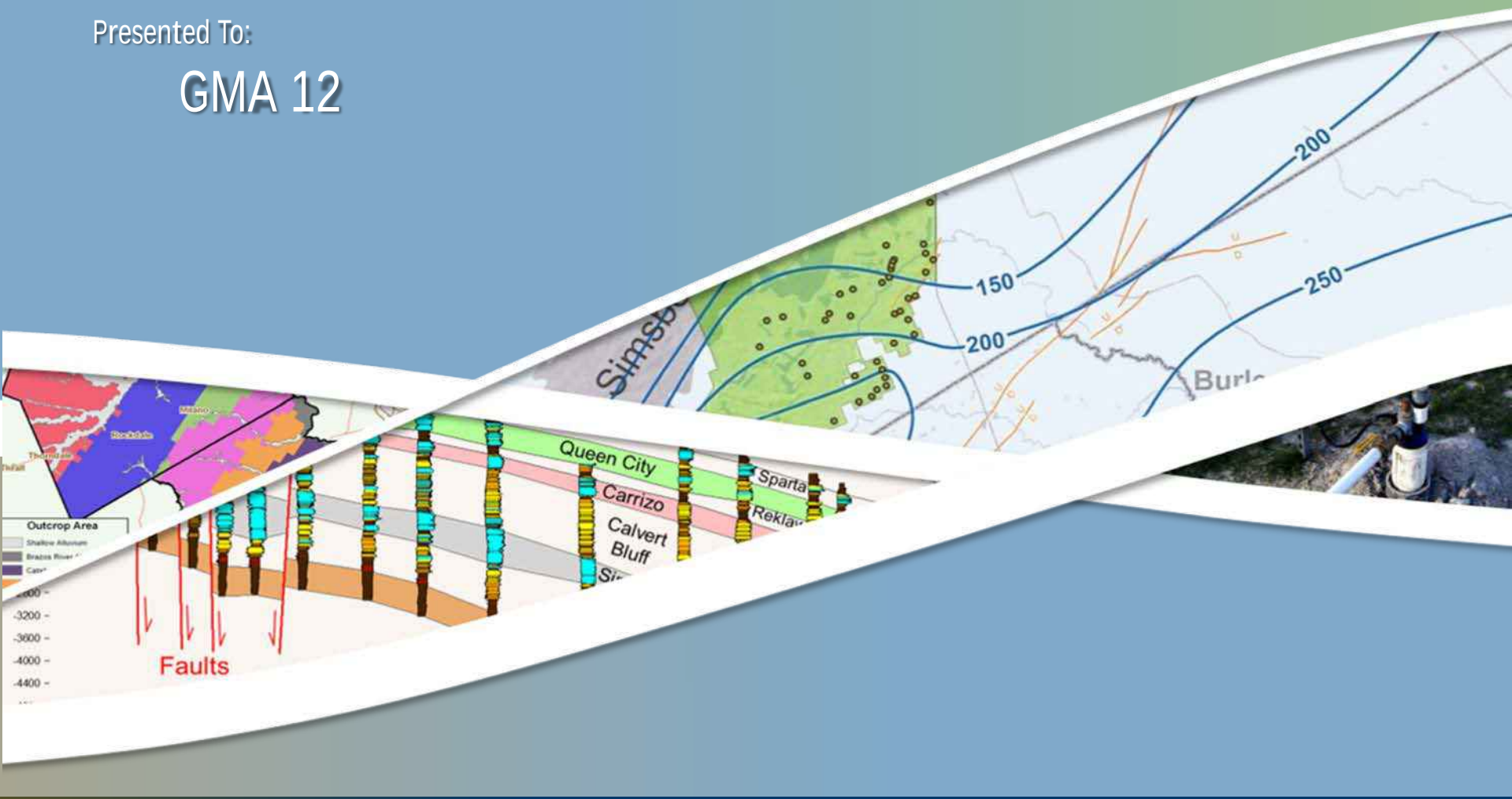
Simulated Surface water – Groundwater Interaction for Brazos River Alluvium

Presented To:

