The District will adopt rules relating to the permitting of wells, the production and transport of groundwater and reducing permitted production. The rules adopted by the District shall be adopted pursuant to TWC Chapter 36 and provisions of this plan. All rules will be adhered to and enforced. The promulgation and enforcement of the rules will be based on technical data recommended by competent professionals and accepted by the Board.

The District shall treat all citizens equally. Citizens may apply to the District for a variance in enforcement of the rules on grounds of adverse economic effect or unique local conditions. In granting a variance to any rule, the Board shall consider the potential for adverse effect on adjacent landowners and the aquifer(s). The exercise of discretion by the Board shall not be construed as limiting the power of the Board.

The District will endeavor to cooperate with other agencies in the implementation of this plan and the management of groundwater supplies within the District. All activities of the District will be undertaken in a spirit of cooperation and coordination with the appropriate state and regional agencies.

14. METHODOLOGY FOR TRACKING DISTRICT PROGRESS IN ACHIEVING MANAGEMENT GOALS

The general manager of the District will prepare and present to the Board an annual report on the District's performance and accomplishment of the management goals and objectives. The presentation of the report will occur during the last monthly Board meeting each fiscal year, beginning after the adoption and certification of this plan. The report will include the number of instances in which each of the activities specified in the management objectives was engaged in during the fiscal year. Each activity will be referenced to the estimated expenditure of staff time and budget in accomplishment of the activity. The notations of activity frequency, staff time and budget will be referenced to the appropriate performance standard for each management objective describing the activity, so that the effectiveness and efficiency of the Districts operations may be evaluated. The Board will maintain the adopted report on file, for public inspection, at the District's offices. This methodology will apply to all management goals contained within this plan.

15. AQUIFER STORAGE AND RECOVERY PROJECTS

An Aquifer Storage and Recovery (ASR) project involves the injection of water into a geological formation for subsequent recovery and beneficial use. The District acknowledges that ASR projects can help to improve the overall management of water resources in GMA 12. However, the District also recognizes that poorly designed and instrumented ASR project can be operated in such a manner as to adversely affect the production capacity of existing wells located near the ASR project. As ASR projects are identified, the District will coordinate with the Texas Commission on Environmental Quality to provide data and/or technical expertise that could assist with the evaluation of the proposed ASR project.

16. MANAGEMENT GOALS, OBJECTIVES, & PERFORMANCE STANDARDS

16.1 Efficient Use of Groundwater

Management Objectives:

1. The District will maintain a monitoring well network with at least 100 monitoring wells to provide coverage across management zones and aquifers within the District. The District will measure water levels at the monitoring well locations at least once every calendar year. A written analysis of the water level measurements from the monitoring wells will be made available through a presentation to the Board of the District at least once every three years.
2. The District will provide educational leadership to citizens within the District concerning this subject. The activity will be accomplished annually through at least one printed publication, such as a brochure, and public speaking at service organizations and public schools as provided for in the District's Public Education Program.

Performance Standards:

1. Maintain a monitoring well network and its criteria, and measure at least 100 monitoring wells at least once every calendar year.
2. Number of monitoring wells measured annually by the District.
3. Written report presented to the Board to document that water levels at these monitoring wells have been measured a minimum of once each year.
4. The number of publications and speaking appearances by the District each year under the District's Public Education Program.

16.2 Controlling and Preventing Waste of Groundwater.

Management Objectives:

The District will provide educational leadership to citizens within the District concerning this subject. The activity will be accomplished annually through at least one printed publication, such as a brochure, and public speaking at service organizations and public schools as provided for in the District's Public Education Program. During years when District revenues are sufficient, the District will consider funding a grant to obtain a review, study, or report of pertinent groundwater issues, or to sponsor the attendance of students at summer camps/seminars that place emphasis on the conservation of water resources.

Performance Standards:

The number of publications and speaking appearances by the District each year, and the number of grants considered and students actually accepting and attending an educational summer camp or seminar.

16.3 Control and Prevent Subsidence

Management Objectives:

The District will monitor drawdowns with due consideration to the potential for land subsidence. At least once every three years, the District will assess the potential for land subsidence for areas where water levels have decreased more than 100 feet since the year 2000.

Performance Standards:

Within three years of the approval of this plan and every three years thereafter, the District will map any region where more than 100 feet of drawdown has occurred since the year 2000 and assess the potential for land subsidence. The results of the assessment will be discussed in a District Board meeting and be document in a presentation or a report.

16.4 Conservation of Groundwater including Rainwater Harvesting, Precipitation Enhancement, Brush Control, Conjunctive Use, and/or Recharge Enhancement of Groundwater Resources in the District

Management Objectives:

1. The District will provide educational leadership to citizens within the District concerning this subject. The educational efforts will be through at least one printed publication, such as a brochure, and at least one public speaking program at a service organization and/or public school as provided for in the District's Public Education Program. Each of the following topics will be addressed in that program:
    A. Conservation
    B. Rainwater Harvesting
    C. Brush Control
    D. Recharge Enhancement
    E. Conjunctive Use
    F. Precipitation Enhancement
2. During years when District revenues are sufficient, the District will consider sponsoring the attendance of students and/or teachers at summer camps/seminars that place emphasis on the conservation of groundwater, rainwater harvesting, brush control, groundwater recharge enhancement, conjunctive use, precipitation enhancement of water resources, or a combination of such groundwater management programs.
3. The District will encourage and support projects and programs to conserve and/or preserve groundwater, and/or enhance groundwater recharge, by annually funding the District's Groundwater Conservation and Enhancement Grant Program, during years when the District's revenues remain at a level sufficient to fund the program. The objective of this program is to obtain the active participation and cooperation of local water utilities, fire departments and

public agencies in the funding and successful completion of programs and projects that will result in the conservation of groundwater and the protection or enhancement of the aquifers in the District. The qualifying water conservation projects and programs will include, as appropriate, projects that: result in the conservation of groundwater, reduce the loss or waste of groundwater, recharge enhancement, rainwater harvesting, precipitation enhancement, brush control, or any combination thereof. The District's objective is to benefit the existing and future users of groundwater in the District by providing for the more efficient use of water, increasing recharge to aquifers, reducing waste, limiting groundwater level declines, and maintaining or increasing the amount of groundwater available, by awarding at least one grant under the program in each county annually.

Performance Standards:

1. The number of publications and speaking appearances by the District each year under the District's Public Education Program.
2. The number of students sponsored to attend a summer camp/seminar emphasizing the conservation of water.
3. Annual funding, when applicable, for the District's Groundwater Conservation and Enhancement Grant Program, and the number of projects and programs reviewed, approved, and funded under that program. A written report providing estimated benefit of the amount of groundwater conserved, of the recharge enhancement, and/or of addition groundwater protection provided by the program.
4. The number and content of reports submitted regarding sponsored programs.

16.5 Conjunctive Use of Surface and Groundwater

Management Objective:

The District will confer annually with the Brazos River Authority (BRA) on cooperative opportunities for conjunctive resource management.

Performance Standard:

1. The number of conferences with the BRA on conjunctive resource management.
2. The number of times each year in which the applicant, general manager or the Board considers conjunctive use in the permitting process.

16.6 Drought Management Strategy

The aquifers within the District are substantially resistant to water level declines during drought conditions. As a result, the District does not have a drought management strategy based on precipitation metrics such as the Palmer Drought Index. The District management strategy is to review and to verify enforcement of Drought Management Plans adopted by District permit holders and entities that contract to purchase water from District permit holders.

