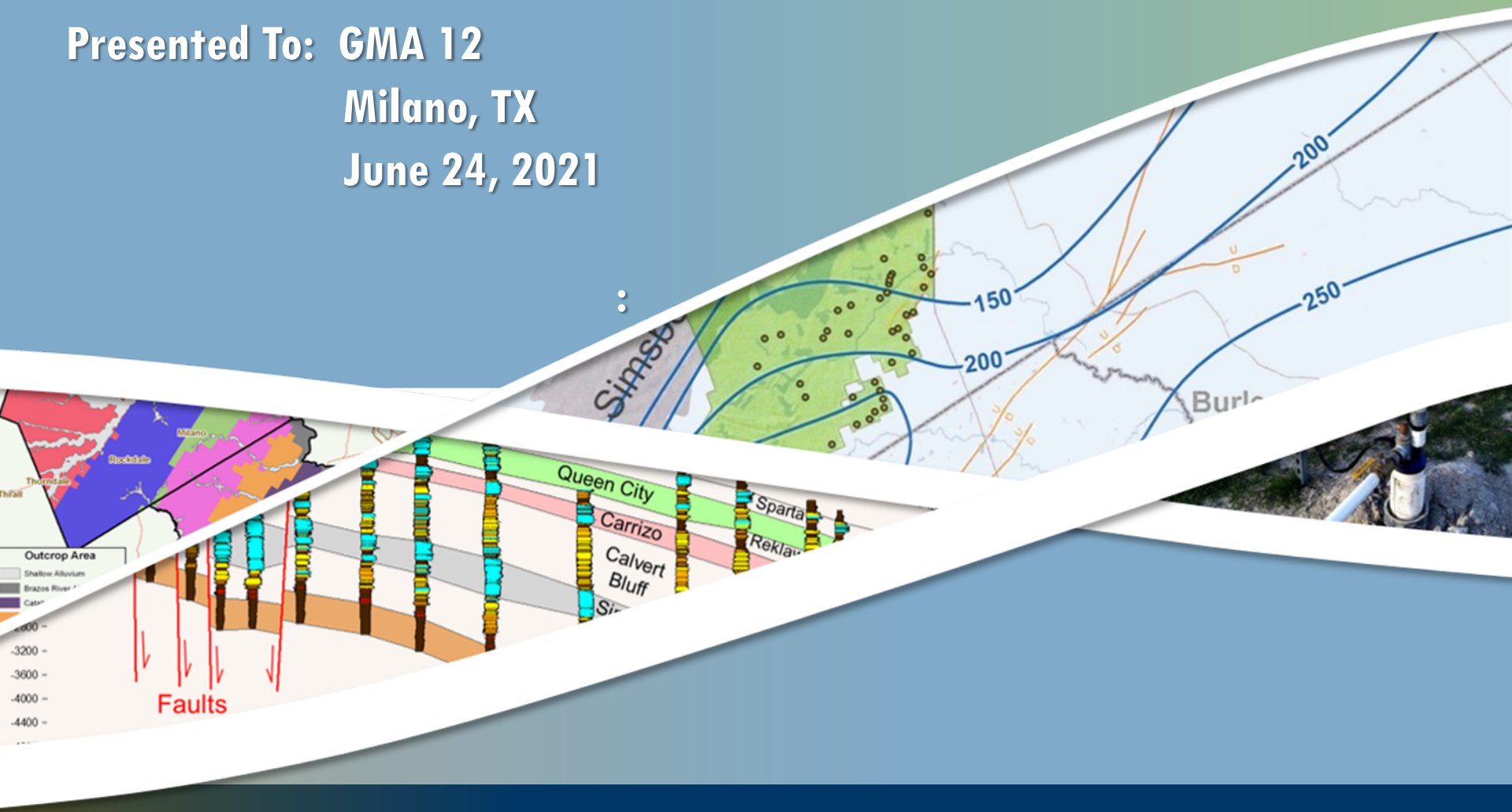
POSGCD Discussion Regarding Proposed Desired Future Conditions

Presented To: GMA 12

Milano, TX

June 24, 2021



Agenda

- Overview of POSGCD Development of DFCs for Sparta, Queen City, and Carrizo-Wilcox aquifers
  - Management triggers prior to GMA 12 DFCs
  - Key Points: developing DFCs for 1st Joint Planning Cycle
  - Key Points: developing DFCs for 2nd Joint Planning Cycle
  - Key Points: developing DFCs for 3rd Joint Planning Cycle
  - Summary of Management Approach
- POSGCD Concerns with Proposed for 3rd Joint Planning DFCs
  - Process Used to Develop DFCs
  - Values for DFCs
- Results from DFC Run 12 Drawdown for POSGCD
  - Tabulation
  - Graphs

Key Points: Pre-Joint Planning POSGCD Aquifer Management Trigger Points for Drawdown*

- Shallow Carrizo-Wilcox Management Zone
  - Maximum 50 ft drawdown in any well
  - Useable groundwater = 33,750 AFY
- Deep Carrizo-Wilcox (excludes Simsboro) Management Zone
  - Average drawdown of 190 ft
  - Useable groundwater = 30,750 AFY
- Deep Simsboro Management Zone
  - Average drawdown of 300 ft
  - Useable groundwater = 60,000 AFY

*POSGCD Management Plan – Adopted May 9, 2006, drawdown measured relative to 2005 water levels

Prior to Joint Planning

Key Points: POSGCD Development of DFCs for 1st DFC Planning Cycle

- DFC committee selected desire drawdown for outcrop and deep portions of aquifer with consideration for:
  - water column above base of wells
  - balance production and conservation
- Calculated preliminary DFC across entire aquifer based on selected drawdowns for outcrop and deep portions of the aquifer
  - GAM simulations were not used to calculate preliminary DFCs
  - GAM simulations were used to adjust the preliminary DFCs for the Carrizo Aquifer and to estimate aquifer production

* Documented in Gary Westbrook (POSGCD General Manager) Presentation to GMA-12 meeting on May 26, 2010

Key Points: POSGCD Development of DFCs for 1st DFC Planning Cycle (con't)

- GAM simulations:
  - considered as unreliable but useful
  - each district responsible for generating the pumping amounts in the MODFLOW well file for the GAM simulation
  - used to check compatibility of GMA-12 DFCs
  - used to evaluate drawdown impacts at specific locations
  - pumping at well locations adjusted to achieve desired drawdowns
- MAG – Managed Available Groundwater
  - should not be used as a cap for permitting
  - should not be used as a constraint on permitting

Key Points: POSGCD Development of DFCs for 1st DFC Planning Cycle (con't)

- Limitations of GAM
  - recognized large uncertainties in model including representation of Simsboro hydraulic properties, location and conductances of faults, surface water-groundwater interaction, &
  - stressed need to improve predictive accuracy – lead effort to fund an update of the SP/QC/CW GAM – submitted proposal to TWDB
  - recommended that variance be allowed between adopted DFC and GAM simulations to account for uncertainty and error in the GAM predictions

POSGCD Preliminary DFCs Submitted During 1st Joint Planning Cycle*

- Submitted to GMA-12 in June 2009

Aquifer	Average Drawdown (ft) Across the District from 2000 to 2060
Sparta	30
Queen City	40
Carrizo	120
Calvert Bluff	150
Simsboro	300
Hooper	180

- Preliminary DFCs developed by setting drawdown limits in aquifer regions established by POSGCD --GAM simulations were used to calculate amounts

Aquifer	Assumed Aquifer Conditions		
	Average Drawdown in Unconfined Area	% Decline in Artesian Pressure in Confined Area	Maximum Drawdown in Confined Area
Sparta	10	0.25	35
Queen City	10	0.25	55
Carrizo	20	0.25	150
Calvert Bluff	20	0.25	200 to 250
Simsboro	20	0.25	400 to 450
Hooper	20	0.25	200 to 250

* Documented in Gary Westbrook (POSGCD General Manager) Presentation to GMA-12 meeting on May 26, 2010

Methodology Used to Develop Preliminary DFCs for 1st Joint Planning Cycle: Carrizo Aquifer

Carrizo Aquifer

- POSGCD prepared several spreadsheet similar to one at right
  - Average drawdown in unconfined area set by single number
  - Average drawdown in confined area set by: 1) % decline artesian pressure; and, 2) maximum drawdown in confined area
- DFC committee selected 120 ft drawdown for the entire Carrizo Aquifer based on scenario outlined in orange

Conditions			Desired Future Conditions - Drawdown
			Aquifer
DD in Unconfined Area	% Decline in artesian pressure	Max DD in Confined Area	Carrizo
5	0.25	150	119
10	0.25	150	119
15	0.25	150	119
20	0.25	150	120
15	0.25	100	85
15	0.25	125	103
15	0.25	150	119
15	0.25	175	135
15	0.25	200	149
15	0.33	100	88
15	0.33	125	107
15	0.33	150	125
15	0.33	175	142
15	0.33	200	159

Methodology Used to Develop Preliminary DFCs for 1st Joint Planning Cycle: Simsboro Aquifer

Simsboro Aquifer

- DFC Committee selected 300 ft drawdown based on the two scenarios outlined in orange

Conditions			Desired Future Conditions - Drawdown
			Aquifer
DD in Unconfined Area	% Decline in artesian pressure	Max DD in Confined Area	Simsboro
10	0.25	450	312
15	0.25	450	313
20	0.25	450	313
25	0.25	450	314
20	0.25	350	260
20	0.25	400	288
20	0.25	450	313
20	0.25	500	336
20	0.25	550	357
20	0.33	350	273
20	0.33	400	305
20	0.33	450	335
20	0.33	500	364
20	0.33	550	390

