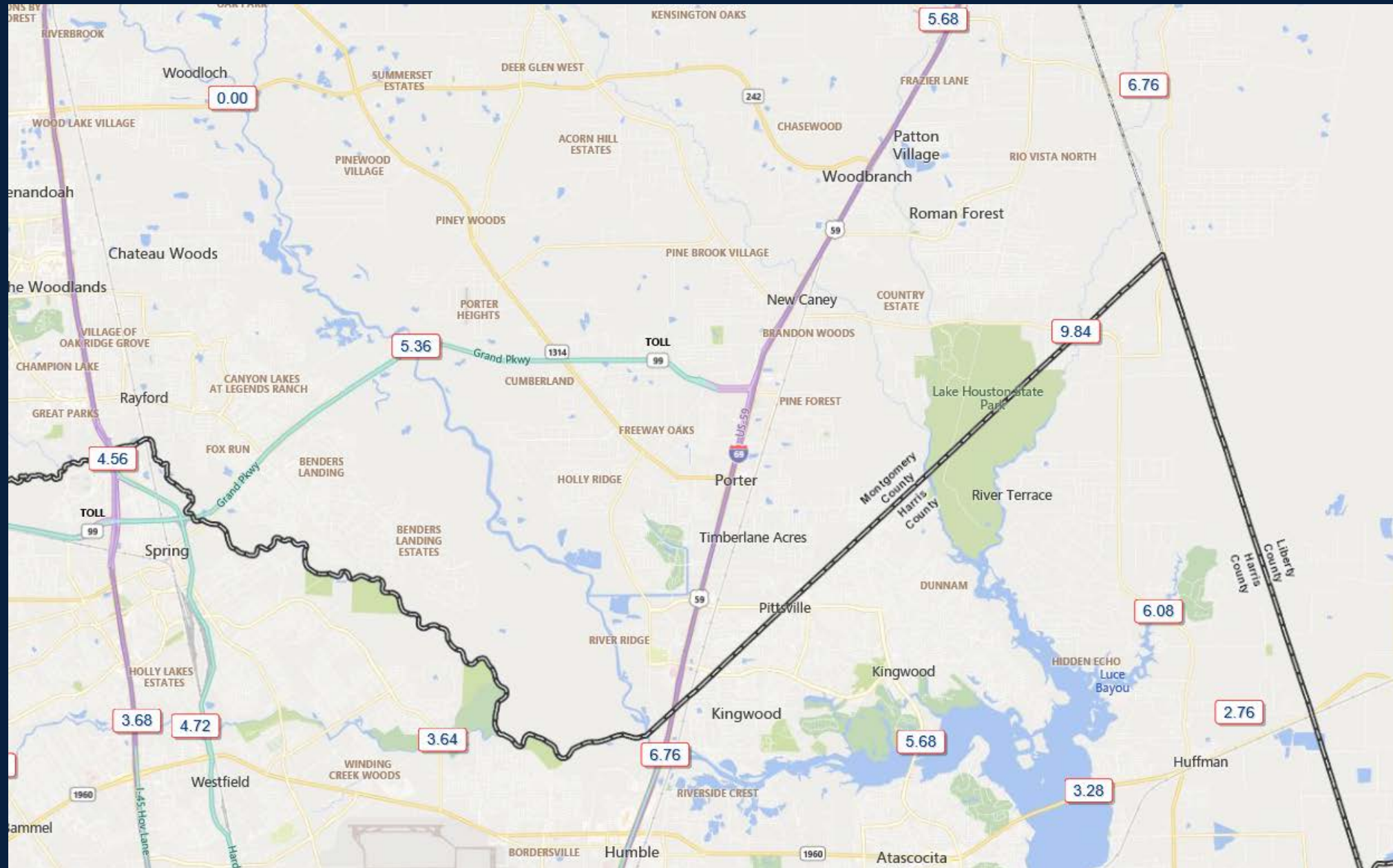
MAY 2019 EVENT

DAILY RAINFALL AND LAKE LEVEL (APRIL 29 - MAY 13, 2019)



