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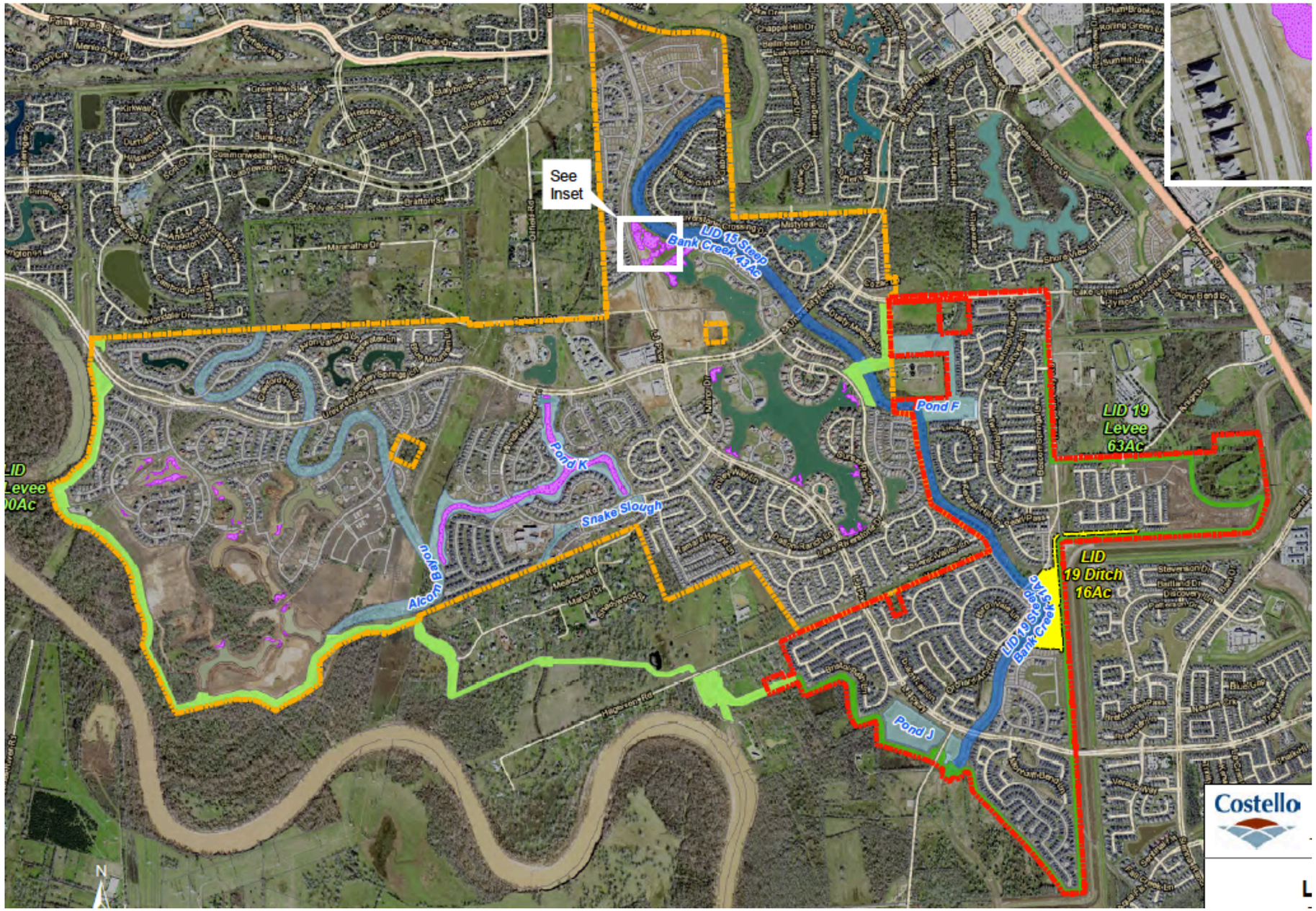
RIVERSTONE

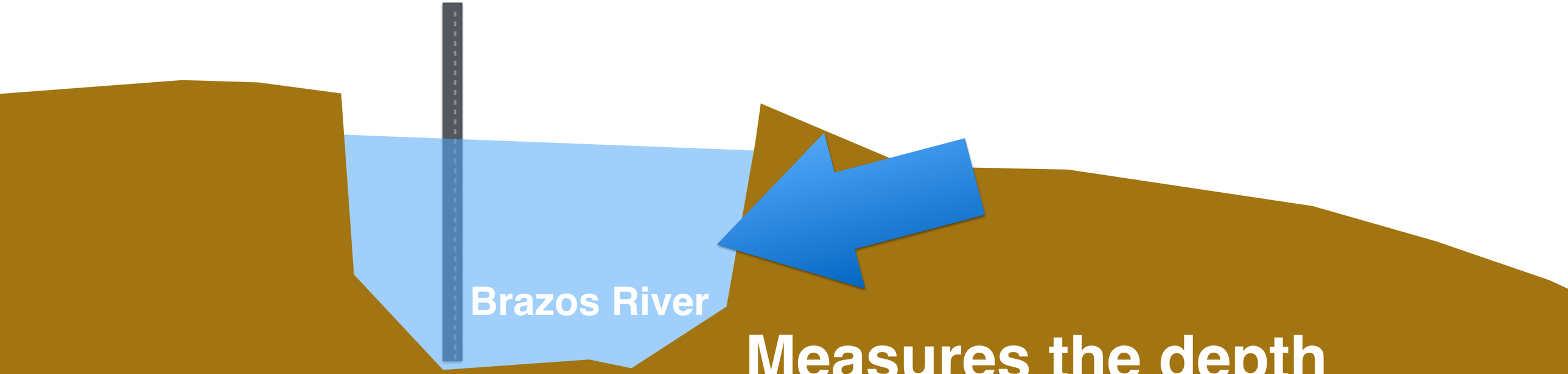


Today we will discuss:

- Flooding Causes
- Quick Recap of Harvey
- Introduce the Richmond Gauge
- Explain your levee
- “Riverstone’s Flood Formula”

Flooding 101: Causes

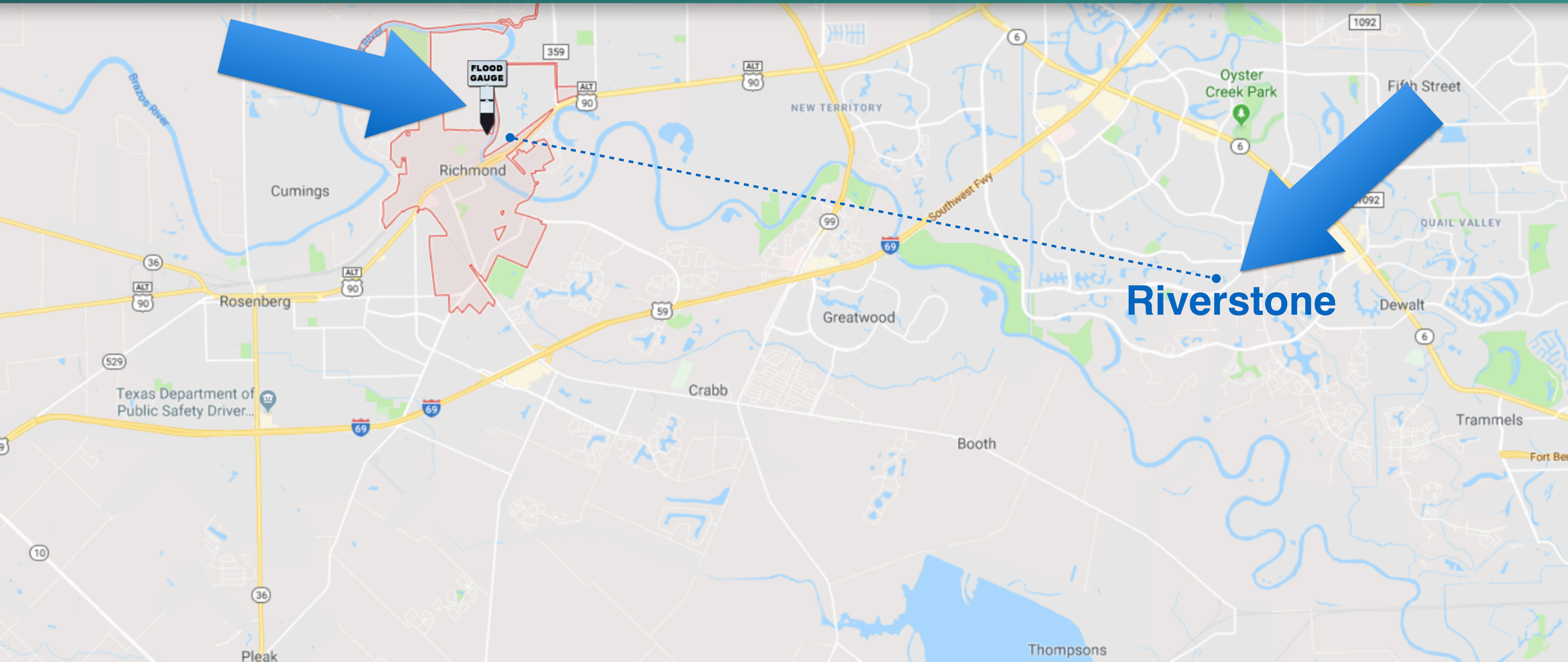
The Richmond Gauge



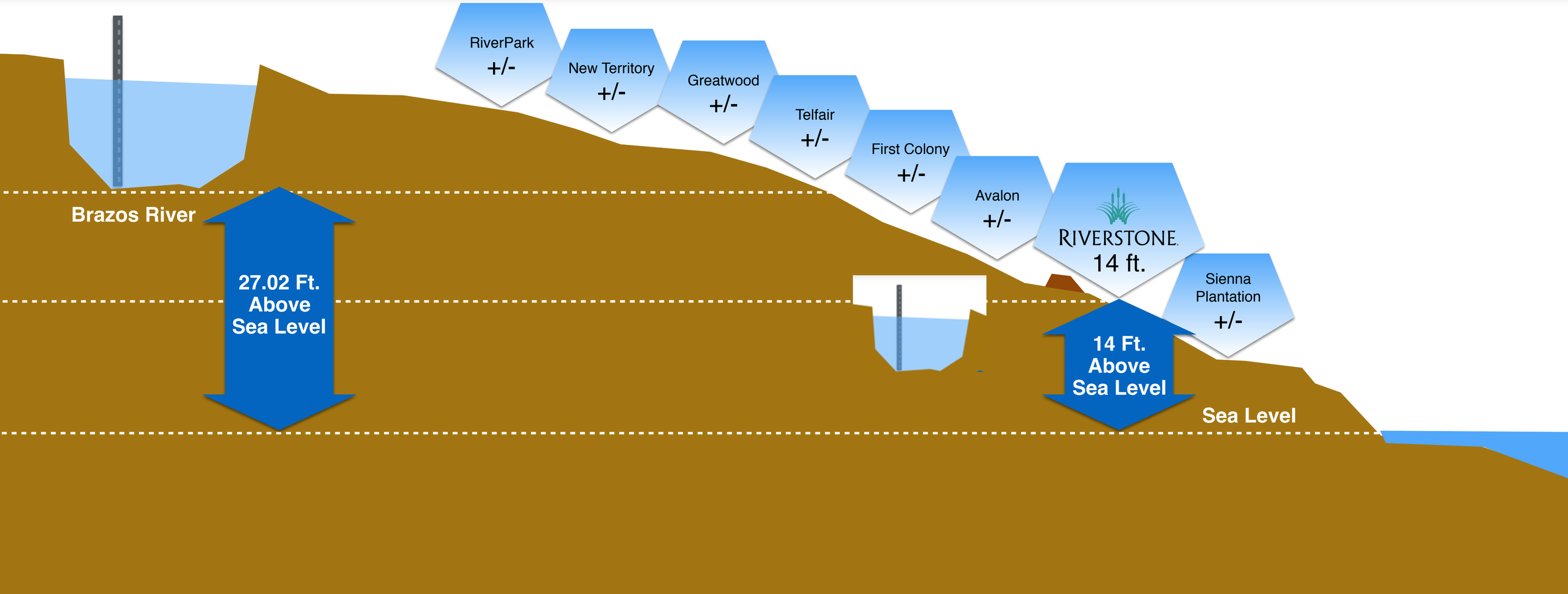