Methodology Used to Develop Final DFCs for 1st Joint Planning Cycle: GAM Simulations

- POSGCD Pumping File for DFC GAM Simulation
  - pumping rates and schedule adjusted to achieve average drawdowns associated with preliminary POSGCD DFCs
  - simulation of LPGCD (45 ft), BVGCD (47 ft), and POSGCD (120 ft) preliminary DFCs for Carrizo Aquifer was not achievable in a GAM simulations
- Adjustment to POSGCD Preliminary DFC
  - POSGCD and GMA 12 adopted all POSGCD preliminary except for the Carrizo Aquifer
  - POSGCD's DFC of 120 ft drawdown was lowered to 65 ft in order for a GAM simulation to show compatibility among all the GCD DFCs for the Carrizo

Methodology Used to Develop Final DFCs for 1st Joint Planning Cycle: GAM Simulations

- Acknowledgment of Limitations Regarding GAM Predictions
  - Statement below was prepared by GMA 12 to state limitations should be acknowledged by

Based on the principle of using the GAM as a joint planning tool and the fact that the GAM predictions contain uncertainty, GMA 12 considered the DFCs to be compatible and physically possible if the difference between modeled drawdown results for model Run 12_7B and the DFC drawdown targets were within 5 feet or 5 percent of the DFC drawdown targets. Factors considered for determining tolerance criteria include:

- model calibration results and statistics,
- information used to calibrate the GAM,
- aquifer and recharge information collected since the GAM was developed,
- sensitivity of the GAM calibration and GAM predictions to changes in the model parameters, and
- range of uncertainty in the model parameters including historical and future pumping, and temporal variation in recharge distribution and magnitude.

*explanation of variance provided in GMA 12 Resolution to Adopt DFCs dated August 11, 2010. Resolution passed with 5 Ayes and 0 Nays.

Key Points: POSGCD Development of DFCs for 2nd DFC Planning Cycle

- Reiterated approach for developing DFCs based spreadsheet calculations (see table or right-hand side)[1]
- Expressed concerns of using a single drawdown for entire aquifer – asked GMA 12 to develop DFCs for shallow areas (outcrops) of aquifers[2]
- Each district responsible for generating the pumping amounts in the MODFLOW well file for the GAM simulation
- Expressed concerns that GAM over predicts drawdowns because of improper representation of faults

Hooper Aquifer

Example Calculation of a DFC Based on Drawdown(DD) Criteria for the Unconfined and Confined Regions

Conditions			Desired Future Conditions - Drawdown
			Aquifer
DD in Unconfined Area	% Decline in artesian pressure	Max DD in Confined Area	Hooper
10	0.25	200	164
15	0.25	200	164
20	0.25	200	165
25	0.25	200	165
20	0.25	100	88
20	0.25	150	127
20	0.25	200	165
20	0.25	250	201
20	0.25	300	236
20	0.33	100	89
20	0.33	150	129
20	0.33	200	169
20	0.33	250	207
20	0.33	300	243
Area (sq. miles) based on 2000 heads		Confined	1116
		Unconfined	124
Average head (ft) 2000		Confined	312.0
		Unconfined	369.9
Storage Volume (acre-ft) 2000		Confined	53,443,897
		Unconfined	1,401,128
Storage Volume (acre-ft) 2060		Confined	53,412,122
		Unconfined	1,156,350
Total Withdrawn (acre-ft)			276,552

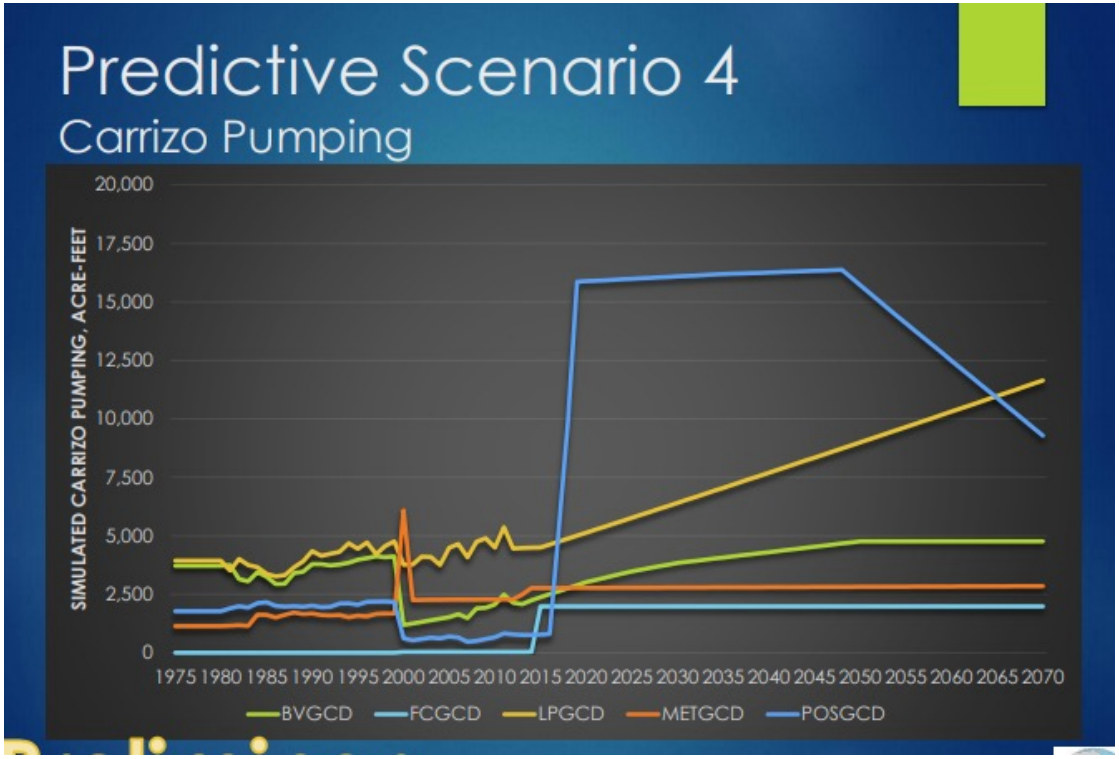
[1] Table included in POSGCD presentation dated June 6, 2014 (similar data presented at other GMA 12 meetings)

[2] Included in POSGCD presentations dated June 27, 2014 and later meetings

Key Points: POSGCD Development of DFCs for 2nd DFC Planning Cycle

- Performed "book-end' GAM simulations to estimate drawdown
  - PS1, PS3 : include all permits, assume permits fully utilized in 2015
  - PS2, PS4: ramped up permits (note that pumping declines at end of VR permit term)

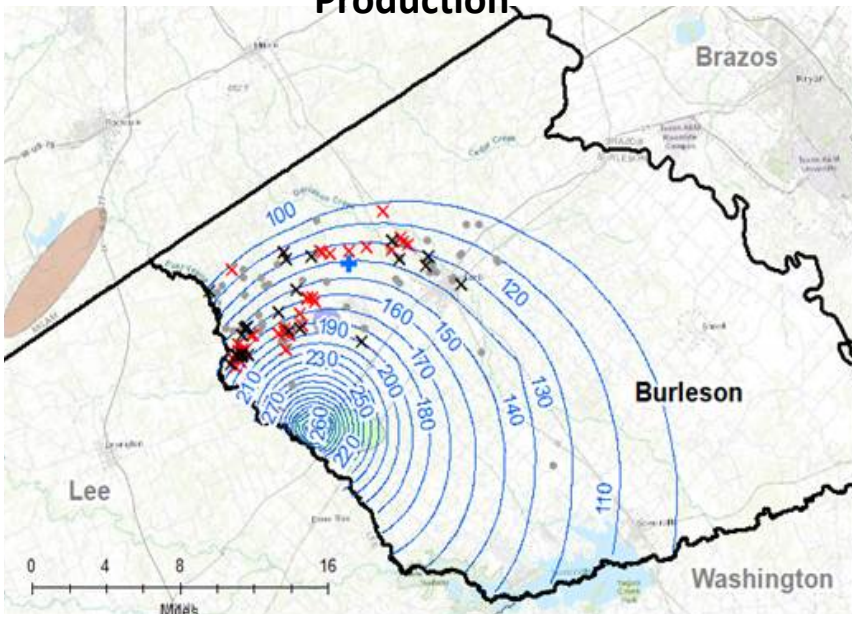
- DFC GAM Run was PS5
  - PS5: update of GMA 12-7B DFC run from 1st joint planning cycle
  - POSGCD pumping rates and DFCs in PS5 were very close to those used in PS12-7B from 1st joint planning cycle



Key Points: POSGCD Development of DFCs for 3rd Planning Cycle

- GMA 12 consultants updated GAM to better represent Simboro aquifer properties near Vista Ridge well field
- Variance between average drawdown values and a proposed DFC increased from 5% to 10% in GAM Run with exception of LPGCD value in the Carrizo
- POSGCD expressed concerns that high pumping in Carrizo used in Run S-7 should be reduced to reduce drawdown impacts at existing wells
- GMA 12 voted that POSGCD could not reduce its pumping rates in Carrizo because its well file for the DFC run had to contain “known” pumping

DFC Committee: Sensitivity of Number of Impacted Wells to POSGCD Carrizo Production



POSGCD Carrizo Production (AFY)	Impacted* Wells		
	2029	2039	2049
18,200	71	114	141
12,200	36	69	97