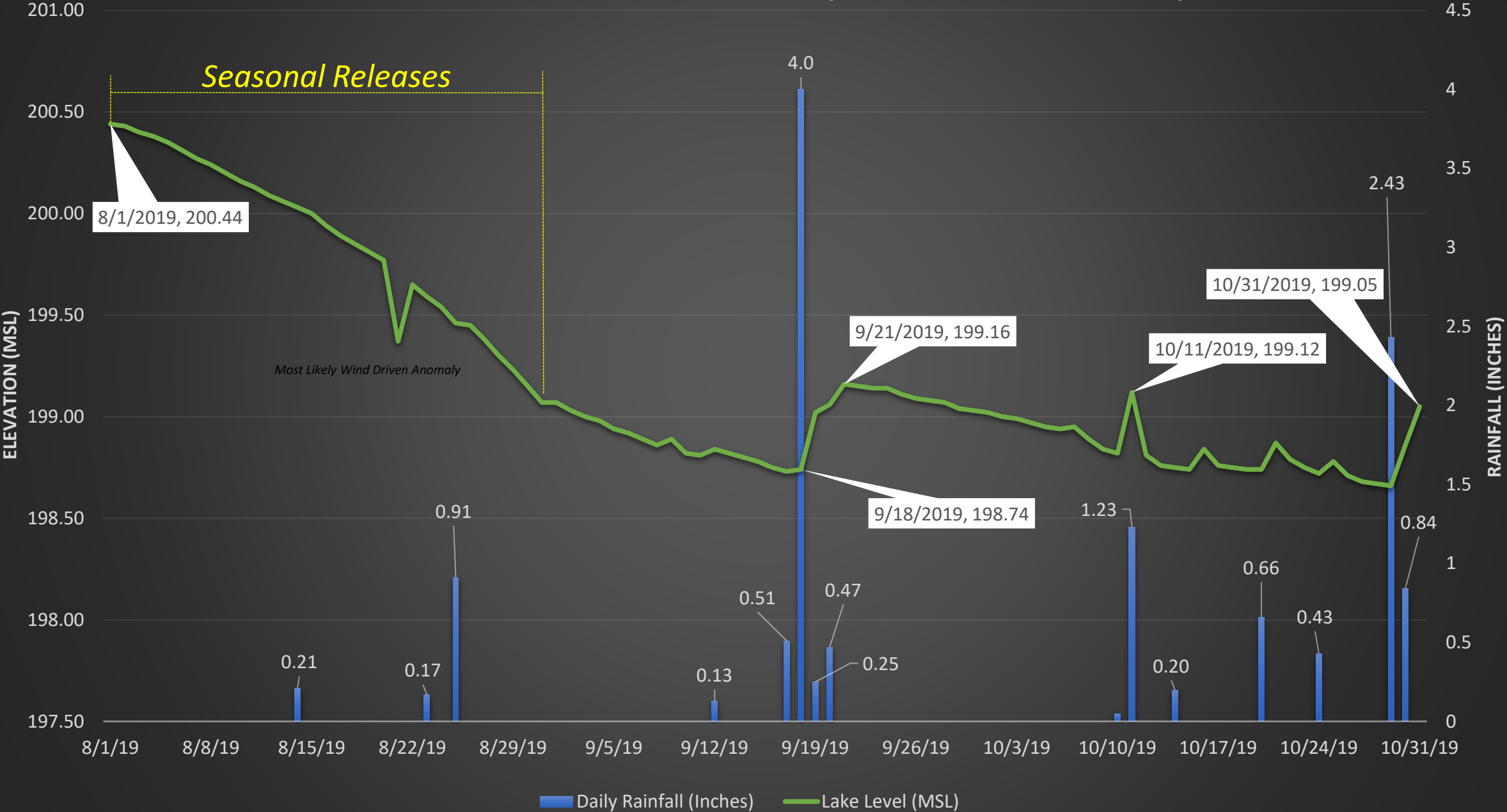


# May 2019 Event



# FALL 2019 SEASONAL LAKE RELEASE

## DAILY RAINFALL AND LAKE LEVEL (AUGUST-OCTOBER 2019)

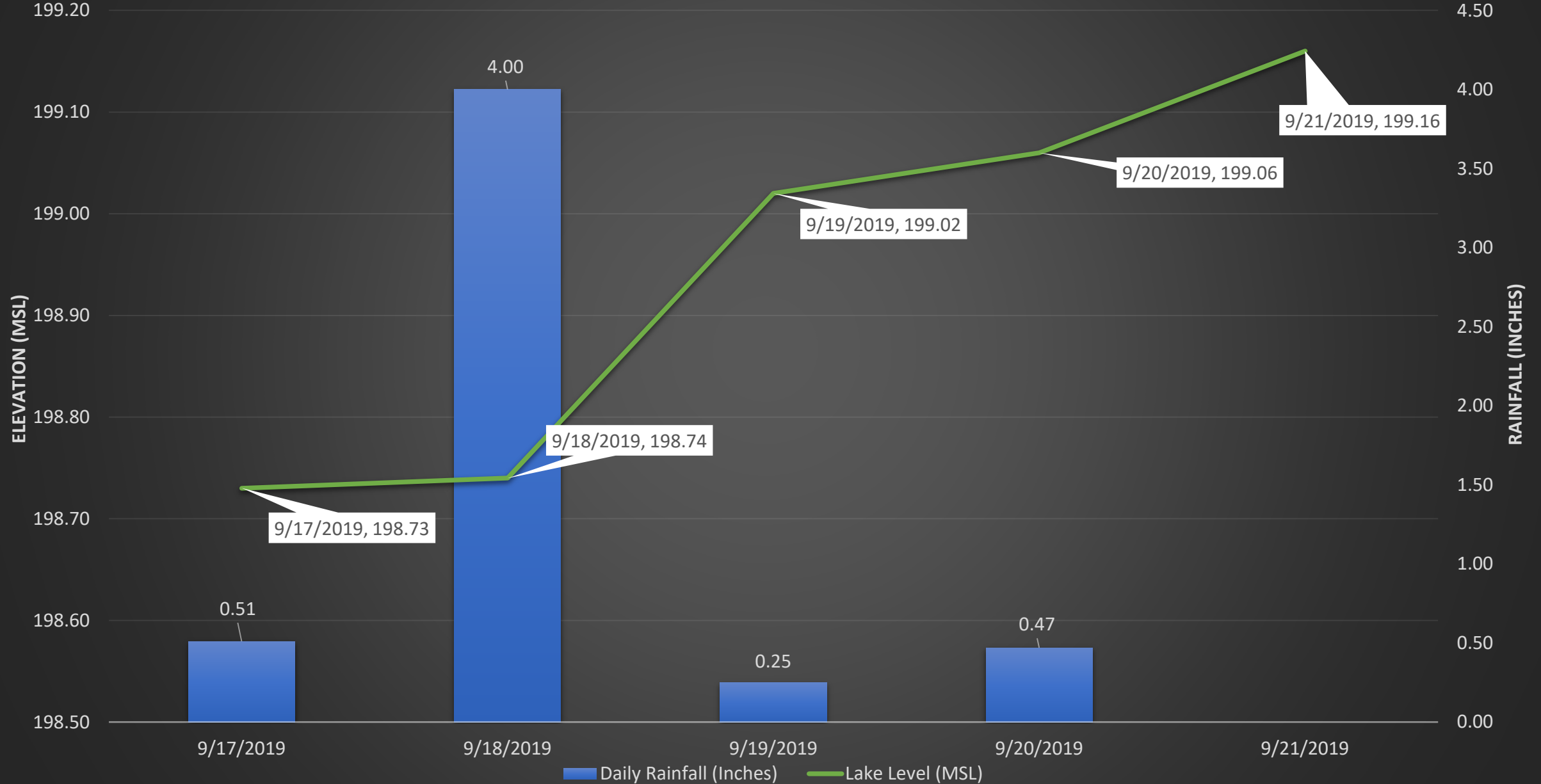


# Fall 2019

- The lake level was 0.56 feet below conservation pool prior to August 1<sup>st</sup> due to external losses (i.e. evaporation, customer sales)
- Seasonal releases ended on August 31, 2019
- 17,098 acre-feet of Houston's water was released
- Lake Conroe has not been at, or above, elevation 201.00 ft msl since May 9, 2019