Measures the depth of the Brazos River

Richmond Gauge Location

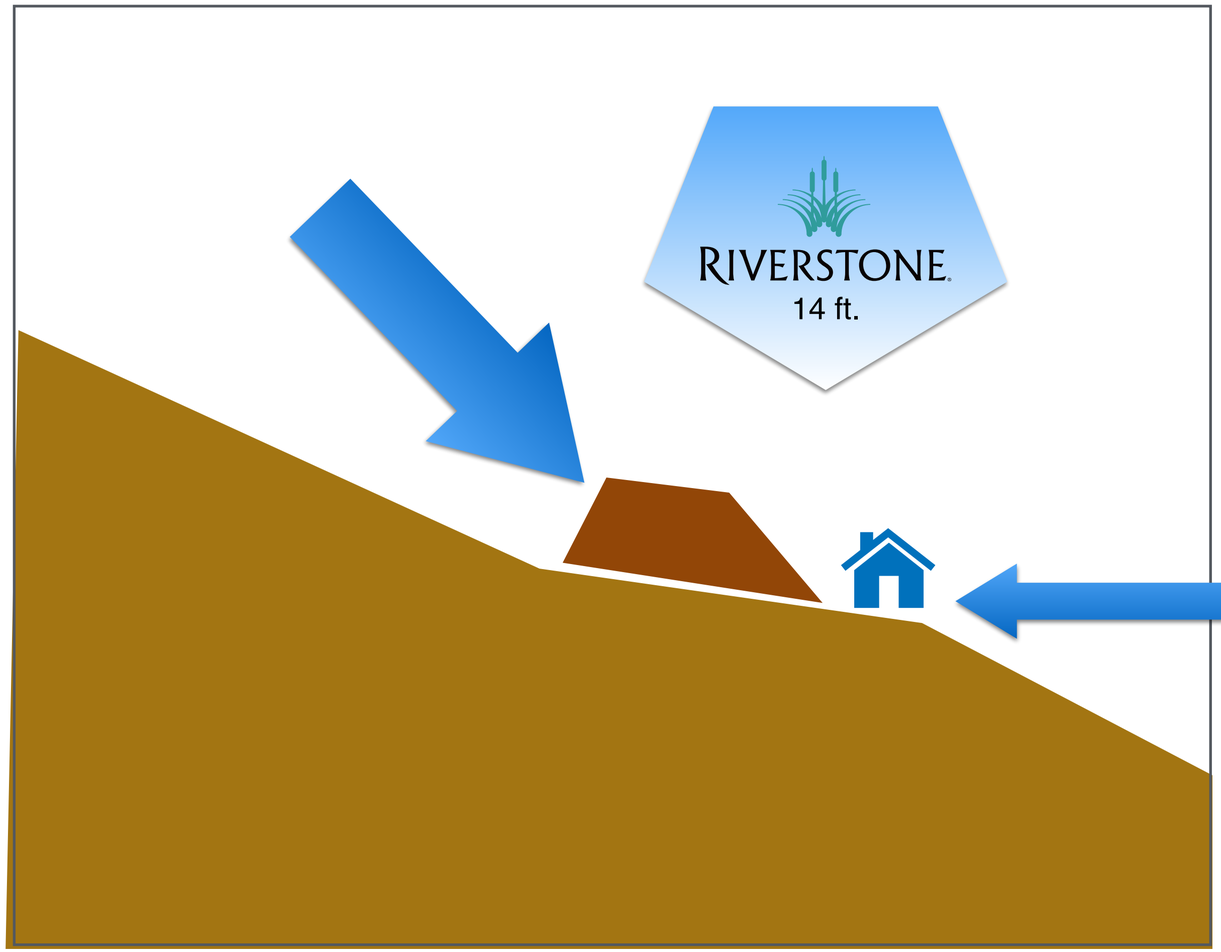
Location Relative to Riverstone



Brazos River Bottom Elevation Relative to Riverstone @ Alcorn Outfall



Riverstone's Levee @ Alcorn Outfall



Height of 75 ft.