Key Points: POSGCD Development of DFCs for 3rd Planning Cycle

- GAM simulations
  - S-1: full permitted production from 2020 to 2070
  - S-2: ramped permitted production from 2019 to 2070
  - S-3: similar to S-2 with reduction in permitted production
  - S-4 to S-6: same as S-1 to S-3 with reduction in recharge rates
  - S-7: similar to S-2 with adjustments
  - S-8: attempt to adjust pumping rates to make DFCs
  - S-9: attempt to adjust S-7 to meet current DFCs
    - Current DFCs are not compatible in new GAM
    - There is more than 10% uncertainty in predicted 2070 drawdowns
  - S-10: adjusted S-7 pumping in POSGCD for SP, QC, CZ, & SB
  - S-11: adjusted S-10, used POSGCD Carrizo pumping from S-7
  - S-12: revised S-11, BVGCD increased pumping in Simsboro
  - S-13: adjusted S-12, used POSGCD Carrizo pumping from S-7

1st, 2nd, and 3rd Planning Cycles: Summary of DFCs and Production Rates

- DFCs
  - Similar values for all three cycles except for Carrizo
  - In 3rd cycle, Carrizo increased from 67 ft (60 yrs) to 172 ft (50 yrs)
  - Increased >250%
- Carrizo Production
  - In 3rd cycle, increased from 7,048 AFY to 18,206 AFY
  - Increase >250%

Aquifer	Average Drawdown		
	2010 Adopted	2015 Adopted	2020 Proposed
	Jan 2000 to Dec 2059	Jan 2000 to Dec 2069	Jan 2010 to Dec 2069
Sparta	30	28	32
Queen City	30	30	31
Carrizo	65	67	172
Calvert Bluff	140	149	179
Simsboro	300	318	336
Hooper	180	205	214

Aquifer	Production[1] Associated with DFC Run			Permitted Amounts[2] (AFY)
	2010 Adopted	2015 Adopted	2021 Proposed	
	2059 Production	2069 Production	2069 Production	
Sparta	6,734	6,735	4,105	4,115
Queen City	502	504	7,838	1,637
Carrizo	7,059	7,058	18,206	21,641
Calvert Bluff	1,038	1,036	4,761	2,285
Simsboro	48,501	48,503	79,433	104,147
Hooper	4,422	4,422	3,126	2,080
Total	68,256	68,258	117,469	135,905

[1] production in acre-ft/year

[2] Permitted amount in Halff database in January 2021

POSGCD Concerns with Process that Lead to Proposed DFCs for 3rd Cycle

- GMA 12 has not yet properly considered nine factors identified in TWC §36.108(d) for POSGCD
- GMA 12 has not yet provided a balance between highest practical level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater TWC (§36.108[d-2]) for POSGCD.
- In 2021 (near end of cycle) GMA 12 had two major changes with regard to creating well files acceptable for a DFC simulation: 1) Pumping files are to include "known pumping" for each aquifer; and 2) Districts (POSGCD) no longer have authority to generate their own pumping file.
- "Known Pumping" has not been defined by GMA 12. How has GMA 12 determined what is "known pumping" for District aquifers? What effects will this methodology have on management of the aquifers in GMA 12?
- Maximum annual pumping in the Carrizo Aquifer in POSGCD was less than ~4,000 AF when PS-7 was developed and was less than ~11,000 AFY when PS-12 was developed. How did GMA 12 determine that production in the Carrizo should be ~18,000 AFY in 2070 for POSGCD?
- GMA 12 Districts should be allowed to select a DFC other than for 2070 as long the other DFCs are considered feasible based on the GAM simulations and the variance allowance of 10%
- DFC Values based on the SP/QC/CW GAM should be clarified as Dec 31, 2010 to January 1, 2070 (motion states 2010 to 2070)
- Each GMA 12 District should evaluate how the proposed DFCs affect existing wells as part of the balance tests required in TWC §36.108

Decadal DFCs for PS12

2010-2030

PS12						
Aquifer	Sparta	Queen City	Carrizo	Calvert Bluff	Simsboro	Hooper
LostPines	11.1	13.5	80.5	74.6	186.9	70.1
BrazosValley	15.2	13.2	31.6	34.0	82.4	47.8
PostOak	15.4	14.3	108.7	81.7	167.1	77.0
Mid-East	8.3	7.9	24.5	27.7	38.8	30.7
Fayette	27.3	42.4	73.6	58.6	130.4	43.4

2010-2040

PS12						
Aquifer	Sparta	Queen City	Carrizo	Calvert Bluff	Simsboro	Hooper
LostPines	14.5	17.9	100.8	108.0	239.6	114.2
BrazosValley	24.2	21.1	45.7	55.5	126.7	83.3
PostOak	20.3	19.3	131.9	122.3	238.4	133.1
Mid-East	13.3	11.9	32.6	38.7	53.6	44.5
Fayette	31.6	50.0	90.3	95.1	183.5	81.9

2010-2050

PS12						
Aquifer	Sparta	Queen City	Carrizo	Calvert Bluff	Simsboro	Hooper
LostPines	17.1	21.3	114.5	127.3	270.1	139.3
BrazosValley	32.3	27.9	56.5	71.2	159.6	110.1
PostOak	24.4	23.3	147.3	146.7	280.9	167.9
Mid-East	17.7	15.2	38.7	46.8	64.2	55.6
Fayette	34.7	55.4	102.0	117.2	212.1	107.2