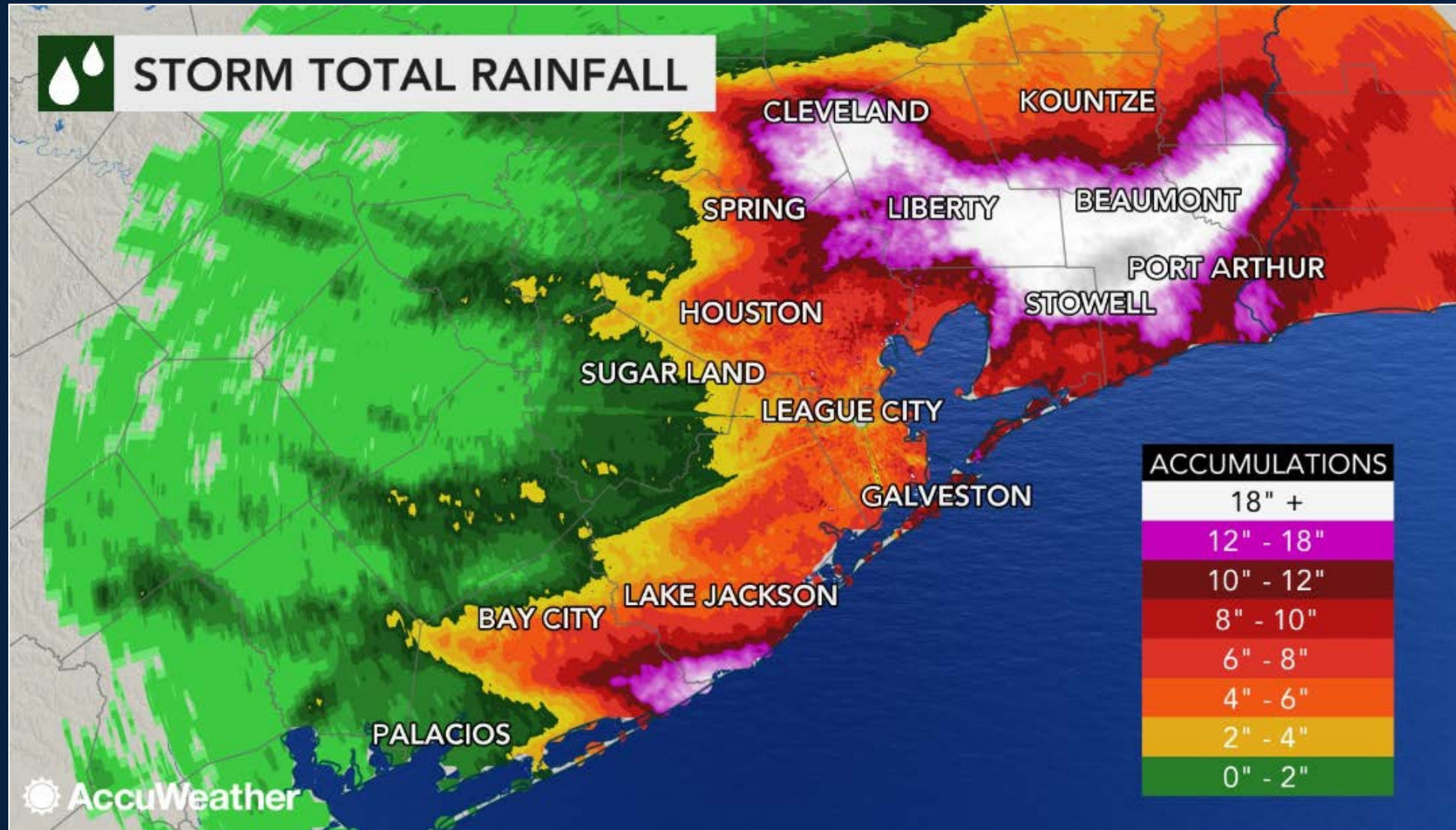
# TROPICAL STORM IMELDA

## DAILY RAINFALL AND LAKE LEVEL (SEPTEMBER 17-21, 2019)



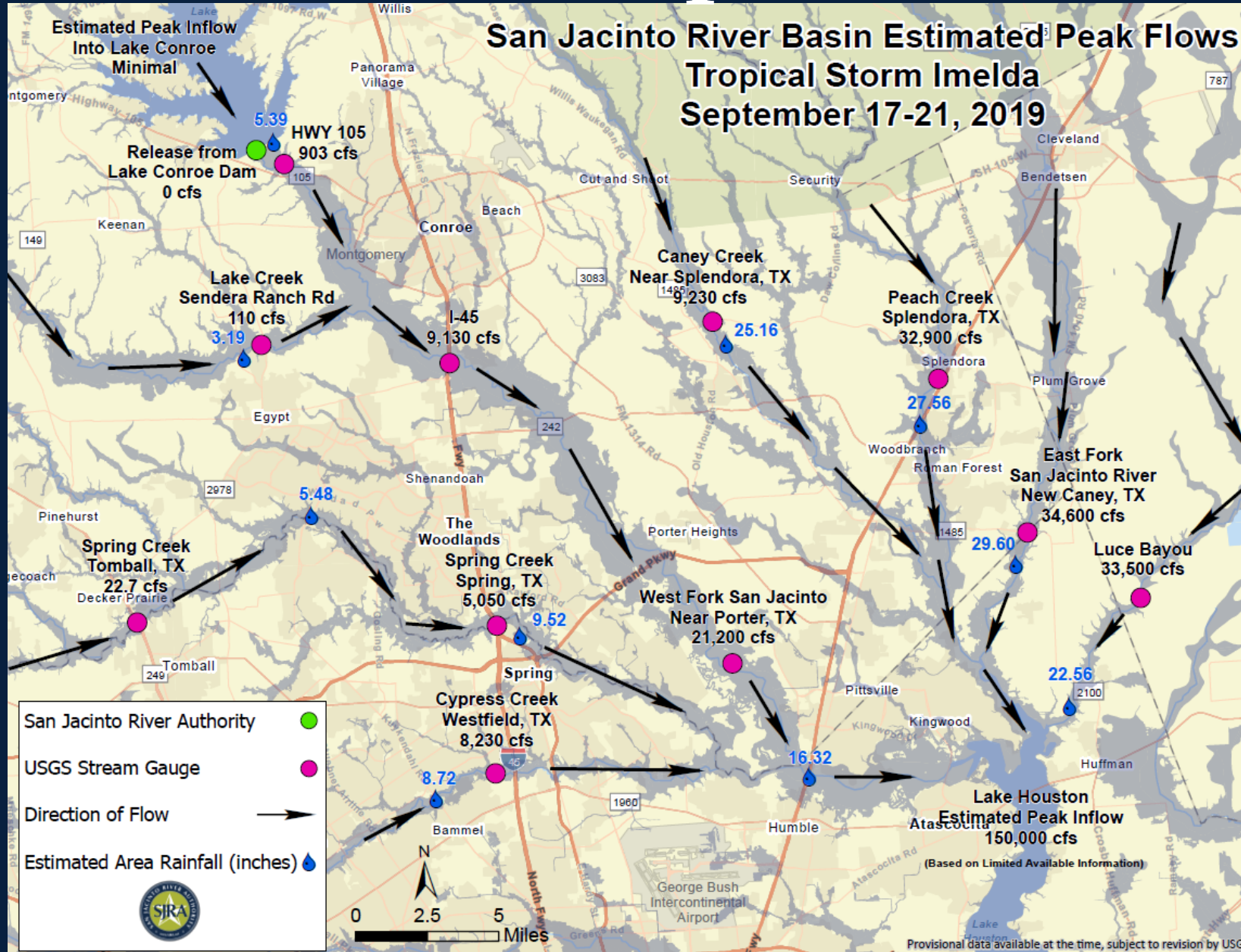


# September 2019 – Tropical Storm Imelda





# September 2019 – Tropical Storm Imelda



# Rainfall in late 2019

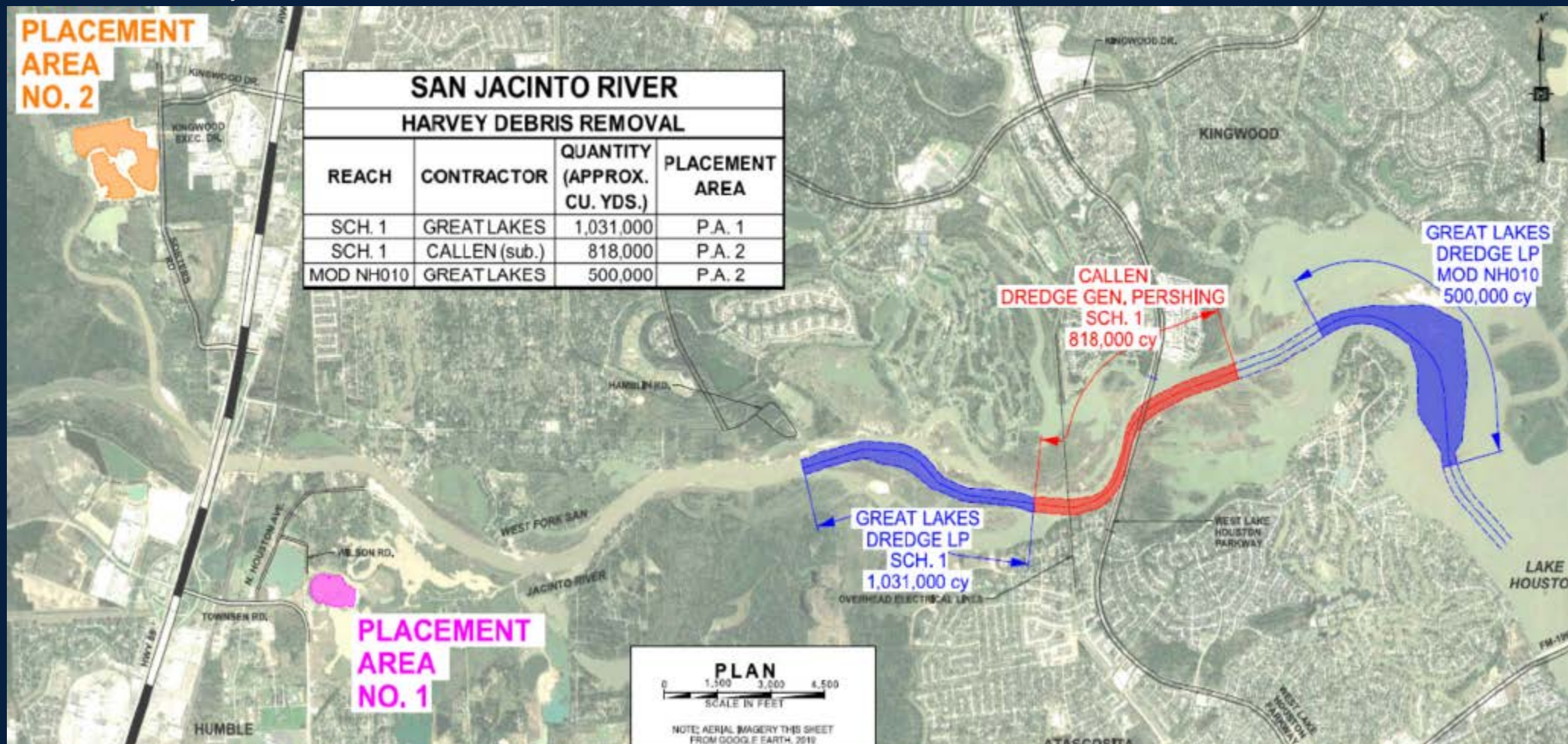
Month	1973-2019 Rainfall Averages (Inches)	2019 Observed Rainfall (Inches)	Rainfall Difference (Inches)
July	3.47	5.72	2.25
August	4.11	1.29	-2.82
September	4.34	1.76	-2.58
October	4.48	5.84	1.36
November	4.05	2.30	-1.75
December	3.55	1.20	-2.35

\* During the last 6-months of 2019 Lake Conroe received 5.89 inches less rainfall than normal.



