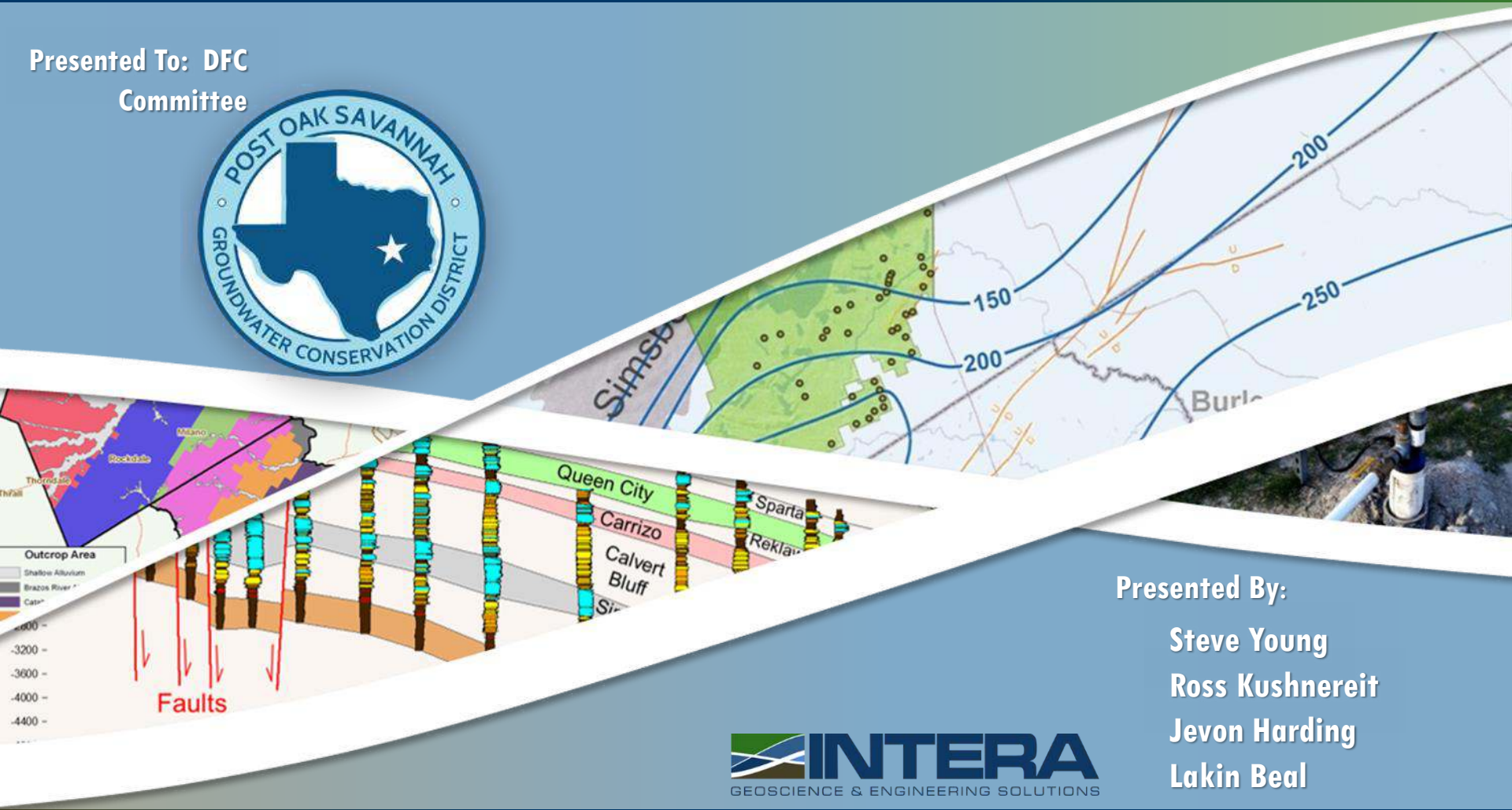
Desired Future Committee Update

Presented To: DFC Committee



Presented By:

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Ross Kushnereit
Jevon Harding
Lakin Beal

INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

December 4, 2020

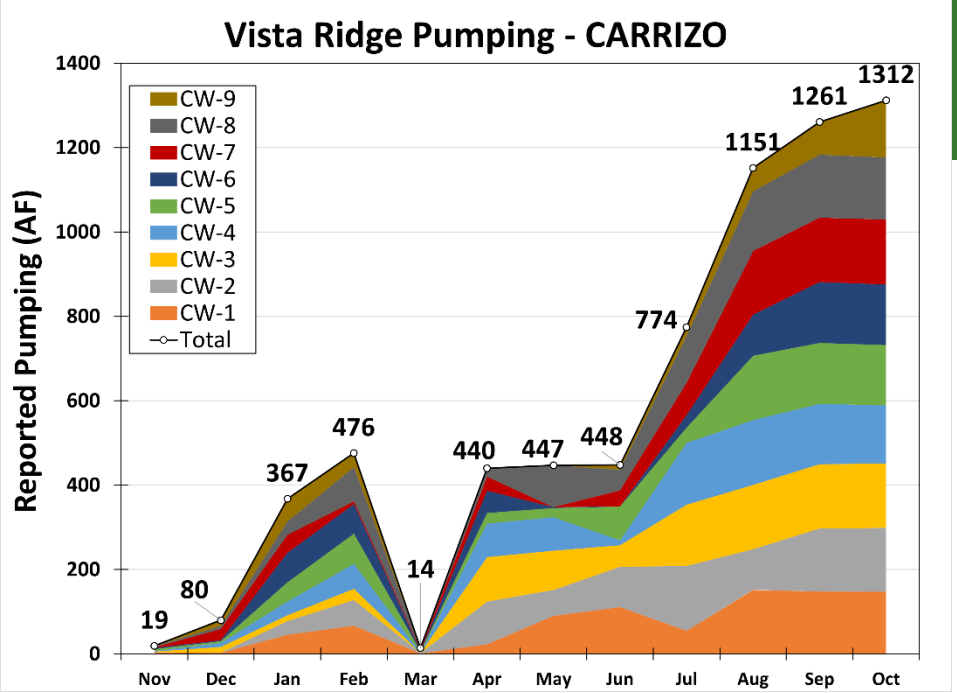
Outline

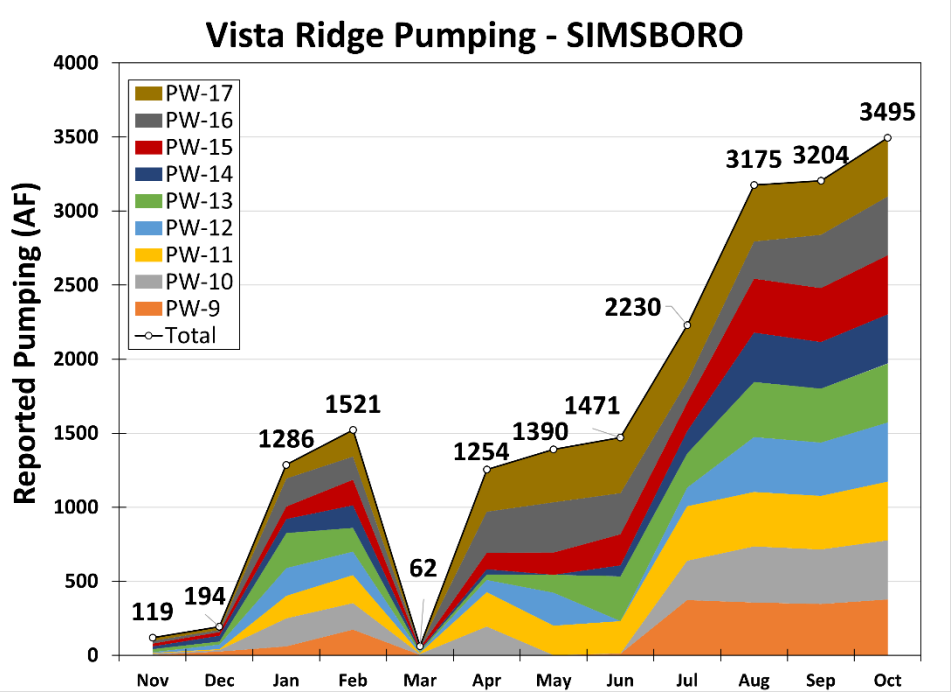
- Vista Ridge Modeling Update
- GWAP Annual Needs Assessment Report
- Compliance for DFCs and PDLs
- Update on Rule 16.4 Thresholds
- Sparta/Queen City/Carrizo-Wilcox GAM Runs and Options for DFC consideration

Vista Ridge Modeling Update

Vista Ridge Pumping Through October 2020

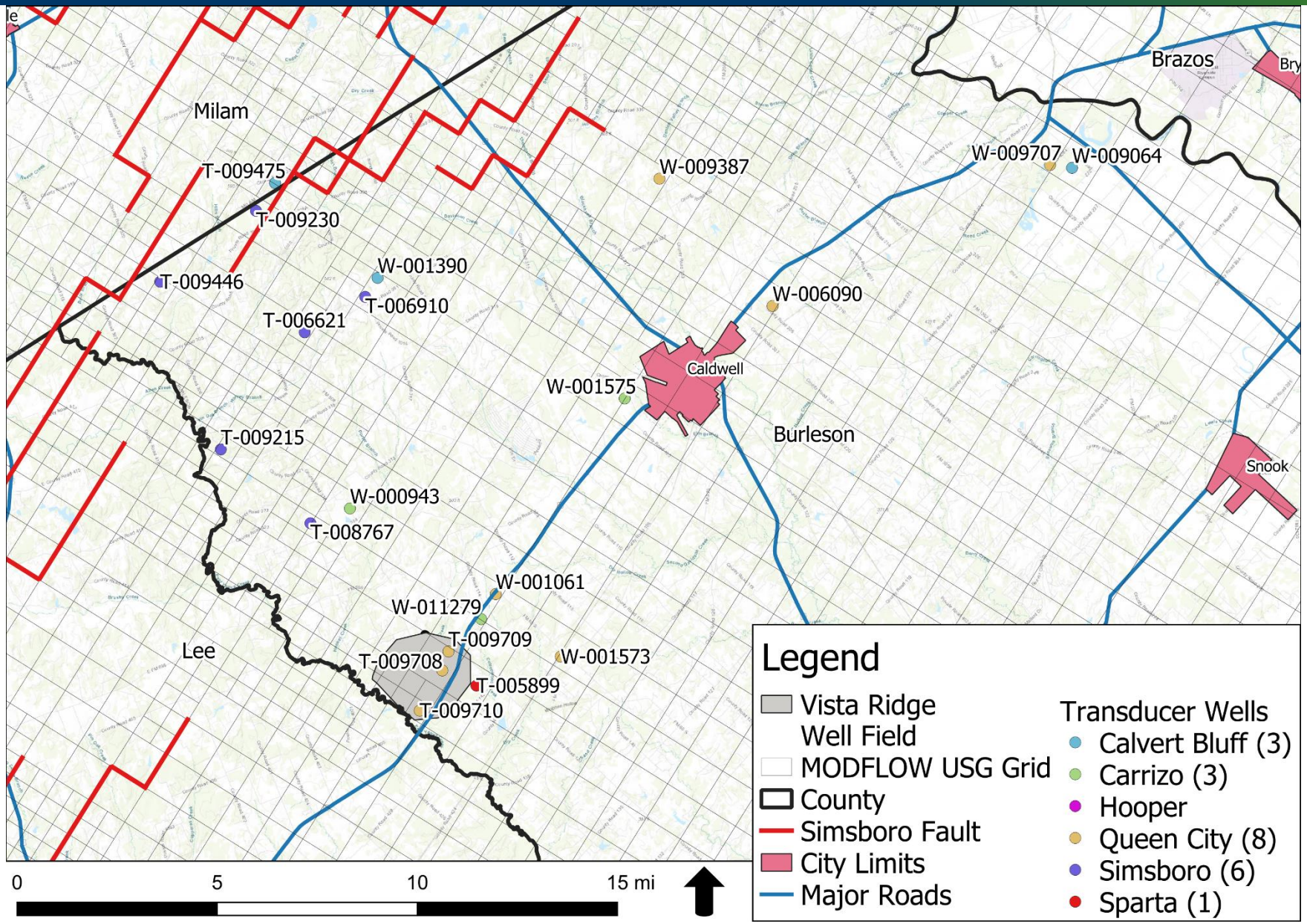
Month	Monthly acre-feet		
	Carrizo	Simsboro	Total
Nov 2019	19	119	138
Dec 2019	80	194	274
Jan 2020	367	1,286	1,653
Feb 2020	476	1,521	1,997
Mar 2020	14	62	76
Apr 2020	440	1,254	1,694
May 2020	447	1,390	1,837
Jun 2020	448	1,471	1,919
Jul 2020	774	2,230	3,004
Aug 2020	1,151	3,175	4,326
Sept 2020	1261	3204	4,464
Oct 2020	1,312	3,495	4,807
Avg. Monthly Permit	1,250	2,994	4,244