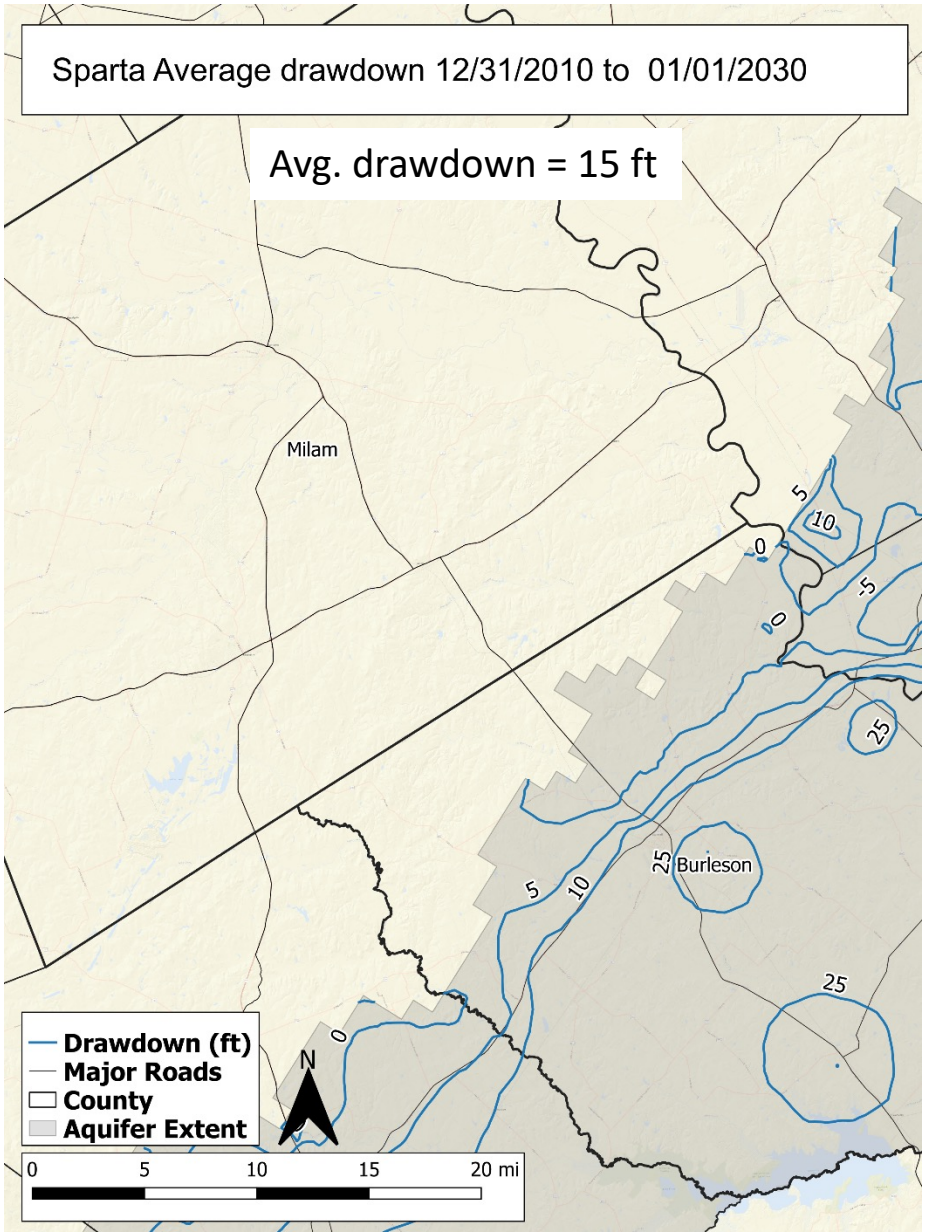
2010-2060

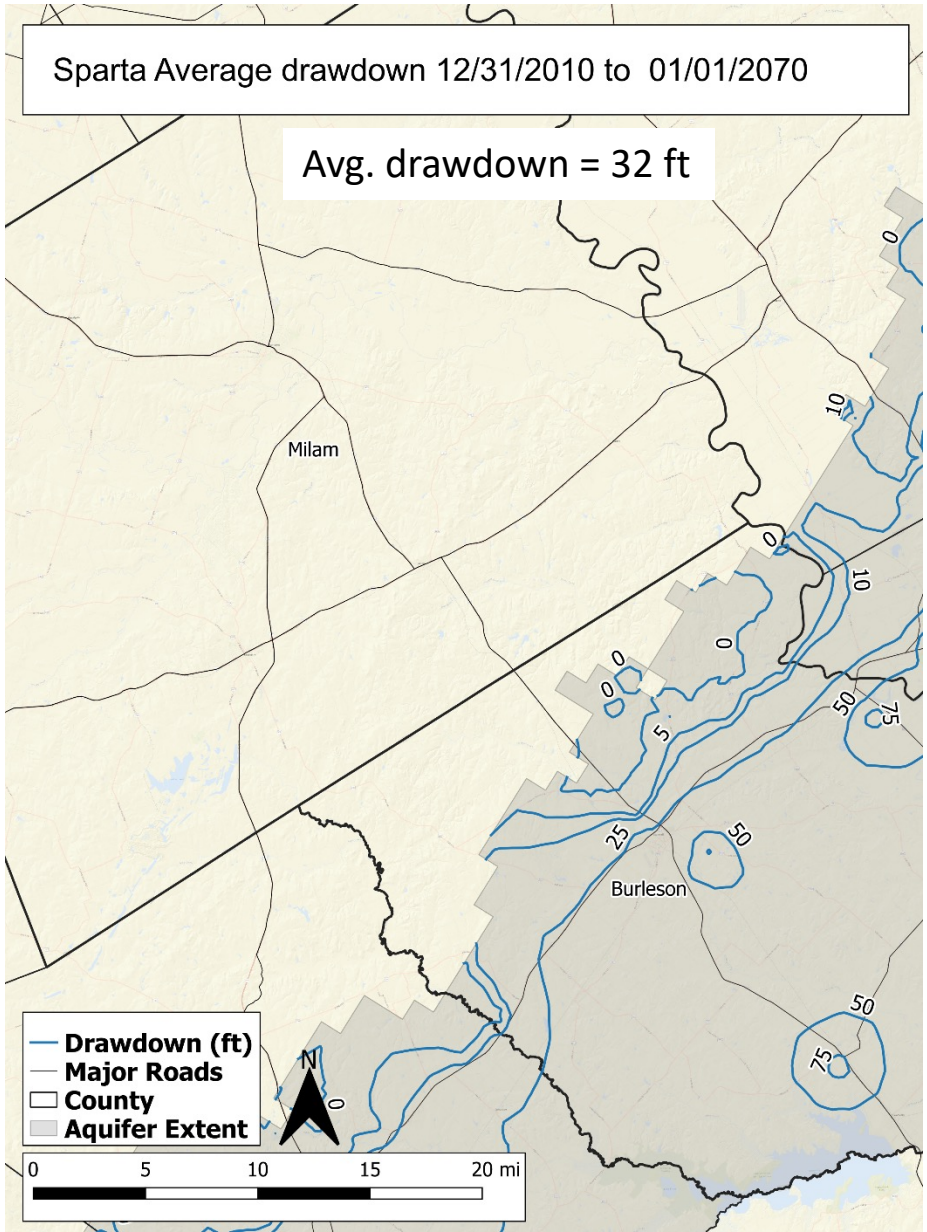
PS12						
Aquifer	Sparta	Queen City	Carrizo	Calvert Bluff	Simsboro	Hooper
LostPines	19.6	24.4	126.1	141.5	291.1	157.3
BrazosValley	39.9	34.2	66.0	83.9	186.9	131.5
PostOak	28.3	27.0	160.0	163.8	309.3	192.5
Mid-East	21.6	18.2	44.0	53.4	72.9	64.9
Fayette	37.5	60.3	112.2	133.3	231.3	125.7

2010-2070

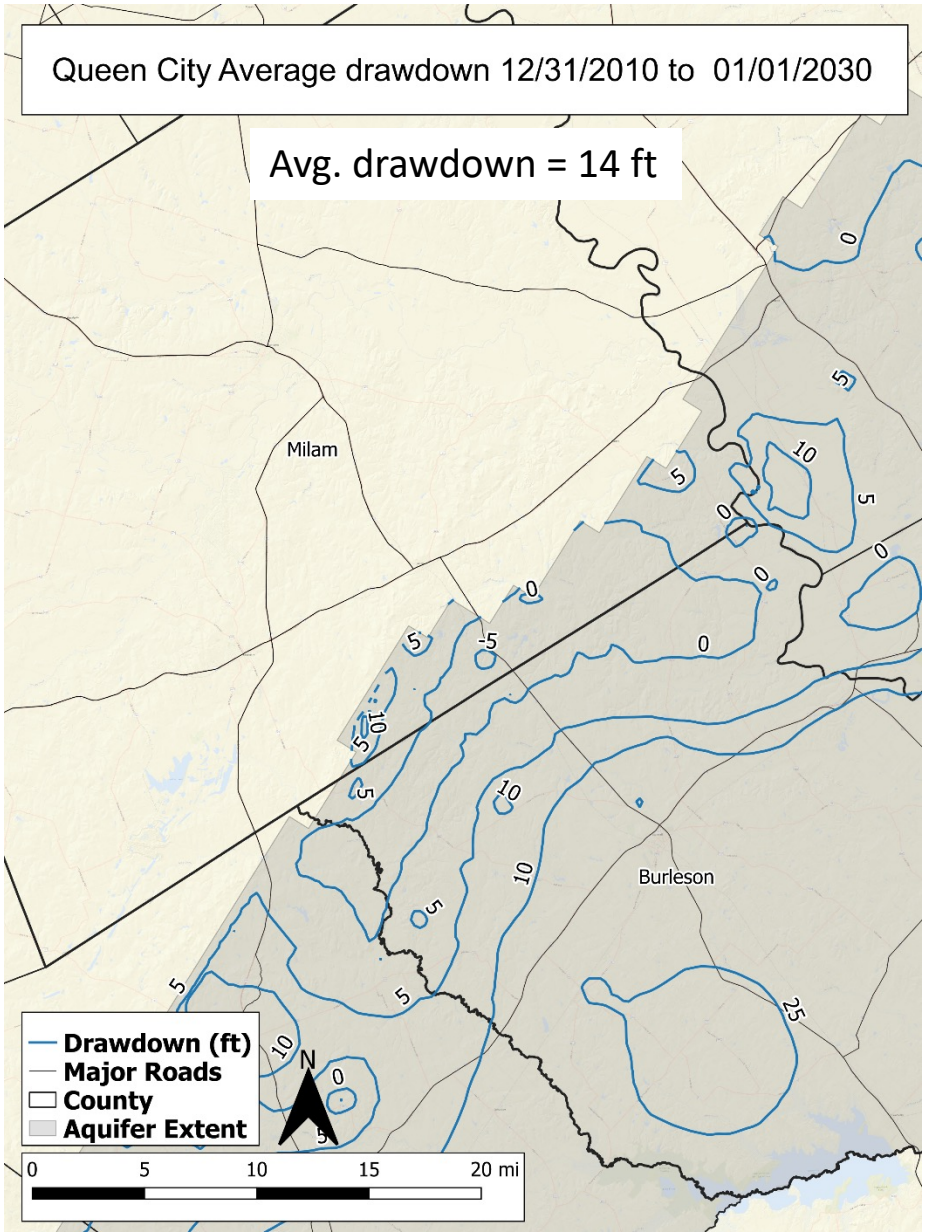
PS12						
Aquifer	Sparta	Queen City	Carrizo	Calvert Bluff	Simsboro	Hooper
LostPines	22.2	27.5	137.4	154.5	310.8	172.7
BrazosValley	47.3	40.3	75.1	95.9	213.3	151.1
PostOak	32.1	30.6	171.8	178.8	336.1	214.1
Mid-East	25.3	20.9	49.0	59.5	81.0	73.3
Fayette	40.1	65.0	122.1	147.2	249.0	141.0