# San Jacinto River Dredging

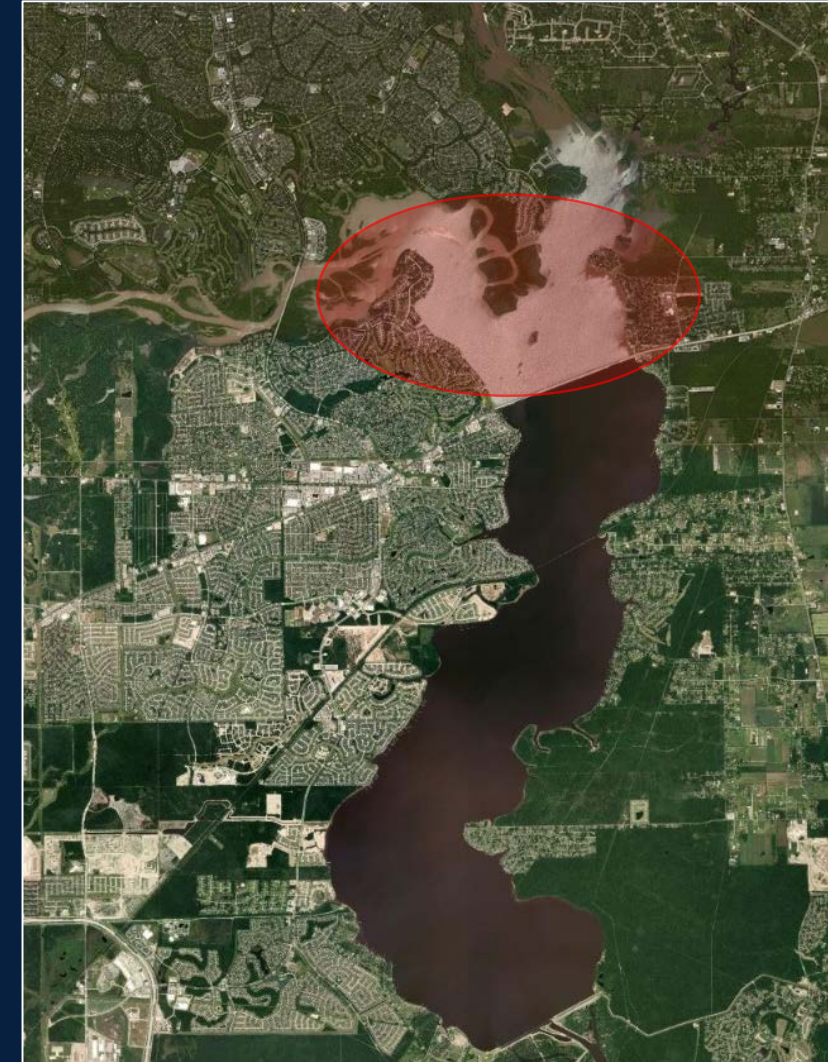
- Dredging completed on August 30, 2019. Original contract removed approximately 1.8 million cubic yards (CY). Contract modification removed additional 500,000 CY from mouth bar in Lake Houston area.