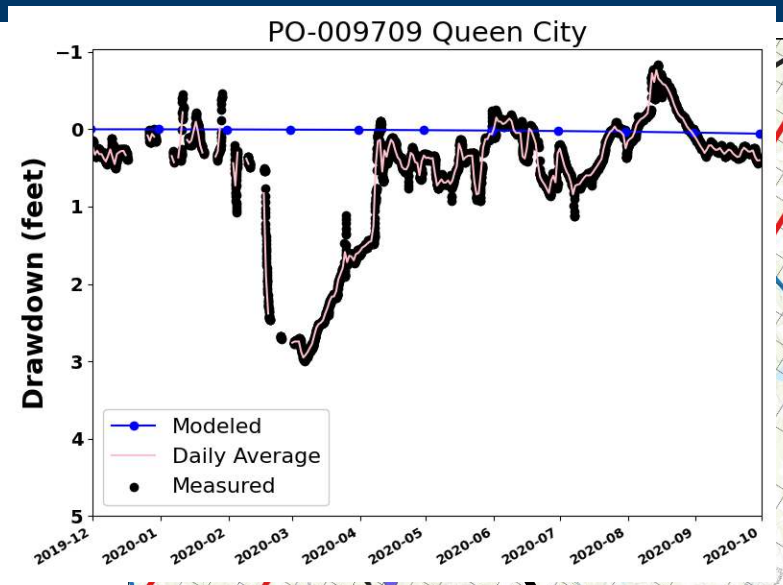


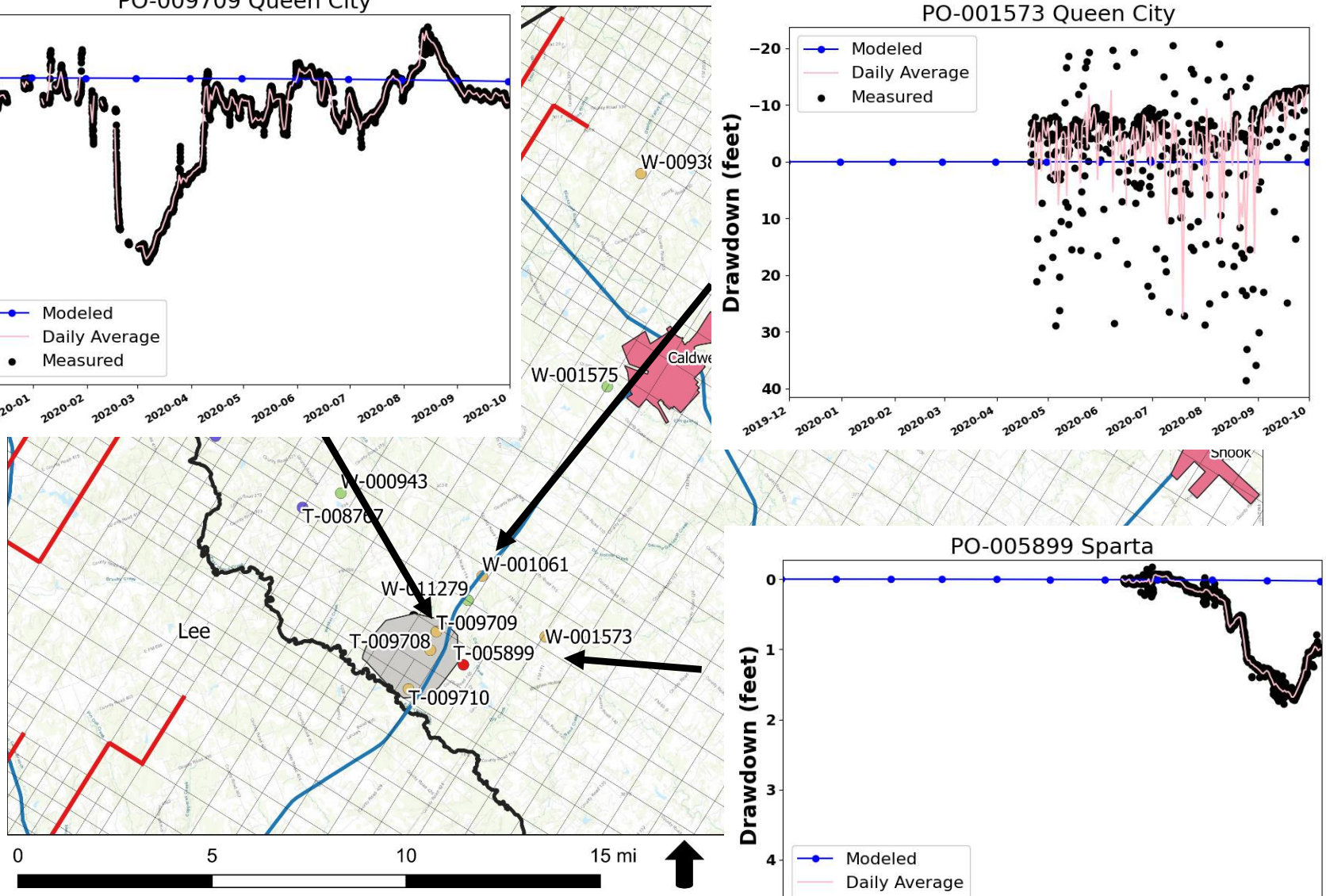
*1000 af/month = 7,428 gpm

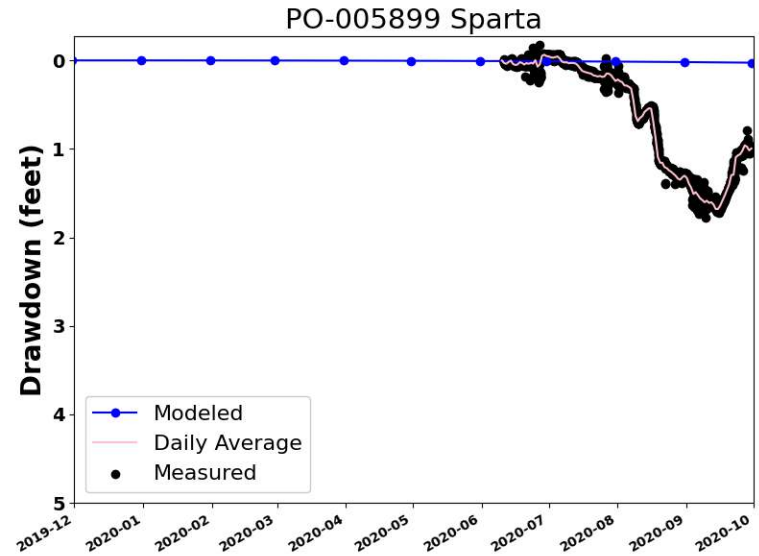
Location of Transducers



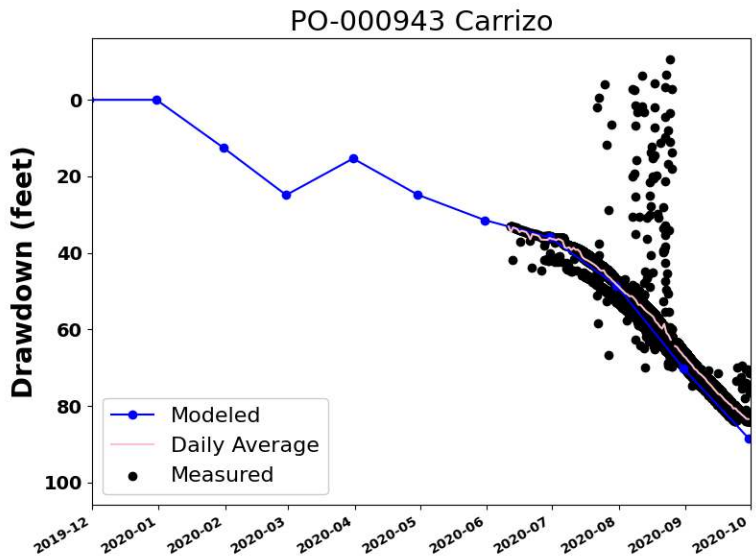
Sparta & Queen City (Dec 2019 to October 2020)

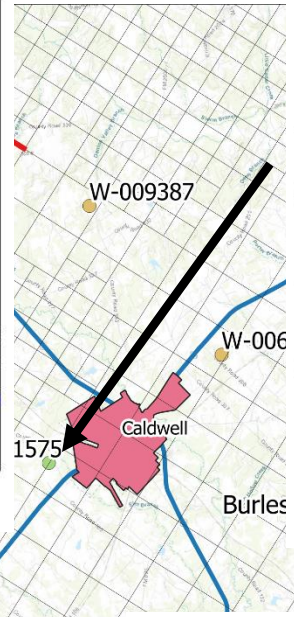


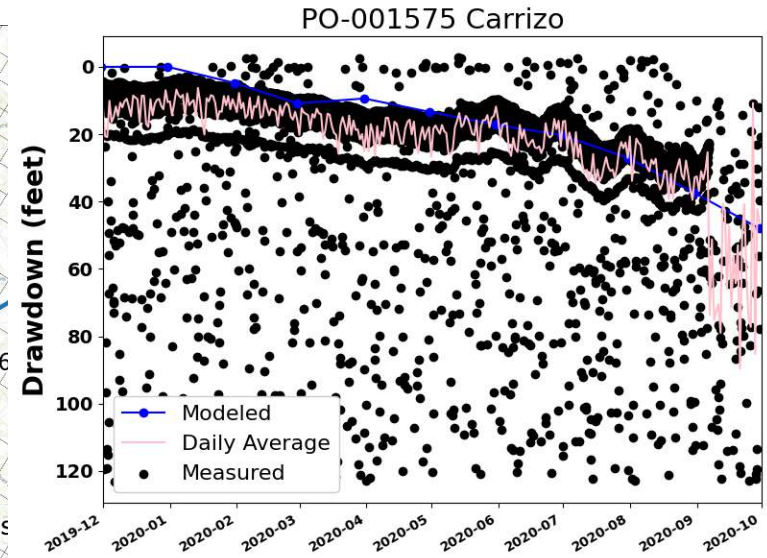


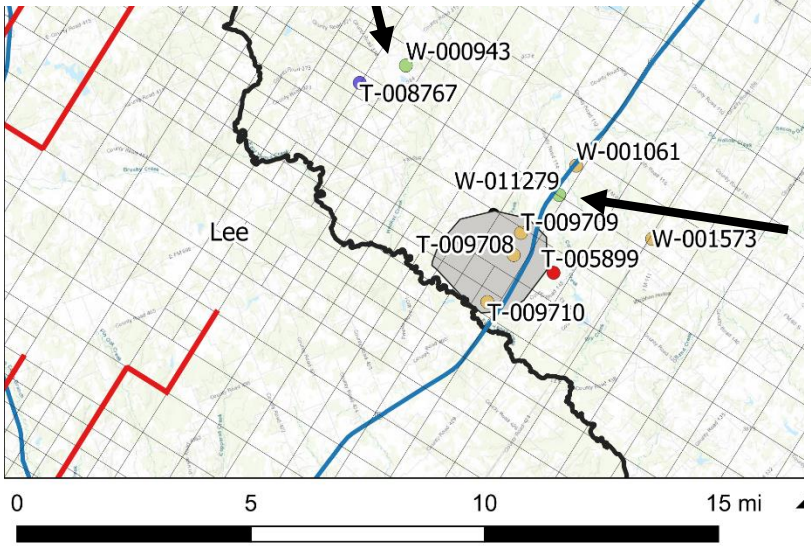


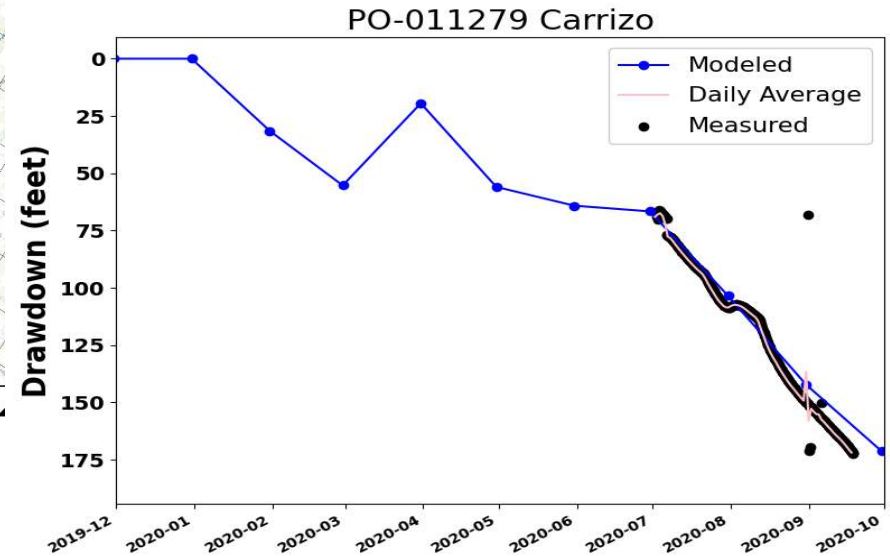
Carrizo (Dec 2019 to October 2020)