Between the river and Riverstone

Slab Elevation @MSL

Riverstone Flood Formula @ Alcorn Outfall

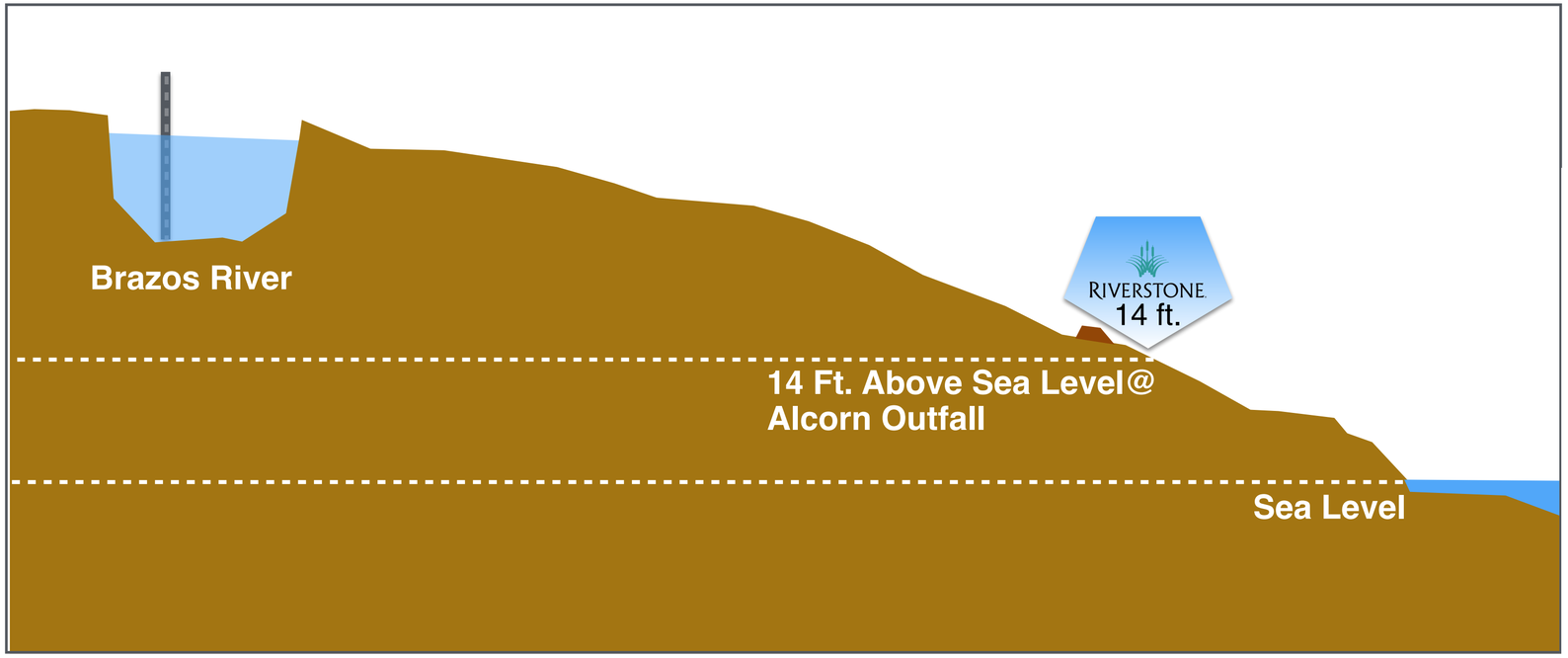
Brazos River Water Level
X ft.

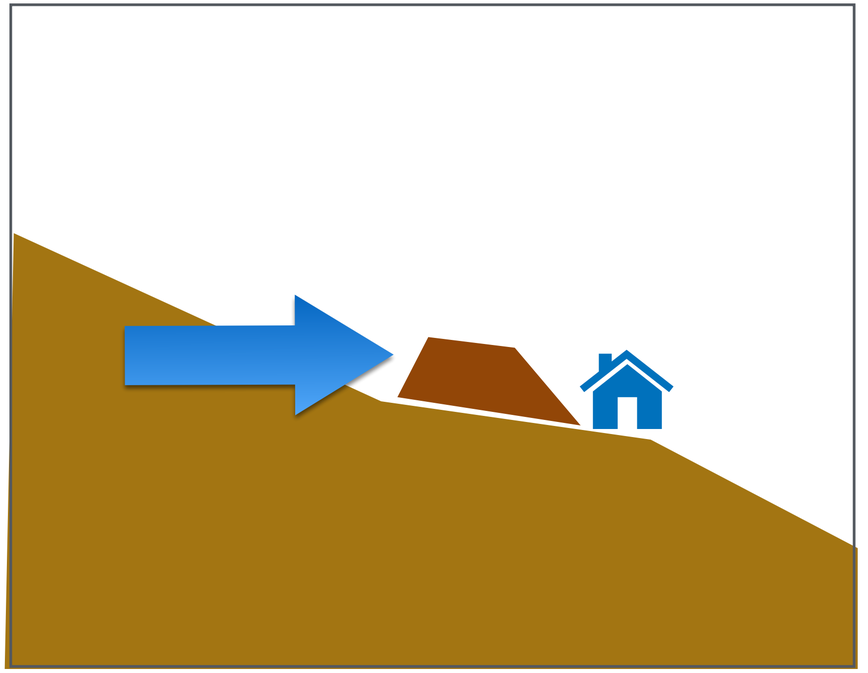
+

Riverstone Sea Level
14 ft.

< / >

Levee Height
75 ft.