Management Objective:

When permits or contracts are issued, as applicable, the District will confirm that all entities have an Drought Management Plan or Drought Contingency Plan that has been approved by the Texas Commission on Environmental Quality or another regulatory agency in the State of Texas.

Performance Standard:

State approved Drought Management Plans or Drought Contingency Plans on file at the District Offices.

16.7 Natural Resource Issues That Impact the Use and Availability of Groundwater and Which are Impacted by the Use of Groundwater

Management Objectives:

1. The District will confer at least once every two years with appropriate agencies on the impact of groundwater resources in the District.
2. The District will evaluate permit applications for new wells and the information submitted by the applicants on those wells prior to drilling. The District will assess the impact of these wells on the groundwater resources in the District.
3. The District will implement the POSGCD Well Closure Program. The objective of the well closure program is to obtain the closure and plugging of derelict and abandoned wells in a manner that is consistent with state law, for the protection of the aquifers, the environment, and the public safety. The District will conduct a program to identify, inspect, categorize and cause abandoned and derelict water, oil and gas wells to be closed and plugged, by annually funding the program or segments or phases of the program appropriate to be funded in such fiscal year. The District will fund the closure of at least one abandoned well during years when the District's revenues remain at a level sufficient to fund the program.

Performance Standards:

1. The number of conferences with a representative of appropriate agencies.
2. Reports to the Board on the number of new well permit applications filed, and the possible impacts of those new wells on the groundwater resources in the District.
3. Annual funding, when applicable, for the District's Well Closure Program, and the number of wells closed and plugged as a result of the Well Closure Program.

16.8 Groundwater Well Assistance Program

Management Objective:

Beginning in 2018, the District will maintain a Groundwater Well Assistance Program (GWAP). The primary purpose of the GWAP is to help restore a water supply to well owners in the District who own wells that have experienced significant adverse impacts, and where applicable to address well conditions to prevent significant adverse impacts, from groundwater level declines caused by aquifer-wide groundwater pumping in GMA 12. A secondary purpose of the GWAP is to improve

the POSGCD monitoring program and the POSGCD's understanding of groundwater aquifer systems in POSGCD by increasing the number of monitoring wells in the monitoring well network and by performing localized hydrogeological studies at these monitoring locations.

Performance Standard:

GWAP adopted before the end of 2018.

16.9 Mitigation

Management Objective:

The District will require filing with the District of mitigation plans required by the District or any State agency regarding impacts caused by groundwater pumping in the District.

Performance Standards:

1. Mitigation plans on file at the District that are related to groundwater pumping in the District.
2. Report of impacts and predicted impacts on well owners in the District on file at the District Offices.

16.10 Desired Future Conditions (DFCs)

Management Objective:

At least once every three years, the District will monitor water levels and evaluate whether the change in water levels is in conformance with the DFCs adopted by the District. The District will estimate total annual groundwater production for each aquifer based on the water use reports, estimated exempted use, and other relevant information, and compare these production estimates to the MAGs listed in Table 8-1.

Performance Standards:

1. At least once every three years, the general manager will report to the Board the measured water levels obtained from the monitoring wells within each Management Zone, the average measured drawdown for each Management Zone calculated from the measured water levels of the monitoring wells within the Management Zone, a comparison of the average measured drawdowns for each Management Zone with the DFCs for each Management Zone, and the District's progress in conforming with the DFCs.
2. At least once every three years, the general manager will report to the Board the total permitted production and the estimated total annual production for each aquifer and compare these amounts to the MAGs listed in Table 8-1 for each aquifer.

17. PROJECTED WATER DEMANDS

The projected net water demands (in acre-feet) within the District based on the 2017 State Water Plan are compiled in Allen (2017), provided as **Appendix A**. The District also

established future Municipal Groundwater Use Demands in the District for planning purposes. The methodology and results of that effort are as follows:

Method for Establishing Future Municipal Use Demands of Groundwater. The District adopted a resolution, dated March 11, 2003, establishing production rights for Local Water Utilities within the District (water supply corporations, special utility districts, municipal utility districts and cities), as a rule. This rule allowed these Local Water Utilities to obtain a permit to produce a volume of water annually according to one of two methods:

1. An amount equal to the highest annual pumpage it reported from wells within the District in any consecutive twelve months prior to September 31, 2001; or
2. The Local Water Utility could present to the Board a Long-Term Plan prepared by a qualified engineer that projects the annualized long-term water needs as the official projection of the water required by that Local Water Utility in the planning period (for not more than forty [40] years) for providing retail water service within that Local Water Utility's defined service area. If a Local Water Utility adopted this plan on or before March 30, 2004, and the Board found the highest annual pumpage projected in the Long-Term Plan (the "Plan Amount") was not unreasonable, the Local Water Utility was authorized to obtain a permit to pump and produce up to the Plan Amount. Table 17-1 below contains the results of this effort.

Table 17-1 Municipal Use Groundwater Demands Projected through 2044

Producer	Estimated Acre-Feet per
Burleson County	
Apache Hills	11
Birch Creek	16
Burl. Co. MUD	73
Burl. Investm.	7
Cade Lakes	123
Centerline	21
Caldwell	1,969
Snook	154
Somerville	670
Clara Hills	5
Clay	7
Cooks Point	10
Deanville	350
Lakeview	21
Little Oak Forrest	5
Lyons	106
Post Oak Hill	11
Shupak Utilities	19
Tunis	108
Whispering Woods	7
Wilderness Sound	15
Total for Burleson Co.	3,708
Milam County	
Alcoa	702
Rockdale	2,129
Gause	74
Marlow	108
Milano	673
Minerva	28
North Milam	369
Southwest Milam	2,492
Total for Milam Co.	6,575
DISTRICT TOTALS	10,283

18. PROJECTED WATER SUPPLIES WITHIN THE DISTRICT

The projected surface water supplies (in acre-feet) within the District based on the 2017 State Water Plan are compiled in Allen (2017), provided as **Appendix A**.

Table 18-1 lists the projected groundwater supplies within the District in acre-feet per year according to the 2017 State Water Plan Data. The District has participated and will

participate in future regional water planning, and will consider the water supply needs and water management strategies included in the adopted state water plan.

Table 18-1. Projected Groundwater Supplies in acre-feet per year Within the District According the 2017 State Water Plan data