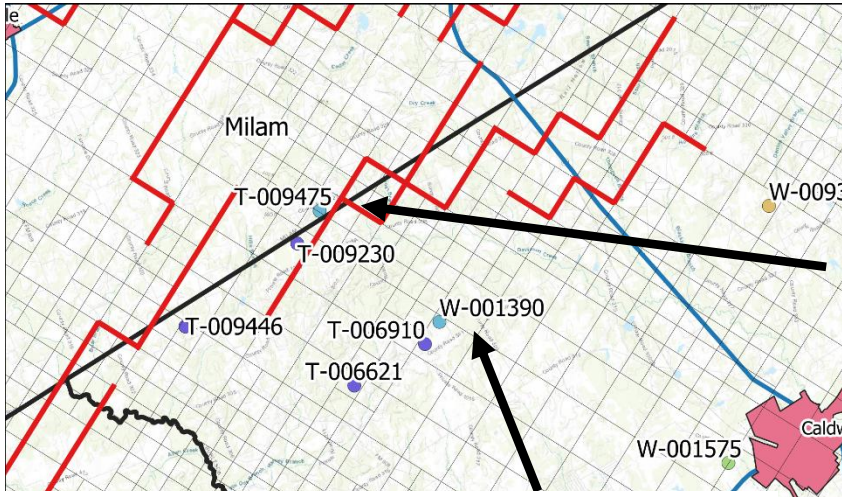


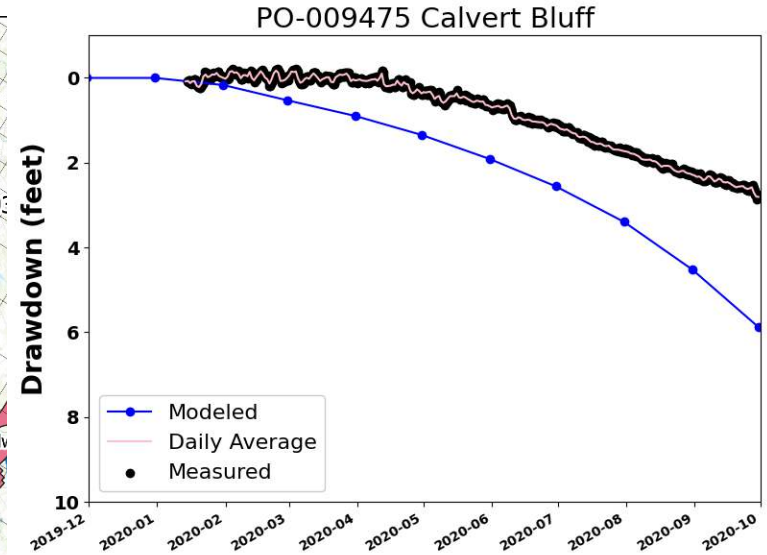


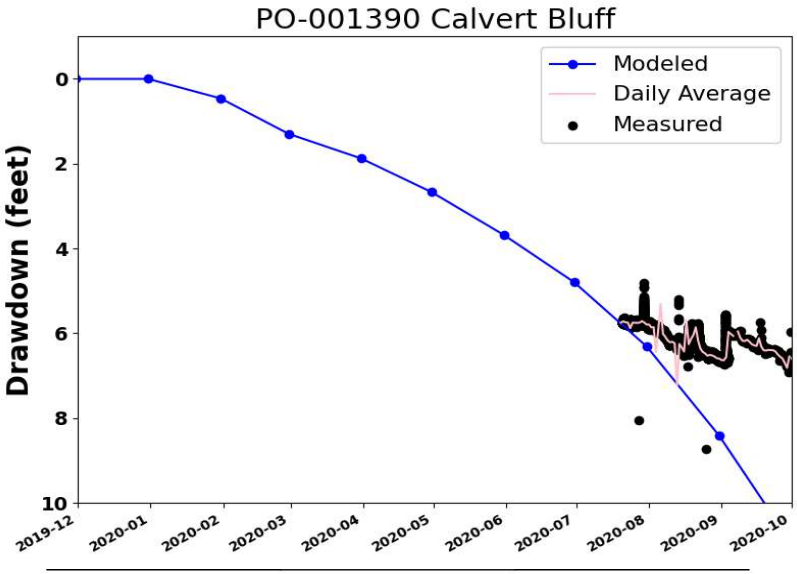


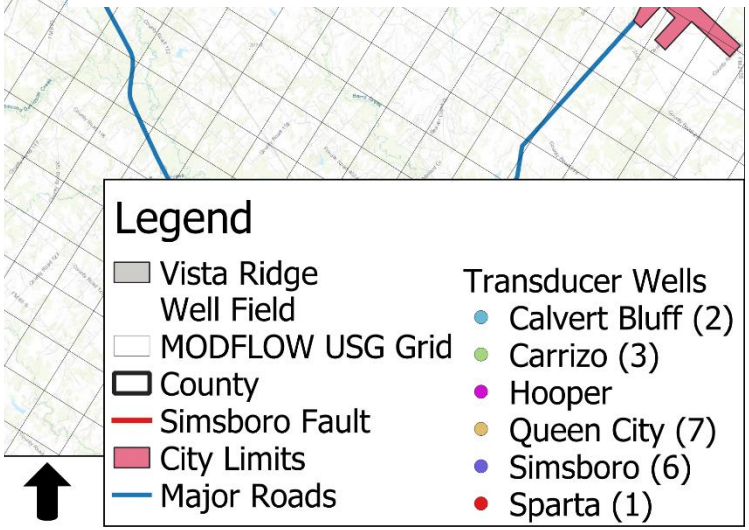


Calvert Bluff (Dec 2019 to October 2020)

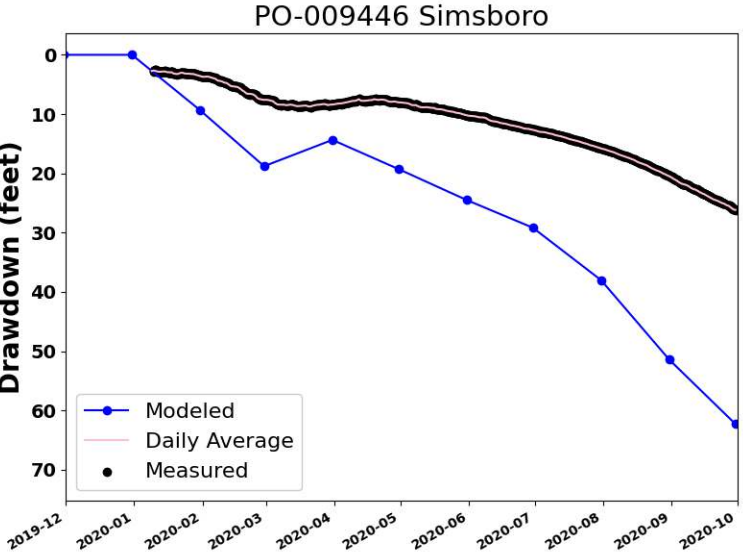


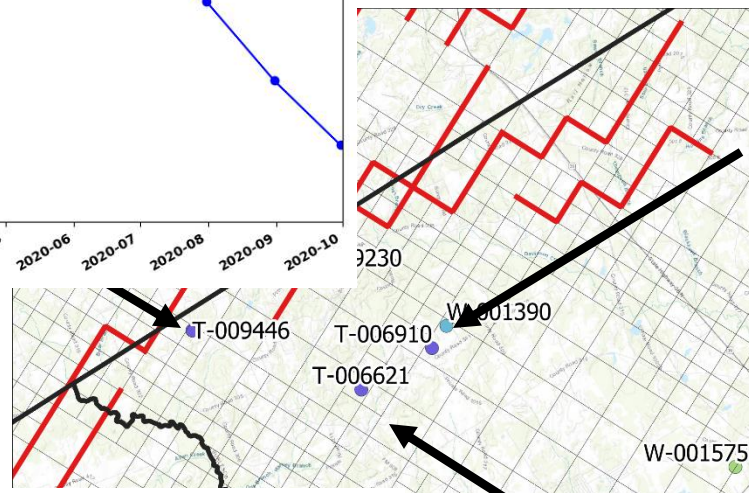


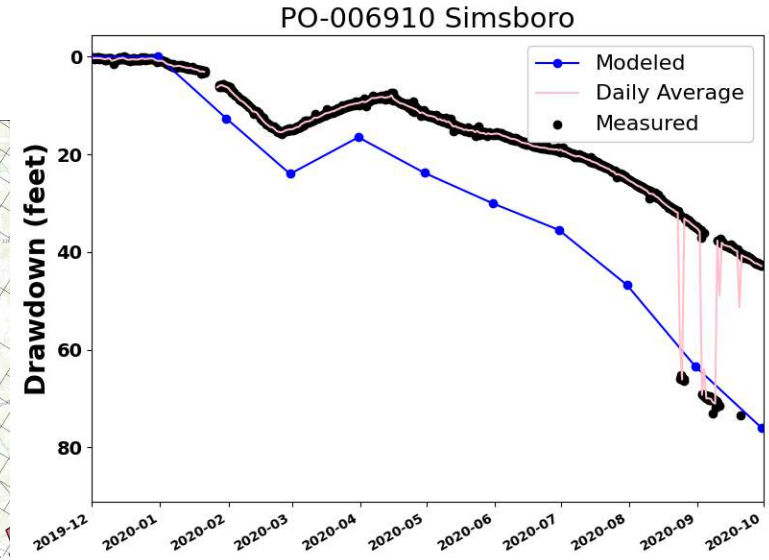


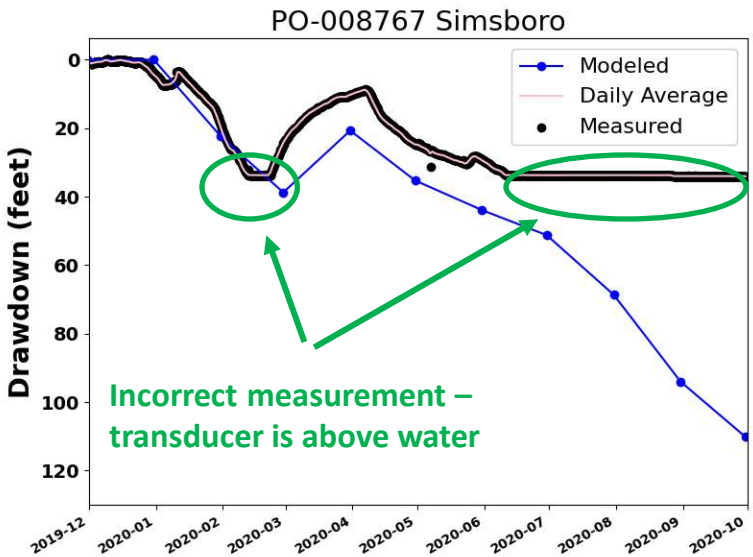


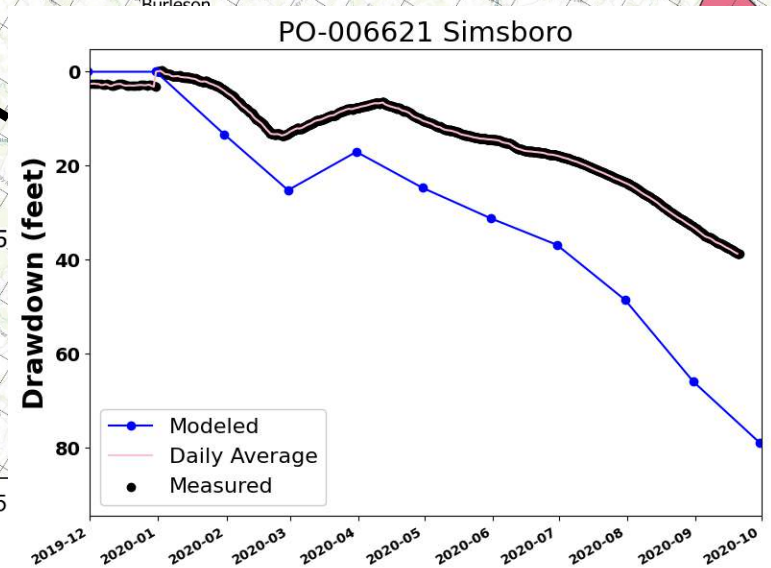
Simsboro (Dec 2019 to October 2020)











Observations

- Measured drawdowns are about the same or less than simulated by groundwater model - - no surprises
- No distinguishable drawdown impacts in Sparta or Queen City attributed to Vista Ridge Production
- Groundwater model simulated drawdowns
  - similar in magnitude than measured values in Carrizo Aquifer
  - greater in magnitude than measured values in Simsboro Aquifer
- Assumptions for groundwater model simulations
  - Monthly time step
  - Only considers pumping from Vista Ridge wells

GWAP Annual Needs Assessment(GANA) Report

GANA

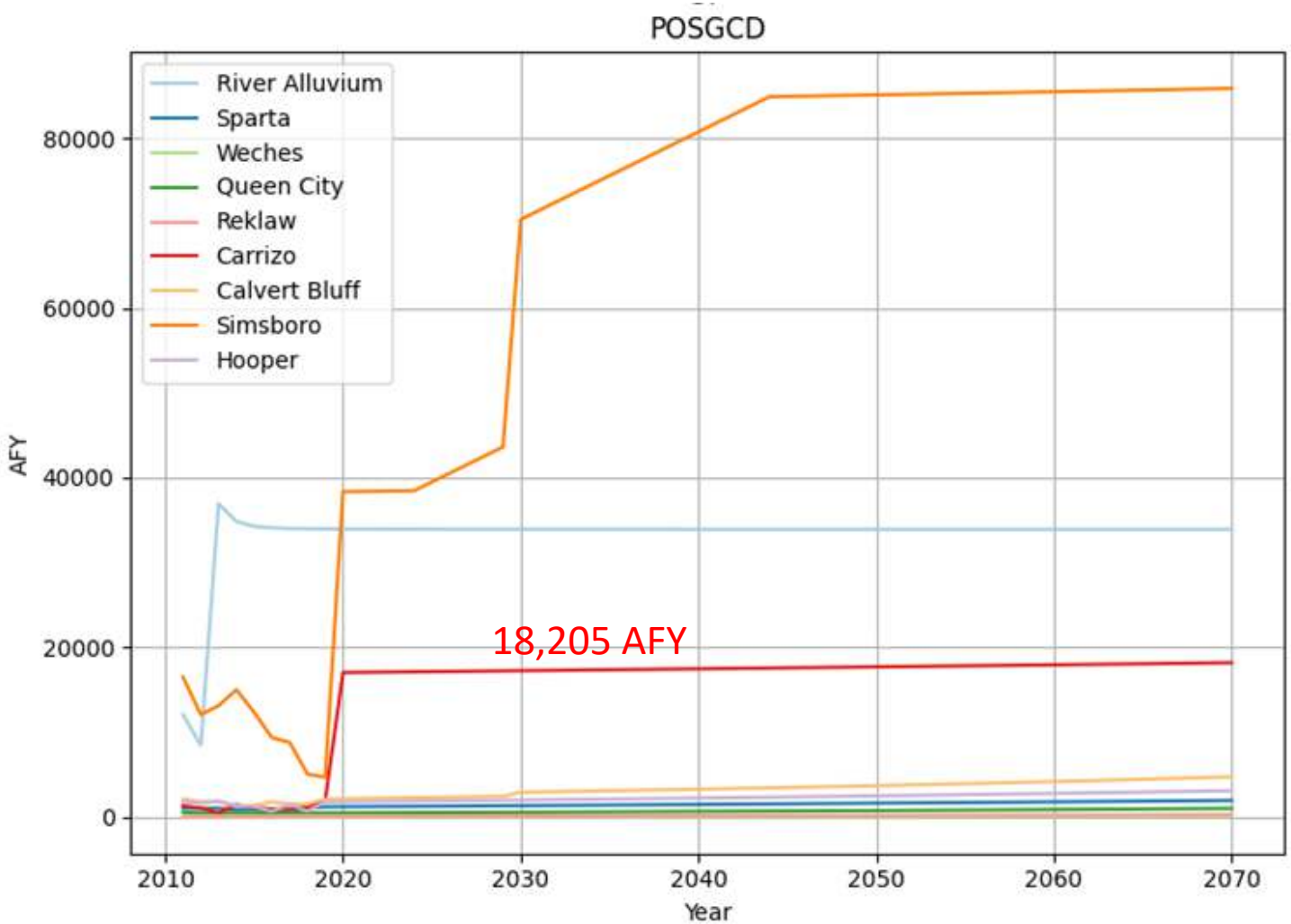
The objective of the GANA is to identify eligible wells where water levels are likely to decline below the elevation of the pump setting as a result of regional groundwater production in GMA 12 within the next 10 years.