GMA 12

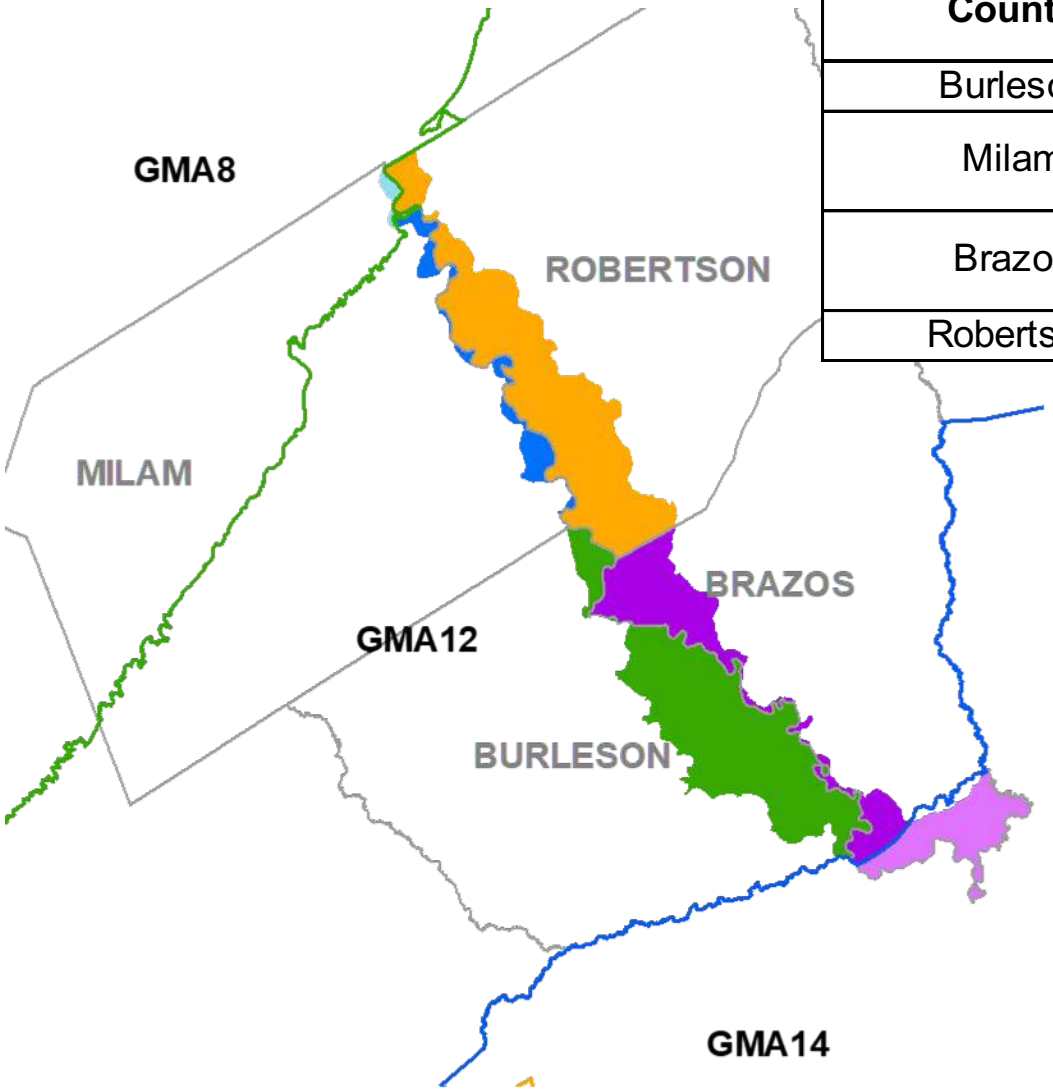


January 29, 2019

Agenda

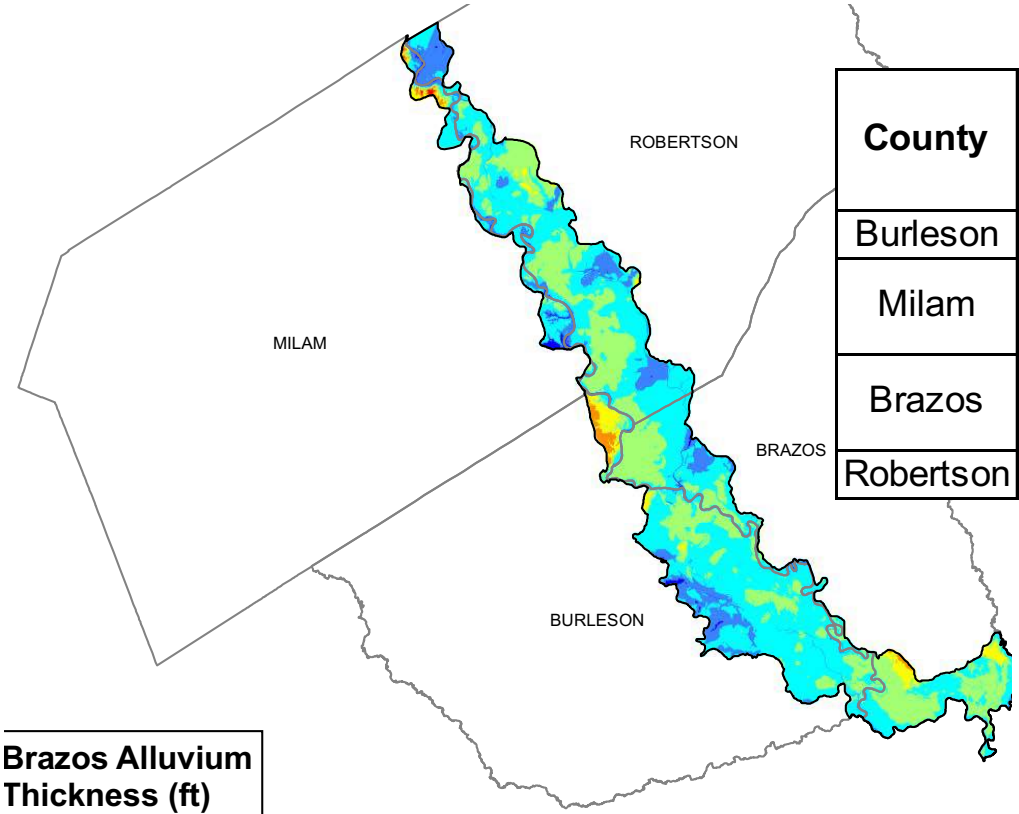
- Introductory Information
- Desired Future Conditions (DFCs) and Modeled Available Groundwater (MAGs)
- Conceptualization of Groundwater Flow in Alluvium
- Model Results from Brazos River Alluvium GAM and Update Sparta/Queen City/Carrizo-Wilcox GAM

Brazos River Alluvium: Areal Extent



County	GMA	Area (sq. miles)	
		GMA	Total
Burleson	12	130	130
Milam	8	3	22
	12	19	
Brazos	12	61	97
	14	36	
Robertson	12	132	132

Brazos River Alluvium: Thickness



County	GMA	Average Thickness		Maximum Thickness
		GMA Area	Total Area	GMA
Burleson	12	55	55	113
Milam	8	55	51	129
	12	49		147
Brazos	12	58	58	125
	14	59		119
Robertson	12	54	54	104

Brazos Alluvium Thickness (ft)

- 0 - 20
- 21 - 40
- 41 - 60
- 61 - 80
- 81 - 100
- 101 - 120
- 121 - 160

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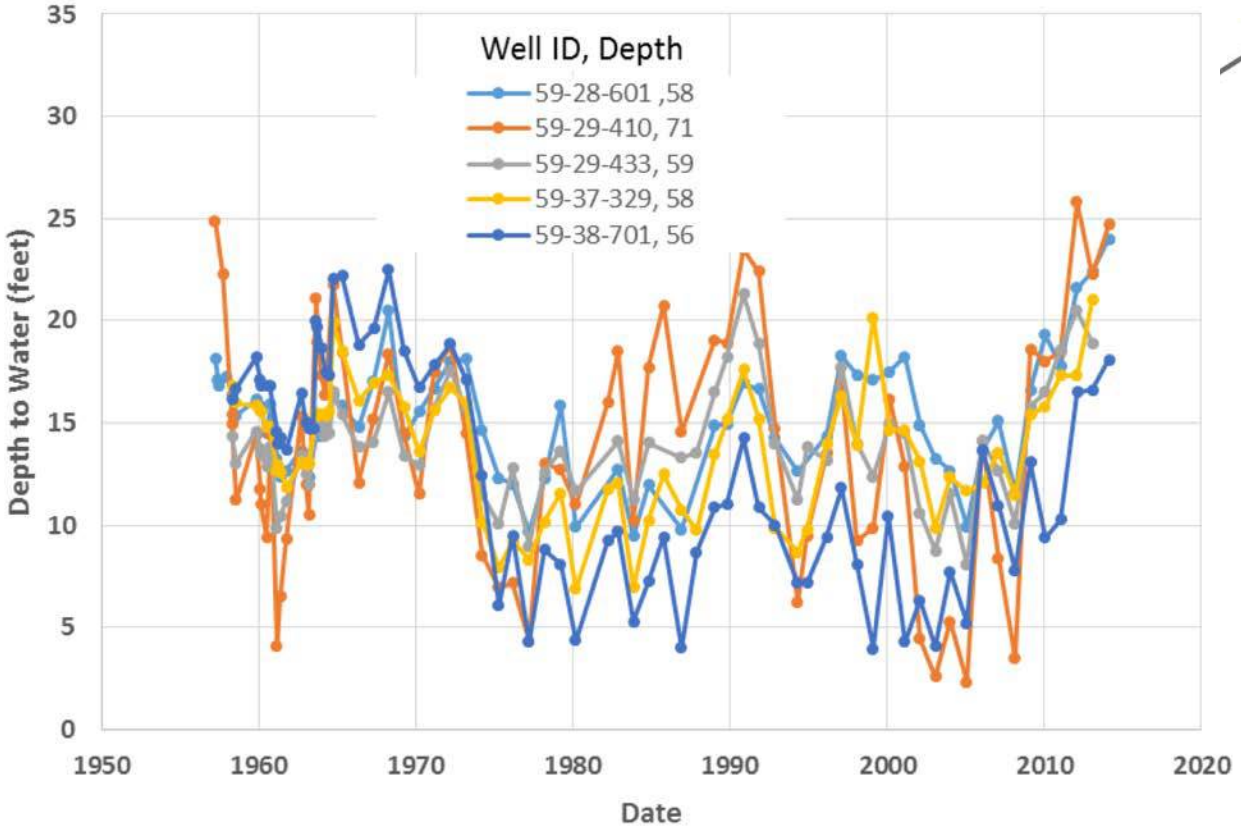
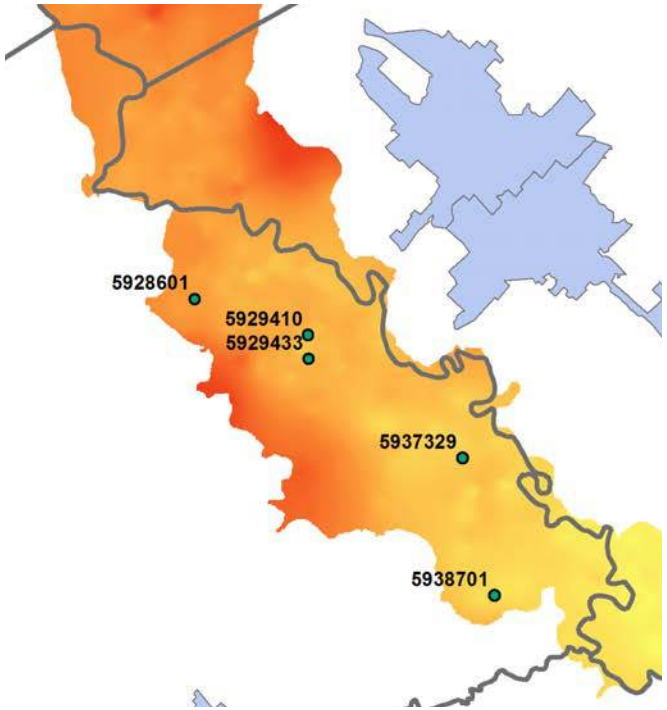
0 5 10 20 Miles

Note: Thickness = ground surface – base of aquifer (from Shah and Houston, 2007)