WUG Entity Name	Source Name	Source Subtype	2020	2030	2040	2050	2060	2070
Burleson County								
Caldwell	Carrizo-Wilcox Aquifer	Groundwater	2,352	2,352	2,352	2,352	2,352	2,352
County-Other, Burleson	Carrizo-Wilcox Aquifer	Groundwater	550	550	550	550	550	550
County-Other, Burleson	Queen City Aquifer	Groundwater	323	323	323	323	323	323
Deanville WSC	Carrizo-Wilcox Aquifer	Groundwater	701	701	701	701	701	701
Irrigation, Burleson	Brazos River Alluvium Aquifer	Groundwater	21,640	21,640	21,640	21,640	21,640	21,640
Irrigation, Burleson	Carrizo-Wilcox Aquifer	Groundwater	204	204	204	204	204	204
Irrigation, Burleson	Yegua-Jackson Aquifer	Groundwater	1,118	1,118	1,118	1,118	1,118	1,118
Manufacturing, Burleson	Sparta Aquifer	Groundwater	139	139	139	139	139	139
Milano WSC	Carrizo-Wilcox Aquifer	Groundwater	250	234	232	232	241	245
Mining, Burleson	Carrizo-Wilcox Aquifer	Groundwater	0	0	0	0	0	0
Snook	Sparta Aquifer	Groundwater	475	475	475	475	475	475
Somerville	Sparta Aquifer	Groundwater	891	891	891	891	891	891
Southwest Milam WSC	Carrizo-Wilcox Aquifer	Groundwater	205	184	154	167	167	158
		TOTAL	*28,848*	*28,811*	*28,779*	*28,792*	*28,801*	*28,796*
Milam County								
Bell-Milam Falls WSC	Trinity Aquifer	Groundwater	79	79	77	77	76	74
Bell-Milam Falls WSC	Trinity Aquifer	Groundwater	352	349	343	342	336	329
Buckholts	Trinity Aquifer	Groundwater	122	122	122	122	122	122
Irrigation, Milam	Brazos River Alluvium Aquifer	Groundwater	3,082	3,082	3,082	3,082	3,082	3,082
Irrigation, Milam	Carrizo-Wilcox Aquifer	Groundwater	2,221	2,066	1,828	2,043	2,135	2,135
Irrigation, Milam	Queen City Aquifer	Groundwater	53	56	56	56	56	56
Milano WSC	Carrizo-Wilcox Aquifer	Groundwater	260	240	237	237	249	255
Mining, Milam	Carrizo-Wilcox Aquifer	Groundwater	14	14	14	14	14	14
Mining, Milam	Trinity Aquifer	Groundwater	0	0	0	0	0	0
Rockdale	Carrizo-Wilcox Aquifer	Groundwater	2,000	1,860	1,396	1,589	1,672	1,672
Southwest Milam WSC	Carrizo-Wilcox Aquifer	Groundwater	1,625	1,443	1,202	1,307	1,314	1,261

WUG Entity Name	Source Name	Source Subtype	2020	2030	2040	2050	2060	2070
Thorndale	Carrizo-Wilcox Aquifer	Groundwater	229	229	229	229	229	229
Steam Electric Power, Milam	Carrizo-Wilcox Aquifer	Groundwater	15,786	13,009	12,943	14,444	15,084	15,074
		TOTAL	*25,823*	*22,549*	*21,529*	*23,542*	*24,369*	*24,303*

19. PROJECTED WATER NEEDS AND WATER STRATEGIES

The projected water supply needs and water management strategies (in acre-feet) within the District based on the 2017 State Water Plan are compiled in Allen (2017), provided as **Appendix A**.

20. ESTIMATED GROUNDWATER USE WITHIN THE DISTRICT

The estimated historical water use (in acre-feet) within the District based on the TWDB Historical Water Use Survey is compiled in Allen (2017), provided as **Appendix A**.

21. ESTIMATED ANNUAL RECHARGE OF GROUNDWATER RESOURCES WITHIN THE DISTRICT

The estimated annual recharge from precipitation to groundwater by aquifer (in acre-feet) within the District is compiled in GAM Run 16-015 (Ballew, 2017), provided as **Appendix B**.

22. ESTIMATED ANNUAL DISCHARGES FROM THE AQUIFER TO SPRINGS AND ANY SURFACE WATER BODIES, INCLUDING LAKES, STREAMS AND RIVERS

The estimated annual discharges from each aquifer to springs and any surface water bodies, including lakes, streams, and rivers (in acre-feet) within the District are compiled in GAM Run 16-015 (Ballew, 2017), provided as **Appendix B**.

23. ESTIMATED ANNUAL GROUNDWATER FLOW INTO AND OUT OF THE DISTRICT WITHIN EACH AQUIFER AND BETWEEN AQUIFERS IN THE DISTRICT

The estimated annual groundwater flow into and out of the District within each aquifer and between aquifers (in acre-feet) within the District is compiled in GAM Run 16-015 (Ballew, 2017), provided as **Appendix B**.

24. REFERENCES

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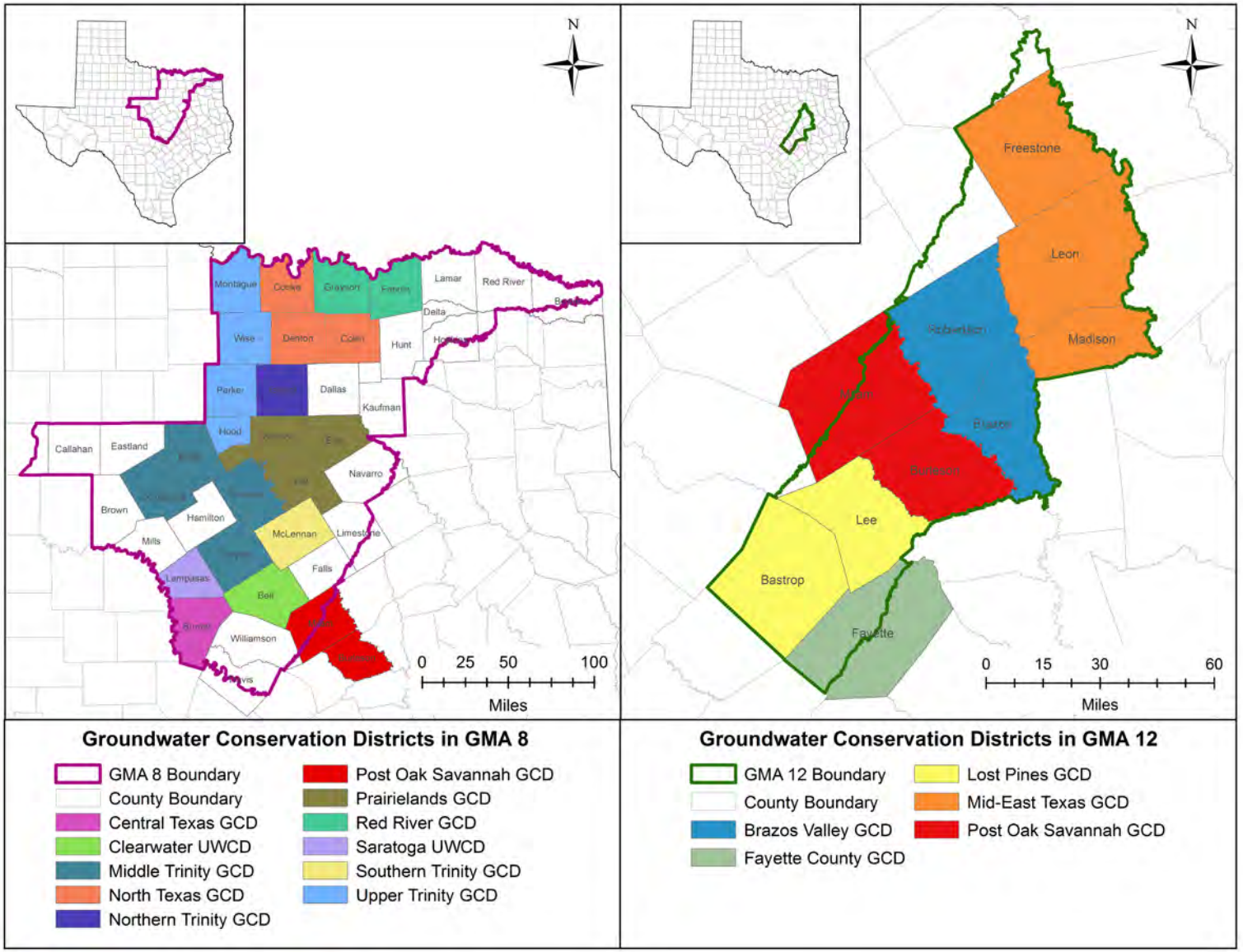

Figure 1. Counties and Groundwater Districts Associated with Groundwater Management Areas 8 and 12