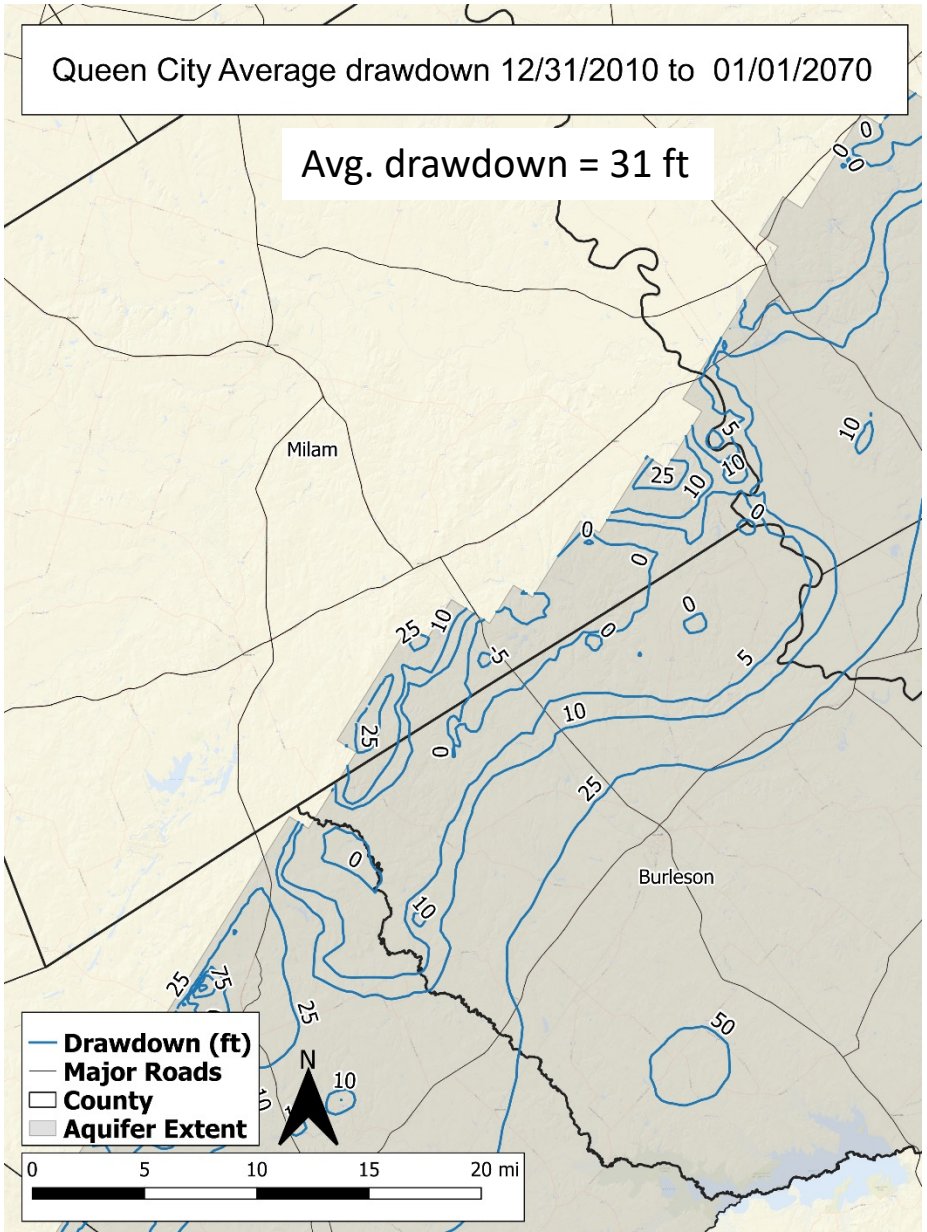
PS12 Estimated Drawdown in Sparta



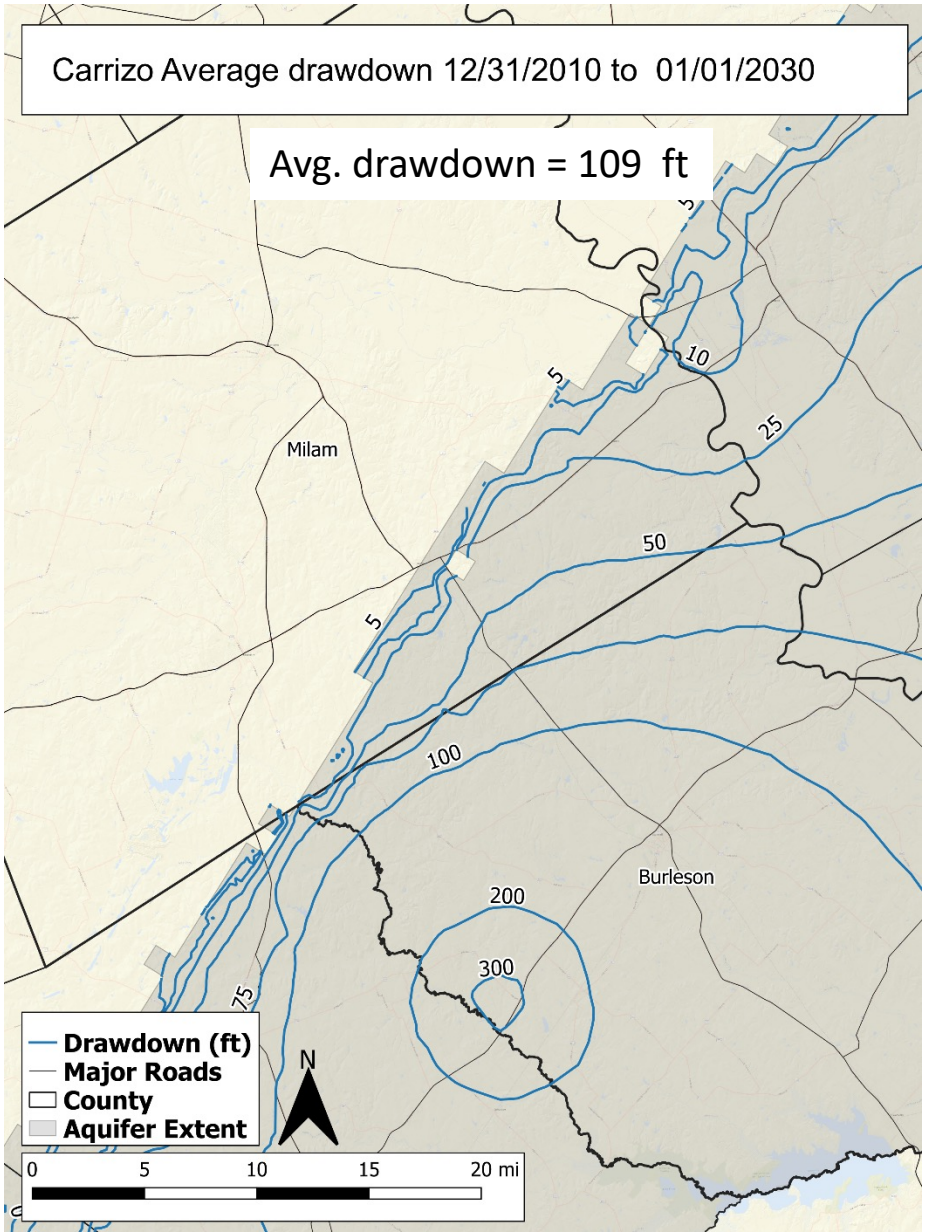


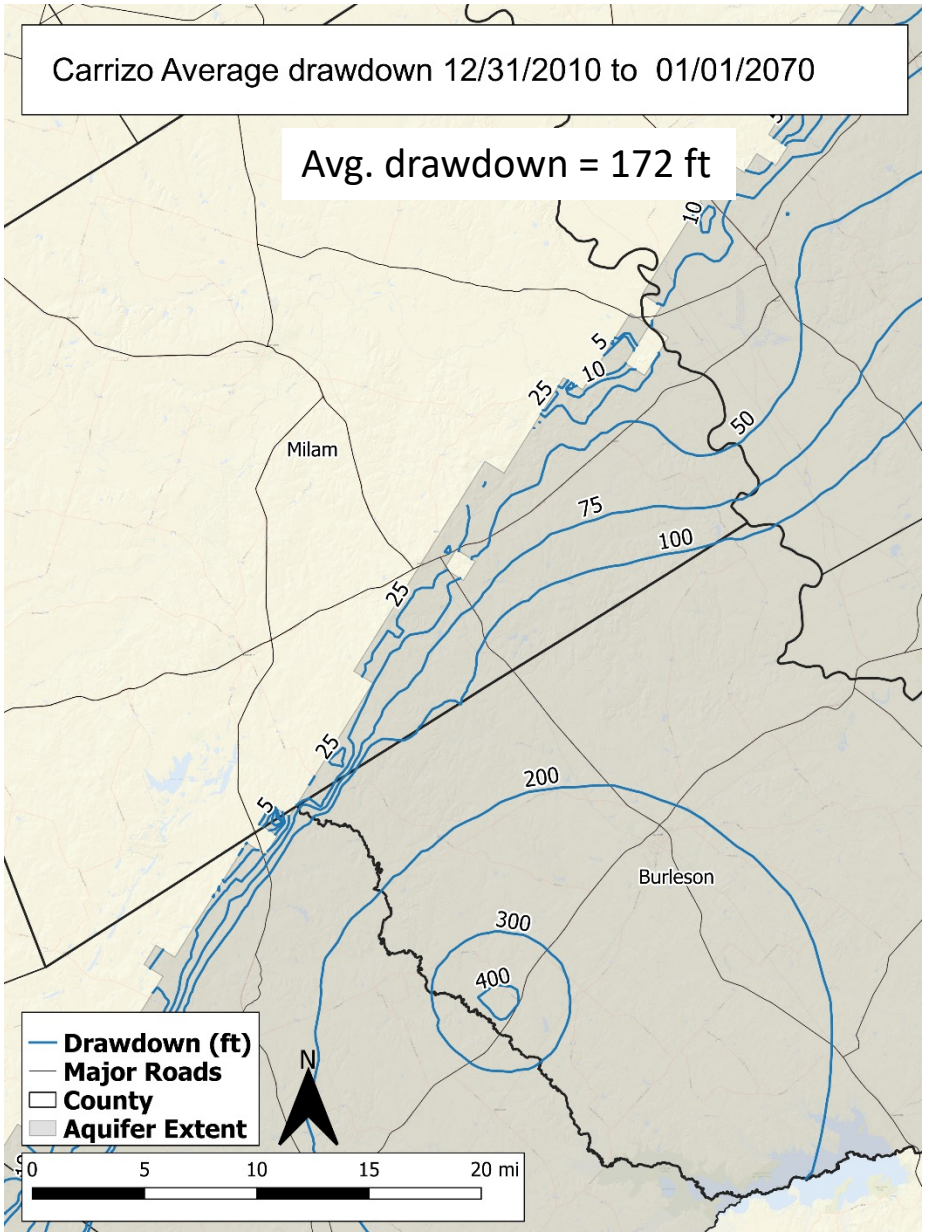