Brazos River Alluvium Water Level Data: Burleson County





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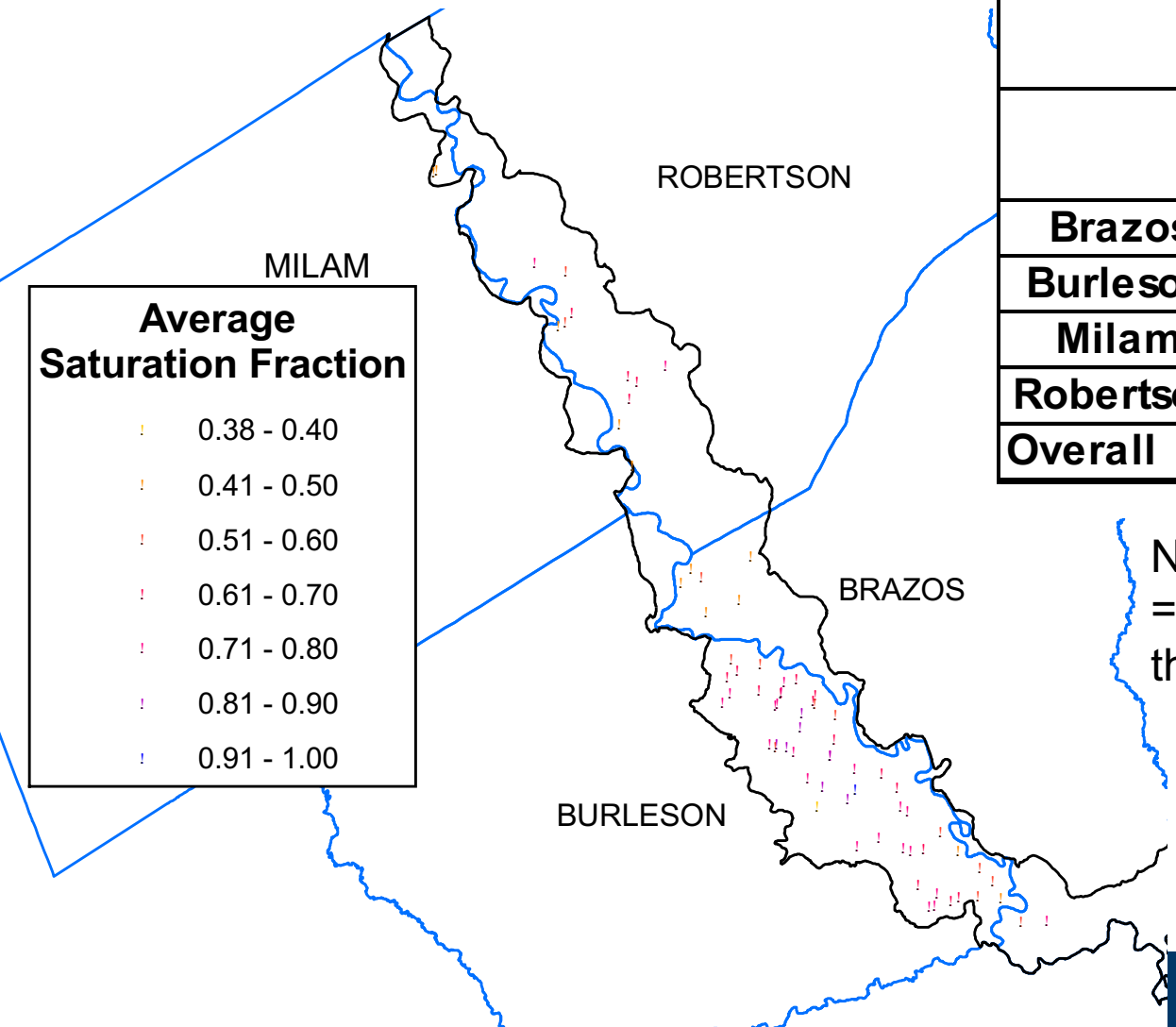
Brazos River Alluvium DFCs

Groundwater Conservation District	County	Desired Future Condition
Brazos Valley	Brazos and Robertson	North of State Highway 21: Percent saturation shall average at least 30 percent of total well depth. South of State Highway 21: Percent Saturation shall average at least 40 percent of total well depth.
Post Oak Savannah	Burleson	A decrease in 6 feet in the average saturated thickness over the period from 2010 to 2070.
Post Oak Savannah	Milam	A decrease in 5 feet in average saturated thickness over the period from 2010 to 2070.

Brazos River Alluvium: Estimated Average Saturation Faction



	Avg Saturation Fraction	
	# wells	Avg value
Brazos	8	0.51
Burleson	54	0.68
Milam	2	0.48
Robertson	11	0.60
Overall	75	0.57

Note: Saturation thickness = saturation fraction * total thickness

Brazos River Alluvium MAGs (AFY)

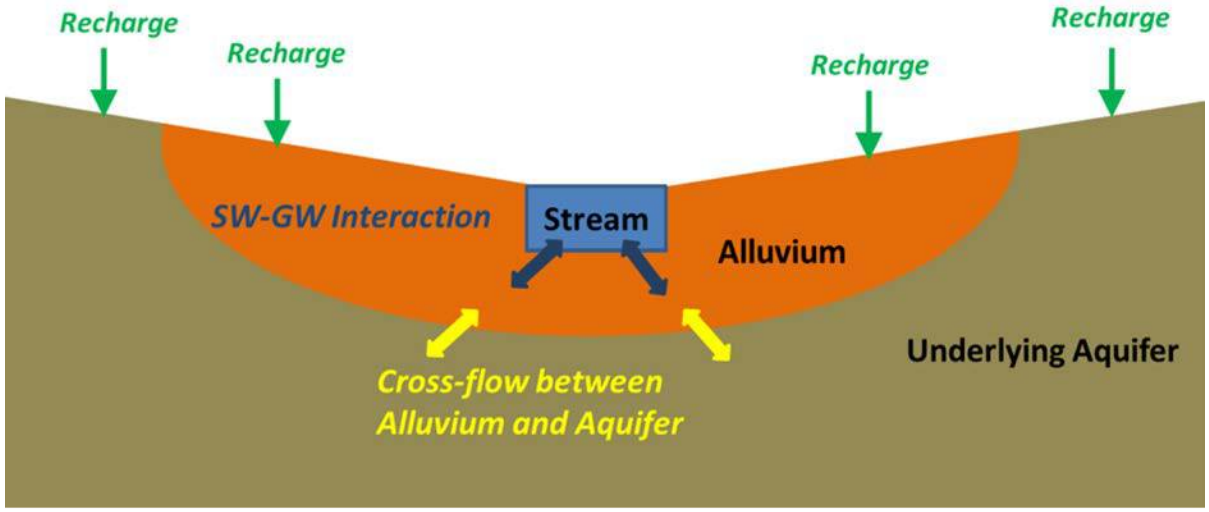
- TWDB GAM RUN 17-030 MAG (AFY) Report (TWDB, 2017)

County	RWPA	River Basin	Aquifer	2020	2030	2040	2050	2060	2070
Brazos	G	Brazos	Brazos River Alluvium	81,581	80,311	80,081	79,976	79,913	79,872
Burleson	G	Brazos	Brazos River Alluvium	28,472	28,418	28,414	28,414	28,414	28,413
Falls	G	Brazos	Brazos River Alluvium	NR	NR	NR	NR	NR	NR
Milam	G	Brazos	Brazos River Alluvium	47,818	47,785	47,779	47,775	47,773	47,771
Robertson	G	Brazos	Brazos River Alluvium	61,161	57,959	57,633	57,544	57,503	57,480
GMA 12 Total			**Brazos River Alluvium**	**219,032**	**214,473**	**213,907**	**213,709**	**213,602**	**213,536**

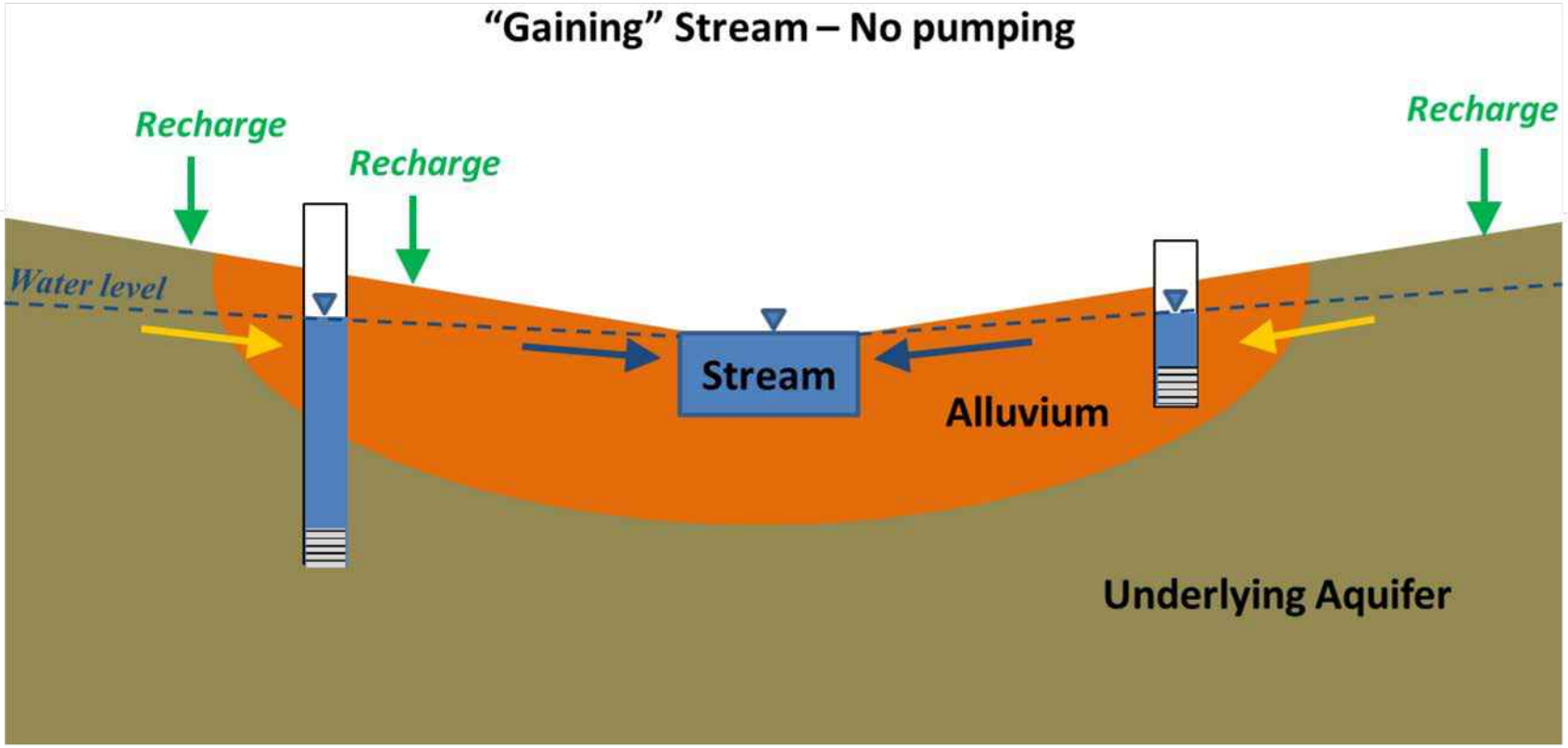
NR: Groundwater Management Area 12 declared the Brazos River Alluvium Aquifer not relevant in these areas.