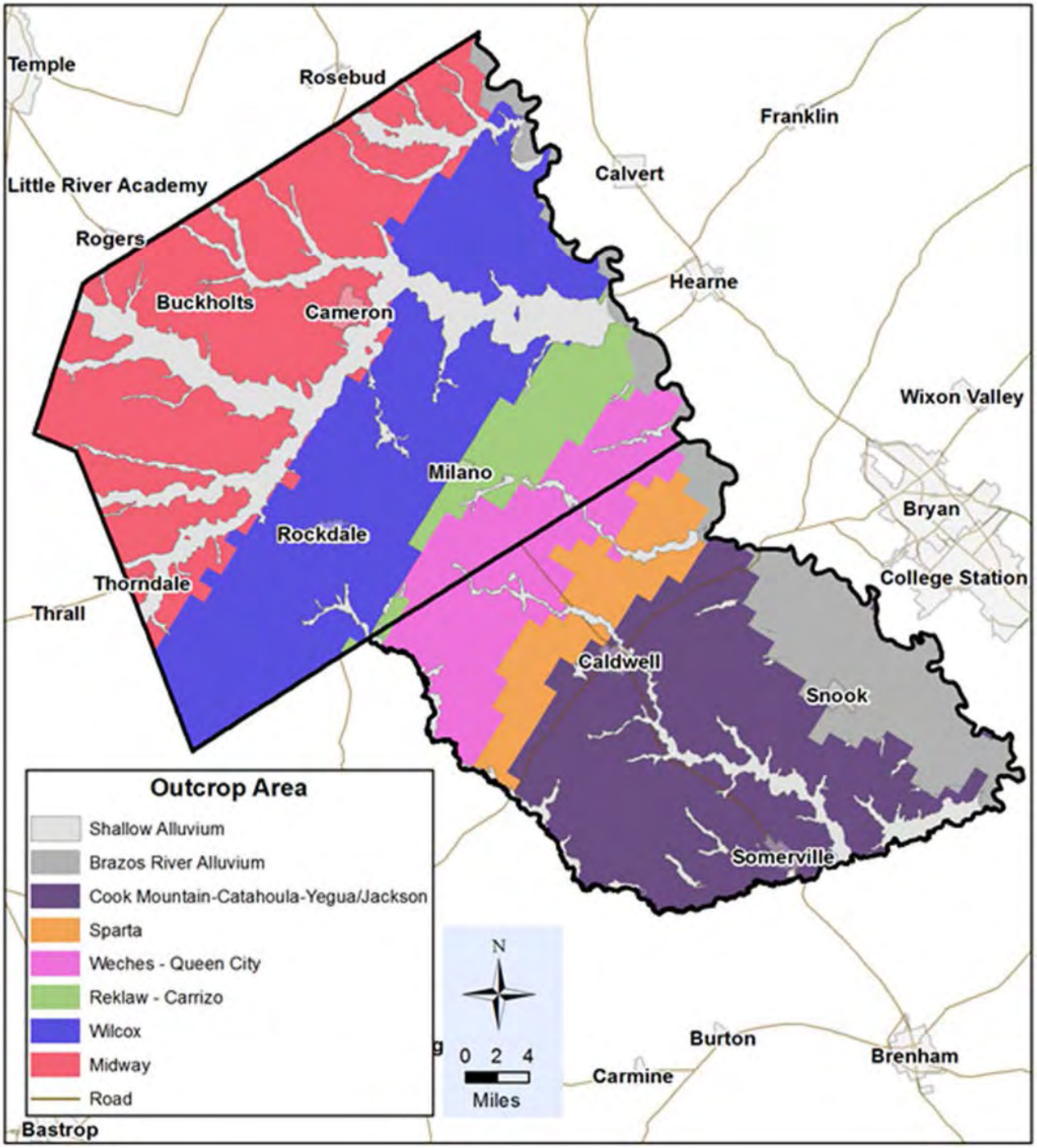

Figure 2. Outcrops Associated with Aquifers and Geological Formations in the District

Estimated Historical Water Use And 2017 State Water Plan Datasets:

Post Oak Savannah Groundwater Conservation District

by Stephen Allen
Texas Water Development Board
Groundwater Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
September 15, 2017

GROUNDWATER MANAGEMENT PLAN DATA:

This package of water data reports (part 1 of a 2-part package of information) is being provided to groundwater conservation districts to help them meet the requirements for approval of their five-year groundwater management plan. Each report in the package addresses a specific numbered requirement in the Texas Water Development Board's groundwater management plan checklist. The checklist can be viewed and downloaded from this web address:

http://www.twdb.texas.gov/groundwater/docs/GCD/GMPChecklist0113.pdf

The five reports included in this part are:

1. Estimated Historical Water Use (checklist item 2)

   from the TWDB Historical Water Use Survey (WUS)
2. Projected Surface Water Supplies (checklist item 6)
3. Projected Water Demands (checklist item 7)
4. Projected Water Supply Needs (checklist item 8)
5. Projected Water Management Strategies (checklist item 9)

   from the 2017 Texas State Water Plan (SWP)

Part 2 of the 2-part package is the groundwater availability model (GAM) report for the District (checklist items 3 through 5). The District should have received, or will receive, this report from the Groundwater Availability Modeling Section. Questions about the GAM can be directed to Dr. Shirley Wade, shirley.wade@twdb.texas.gov, (512) 936-0883.

DISCLAIMER:

The data presented in this report represents the most up-to-date WUS and 2017 SWP data available as of 9/15/2017. Although it does not happen frequently, either of these datasets are subject to change pending the availability of more accurate WUS data or an amendment to the 2017 SWP. District personnel must review these datasets and correct any discrepancies in order to ensure approval of their groundwater management plan.

The WUS dataset can be verified at this web address:

http://www.twdb.texas.gov/waterplanning/waterusesurvey/estimates/

The 2017 SWP dataset can be verified by contacting Sabrina Anderson (sabrina.anderson@twdb.texas.gov or 512-936-0886).

For additional questions regarding this data, please contact Stephen Allen (stephen.allen@twdb.texas.gov or 512-463-7317).

Estimated Historical Water Use
TWDB Historical Water Use Survey (WUS) Data

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2016. TWDB staff anticipates the calculation and posting of these estimates at a later date.

BURLESON COUNTY

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2015	GW	2,722	111	2,018	0	8,311	332	13,494
	SW	0	0	224	0	4,351	775	5,350
2014	GW	2,754	111	1,351	0	16,476	319	21,011
	SW	0	0	150	0	2,640	745	3,535
2013	GW	2,935	111	127	0	23,875	304	27,352
	SW	0	0	14	0	3,518	710	4,242
2012	GW	3,299	111	24	0	26,456	320	30,210
	SW	0	0	2	0	4,363	746	5,111
2011	GW	3,549	111	248	0	22,182	579	26,669
	SW	0	0	15	0	7,413	1,350	8,778
2010	GW	2,974	117	17	0	18,749	563	22,420
	SW	0	0	1	0	8,350	1,314	9,665
2009	GW	2,978	117	42	0	22,893	356	26,386
	SW	0	0	2	0	4,695	830	5,527
2008	GW	2,763	117	66	0	15,567	392	18,905
	SW	0	0	4	0	6,868	914	7,786
2007	GW	2,550	117	0	0	5,758	489	8,914
	SW	0	0	0	0	15,313	1,141	16,454
2006	GW	2,877	117	0	0	22,065	505	25,564
	SW	0	0	0	0	2,435	1,178	3,613
2005	GW	2,791	117	0	0	17,060	520	20,488
	SW	0	0	0	0	6,612	1,215	7,827
2004	GW	2,519	117	0	0	20,665	589	23,890
	SW	0	0	0	0	6,106	885	6,991
2003	GW	2,561	172	0	0	15,308	613	18,654
	SW	0	0	0	0	2,860	921	3,781
2002	GW	2,657	147	0	0	9,591	551	12,946
	SW	0	0	0	0	2,250	826	3,076
2001	GW	2,592	144	0	0	8,705	536	11,977
	SW	0	0	0	0	2,042	804	2,846
2000	GW	2,716	150	0	0	14,845	569	18,280
	SW	0	0	0	0	3,394	853	4,247