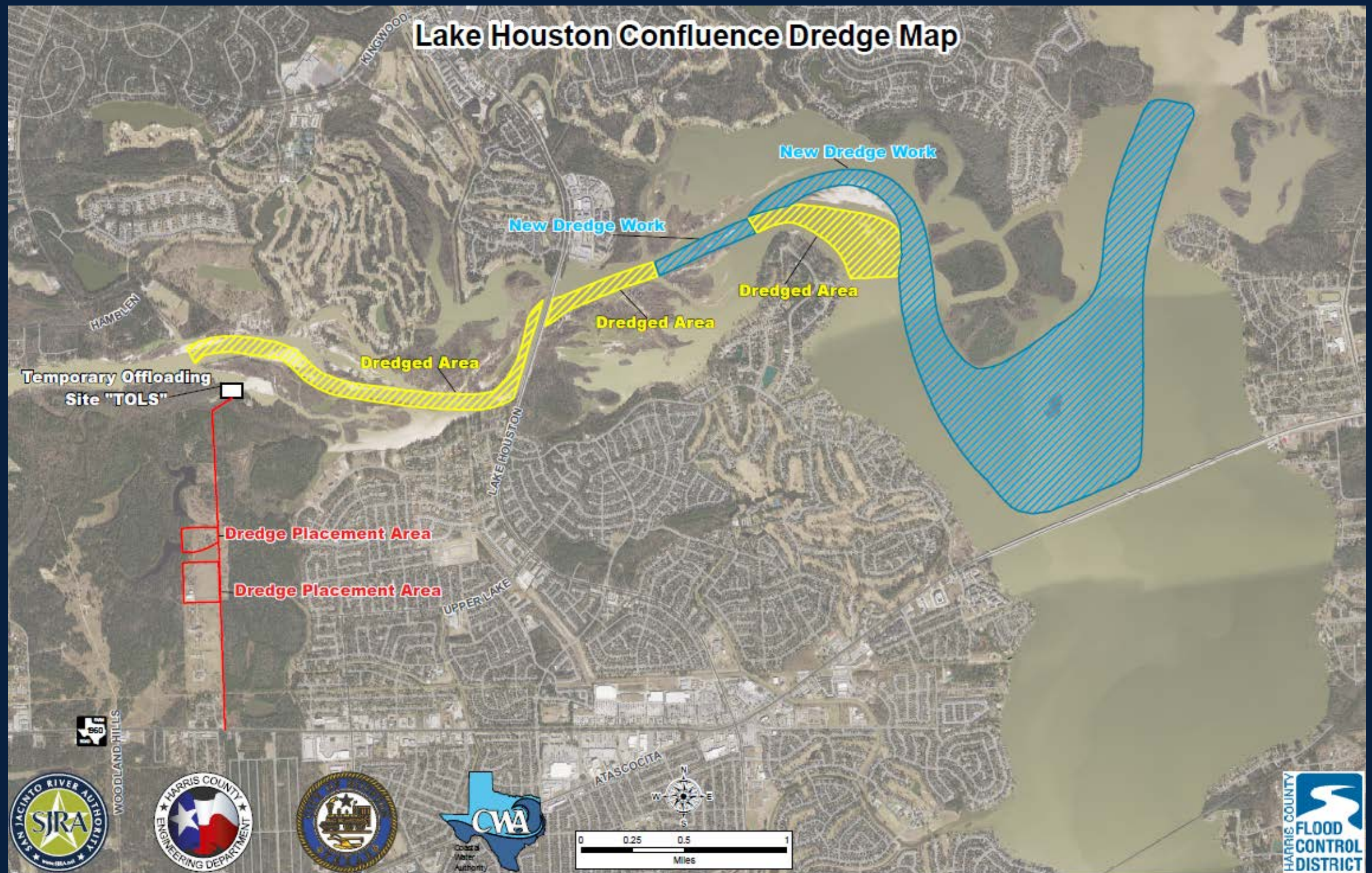
# San Jacinto River Dredging

- The CoH issued a Notice to Proceed for additional dredging in Lake Houston near WFSJR the week of January 6, 2020
- The total cost of this phase of the dredging effort is \$40 million
  - City of Houston
  - Harris County Flood Control District
  - Texas Water Development Board
- Expected to remove additional 400,000 CY of material over the next 24 months