SW-GW Interaction

- Under natural conditions, groundwater should be recharging major streams in GMA 12
- Two important interactions: Stream and alluvium; alluvium and underlying aquifer
- For well in alluvium what is the source of the water?
- For well in underlying aquifer, what is the source of water that is pumped?



SW-GW Interaction– No Pumping

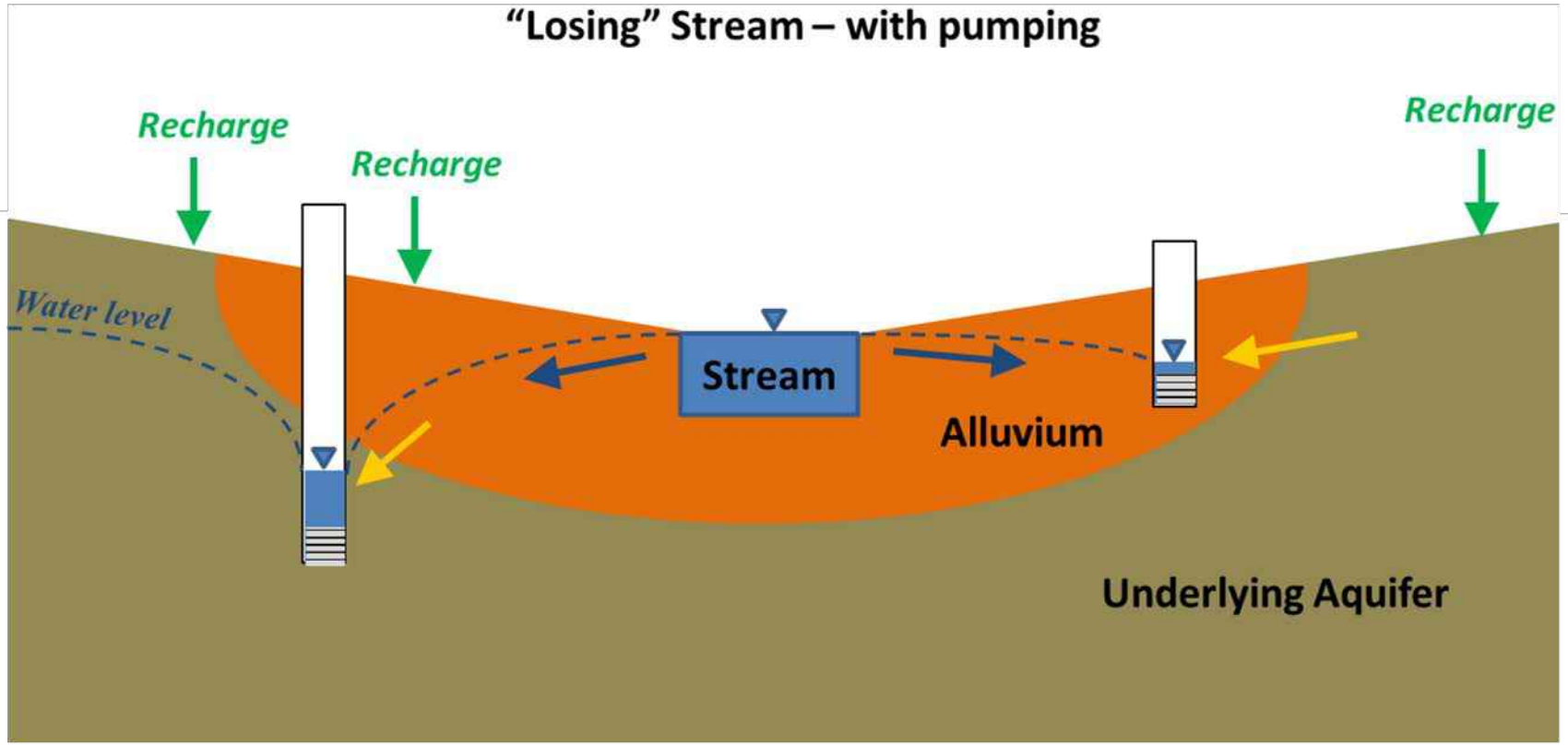


Surface-Groundwater interaction (between Stream & Alluvium)

Crossflow between Alluvium & Aquifer

Water Level

SW-GW Interaction– Pumping



Surface-Groundwater interaction (between Stream & Alluvium)