PS12 Estimated Drawdown in Queen City



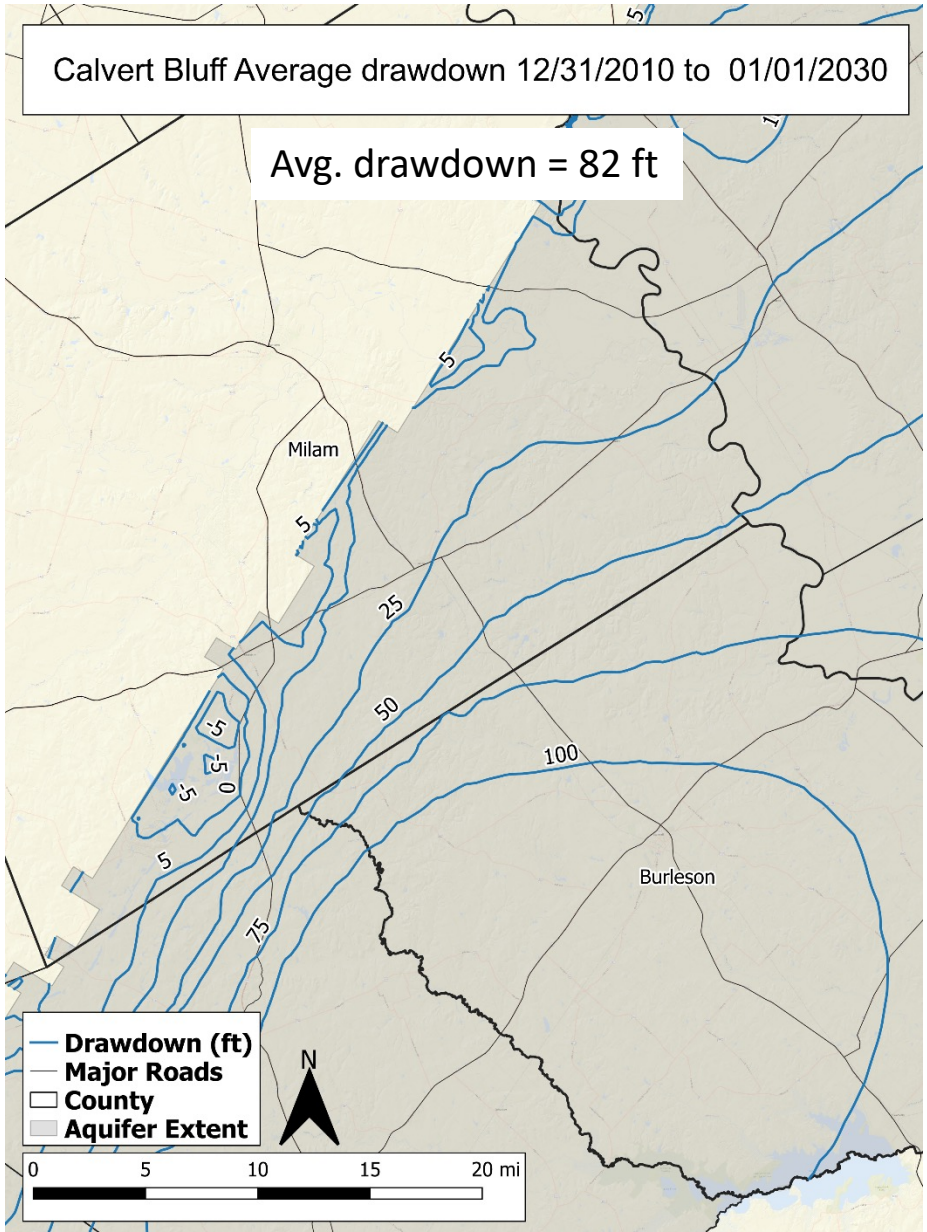


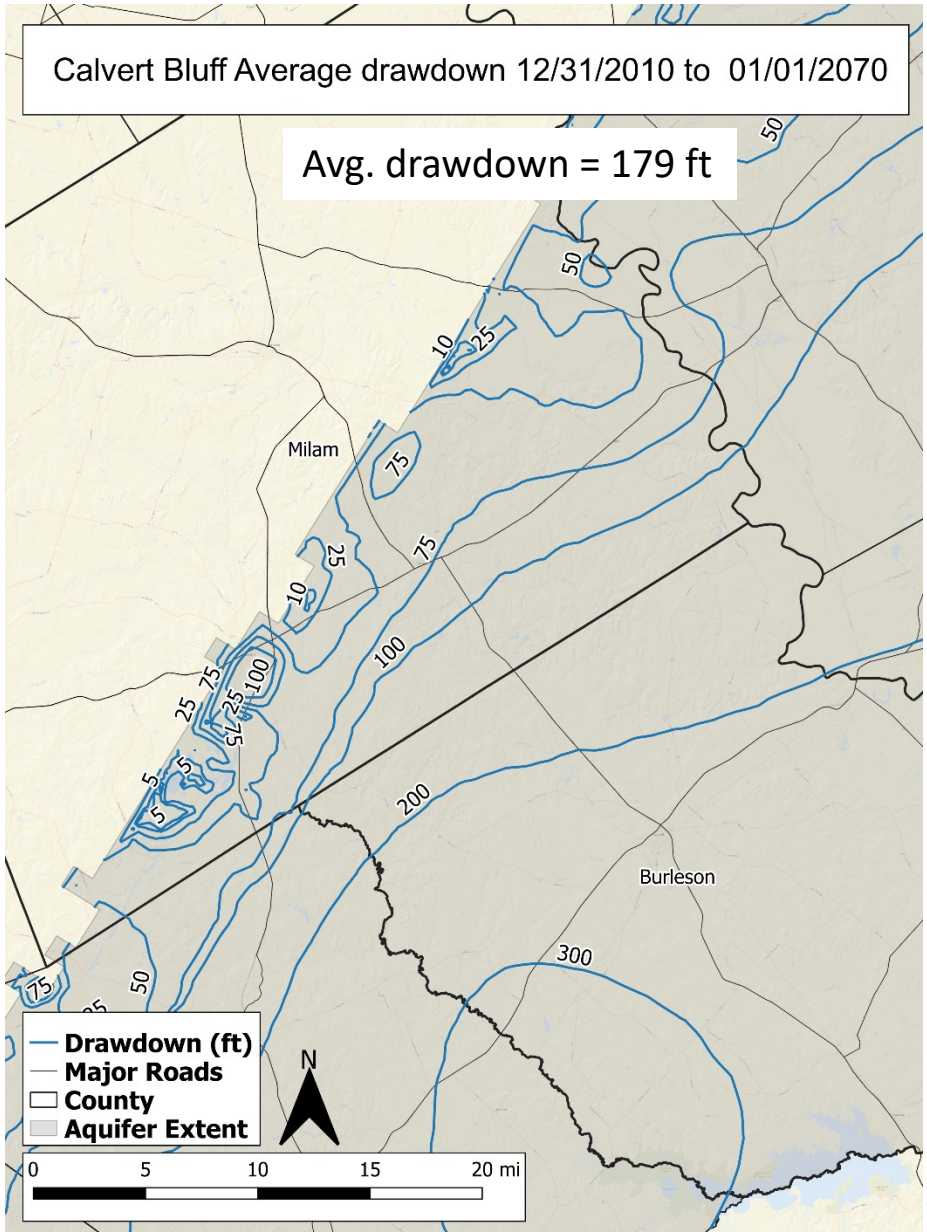