During Harvey

Brazos River Reached Record Level of 55.2 ft.

Harvey's Formula Numbers

Brazos River Water Level		Riverstone @ Alcorn Outfall Sea Level				Riverstone Levee
55.2 ft.	+	14 ft.	=	69.2 ft.	<	75 ft.

Riverstone Levee held strong!

With 6 ft. of freeboard

Freeboard is a factor of safety usually expressed in feet above a flood level for purposes of floodplain management.

Riverstone @ Alcorn Outfall Flood Formula

Brazos River Water Level
X ft.

+

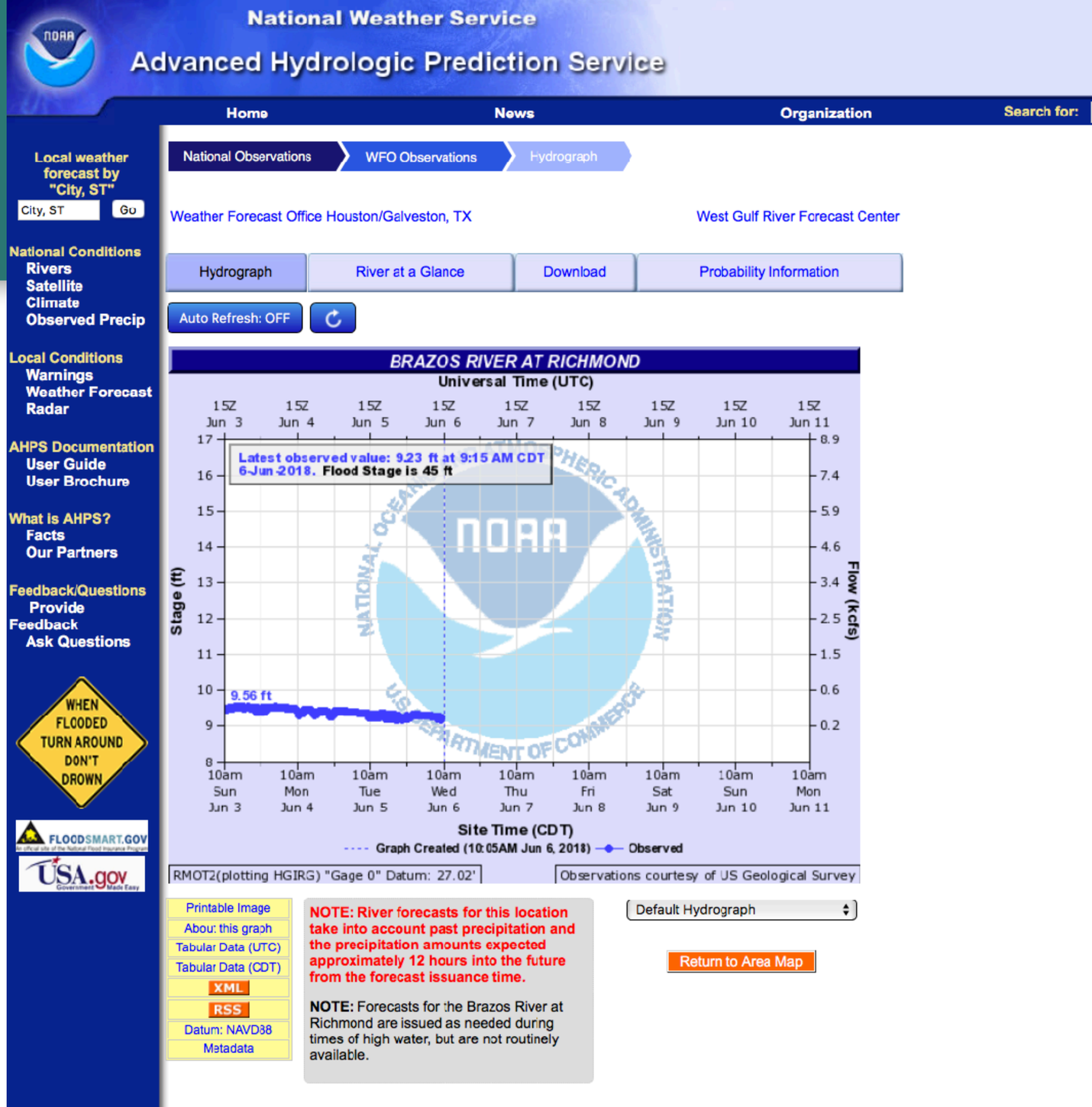
Riverstone Sea Level
14 ft.

< / >

Levee Height
75 ft.

Practice the math:

Recent Brazos River depth: 9.23 ft.



Fill in the formula:

Brazos River Water Level
9.23 ft.

+

Riverstone Sea Level
14 ft.

< / >

Levee Height
75 ft.

23.23 ft. < 75 ft.
51.77 ft. of freeboard

Remember your formula

Riverstone @ Alcorn Outfall Flood Formula:

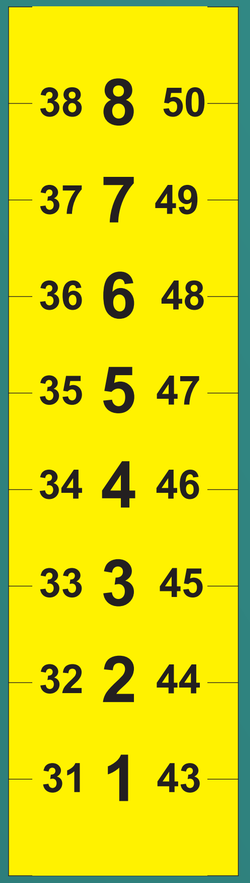
Brazos River Water Level
X ft.