Eligibility Requirements

- Located in Milam or Burleson counties
- Functional and registered with the District
- Accessible for monitoring water levels by POSGCD
- Owner must agree to allow monitoring by POSGCD
- Either a low-capacity permitted well that produces less than 50 gallons per minute (gpm) OR an exempt well used for domestic and/or livestock use as defined in the District's Rules
- Completed in any aquifer in the District other than the Trinity Aquifer, Yegua-Jackson Aquifer and river alluvial or terraced formations
- May not be covered by a mitigation agreement included in a permit issued by the District or required by the State of Texas

Approach

- Simulate water levels using recently modified SP/QC/CW GAM
- Future pumping using a slightly modified PS-7



High-Priority Wells

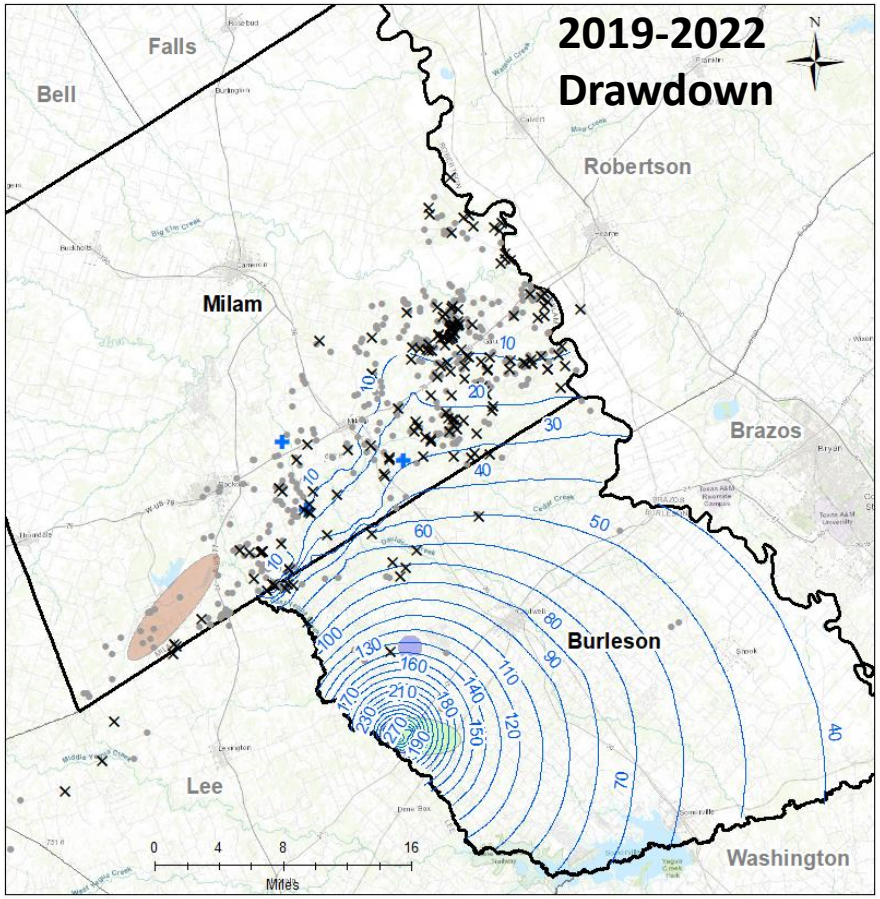
high-priority well meet the following two conditions:

(1) the simulated water level is greater than 15 ft above the pump elevation in 2019, and
(2) the simulated water level is less than 15 ft above the pump elevation in 2029.

Aquifer	Eligible Wells w/Pump Info	Year	Simulated Water Level Elevation Relative to Pump Elevation							
			<15 ft above pump	<10 ft above pump	<5 ft above pump	> 5 ft below pump	>20 ft below pump	>25 ft below pump	>50 ft below pump	> 100 ft below pump
Sparta	116	2029	0	0	1	0	0	0	0	0
Queen City	127	2029	1	2	1	1	0	0	0	0
Carrizo	80	2029	36	36	35	30	28	24	13	3
Calvert Bluff	168	2029	3	4	2	2	1	1	0	0
Simsboro	44	2029	1	0	0	1	4	4	0	0
Hooper	140	2029	0	2	0	0	0	0	0	0

41 high-priority wells

Calvert Bluff



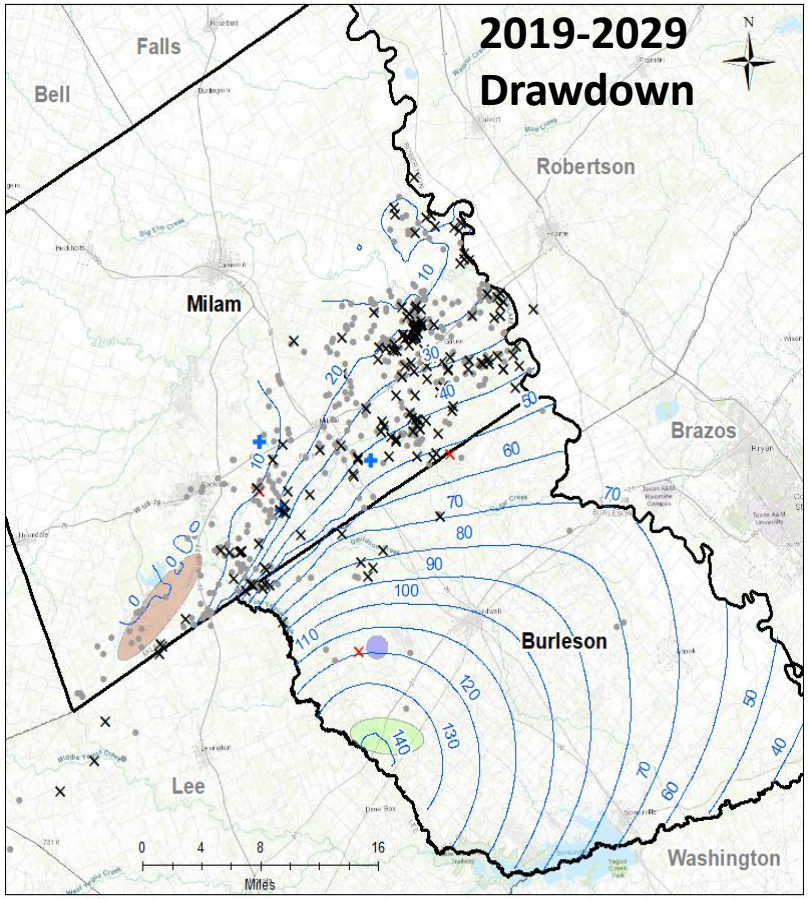
Calvert Bluff

- 130 Well Field
- ALCOA Well Field
- Vista Ridge Well Field
- POSGCD Boundary
- County Line

Eligible Wells

- WL > 15 ft above pump in 2022 (n=168)
- WL < 15 ft above pump in 2022 (n=0)
- WL < 15 ft above pump in 2019 (n=10)
- No Pump Depth Information (n=380)
- 3 Year Drawdown

0 high-priority well



Calvert Bluff

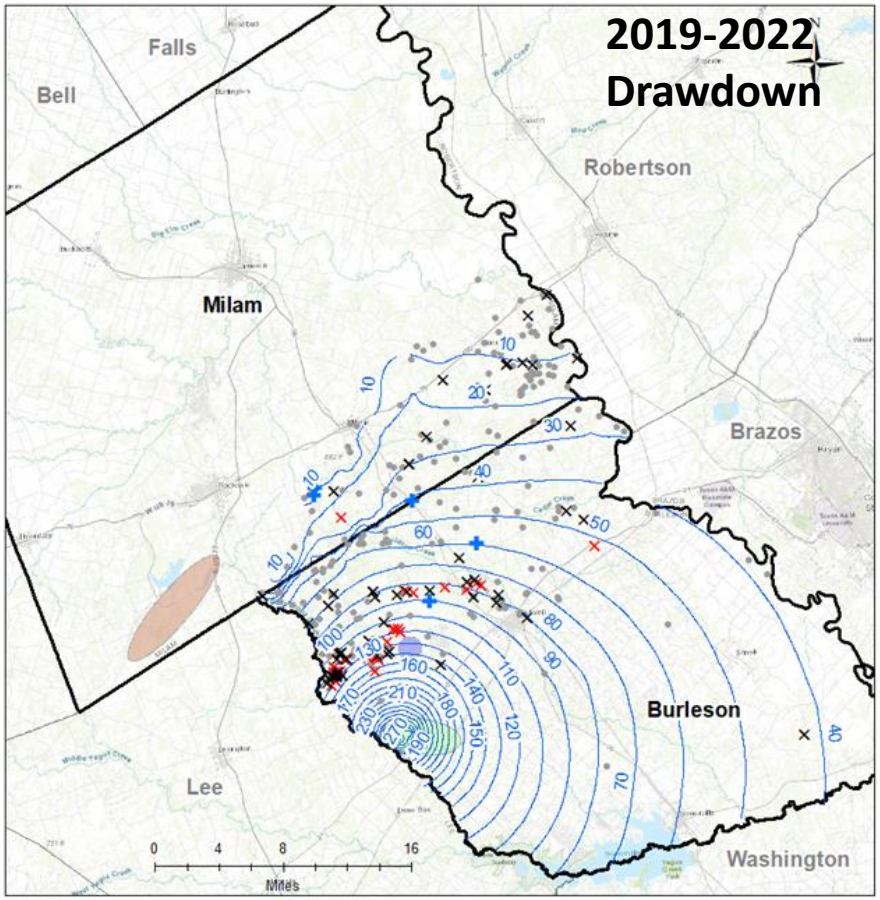
- 130 Well Field
- ALCOA Well Field
- Vista Ridge Well Field
- POSGCD Boundary
- County Line

Eligible Wells

- WL > 15 ft above pump in 2029 (n=165)
- WL < 15 ft above pump in 2029 (n=3)
- WL < 15 ft above pump in 2019 (n=3)
- No Pump Depth Information (n=380)
- 10 Year Drawdown

3 high-priority well

Carrizo



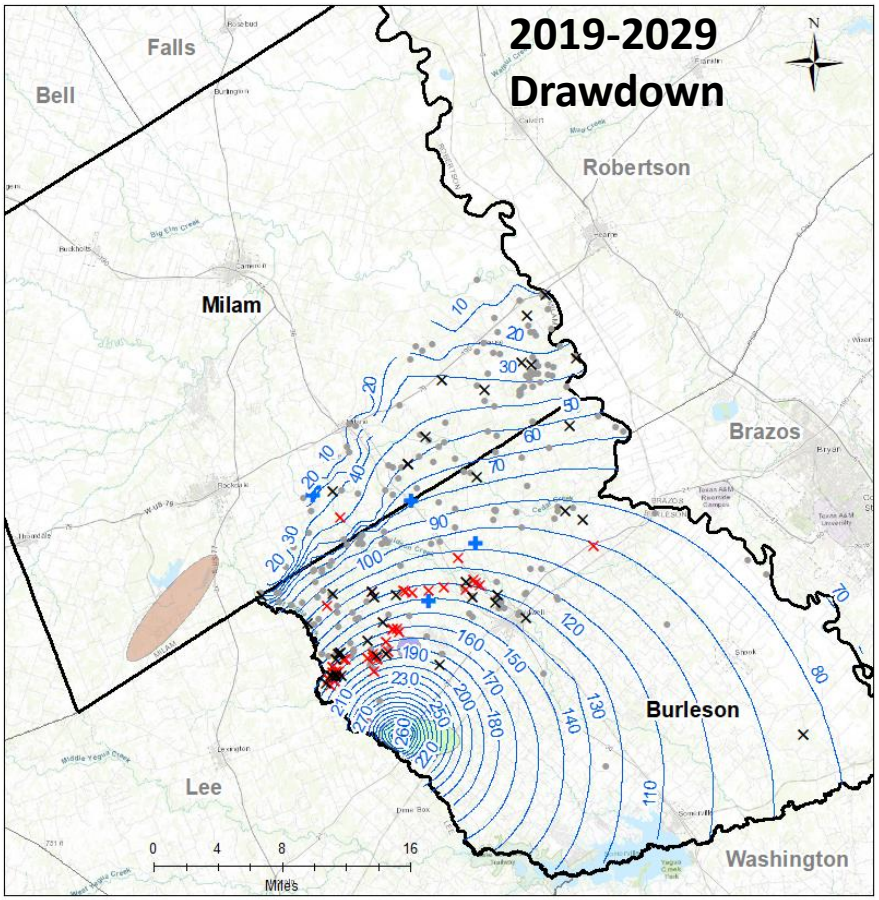
Carrizo

- 130 Well Field
- ALCOA Well Field
- Vista Ridge Well Field
- POSGCD Boundary
- County Line

Eligible Wells

- × WL > 15 ft above pump in 2022 (n=54)
- × WL < 15 ft above pump in 2022 (n=26)
- ✚ WL < 15 ft above pump in 2019 (n=5)
- • No Pump Depth Information (n=202)
- —— 3 Year Drawdown

26 high-priority well



Carrizo

- 130 Well Field
- ALCOA Well Field
- Vista Ridge Well Field
- POSGCD Boundary
- County Line

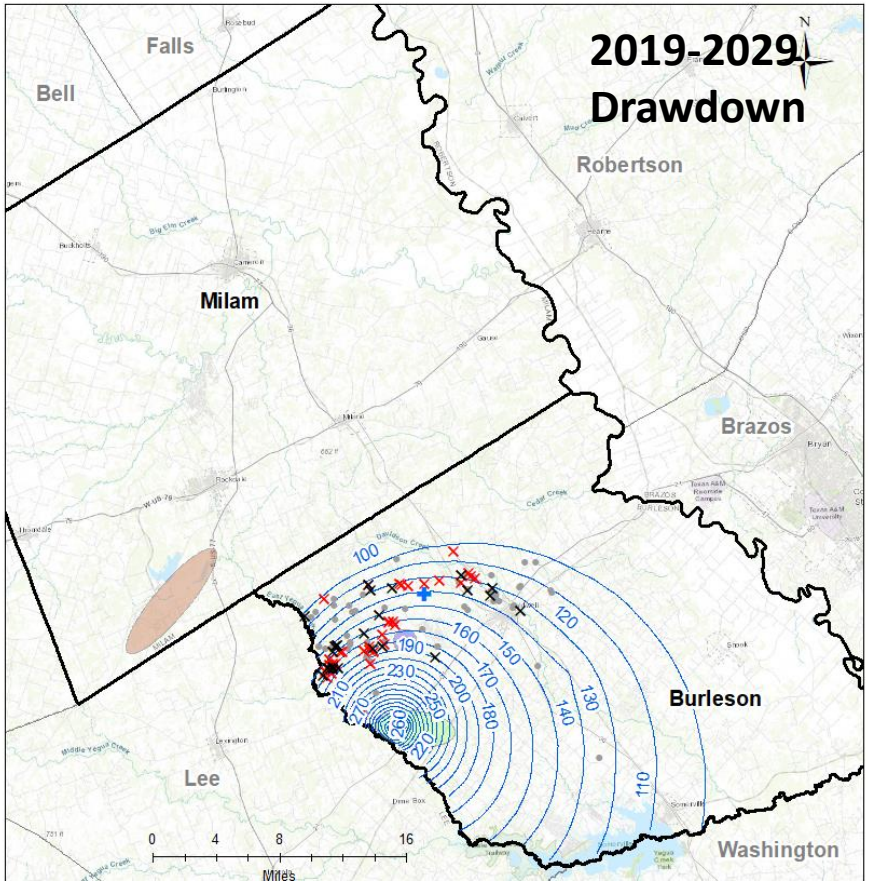
Eligible Wells

- × WL > 15 ft above pump in 2029 (n=44)
- × WL < 15 ft above pump in 2029 (n=36)
- ✚ WL < 15 ft above pump in 2019 (n=5)
- • No Pump Depth Information (n=202)
- —— 10 Year Drawdown