PS12 Estimated Drawdown in Carrizo



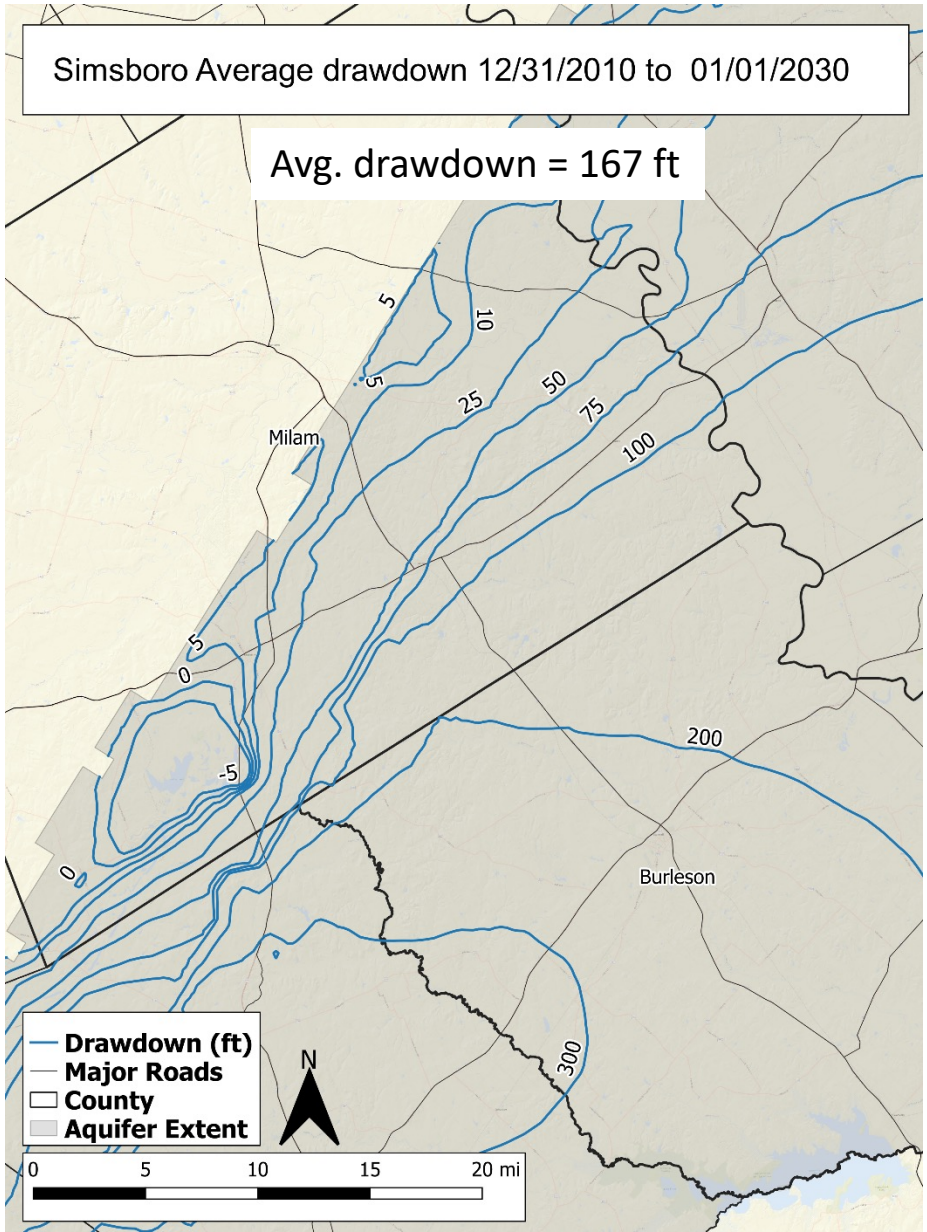


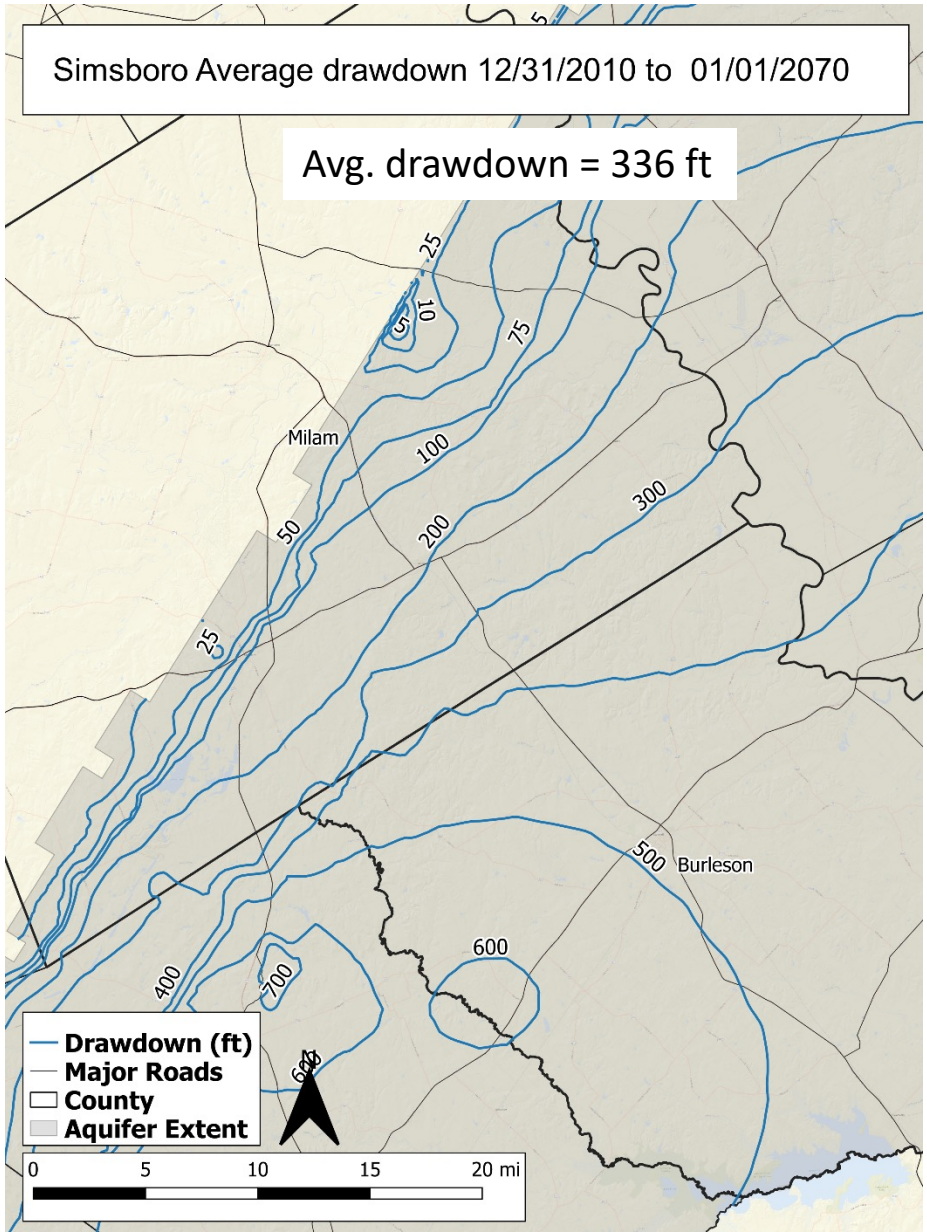
PS12 Estimated Drawdown in Calvert Bluff