+

Riverstone Sea Level
14 ft.

< / >

Levee Height
75 ft.



Riverstone Steep Bank Creek

Pump Station


Power
Generation

Riverstone Alcorn Bayou

Pump Station


CATERPILLAR
CAT

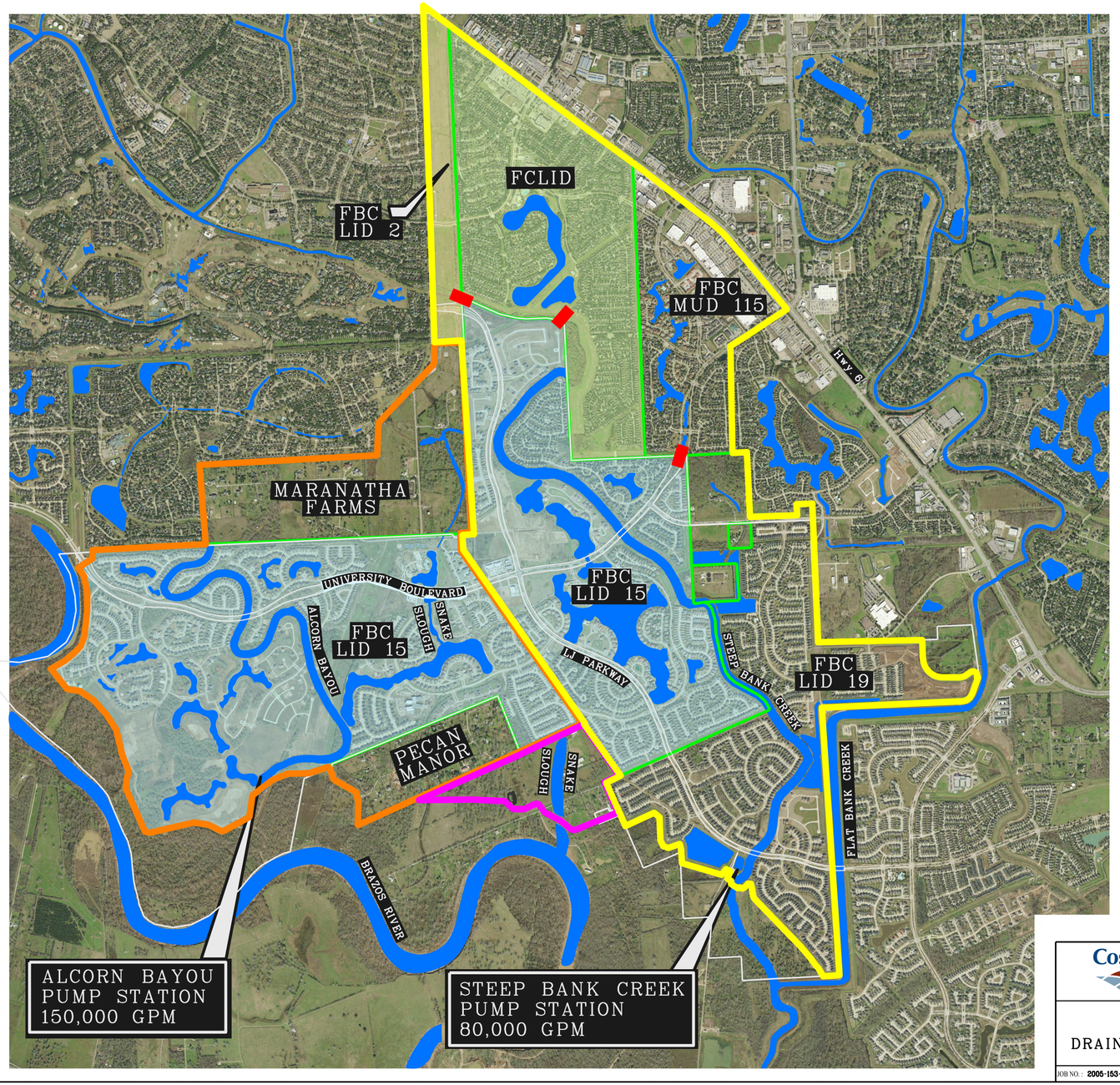

RIVERSTONE
FLOOD RESPONSE UNIT
Fort Bend County LID #15


Texas Custom Trailers
Texas Custom Trailers
Texas Custom Trailers
Texas Custom Trailers

Thank you for your time.

RIVERSTONE

LMS
Levee Management Services, LLC



N

LEGEND

- ALCORN BAYOU DRAINAGE AREA
- SNAKE SLOUGH DRAINAGE AREA
- STEEP BANK CREEK DRAINAGE AREA
- STEEP BANK CREEK OUTFALL
- DETENTION FACILITIES

Costello
Engineering and Surveying
9990 Richmond Avenue, Suite 450 N
Houston, Texas 77042
(713) 783-7788 (713) 783-3580, Fax
TBPE FIRM REG. No. 280
TBPLS FIRM REG. No. 100486