36 high-priority well

Evaluation of Wells Without Pump Information

Number of Wells Encircled by the 100 ft Drawdown Contour in 2029*				
(a) Wells with Pump Information	(b) Number of High Priority Well	(c) Percent of Wells with Pump Information that are High-Priority Wells	(d) Number of Wells with No Pump Information	(e) Number of wells in Column (d) that are moderate-risk wells based on the percentage in Column (c)
58	34	59%	56	33



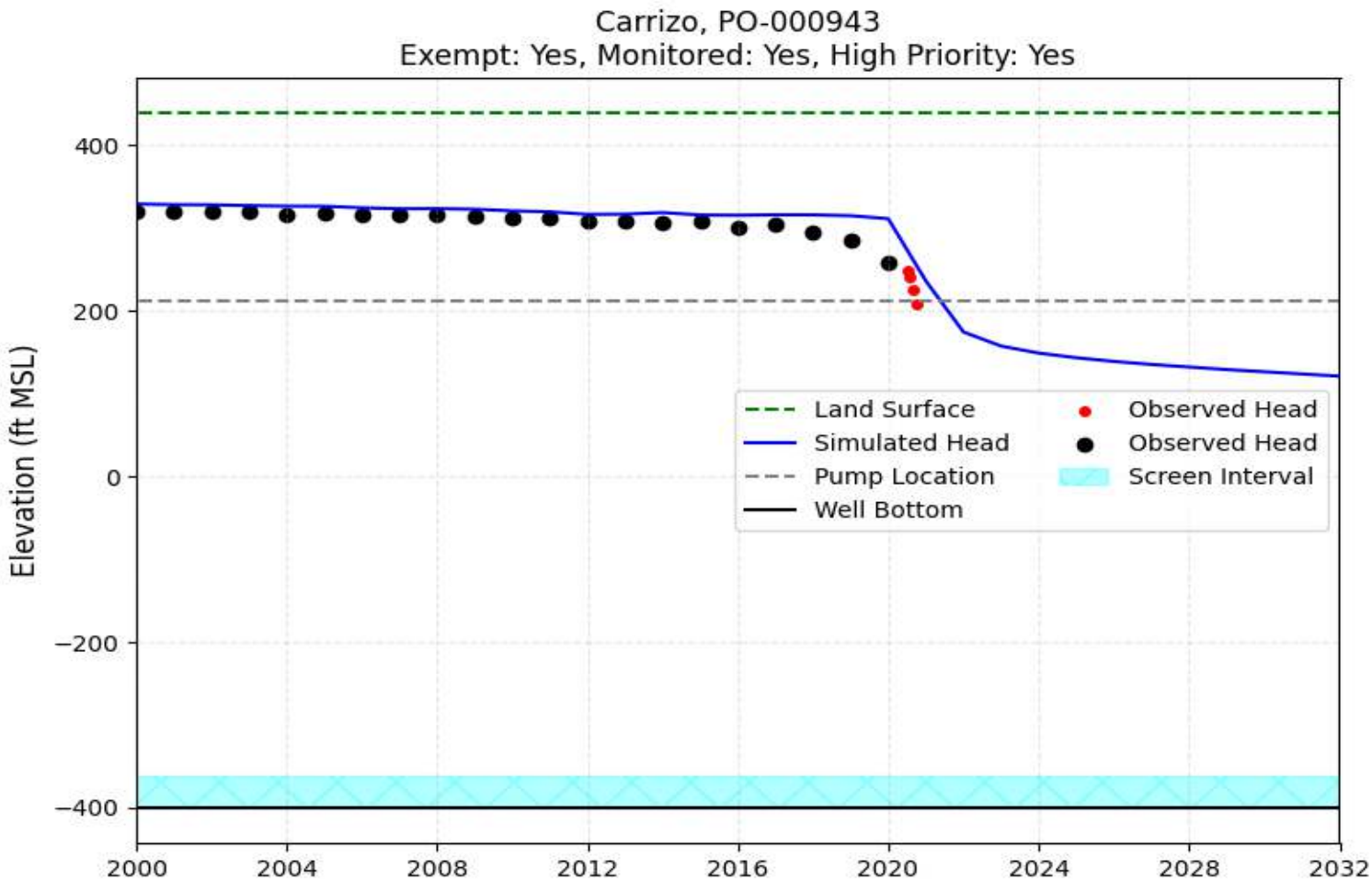
Carrizo

- 130 Well Field
- ALCOA Well Field
- Vista Ridge Well Field
- POSGCD Boundary
- County Line

Eligible Wells

- × WL > 15 ft above pump in 2029 (n=24)
- × WL < 15 ft above pump in 2029 (n=34)
- ✚ WL < 15 ft above pump in 2019 (n=1)
- • No Pump Depth Information (n=56)
- —— 10 Year Drawdown

Example Hydrographs

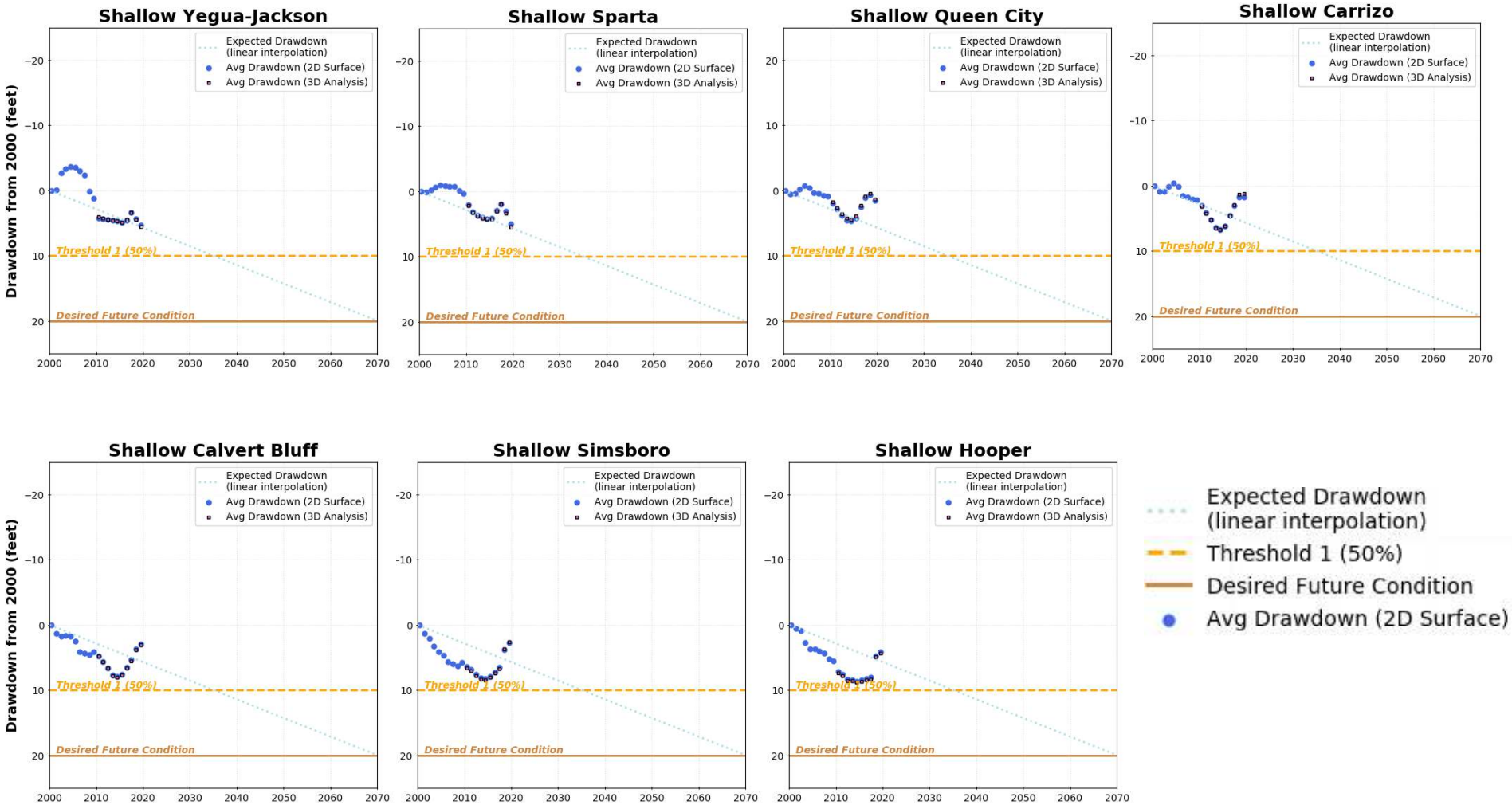


Summary of Carrizo Well Impacts

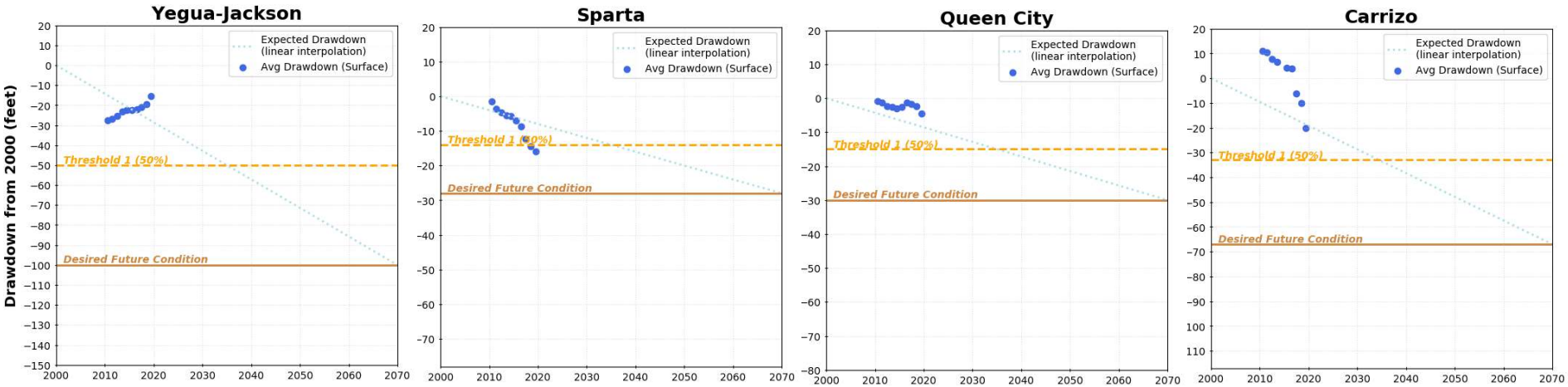
- Well with Pump Info
  - 36 high-priority wells (2029);
  - 26 estimated to have problems in 2022
- Wells without Pump Info
  - 56 wells with >100 ft drawdown from 2019 to 2029
  - 22 wells estimated to have low water levels in 2022
  - 33 wells estimated to have low water levels in 2029
- Total wells that may need corrective actions
  - 48 wells from 2019 to 2022
  - 69 wells from 2019 to 2029

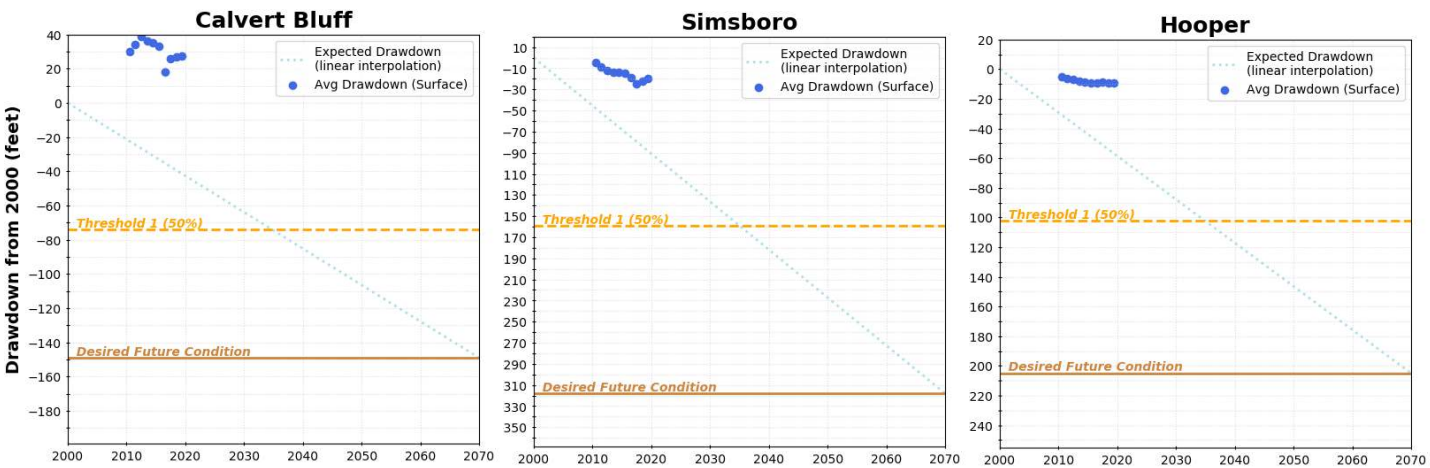
Compliance for DFCs and PDLs

Compliance with POSGCD Shallow PDLs



Compliance with POSGCD DFCs





	Current DFC (feet)	Current MAG in 2070
Sparta	28	6,735
Queen City	30	504
Carrizo	67	7,058
Calvert Bluff	149	1,036
Simsboro	318	48,503
Hooper	205	4,422

Expected Drawdown (linear interpolation)
Threshold 1 (50%)
Desired Future Condition
Avg Drawdown (2D Surface)