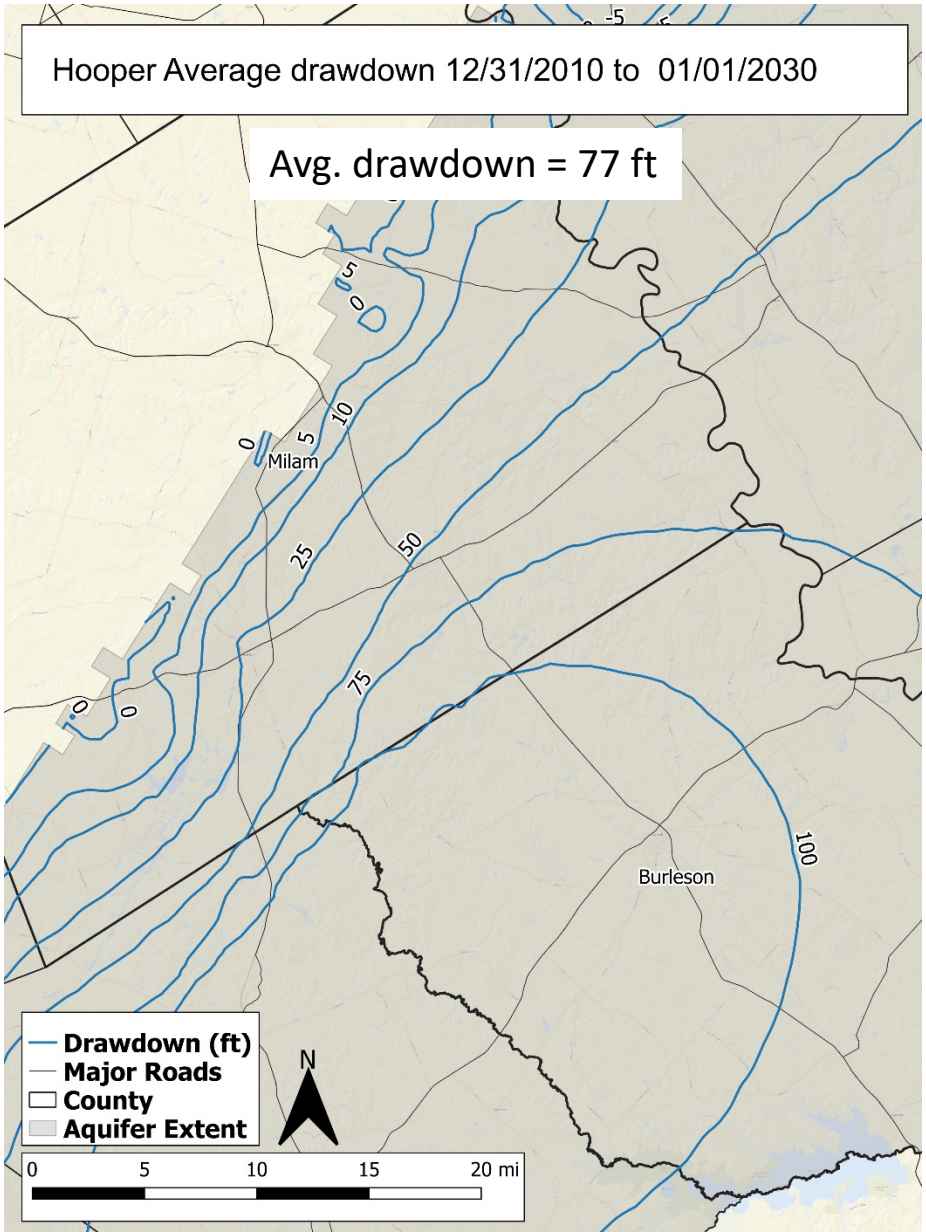


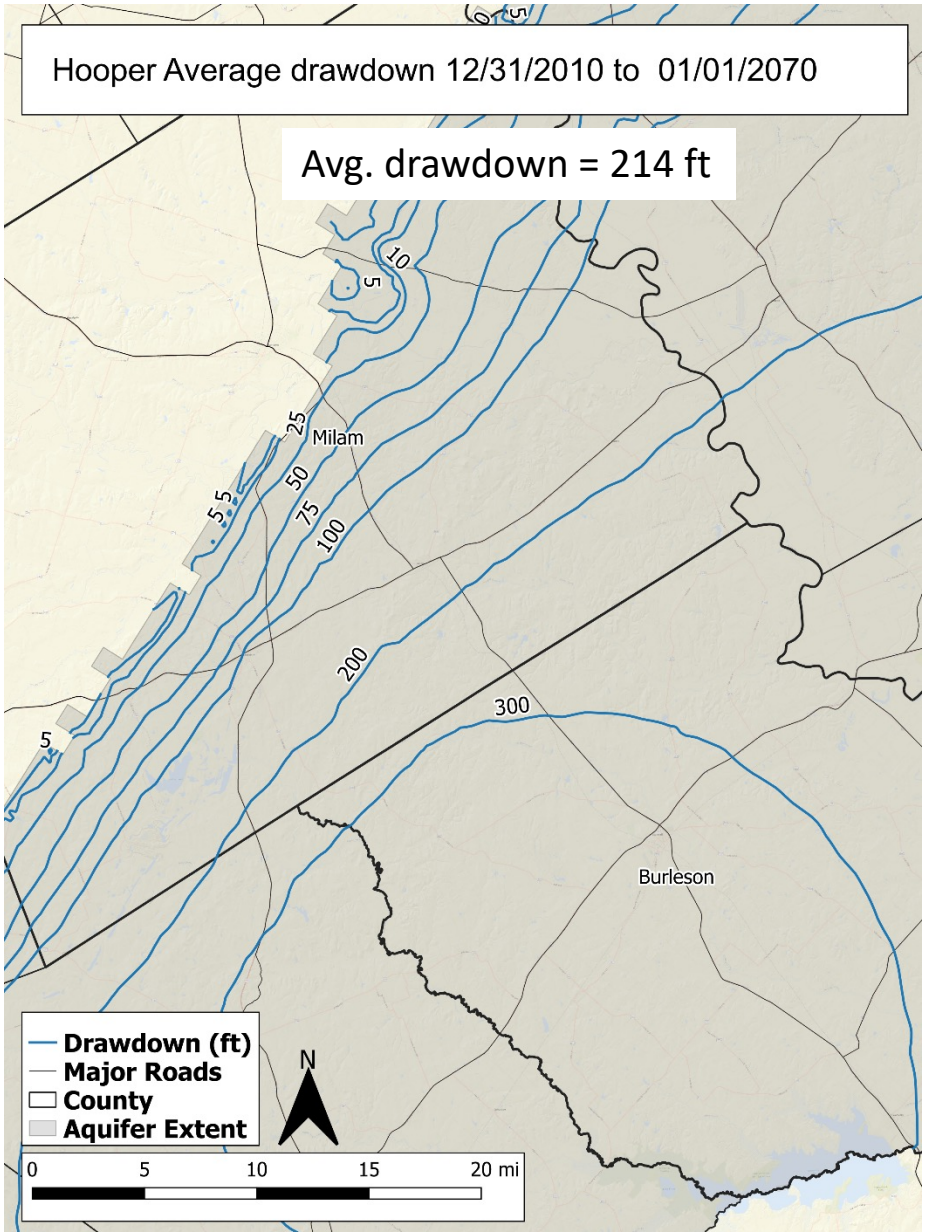
PS12 Estimated Drawdown in Simsboro

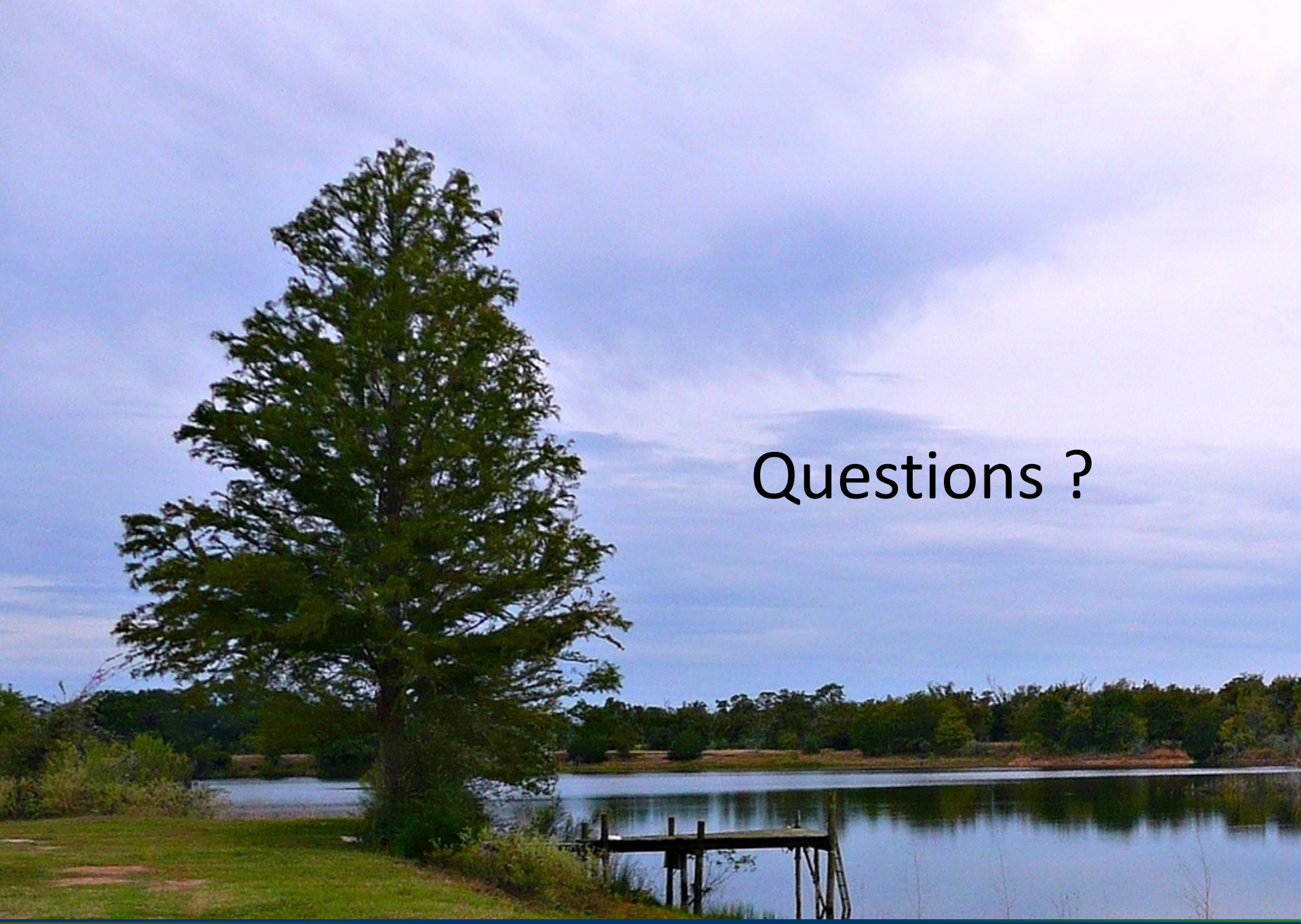




PS12 Estimated Drawdown in Hooper






Questions ?

Concerns with Process With Notes

- GMA 12 did not properly consider nine factors identified in TWC §36.108(d)

  (aquifer needs & conditions, needs & strategies, hydrologic conditions, environmental impacts, subsidence, socioeconomics impacts, private property rights, feasibility, other considerations)

- GMA 12 did not achieve TWC §36.108(d-2)

  (must provide a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging, and prevention of waste of groundwater … in the management area)

- Known pumping
  - VR pumping in 2020 was 8,800 AF

- GMA 12 is not required to account for "known pumping" in the future pumping scenario to define a DFC

  (POSGCD set most of its original DFCs without a model simulation , there is not GMA 12 definition of known pumping, maximum yearly Carrizo pumping <12,000 AFY, how to defined "known pumping" for POSGCD permits that terminate decades before 2070)

- POSGCD request to not include full permitted productions or requested production by well owners is not a process change

  (POSGCD has not changed it process for submitting it pumping rates since the first round of planning, For example, during the the first round of planning Simsboro pumping was added until a DFC of 300 ft was achieved and the Carrizo pumping was lowered until an acceptable Carrizo DFC for LPGCD was achieved by the GAM Run)

- DFC Values based on the SP/QC/CW GAM should be for the time interval 2011 to 2070 and not 2010 to 2070

  (Appears to be an oversight during the March 2021 GMA 12 meeting)

Impacts of Reduced Carrizo Pumping on Proposed DFCs - Notes

GCD	Average Drawdown (ft) in Carrizo		Difference between PS-12 and PS-13	10% Variance Allowed on DFC
	PS-12 (18,200 AFY)	PS-13 (12,000 AFY)		
Lost Pines	137	123	-14	13.7
Brazos Valley	75	70	-5	7.5
Post Oak Savannah	172	145	-27	17.2
Mid-East Texas	49	48	-1	4.9
Fayette	122	116	-6	12.2

* Based on comparison of PS-13 and PS-12