MILAM COUNTY

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2015	GW	2,866	0	2	8,968	4,981	766	17,583
	SW	1,356	0	0	12,105	284	1,788	15,533
2014	GW	3,103	0	25	11,747	5,883	745	21,503
	SW	1,327	0	3	12,962	522	1,739	16,553
2013	GW	3,307	0	139	9,800	6,085	746	20,077
	SW	1,340	0	3	17,712	615	1,740	21,410
2012	GW	6,982	0	259	0	8,844	826	16,911
	SW	7,872	12	2	19,273	446	1,928	29,533
2011	GW	4,228	0	32	13,716	5,273	912	24,161
	SW	1,729	12	2	13,034	1,350	2,127	18,254
2010	GW	3,698	0	15	12,653	1,920	912	19,198
	SW	1,450	12	1	19,601	1,574	2,128	24,766
2009	GW	3,536	11,206	0	0	2,613	552	17,907
	SW	1,470	8,903	0	0	2,155	1,287	13,815
2008	GW	2,890	11,171	0	0	3,099	538	17,698
	SW	1,557	8,876	0	0	1,782	1,257	13,472
2007	GW	2,603	24,678	0	0	4,210	509	32,000
	SW	1,365	4,482	0	0	3	1,188	7,038
2006	GW	3,298	30,116	0	0	5,655	564	39,633
	SW	1,601	12,568	0	0	492	1,315	15,976
2005	GW	3,268	34,762	0	0	4,752	570	43,352
	SW	1,400	11,177	0	0	860	1,329	14,766
2004	GW	2,399	36,435	0	0	3,589	755	43,178
	SW	1,338	11,607	0	0	1,672	1,132	15,749
2003	GW	3,073	36,329	0	0	4,469	756	44,627
	SW	1,655	15,166	0	0	756	1,134	18,711
2002	GW	2,912	35,496	0	0	900	743	40,051
	SW	1,655	12,861	0	0	1,827	1,114	17,457
2001	GW	2,924	31,903	0	0	787	719	36,333
	SW	1,816	12,625	0	0	1,597	1,078	17,116
2000	GW	3,164	31,968	0	0	779	712	36,623
	SW	1,916	14,447	0	0	1,613	1,068	19,044

Projected Surface Water Supplies
TWDB 2017 State Water Plan Data

BURLESON COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
G	LIVESTOCK, BURLESON	BRAZOS	BRAZOS LIVESTOCK LOCAL SUPPLY	1,508	1,508	1,508	1,508	1,508	1,508
	Sum of Projected Surface Water Supplies (acre-feet)			**1,508**	**1,508**	**1,508**	**1,508**	**1,508**	**1,508**

MILAM COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
G	BELL-MILAM FALLS WSC	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	352	349	343	342	336	329
G	BUCKHOLTS	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	122	122	122	122	122	122
G	CAMERON	BRAZOS	BRAZOS RUN-OF-RIVER	2,615	2,615	2,615	2,615	2,615	2,615
G	COUNTY-OTHER, MILAM	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	793	793	793	793	793	793
G	COUNTY-OTHER, MILAM	BRAZOS	BRAZOS RUN-OF-RIVER	163	163	163	163	163	163
G	IRRIGATION, MILAM	BRAZOS	BRAZOS RUN-OF-RIVER	42	42	42	42	42	42
G	LIVESTOCK, MILAM	BRAZOS	BRAZOS LIVESTOCK LOCAL SUPPLY	1,822	1,822	1,822	1,822	1,822	1,822
G	MANUFACTURING, MILAM	BRAZOS	BRAZOS RUN-OF-RIVER	14	14	14	14	14	14
G	STEAM ELECTRIC POWER, MILAM	BRAZOS	ALCOA LAKE/RESERVOIR	14,000	14,000	14,000	14,000	14,000	14,000
G	STEAM ELECTRIC POWER, MILAM	BRAZOS	BRAZOS RIVER AUTHORITY LITTLE RIVER LAKE/RESERVOIR SYSTEM	2,683	4,329	4,352	4,673	4,609	4,508
G	STEAM ELECTRIC POWER, MILAM	BRAZOS	BRAZOS RUN-OF-RIVER	650	650	650	650	650	650
	Sum of Projected Surface Water Supplies (acre-feet)			**23,256**	**24,899**	**24,916**	**25,236**	**25,166**	**25,058**

Projected Water Demands
TWDB 2017 State Water Plan Data

Please note that the demand numbers presented here include the plumbing code savings found in the Regional and State Water Plans.

BURLESON COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
G	CALDWELL	BRAZOS	1,027	1,043	1,073	1,073	1,091	1,108
G	COUNTY-OTHER, BURLESON	BRAZOS	615	673	703	771	809	841
G	DEANVILLE WSC	BRAZOS	465	471	490	487	493	499
G	IRRIGATION, BURLESON	BRAZOS	22,855	21,904	21,057	20,115	19,216	18,469
G	LIVESTOCK, BURLESON	BRAZOS	1,508	1,508	1,508	1,508	1,508	1,508
G	MANUFACTURING, BURLESON	BRAZOS	139	161	183	203	221	241
G	MILANO WSC	BRAZOS	212	220	224	231	237	243
G	MINING, BURLESON	BRAZOS	995	1,923	1,512	1,100	686	428
G	SNOOK	BRAZOS	184	195	201	209	216	221
G	SOMERVILLE	BRAZOS	266	277	285	296	305	313
G	SOUTHWEST MILAM WSC	BRAZOS	129	135	138	143	147	151
	Sum of Projected Water Demands (acre-feet)		**28,395**	**28,510**	**27,374**	**26,136**	**24,929**	**24,022**

MILAM COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
G	BELL-MILAM FALLS WSC	BRAZOS	255	264	269	279	290	300
G	BUCKHOLTS	BRAZOS	68	70	71	73	76	79
G	CAMERON	BRAZOS	1,359	1,409	1,441	1,500	1,556	1,612
G	COUNTY-OTHER, MILAM	BRAZOS	300	313	324	339	351	364
G	IRRIGATION, MILAM	BRAZOS	5,081	5,040	4,995	4,956	4,915	4,875
G	LIVESTOCK, MILAM	BRAZOS	1,822	1,822	1,822	1,822	1,822	1,822
G	MANUFACTURING, MILAM	BRAZOS	12	12	12	14	14	14
G	MILANO WSC	BRAZOS	220	225	228	236	244	253
G	MINING, MILAM	BRAZOS	14	14	14	14	14	14
G	ROCKDALE	BRAZOS	1,159	1,198	1,222	1,269	1,317	1,364
G	SOUTHWEST MILAM WSC	BRAZOS	1,021	1,055	1,078	1,121	1,163	1,204
G	STEAM ELECTRIC POWER, MILAM	BRAZOS	32,023	32,023	32,023	40,989	40,989	40,989
G	THORNDALE	BRAZOS	184	188	190	197	204	211
	Sum of Projected Water Demands (acre-feet)		**43,518**	**43,633**	**43,689**	**52,809**	**52,955**	**53,101**

Projected Water Supply Needs
TWDB 2017 State Water Plan Data

Negative values (in red) reflect a projected water supply need, positive values a surplus.