Current Model Available Groundwater (MAGs)

GAM	Aquifer	Modeled available groundwater in acre-ft/year (AFY)					
		2010	2020	2030	2040	2050	2060
Brazos River Alluvium	GMA 8: Declared a Non-Relevant Aquifer	NA	NA	NA	NA	NA	NA
	GMA 12: Milam and Burleson County[1]	25,138	25,138	25,138	25,138	25,138	25,138
Aquifers in Trinity GAM	Paluxy[2]	0	0	0	0	0	0
	Glen Rose[2]	149	149	149	149	149	149
	Hensell[2]	36	36	36	36	36	36
	Hosston[2]	103	103	103	103	103	103
	Subtotal	*288*	*288*	*288*	*288*	*288*	*288*
Aquifers in the Queen City/ Sparta GAM	Sparta[3]	1,570	2,245	4,041	5,612	6,734	6,734
	Queen City[4]	430	468	502	502	502	502
	Carrizo[5]	4,025	4,706	5,177	6,118	6,353	7,059
	Upper Wilcox (Calvert	502	1,038	1,038	1,038	1,038	1,038
	Middle Wilcox	36,507	38,468	37,899	40,041	46,027	48,501
	Lower Wilcox (Hooper	899	2,960	4,139	4,433	4,433	4,422
	Subtotal	*43,933*	*49,885*	*52,796*	*57,744*	*65,087*	*68,256*
Yegua-Jackson Aquifer	Yegua-Jackson Aquifer[6]	12,923	12,923	12,923	12,923	12,923	12,923
	TOTAL	*82,282*	*88,234*	*91,145*	*96,093*	*103,43*	*106,605*

Section 16.4 Threshold Exceedances

Threshold	Description	Aquifer(s)
Level 1	> 50% of DFCs	**Sparta (28 ft)**
Level 1	> PDLs in 15 years	**Carrizo (20 ft), Calvert Bluff (20 ft), Simsboro (20 ft)**
Level 1	> 60% of MAG	**Simsboro (38,468 AFY)**
Level 2	> 70% of MAG	**Queen City (468 AFY), Carrizo(4,706 AFY)**

Note 1: Modeled Available Groundwater(MAG) is for 2020
Desired Future Conditions (DFC) is for 2070
Protective Drawdown Limit (PDL) is for 2070

Note 2: Green colored aquifers indicates exceedance anticipated before December 31, 2020

Rule 16.4. Actions Based on Monitoring Results

Threshold 1

1. Perform studies to improve quantification of pumping effects, characterization of aquifer, and prediction of changes in future water levels

2. Evaluate options for possible curtailment to achieve management goals

Threshold 2

1. Evaluate the Management Plan and rules regarding management zones, collection and analysis of monitoring data, and DFCs.

2. May notify well owners of possible curtailment of groundwater production

Threshold 3

1. Conduct public hearing to discuss aquifer conditions. Develop a Response Action Work Plan to achieve DFCs and PDLs.

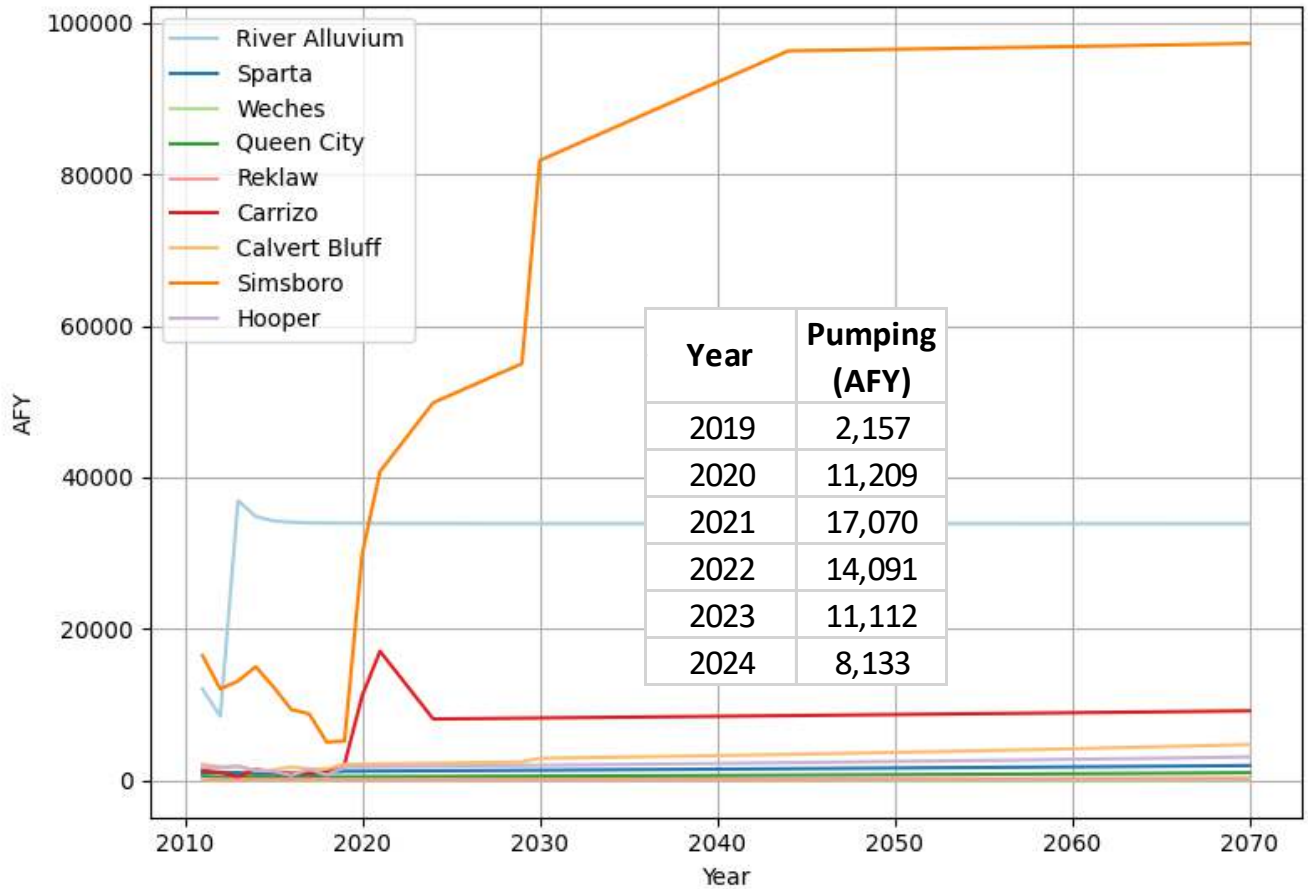
2. May reduce the maximum water production permitted per acre for the Management Zone and the water authorized to be produced under any permit issued by the District for that zone

Summary of Actions: Hydrogeologic Studies

- Hydrogeological Studies
  - Additional Groundwater Water Level Measurements
    - Fall 2020 monitoring event
    - Addition of approximately 25 InSitu/WellIntel equipment
  - Analysis of Water Level for PDL/DFC Compliance
    - Geostatistical investigations with UT at Austin
    - Developed alternative technique
  - Compliance Report for DFCs and PDLs
    - Documents using measured water levels to assess compliance
    - Schedule completion date is December 2020
  - Improved Prediction of Future Water Level Changes
    - GMA 12 update of GAM regarding Simsboro properties near Vista Ridge wells
    - 2021 project to continually improve the GAM
  - Developed Outline for Management Strategies Report
    - Assess effectiveness of current strategies for achieving goals
    - Identify changes in strategies to improve likelihood of achieving goals

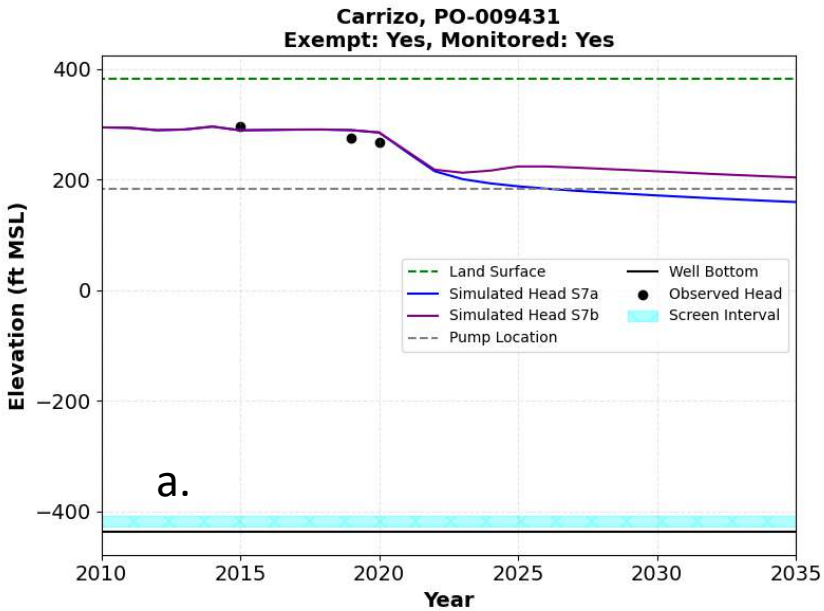
Summary of Actions: Curtailment Options

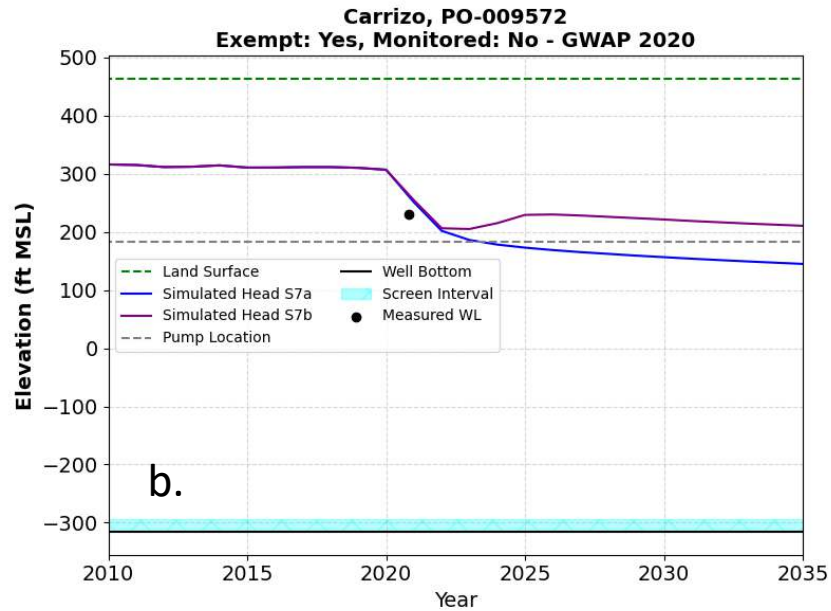
- Perform simulations investigating curtailment of permits in the Carrizo

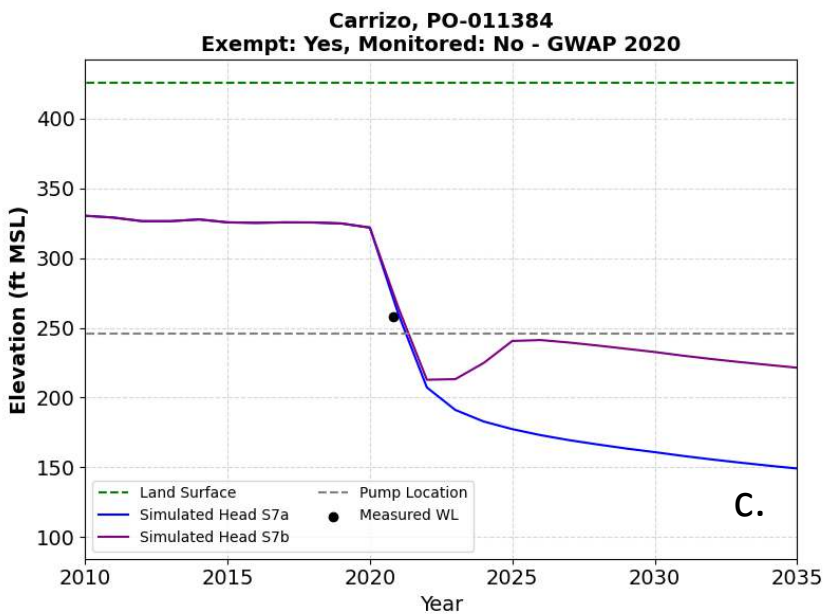


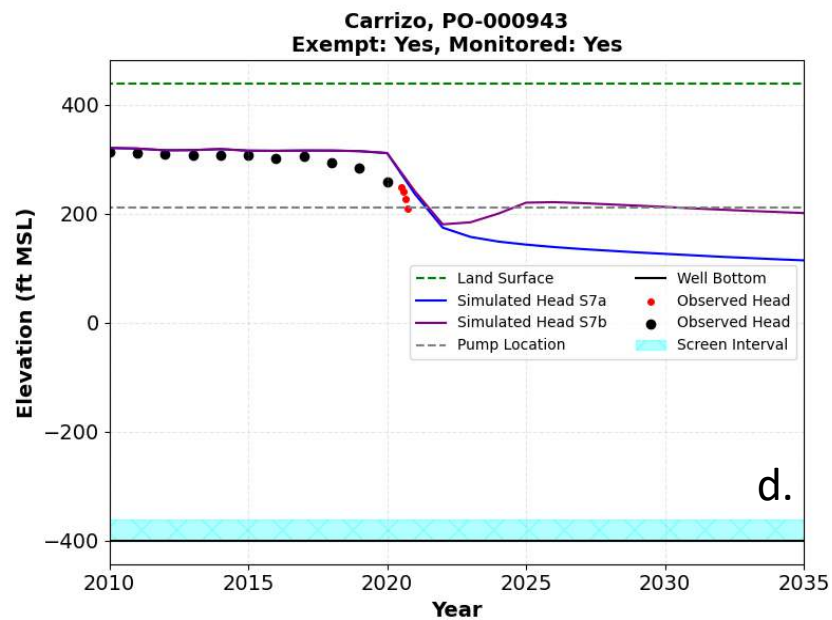
Year	Pumping (AFY)
2019	2,157
2020	11,209
2021	17,070
2022	14,091
2023	11,112
2024	8,133