Crossflow between Alluvium & Aquifer

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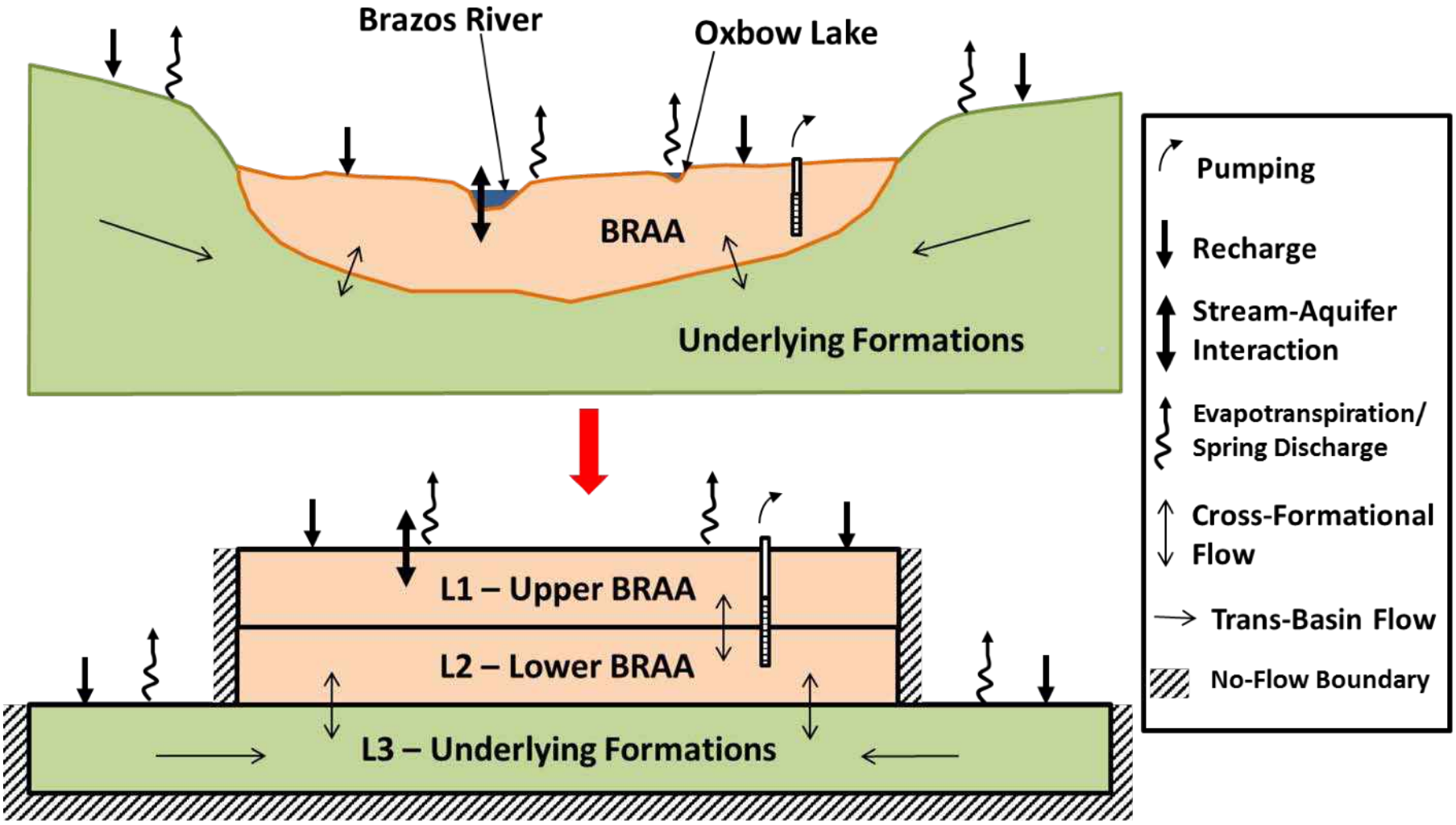
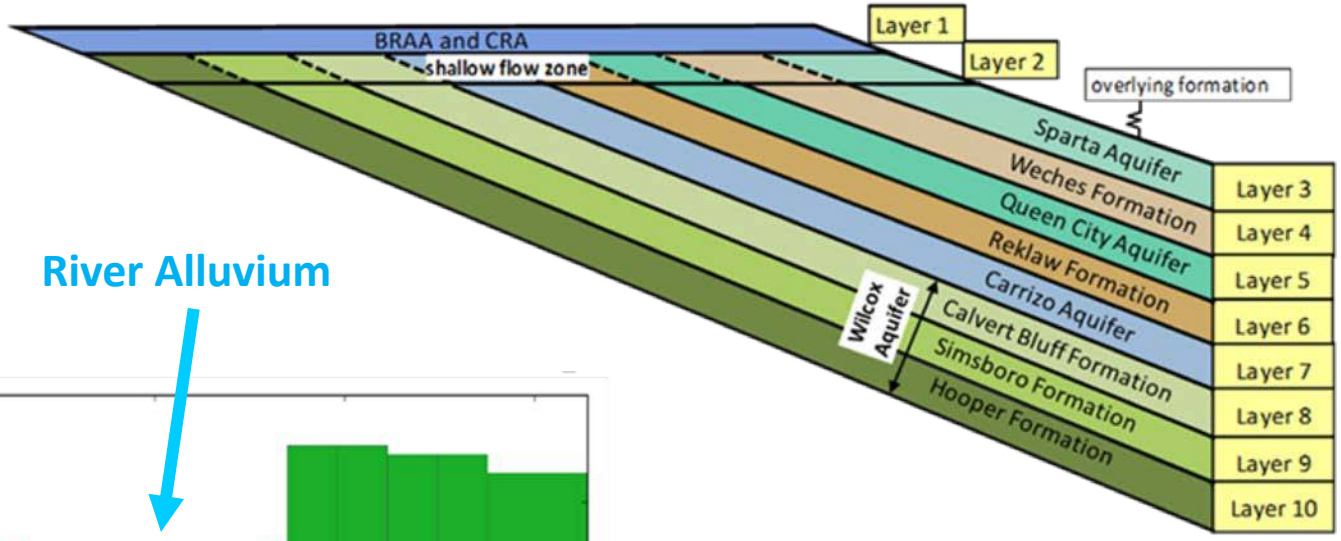
Brazos River Alluvium GAM: Conceptual Model



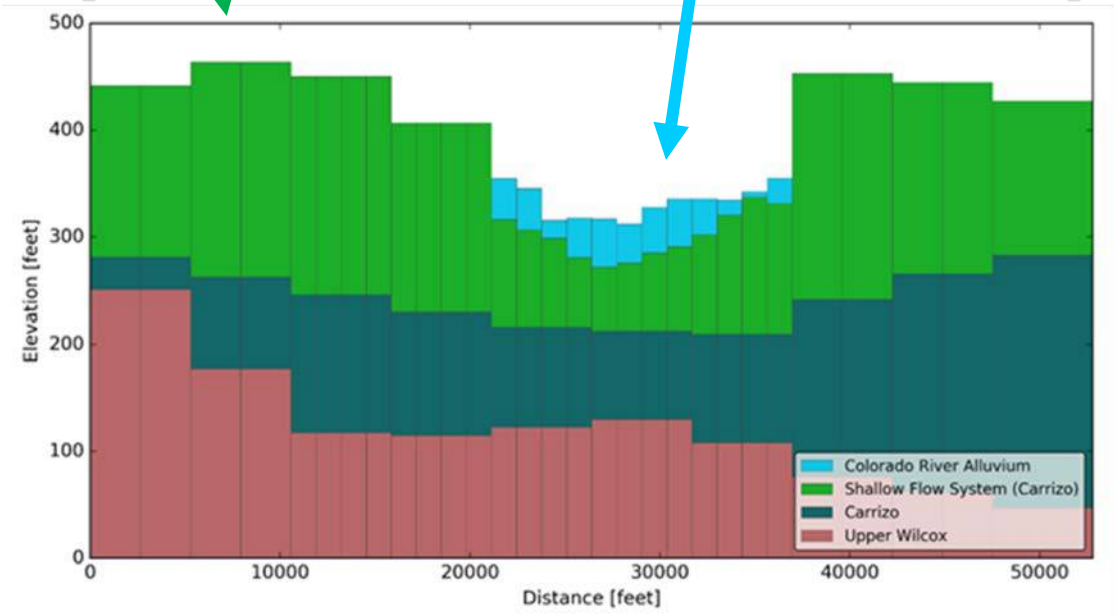
Updated Sparta/Queen City/Carrizo-Wilcox GAM: Conceptual Model

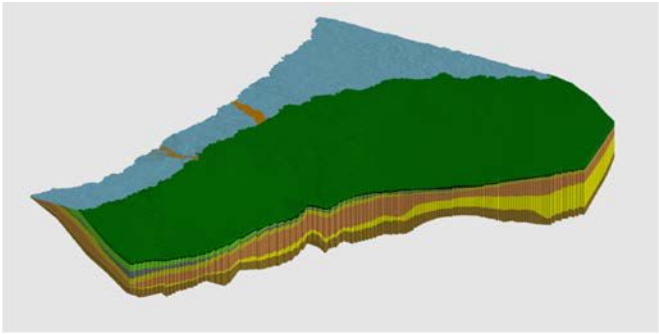
Vertical Layering– added two layers – river alluvium and a shallow groundwater flow zone