BURLESON COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
G	CALDWELL	BRAZOS	1,325	1,309	1,279	1,279	1,261	1,244
G	COUNTY-OTHER, BURLESON	BRAZOS	258	200	170	102	64	32
G	DEANVILLE WSC	BRAZOS	236	230	211	214	208	202
G	IRRIGATION, BURLESON	BRAZOS	107	1,058	1,905	2,847	3,746	4,493
G	LIVESTOCK, BURLESON	BRAZOS	0	0	0	0	0	0
G	MANUFACTURING, BURLESON	BRAZOS	0	-22	-44	-64	-82	-102
G	MILANO WSC	BRAZOS	38	14	8	1	4	2
G	MINING, BURLESON	BRAZOS	-995	-1,923	-1,512	-1,100	-686	-428
G	SNOOK	BRAZOS	291	280	274	266	259	254
G	SOMERVILLE	BRAZOS	625	614	606	595	586	578
G	SOUTHWEST MILAM WSC	BRAZOS	76	49	16	24	20	7
	Sum of Projected Water Supply Needs (acre-feet)		**-995**	**-1,945**	**-1,556**	**-1,164**	**-768**	**-530**

MILAM COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
G	BELL-MILAM FALLS WSC	BRAZOS	528	513	494	482	458	432
G	BUCKHOLTS	BRAZOS	176	174	173	171	168	165
G	CAMERON	BRAZOS	1,256	1,206	1,174	1,115	1,059	1,003
G	COUNTY-OTHER, MILAM	BRAZOS	656	643	632	617	605	592
G	IRRIGATION, MILAM	BRAZOS	317	206	13	267	400	440
G	LIVESTOCK, MILAM	BRAZOS	0	0	0	0	0	0
G	MANUFACTURING, MILAM	BRAZOS	2	2	2	0	0	0
G	MILANO WSC	BRAZOS	40	15	9	1	5	2
G	MINING, MILAM	BRAZOS	0	0	0	0	0	0
G	ROCKDALE	BRAZOS	841	662	174	320	355	308
G	SOUTHWEST MILAM WSC	BRAZOS	604	388	124	186	151	57
G	STEAM ELECTRIC POWER, MILAM	BRAZOS	1,096	-35	-78	-7,222	-6,646	-6,757
G	THORNDALE	BRAZOS	45	41	39	32	25	18
	Sum of Projected Water Supply Needs (acre-feet)		**0**	**-35**	**-78**	**-7,222**	**-6,646**	**-6,757**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

BURLESON COUNTY

WUG, Basin (RWPG) All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
CALDWELL, BRAZOS (G)							
MUNICIPAL WATER CONSERVATION (SUBURBAN) - CALDWELL	DEMAND REDUCTION [BURLESON]	40	121	203	240	242	246
		40	**121**	**203**	**240**	**242**	**246**
MANUFACTURING, BURLESON, BRAZOS (G)							
INDUSTRIAL WATER CONSERVATION	DEMAND REDUCTION [BURLESON]	4	8	13	14	15	17
SPARTA AQUIFER DEVELOPMENT	SPARTA AQUIFER [BURLESON]	0	50	50	50	85	85
		4	**58**	**63**	**64**	**100**	**102**
MINING, BURLESON, BRAZOS (G)							
INDUSTRIAL WATER CONSERVATION	DEMAND REDUCTION [BURLESON]	30	96	106	77	48	30
SPARTA AQUIFER DEVELOPMENT	SPARTA AQUIFER [BURLESON]	740	740	740	740	740	740
		770	**836**	**846**	**817**	**788**	**770**
SNOOK, BRAZOS (G)							
MUNICIPAL WATER CONSERVATION (RURAL) - SNOOK	DEMAND REDUCTION [BURLESON]	11	26	42	59	76	91
		11	**26**	**42**	**59**	**76**	**91**
SOMERVILLE, BRAZOS (G)							
MUNICIPAL WATER CONSERVATION (SUBURBAN) - SOMERVILLE	DEMAND REDUCTION [BURLESON]	8	26	23	23	23	24
		8	**26**	**23**	**23**	**23**	**24**
SOUTHWEST MILAM WSC, BRAZOS (G)							
MUNICIPAL WATER CONSERVATION (RURAL) - SOUTHWEST MILAM WSC	DEMAND REDUCTION [BURLESON]	3	0	0	0	0	0
		3	**0**	**0**	**0**	**0**	**0**
Sum of Projected Water Management Strategies (acre-feet)		**836**	**1,067**	**1,177**	**1,203**	**1,229**	**1,233**

MILAM COUNTY

WUG, Basin (RWPG) All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
CAMERON, BRAZOS (G)							
MUNICIPAL WATER CONSERVATION (RURAL) - CAMERON	DEMAND REDUCTION [MILAM]	58	163	269	389	448	464

		58	**163**	**269**	**389**	**448**	**464**
ROCKDALE, BRAZOS (G)							
MUNICIPAL WATER CONSERVATION (RURAL) - ROCKDALE	DEMAND REDUCTION [MILAM]	43	128	198	195	200	207
		43	**128**	**198**	**195**	**200**	**207**
SOUTHWEST MILAM WSC, BRAZOS (G)							
MUNICIPAL WATER CONSERVATION (RURAL) - SOUTHWEST MILAM WSC	DEMAND REDUCTION [MILAM]	22	1	0	0	0	0
		22	**1**	**0**	**0**	**0**	**0**
STEAM ELECTRIC POWER, MILAM, BRAZOS (G)							
INDUSTRIAL WATER CONSERVATION	DEMAND REDUCTION [MILAM]	0	1,601	2,869	2,869	2,869	2,869
LITTLE RIVER OCR	LITTLE RIVER OFF-CHANNEL LAKE/RESERVOIR [RESERVOIR]	0	0	0	4,353	4,000	4,000
		0	**1,601**	**2,869**	**7,222**	**6,869**	**6,869**
Sum of Projected Water Management Strategies (acre-feet)		**123**	**1,893**	**3,336**	**7,806**	**7,517**	**7,540**

GAM Run 16-015: Post Oak Savannah Groundwater Conservation District Groundwater Management Plan

Natalie Ballew, GIT
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Department
512-463-2779
August 31, 2017

Cynthia K. Ridgeway is the Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by Natalie Ballew under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G. 471 on August 31, 2017.

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GAM RUN 16-015: POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT GROUNDWATER MANAGEMENT PLAN

Natalie Ballew, GIT
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Department
512-463-2779
August 31, 2017

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h) (Texas Water Code, 2015), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the Executive Administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the Executive Administrator.

The TWDB provides data and information to the Post Oak Savannah Groundwater Conservation District in two parts. Part 1 is the Estimated Historical Water Use/State Water Plan dataset report, which will be provided to you separately by the TWDB Groundwater Technical Assistance Department. Please direct questions about the water data report to Mr. Stephen Allen at 512-463-7317 or stephen.allen@twdb.texas.gov. Part 2 is the required groundwater availability modeling information and this information includes

1. the annual amount of recharge from precipitation, if any, to the groundwater resources within the district;
2. for each aquifer within the district, the annual volume of water that discharges from the aquifer to springs and any surface-water bodies, including lakes, streams, and rivers; and
3. the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

The groundwater management plan for the Post Oak Savannah Groundwater Conservation District should be adopted by the district on or before September 18, 2017, and submitted to the Executive Administrator of the TWDB on or before October 18, 2017. The current

management plan for the Post Oak Savannah Groundwater Conservation District expires on December 17, 2017.