Examples of Changes in Simulated Hydrographs

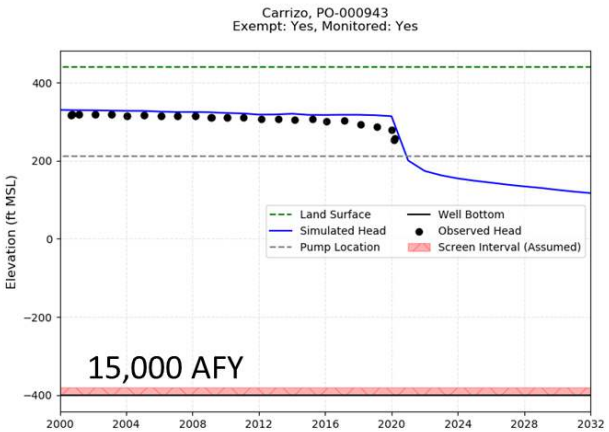


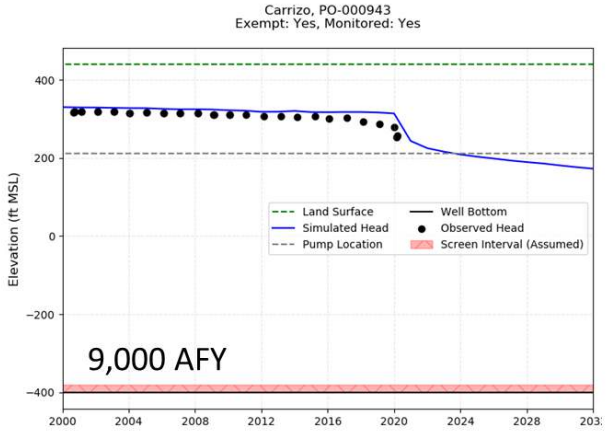


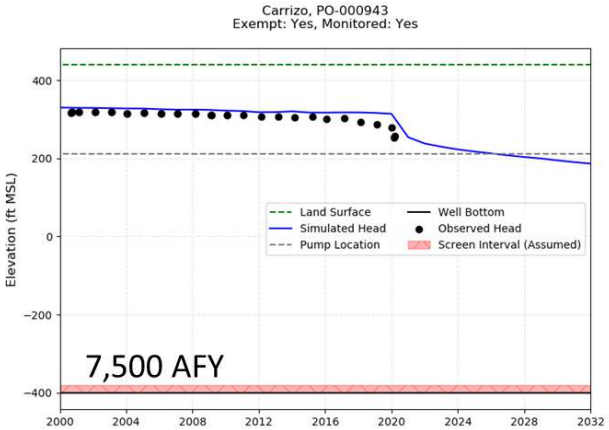


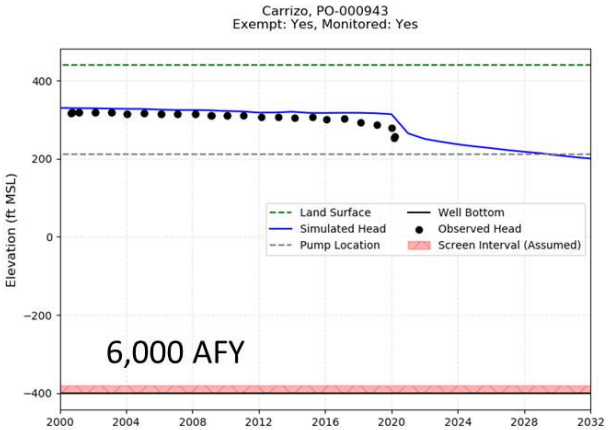


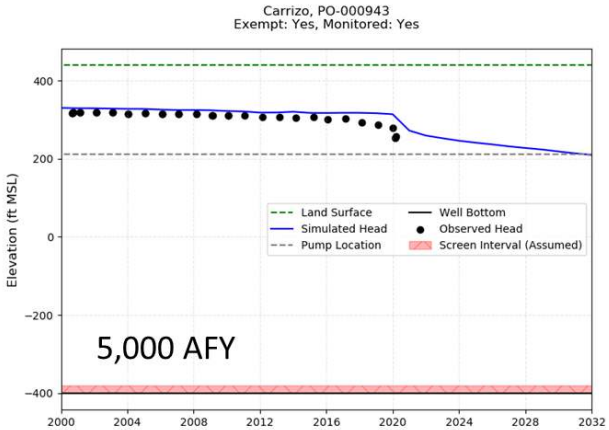
Summary of Actions: Curtailment Options

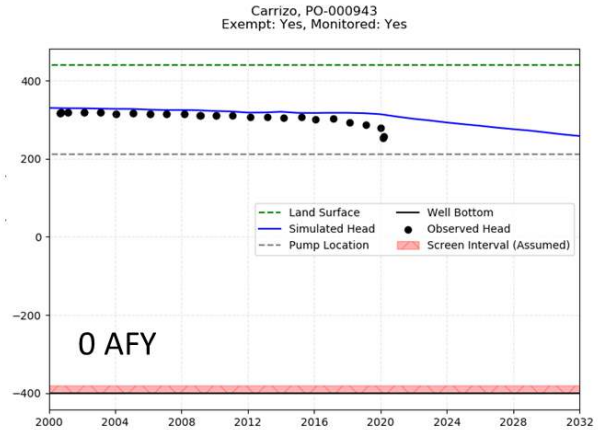










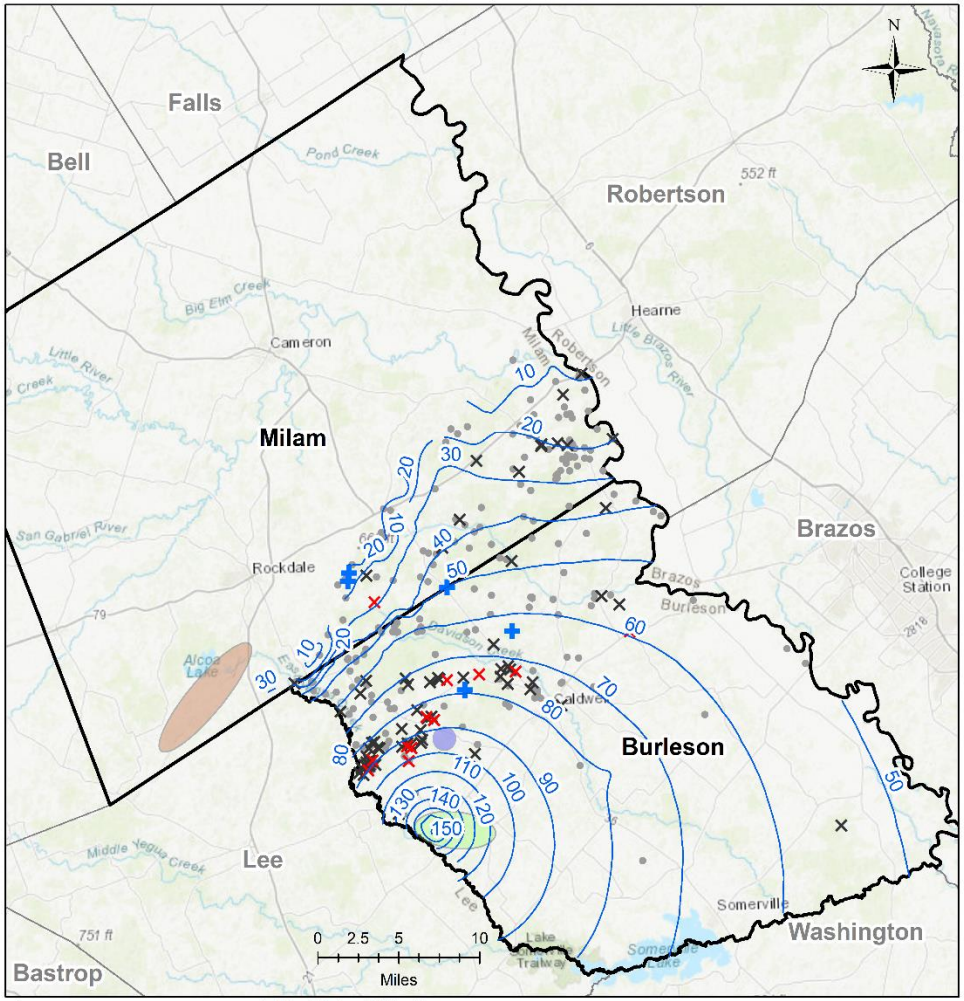


Summary of Actions: Curtailment Options

Vista Ridge Carrizo Pumping (AFY)	DFC (2010 - 2070)		
	Carrizo	Calvert Bluff	Simsboro
0	105	157	347
5,000	127	165	349
6,000	132	166	349
7,500	139	169	349
9,000	145	171	350
15,000	172	181	351

Effects of Curtailment: Reduction of Carrizo Pumping in PS-7 by 9,000 AFY in 2023

- DFC
  - 2070 DFC-drawdown from 172 ft to 123 ft
- PDL change
  - 2070 PDL-drawdown from 89 to 79
- Impacts to existing well owners
  - Wells likely to need corrective action is reduced from about 70 to 20 wells



Carrizo

- 130 Well Field
- ALCOA Well Field
- Vista Ridge Well Field
- POSGCD Boundary
- County Line

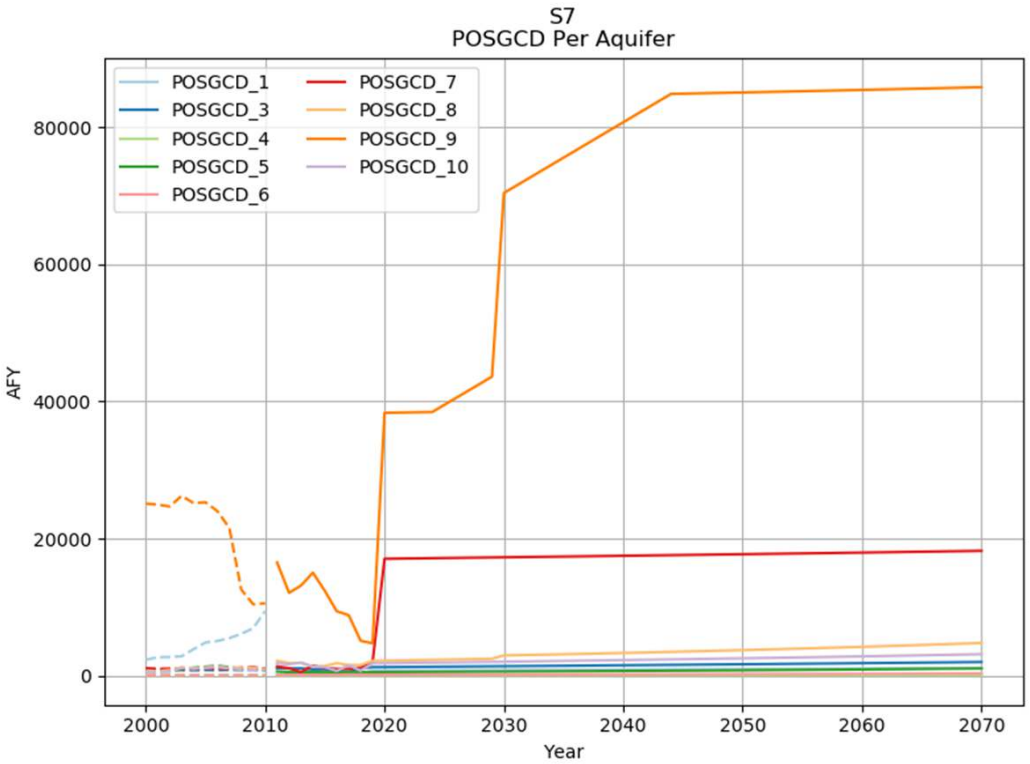
Eligible Wells

- WL > 15 ft above pump in 2029 (n=68)
- WL < 15 ft above pump in 2029 (n=12)
- WL < 15 ft above pump in 2019 (n=5)
- No Pump Depth Information (n=202)
- 10 Year Drawdown

Desired Future Conditions

POSGCD Pumping for PS-7*

	Current DFC (feet)	Current MAG in 2070	S-7 Drawdown from 2010 to 2070 (feet)	S-7 Pumpage in 2070 (acre-feet)
Sparta	28	6,735	17	1,983
Queen City	30	504	18	1,045
Carrizo	67	7,058	173	18,205
Calvert Bluff	149	1,036	184	4,761
Simsboro	318	48,503	352	85,855
Hooper	205	4,422	223	3,126