Shallow Flow Zone

River Alluvium





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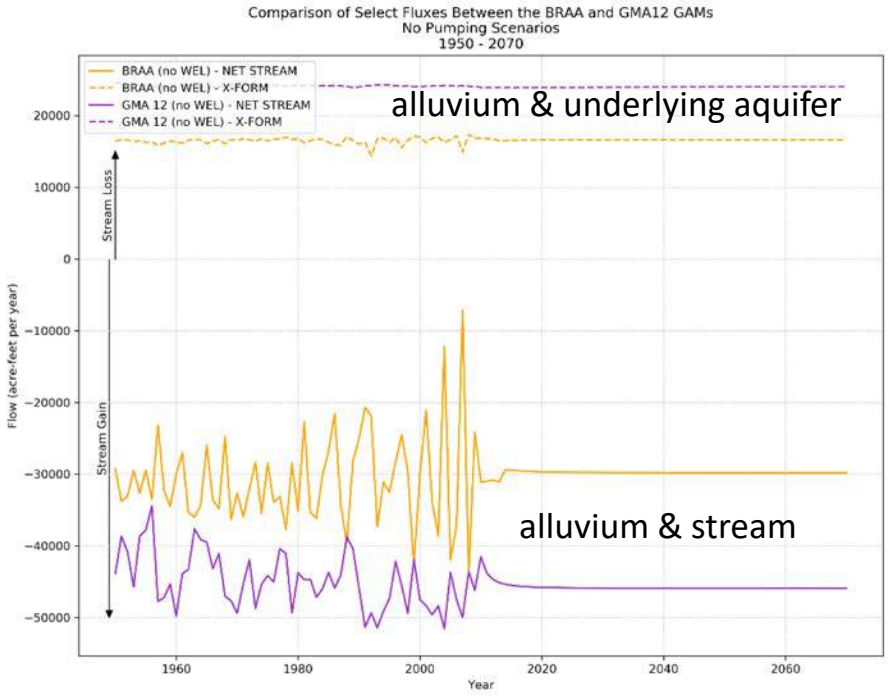
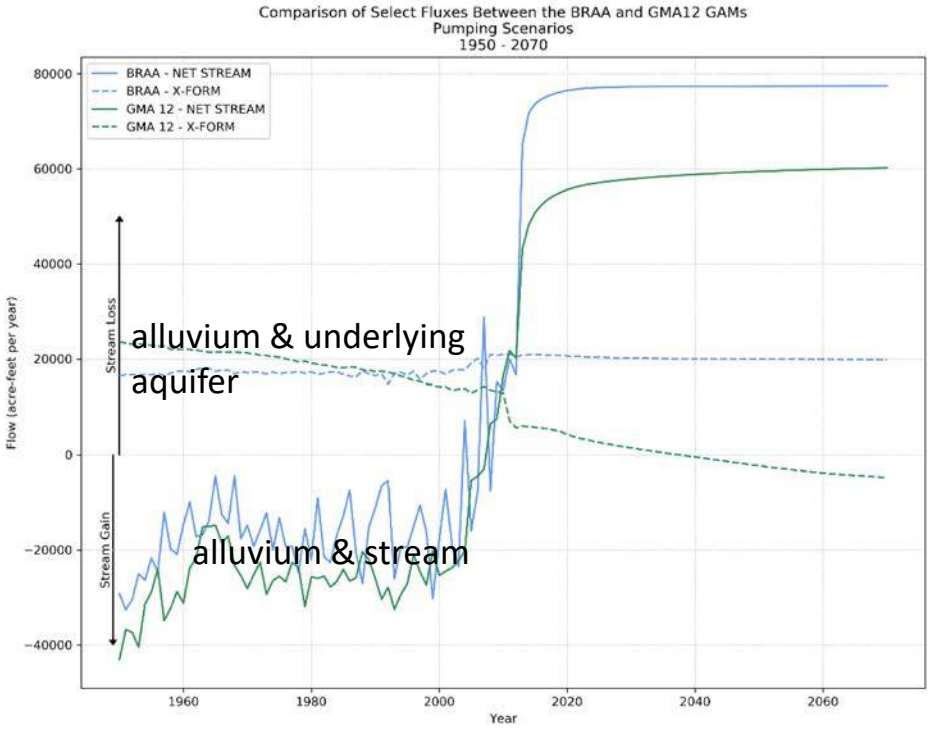
Water Budget for Brazos River for Pumping and No Pumping Conditions

No Pumping

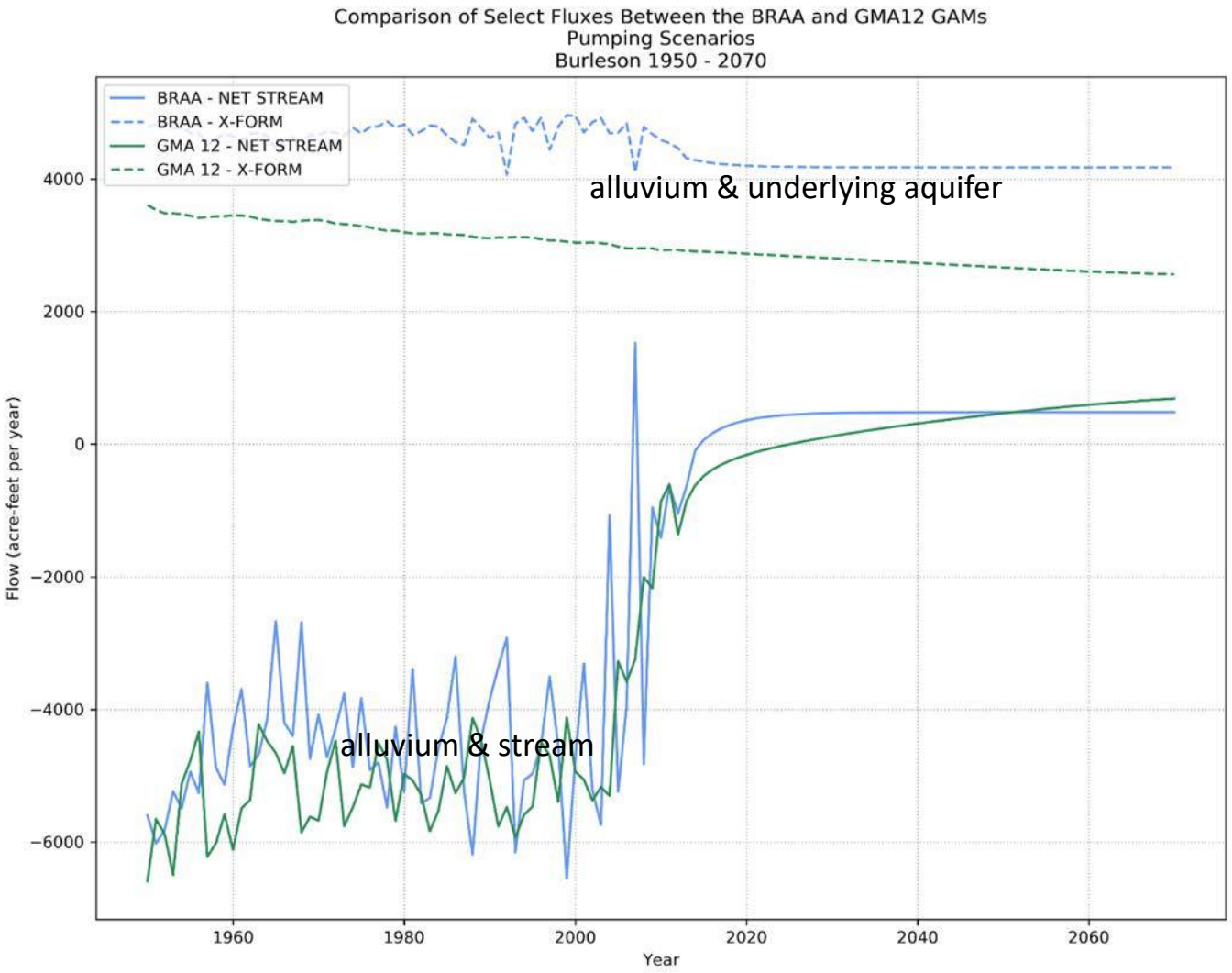


Pumping



- Under No pumping conditions, Brazos River gains about 40,000 AFY consistently
- Under pumping conditions, Brazos River gains about 20,000 AFY until year 2000
- At about 2010, Brazos becomes a losing stream. DFC runs cause stream to lose 65,000 AFY