We used four groundwater availability models to estimate the management plan information for the aquifers within the Post Oak Savannah Groundwater Conservation District. Information for the Trinity Aquifer is from version 2.01 of the groundwater availability model for the northern portion of the Trinity and Woodbine aquifers (Kelley and others, 2014). Information for the Carrizo-Wilcox, Queen City, and Sparta aquifers is from version 2.02 of the groundwater availability model for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers (Kelley and others, 2004). Information for the Yegua-Jackson Aquifer is from version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer (Deeds and others, 2010). Information for the Brazos River Alluvium Aquifer is from version 1.01 of the groundwater availability model for the Brazos River Alluvium Aquifer (Ewing and Jigmond, 2016).

This report replaces the results of GAM Run 10-029 (Aschenbach, 2011). GAM Run 16-015 meets current standards set after the release of GAM Run 10-029 and includes results from recently released groundwater availability models for the northern portion of the Trinity and Woodbine aquifers (Kelley and others, 2014) and for the Brazos River Alluvium Aquifer (Ewing and Jigmond, 2016). Tables 1 through 6 summarize the groundwater availability model data required by statute and Figures 1 through 6 show the area of the model from which the values in the tables were extracted. If, after review of the figures, the Post Oak Savannah Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB at your earliest convenience.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the four groundwater availability models mentioned above were used to estimate information for the Post Oak Savannah Groundwater Conservation District management plan. Water budgets were extracted for the historical model periods for the Trinity Aquifer (1980 through 2012), Carrizo-Wilcox, Queen City, and Sparta aquifers (1980 through 1999), Yegua-Jackson Aquifer (1980 through 1997) using ZONEBUDGET Version 3.01 (Harbaugh, 2009). The water budget for the Brazos River Alluvium Aquifer was extracted for the historical model period (1980 through 2012) using ZONEBUDGET-USG (Panday and others, 2013). The average annual water budget values for recharge, surface-water outflow, inflow to the district, and outflow from the district for the aquifers within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Trinity Aquifer

- We used version 2.01 of the groundwater availability model for the northern portion of the Trinity and Woodbine aquifers. See Kelley and others (2014) for assumptions and limitations of the model.
- The groundwater availability model for the northern portion of the Trinity and Woodbine aquifers contains eight layers: Layer 1 (the surficial outcrop area of the units in layers 2 through 8 and units younger than Woodbine Aquifer), Layer 2 (Woodbine Aquifer and pass-through cells), Layer 3 (Washita and Fredericksburg, Edwards [Balcones Fault Zone], and pass-through cells), and Layers 4 through 8 (Trinity Aquifer).
- The Woodbine Aquifer does not exist within the Post Oak Savannah Groundwater Conservation District; water budgets for this aquifer were not calculated for this report.
- The model was run with MODFLOW-NWT (Niswonger and others, 2011).

Carrizo-Wilcox, Queen City, and Sparta aquifers

- We used version 2.02 of the groundwater availability model for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers. See Dutton and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater availability model for the central part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.
- This groundwater availability model includes eight layers, which generally represent the Sparta Aquifer (Layer 1), the Weches Formation confining unit (Layer 2), the Queen City Aquifer (Layer 3), the Reklaw Formation confining unit (Layer 4), the Carrizo Formation (Layer 5), the Calvert Bluff Formation (Layer 6), the Simsboro Formation (Layer 7), and the Hooper Formation (Layer 8).
- Individual water budgets for the district were determined for the Sparta Aquifer (Layer 1), the Queen City Aquifer (Layer 3), and the Carrizo-Wilcox Aquifer (Layers 5 through 8, collectively).
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

Yegua-Jackson Aquifer

- We used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model.
- This groundwater availability model includes five layers which represent the outcrop of the Yegua-Jackson Aquifer and younger overlying units—the Catahoula Formation (Layer 1), the upper portion of the Jackson Group (Layer 2), the lower portion of the Jackson Group (Layer 3), the upper portion of the Yegua Group (Layer 4), and the lower portion of the Yegua Group (Layer 5).
- An overall water budget for the district was determined for the Yegua-Jackson Aquifer (Layer 1 through Layer 5, collectively, for the portions of the model that represent the Yegua-Jackson Aquifer).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

Brazos River Alluvium Aquifer

- We used version 1.01 of the groundwater availability model for the Brazos River Alluvium Aquifer released on December 16, 2016. See Ewing and Jigmond (2016) for assumptions and limitations of the model.
- The groundwater availability model for the Brazos River Alluvium Aquifer contains three layers. Layers 1 and 2 represent the Brazos River Alluvium Aquifer and Layer 3 represents the surficial portions of the Carrizo-Wilcox, Queen City, Sparta, Yegua-Jackson, and Gulf Coast aquifers as well as various geologic units of the Cretaceous System.
- Perennial rivers and streams were simulated using the MODFLOW Streamflow-Routing package and ephemeral streams were simulated using the MODFLOW River package. Springs were simulated using the MODFLOW Drain package.
- The model was run with MODFLOW-USG (unstructured grid; Panday and others, 2013).

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifers according to the groundwater availability model. Selected groundwater budget

components listed below were extracted from the groundwater availability model results for the Trinity, Carrizo-Wilcox, Queen City, Sparta, Yegua-Jackson, and Brazos River Alluvium aquifers located within Post Oak Savannah Groundwater Conservation District and averaged over the historical calibration periods, as shown in Tables 1 through 6.

1. Precipitation recharge—the areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.

2. Surface-water outflow—the total water discharging from the aquifer (outflow) to surface-water features such as streams, reservoirs, and springs.

3. Flow into and out of district—the lateral flow within the aquifer between the district and adjacent counties.

4. Flow between aquifers—the net vertical flow between the aquifer and adjacent aquifers or confining units. This flow is controlled by the relative water levels in each aquifer and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs.

The information needed for the district's management plan is summarized in Tables 1 through 6. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.

TABLE 1. SUMMARIZED INFORMATION FOR THE TRINITY AQUIFER FOR POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Trinity Aquifer	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Trinity Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Trinity Aquifer	740
Estimated annual volume of flow out of the district within each aquifer in the district	Trinity Aquifer	382
Estimated net annual volume of flow between each aquifer in the district		NA[1]

[1] Not available because the model assumes a no-flow boundary condition at the base.