RIVERSTONE
DRAINAGE AREA EXHIBIT

JOB NO.: 2005-153-100	DATE: SEPT. 2017	EXHIBIT NO.: 1 of 1

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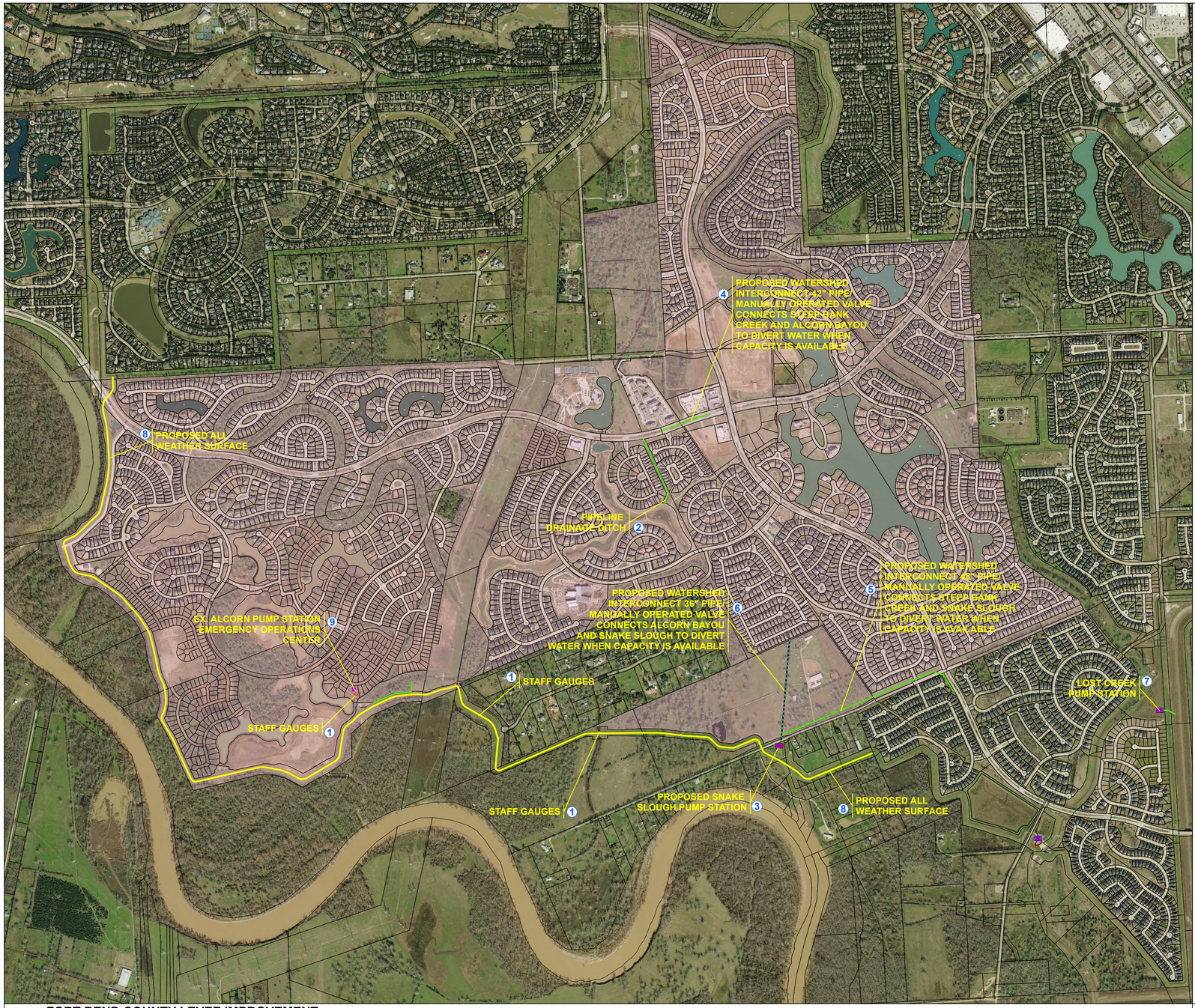

Project 1: **Staff Gauges at District Outfalls**

Scope/Benefit:	Allow for direct measurement of water levels inside and outside the levee and compare those elevations to Mean Sea Level, the River Gauge at Richmond and water depth.
Total Cost:	$20,500
FBCLID 19 Share of Cost:	$4,500 : Steep Bank Creek Outfall is shared
FBCLID 15 Share of Cost:	$16,000
Basis of Cost Share:	The only outfall staff gauge that is shared is the one located at Steep Bank Creek. The other staff gauges are 100% LID 15. The Steep Bank Creek staff gauge is shared based on the proportion of the District in the watershed.
Estimated Schedule:	The staff gauges will be installed in the within the first two weeks of June.
Status of Project:	Staff gauges have been ordered and will be installed once they arrive.

Project 2: **Pipeline Drainage Ditch (East of Prestwick)**

Scope/Benefit:	Provides a drainage path for water that could flow over University Boulevard to be conveyed to the detention pond system between Prestwick and Providence
Construction Cost:	$408,610
FBCLID 15 Share of Cost:	100% ($408,610)
Status of Project:	Project is complete except for establishing grass.

Project 3: **Proposed Snake Slough Pump Station (aka Hagerson Road Pump Station)**

Scope/Benefit:	Provides a storm water pump station for the Snake Slough watershed. Oversizing of this pump station is proposed to provide additional capacity to the Snake Slough watershed if necessary and provide redundancy to both the Snake Slough pump station and the Steep Bank Creek pump station should an event cripple one of those facilities. The pump station would be sized for 30,000 gallons per minute without FBCLID 19 participation, but with their participation, it will be sized for 50,000 gallons per minute.
Total Cost:	$2,700,000
FBCLID 19 Share of Cost:	40% ($1,080,000)
FBCLID 15 Share of Cost:	60% ($1,620,000)
Basis of Cost Share:	The cost share is based on the oversizing of the pump station available for FBCLID 19 flows. The outfall for the pump station is an existing 5'x5' box culvert under the levee. This box culvert is the limiting factor for the pump station size.
Estimated Schedule:	Construction will take approximately 9 months to complete once started and should be complete summer 2019.
Status of Project:	Engineering design is nearing completion for City/County review and approval.