Brazos Alluvium: Burleson County



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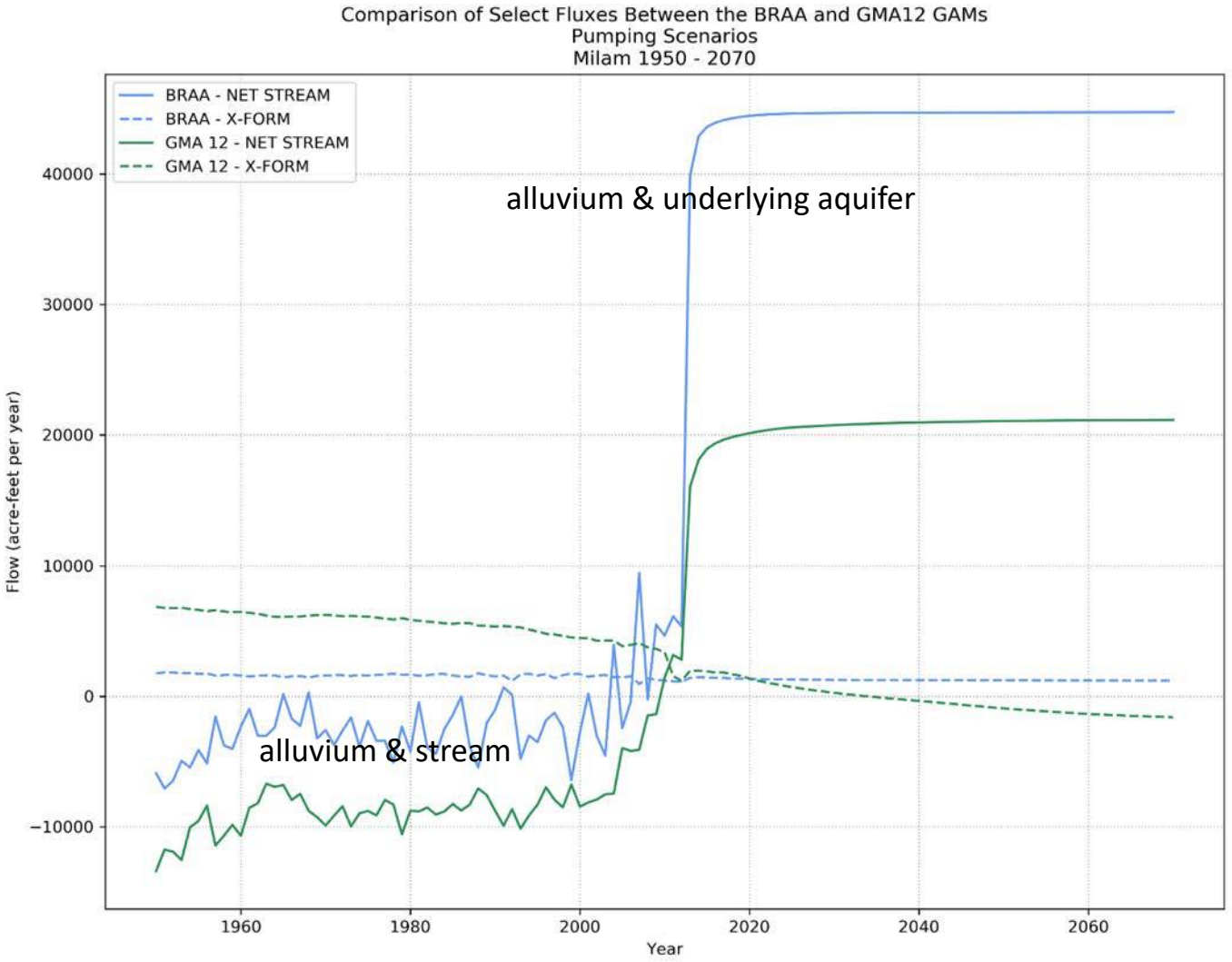
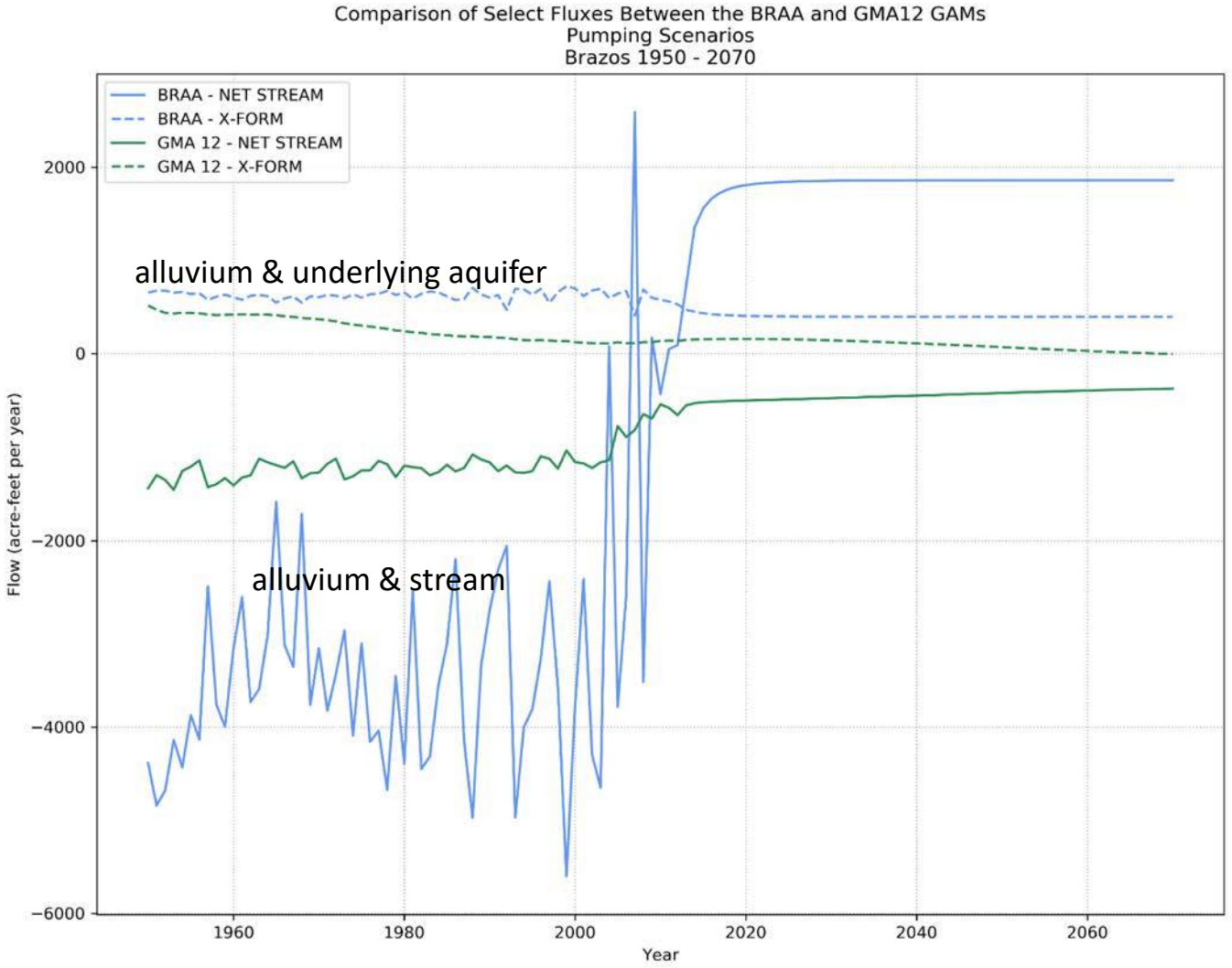
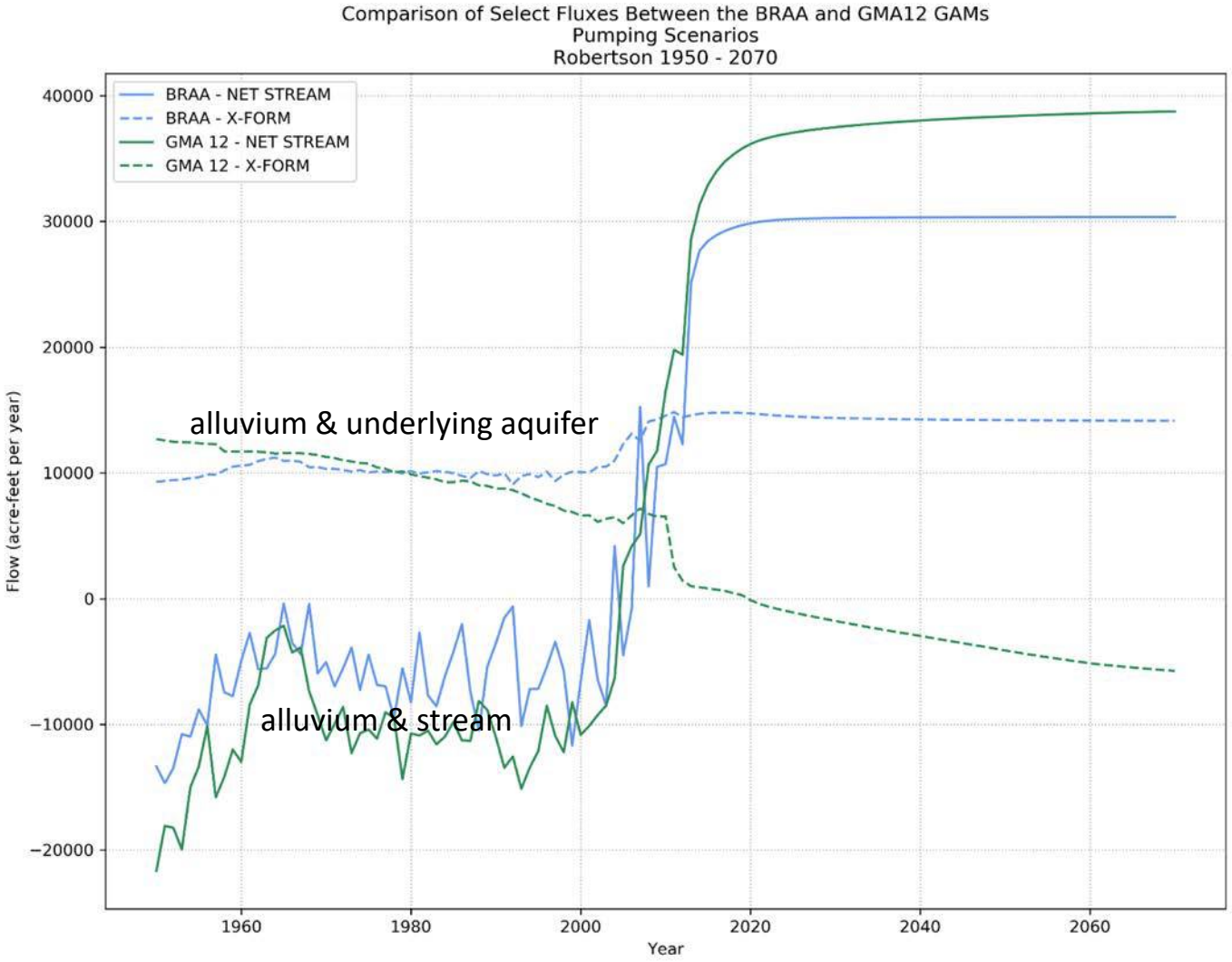
Brazos Alluvium: Milam County