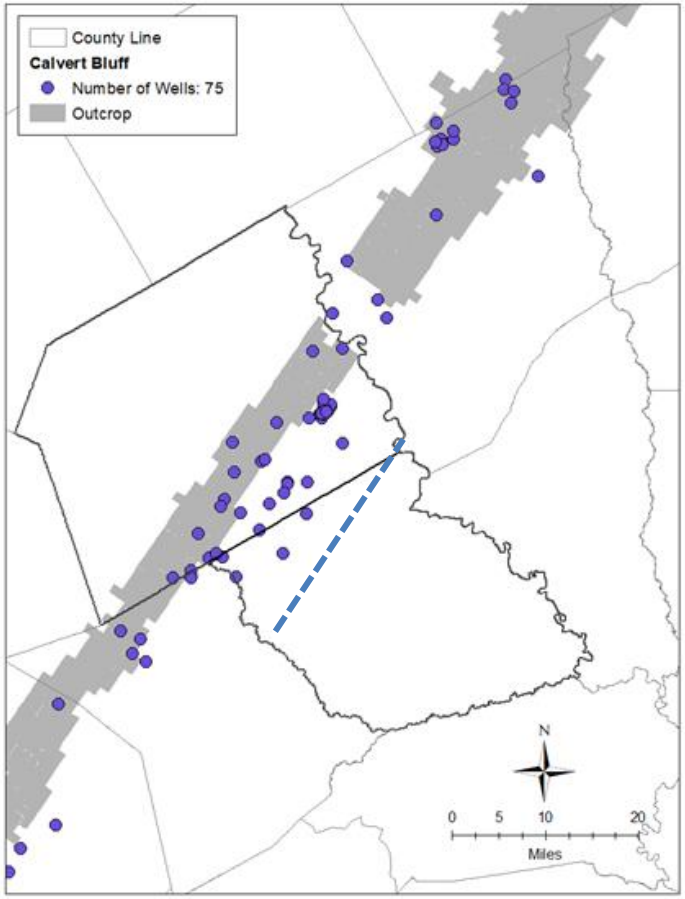
* Updated since Sept 2019

Consideration for Evaluating DFCs

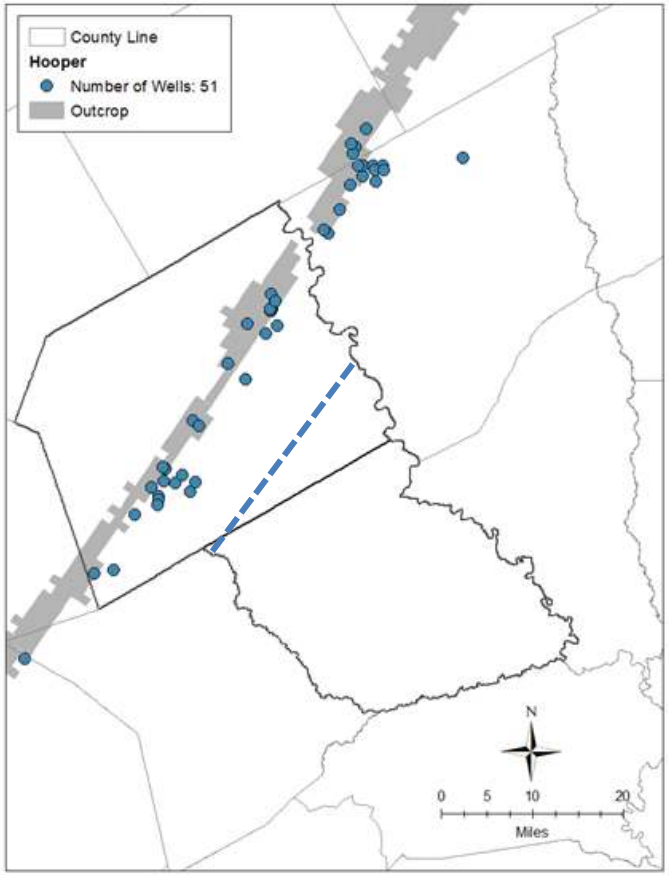
- Permitted Pumping
- Impact of Pumping on Water Levels at Existing Wells
- Compliance with existing DFCs and PDLs
- Existing Water Column above the Top of the Aquifer (Available drawdown)
- Impact on Pumping in Adjacent GCDs on DFCs in POSGCD
- Reported Pumping is Less than the Permitted Pumping
- Addition of Management Zones and Changes in DFC
- Uncertainty in model predictions (± 10%)
- Nine Factors Listed in TWC Section 36.108

Management Zones

Calvert Bluff



Hooper

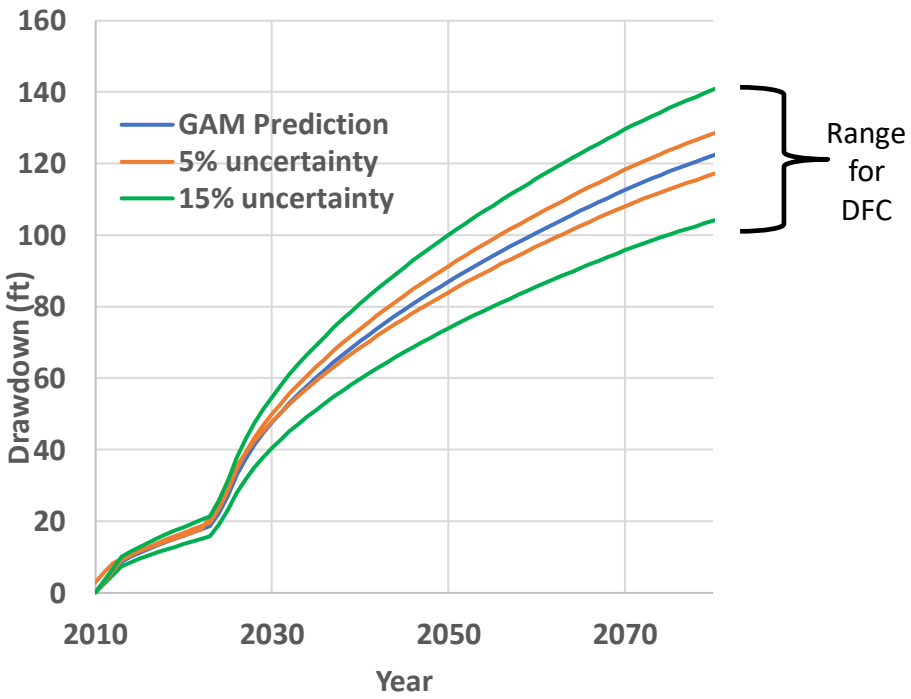


Uncertainty Associated with GAM Prediction

Sources of Uncertainty

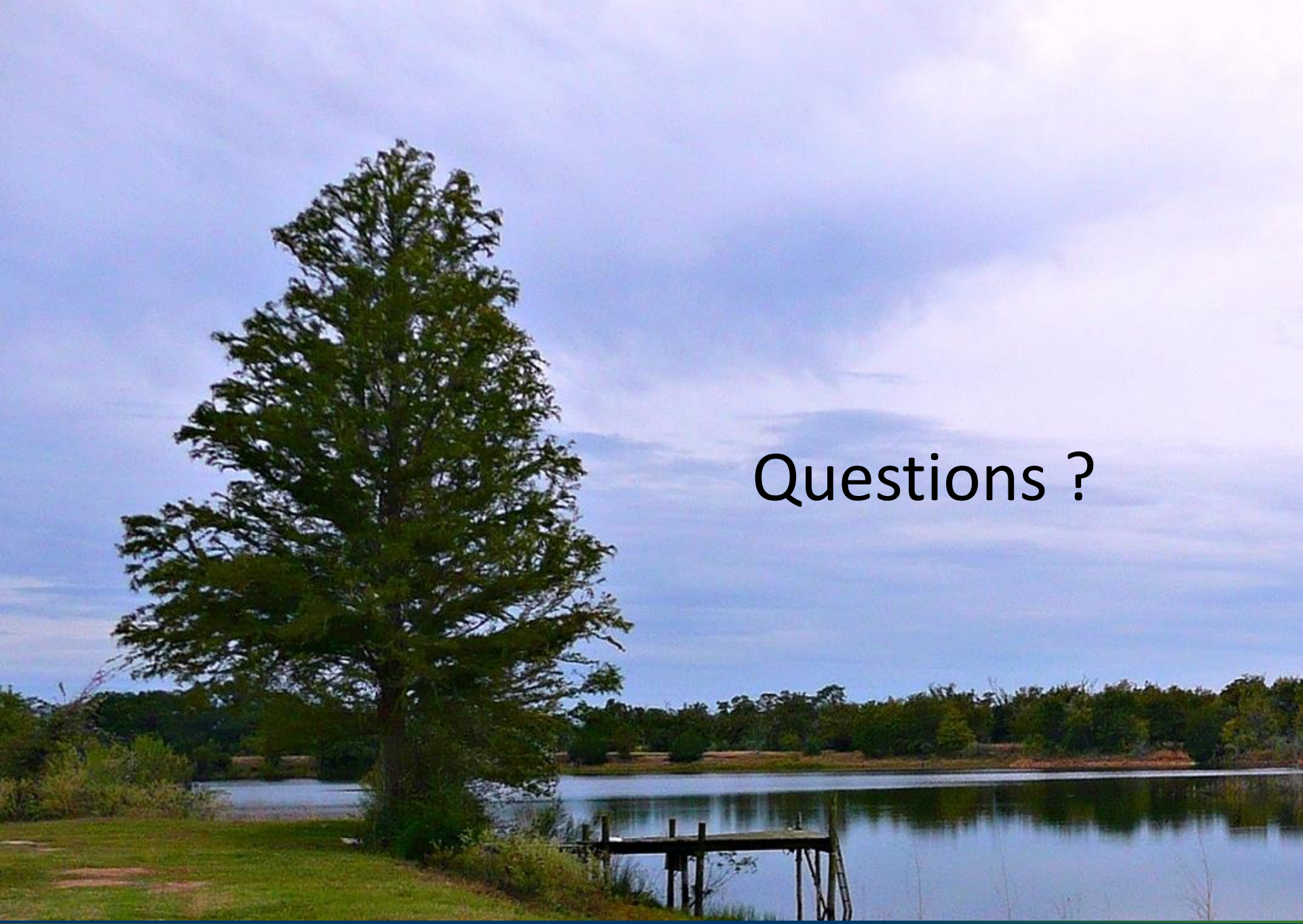
- Model Error (aquifer properties, boundary conditions)
- Future Permitted Pumping Rates (exempt and non-exempt)
- Location of Pumping Rates (exempt and non-exempt)
- Recharge conditions

Uncertainty Associated with DFC Simulation



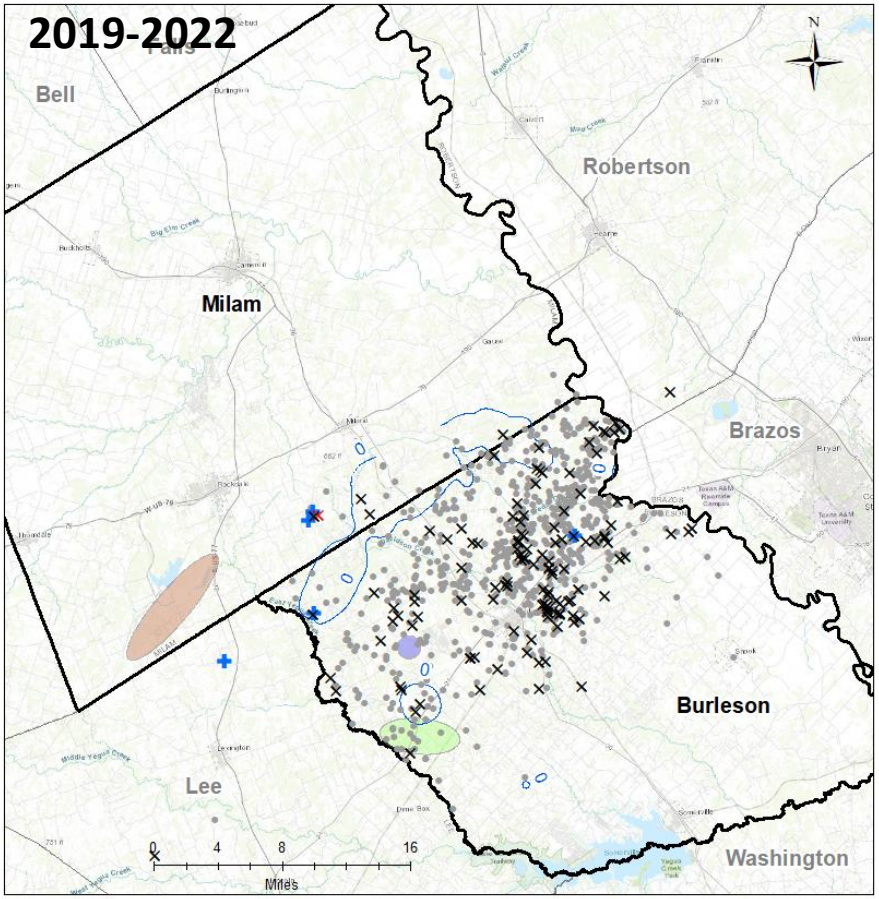
DFCs Discussion: Directions for Future Scenarios

- Ranges of POSGCD Pumping Rates by Aquifer
- Range of Average Drawdowns in POSGCD by Aquifer
- Impact of POSGCD wells
- Area of Interest for DFCs
- Range of Uncertainty



Questions ?

Queen City



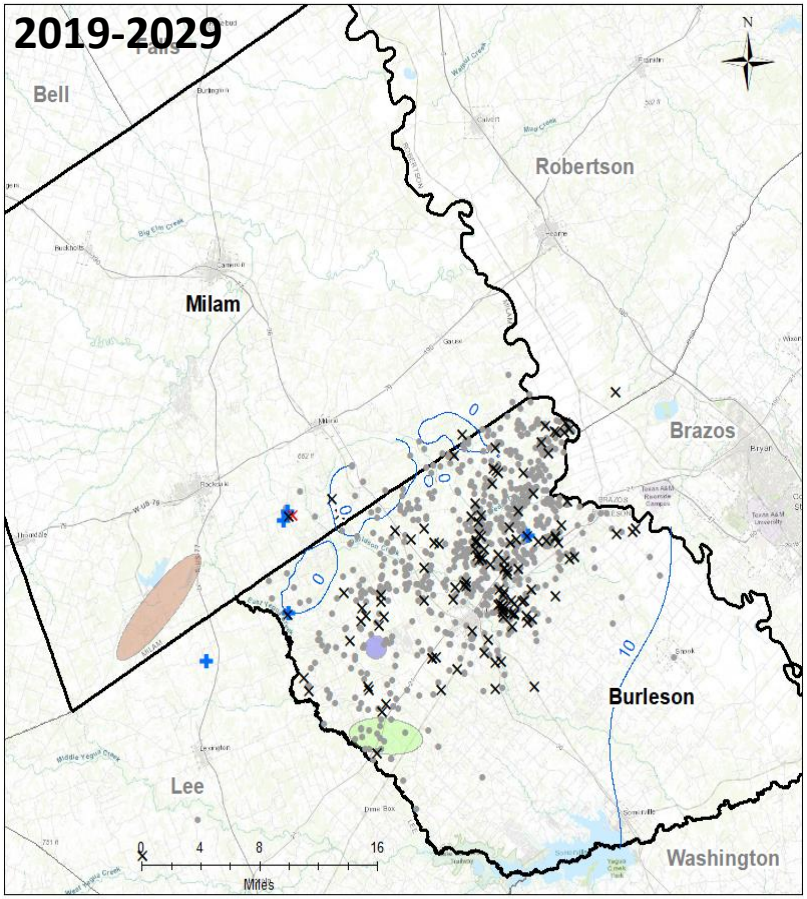
Queen City

- 130 Well Field
- ALCOA Well Field
- Vista Ridge Well Field
- POSGCD Boundary
- County Line

Eligible Wells

- WL > 15 ft above pump in 2022 (n=126)
- WL < 15 ft above pump in 2022 (n=1)
- WL < 15 ft above pump in 2019 (n=5)
- No Pump Depth Information (n=380)
- 3 Year Drawdown

1 high-priority well



Queen City

- 130 Well Field
- ALCOA Well Field
- Vista Ridge Well Field
- POSGCD Boundary
- County Line

Eligible Wells

- WL > 15 ft above pump in 2029 (n=126)
- WL < 15 ft above pump in 2029 (n=1)
- WL < 15 ft above pump in 2019 (n=5)
- No Pump Depth Information (n=712)
- 10 Year Drawdown

1 high-priority well