Project 4: **Watershed Interconnect on University Boulevard**

Scope/Benefit:	Connects the Steep Bank Creek watershed to the Alcorn Bayou watershed with an underground storm sewer line that is normally valved closed. This pipe can provide drainage relief to either watershed in the event that one system has surplus capacity. It also provides redundancy to the Alcorn Bayou pump station and the Steep Bank Creek pump station should an event cripple one of those facilities.
Total Cost:	$590,000
FBCLID 19 Share of Cost:	50% ($295,000)
FBCLID 15 Share of Cost:	50% ($295,000)
Basis of Cost Share:	The facility provides equal benefit to each of the watersheds and associated pump stations.
Estimated Schedule:	Construction will take approximately 60 days to complete once started and should be complete fall 2018.
Status of Project:	Construction plans are under review by City/County.

Project 5: **Proposed Watershed Interconnect on Hagerson Road**

Scope/Benefit:	Connects the Steep Bank Creek watershed to the Snake Slough watershed with an underground storm sewer line that is normally valved closed. This pipe can provide drainage relief to either watershed in the event that one system has surplus capacity. It also provides redundancy to the Snake Slough pump station and the Steep Bank Creek pump station should an event cripple one of those facilities.
Total Cost:	$1,230,000
FBCLID 19 Share of Cost:	38% ($467,000)
FBCLID 15 Share of Cost:	38% ($467,000)
FBCMUD 149 Share of Cost:	24% ($295,000)
Basis of Cost Share:	The storm sewer located along Hagerson Road would have been built to service that road by FBCMUD 149. The associated oversizing of that storm sewer line and its extension is shared equally by FBCLID 19 and FBCLID 15 as it provides equal benefit to the associated pump stations and watersheds.
Estimated Schedule:	Construction will take approximately 6 months to complete once started and should be complete early in 2019.
Status of Project:	Engineering design is nearing completion for City/County review and approval.

Project 6: **Proposed Watershed Interconnect South of Auburn Manor**

Scope/Benefit:	Connects the Alcorn Bayou watershed to the Snake Slough watershed with an underground storm sewer line that is normally valved closed. This pipe can provide drainage relief to either watershed in the event that one system has surplus capacity. It also provides redundancy to the Snake Slough pump station and the Alcorn Bayou pump station should an event cripple one of those facilities.
Total Cost:	$75,000
FBCLID 15 Share of Cost:	100% ($75,000)
Estimated Schedule:	Construction will occur during the development of the Hagerson Road tract. It is anticipated that the connection will be constructed in phase 2 of the development (2019).
Status of Project:	Project is in planning phase.

Project 7: **Future Lost Creek Pump Station**

Scope/Benefit:	Increases the overall pumping capacity within the Steep Bank Creek watershed to remove 10" of rainfall from the entire watershed on a daily basis.
Total Cost:	$14,500,000
FBCLID 19 Share of Cost:	27.4% ($3,973,000)
FBCLID 15 Share of Cost:	34.1% ($4,945,000)
FBCMUD 115 Share of Cost:	12.0% ($1,740,000)
FCLID Share of Cost:	22.4% ($3,248,000)
FBCLID 2 Share of Cost:	4.1% ($595,000)
Basis of Cost Share:	Prorated based on the area of the District located within the Steep Bank Creek watershed.
Estimated Schedule:	TBD (2 years to complete construction once design is started)
Status of Project:	Planning phase and working on getting commitments from other Districts.

Project 8: **Future All Weather Surface on Levee Top**

Scope/Benefit:	Provides the District's consultants a path, regardless of weather, to monitor and perform inspections during river events. Additionally, it provides the District's operator to mobilize equipment around the levee and outfalls in the event of street flooding.
Total Cost:	$1,500,000
FBCLID 19 Share of Cost:	100% ($1,500,000)
Estimated Schedule:	TBD (likely to be completed in phases once authorized and funded)
Status of Project:	Planning phase.

Project 9: **Future Emergency Operations Center During River Events (Located at Alcorn Bayou Pump Station)**

Scope/Benefit:	Provides the District's consultants a central location adjacent to the District to monitor the pump station(s), monitor river levels, and provide inspections from during a river event. It also provides a place for rest and a shower for employees who may be working extreme hours during a river event (they may be unable to go home during the event). This would be located at the Alcorn Bayou pump station site due to its close proximity to water and sewer facilities.
Total Cost:	$600,000
FBCLID 19 Share of Cost:	50% ($300,000)
FBCLID 15 Share of Cost:	50% ($300,000)
Estimated Schedule:	TBD (Not yet authorized)
Status of Project:	Planning phase.

FORT BEND COUNTY LEVEE IMPROVEMENT DISTRICT NO.15

DRAINAGE PROJECTS

0 250 500 1,000 Feet

1 in = 500 ft

N W E S

Legend

- Bunk House
- River Gauge
- Pump Station
- Interconnect
- Pipe
- Fort Bend County LID No.15 Levee
- Parcels
- Fort Bend County LID No. 15 Area

Costello, Inc.
Engineering and Surveying
Texas Board of Professional Engineers Firm Registration No. 280

DATE: JUNE 2018 | JOB NO. 1998030-100 | BY CMP

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