Brazos Alluvium: Brazos County

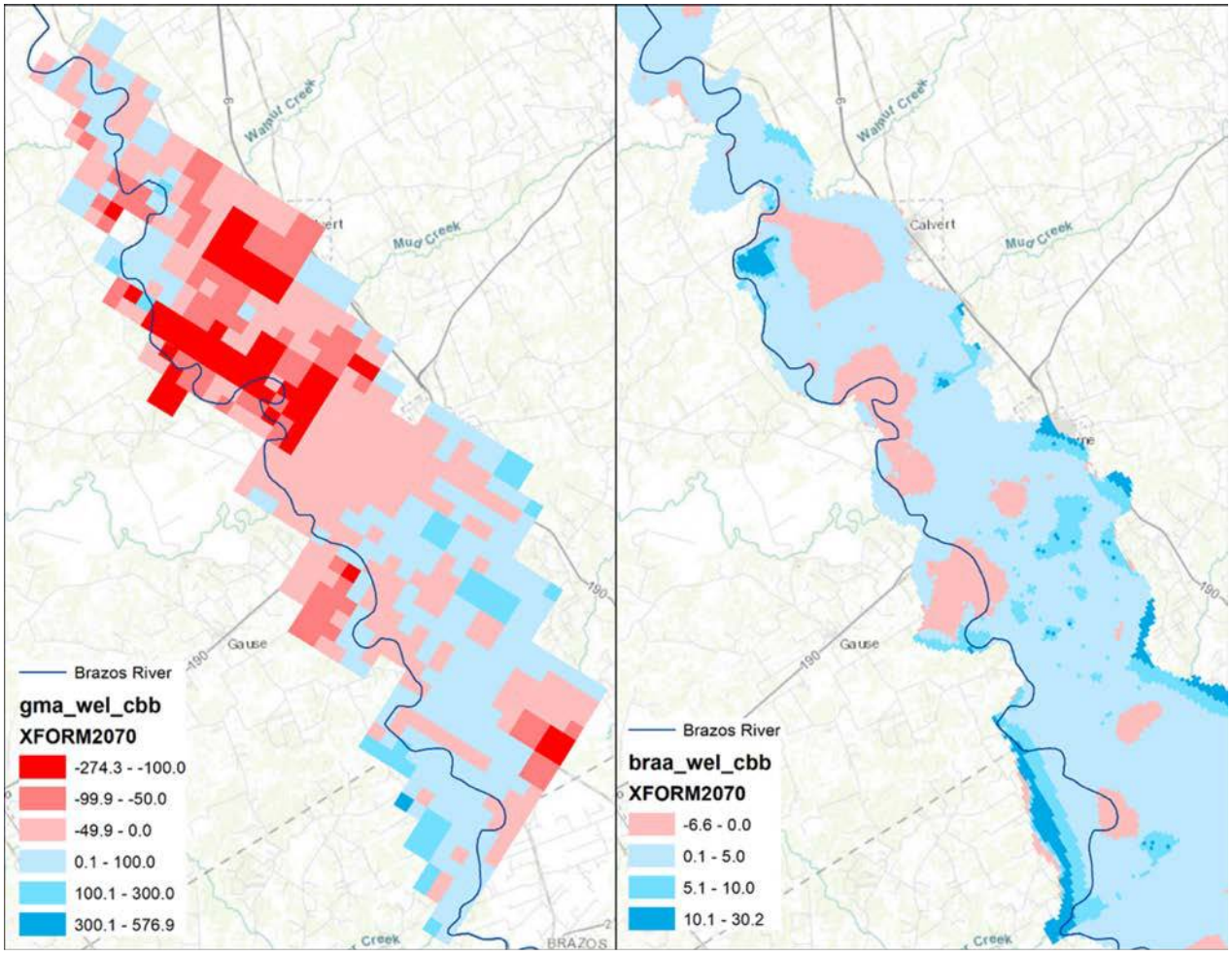


Brazos Alluvium: Robertson County



BRAA GAM and Central SP/QC/CW GAM Differ with Cross-Flow Between Alluvium and Underlying Aquifer

Cross-flow (AFY) between Brazos Alluvium and Underlying Aquifer



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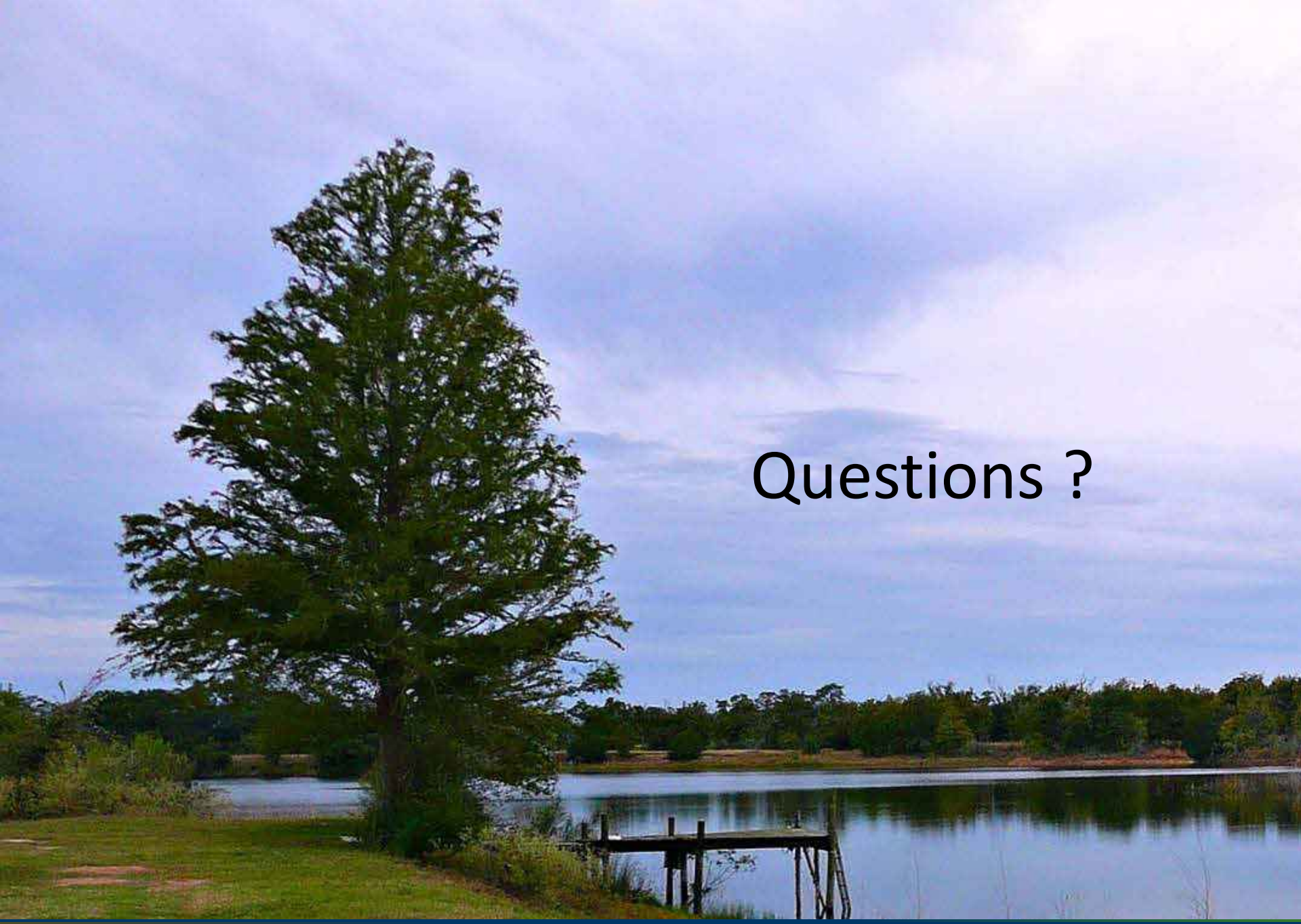
Issues of Potential Interest to GMA 12

- DFC other than percent saturation?
- Additional monitoring?
- Which GAM to used for DFC calculations?
- Options for Estimating Pumping Rates and Locations
  - Historical
  - Future


Questions ?