# Lake Houston Confluence Dredge Map





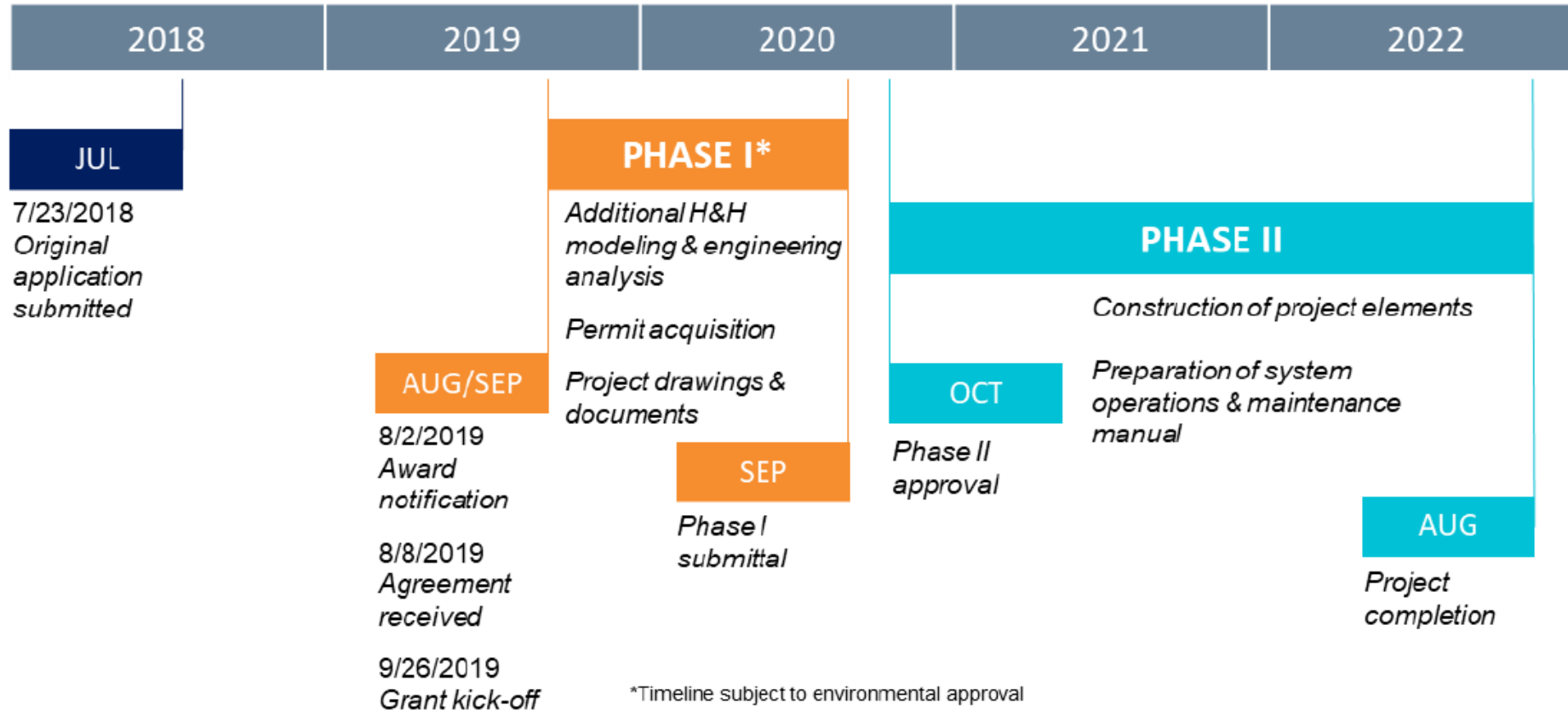
# Lake Houston Spillway



# Gates on Lake Houston Dam

The Lake Houston Dam Spillway project, located on Lake Houston along the San Jacinto River, will increase outflow capacity of the Lake Houston Dam. The project proposes rehabilitating existing bays that do not currently have gated structures with 10 additional gates. This will allow for rapid decrease of water levels in Lake Houston in advance of storm events to prevent or reduce upstream flooding.

	Total Cost	Federal Share	Local Share
<b>Lake Houston Dam Spillway</b>	\$47,170,953	\$35,378,215	\$11,792,738
<b>Phase I: Design</b>	\$4,375,199	\$3,281,399	\$1,093,800
<b>Phase II: Construction</b>	\$42,795,754	\$32,096,816	\$10,698,938



# Other Mitigation Projects

The following mitigation projects were included in the Harris County Bond Election and may have a direct benefit on the Lake Houston Area:

- Multiple Channel Maintenance, Conveyance Improvements, and/or Restoration Projects
- Multiple Detention Basin Construction/Improvements Projects
- Multiple Subdivision and General Drainage Improvements Projects
- Multiple Right-of-Way Acquisition and Floodplain Preservation Projects
- Spring Creek Reservoir Construction
- Countywide Storm Repairs

# San Jacinto Regional Watershed Master Drainage Plan

- Develop H&H models that will help predict flood risks in the study areas
- Evaluate flood mitigation measures
- Evaluate sediment management strategies
- Analyze existing watershed conditions
- Identify flood mitigation projects that will potentially reduce the flood risk in the study area
- Study Goal: to identify vulnerabilities to flood hazards and develop a comprehensive flood mitigation plan

## **3,000 SQUARE MILES OF STUDY AREA**

The watershed for the streams to be studied covers an expanse of nearly 3,000 square miles, located in seven different counties:

- Grimes County
- Harris County
- Liberty County
- Montgomery County
- San Jacinto County
- Walker County
- Waller County

The study includes approximately 535 miles of stream, including West Fork San Jacinto River, East Fork San Jacinto River, San Jacinto River, Lake Creek, Cypress Creek, Little Cypress Creek, Spring Creek, Willow Creek, Caney Creek, Peach Creek, Luce Bayou, Tarkington Bayou, and Jackson Bayou.



# Schedule

- Staff will continue to coordinate with the City of Houston on their plans related to the release of the city's water from Lake Conroe
- The SJRA Board will further consider this initiative on February 20th at 6:00pm at the Lone Star Convention Center



# Online Resources

- KnowYourWatershed.com
- SanJacinto.onerain.com
- HarrisCountyfws.org
- SanJacStudy.org