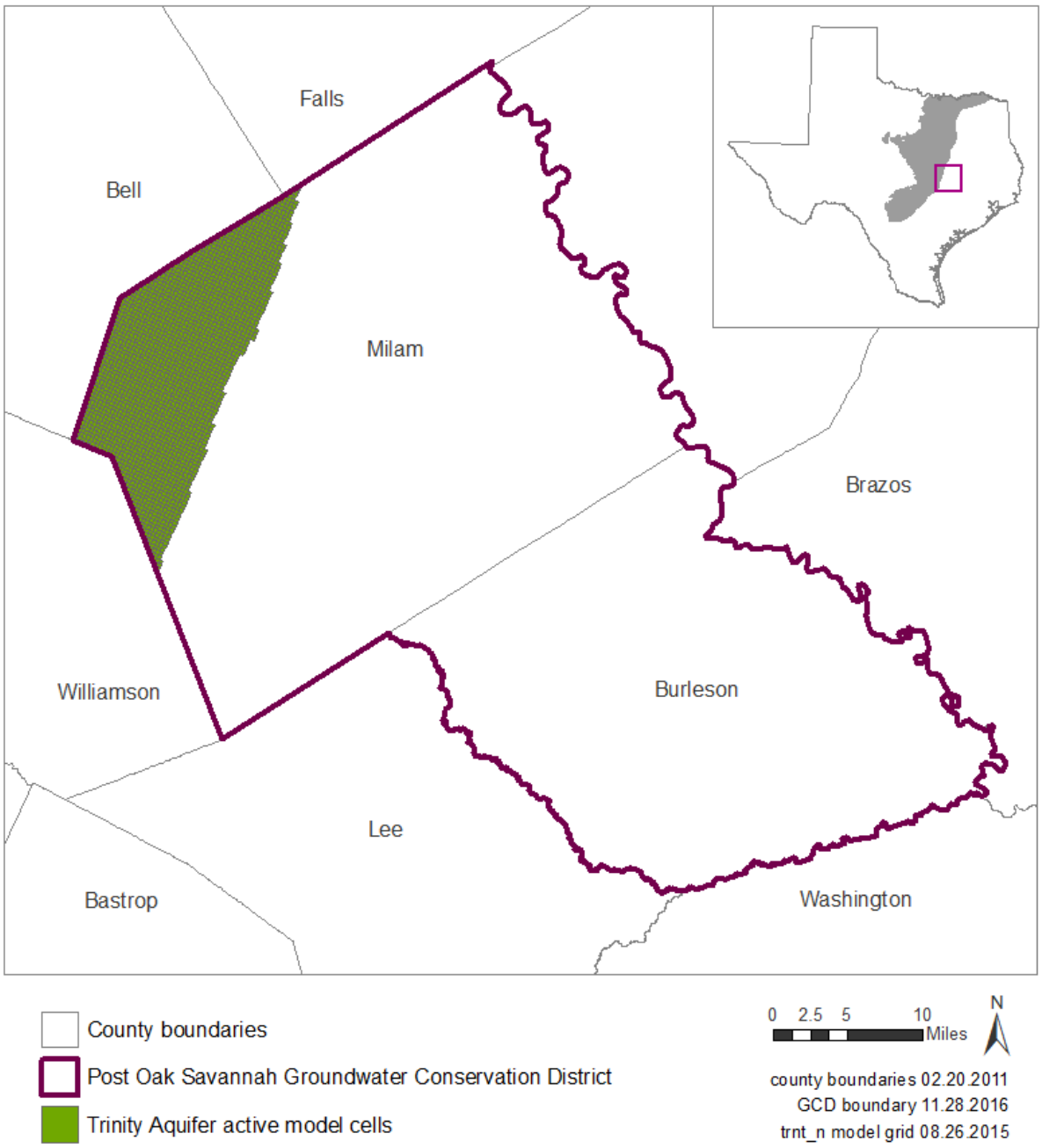

FIGURE 1. AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE TRINITY AQUIFER FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 2. SUMMARIZED INFORMATION FOR THE CARRIZO-WILCOX AQUIFER FOR POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	26,266
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	29,010
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	19,237
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	25,823
Estimated net annual volume of flow between each aquifer in the district	Carrizo-Wilcox Aquifer into the overlying Reklaw Confining Unit	237

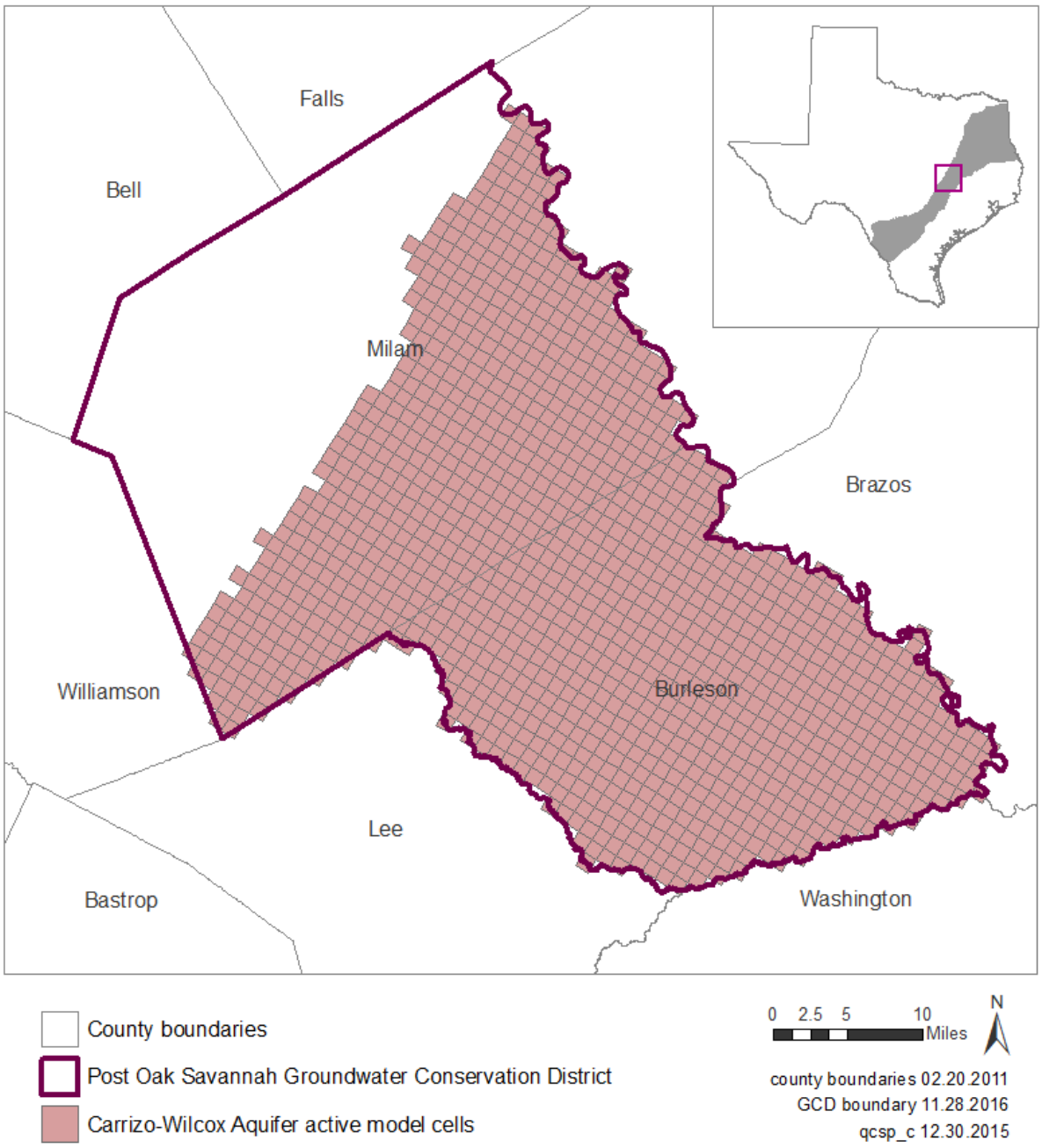

FIGURE 2. AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CARRIZO-WILCOX AQUIFER FROM WHICH THE INFORMATION IN TABLE 2 WAS EXTRACTED (THE AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 3. SUMMARIZED INFORMATION FOR THE QUEEN CITY AQUIFER FOR POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	8,811
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Queen City Aquifer	12,030
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	1,343
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	965
Estimated net annual volume of flow between each aquifer in the district	Queen City Aquifer into the Overlying Weches Confining Unit	1,448
	Reklaw Confining Unit and adjacent underlying areas into the Queen City Aquifer	866

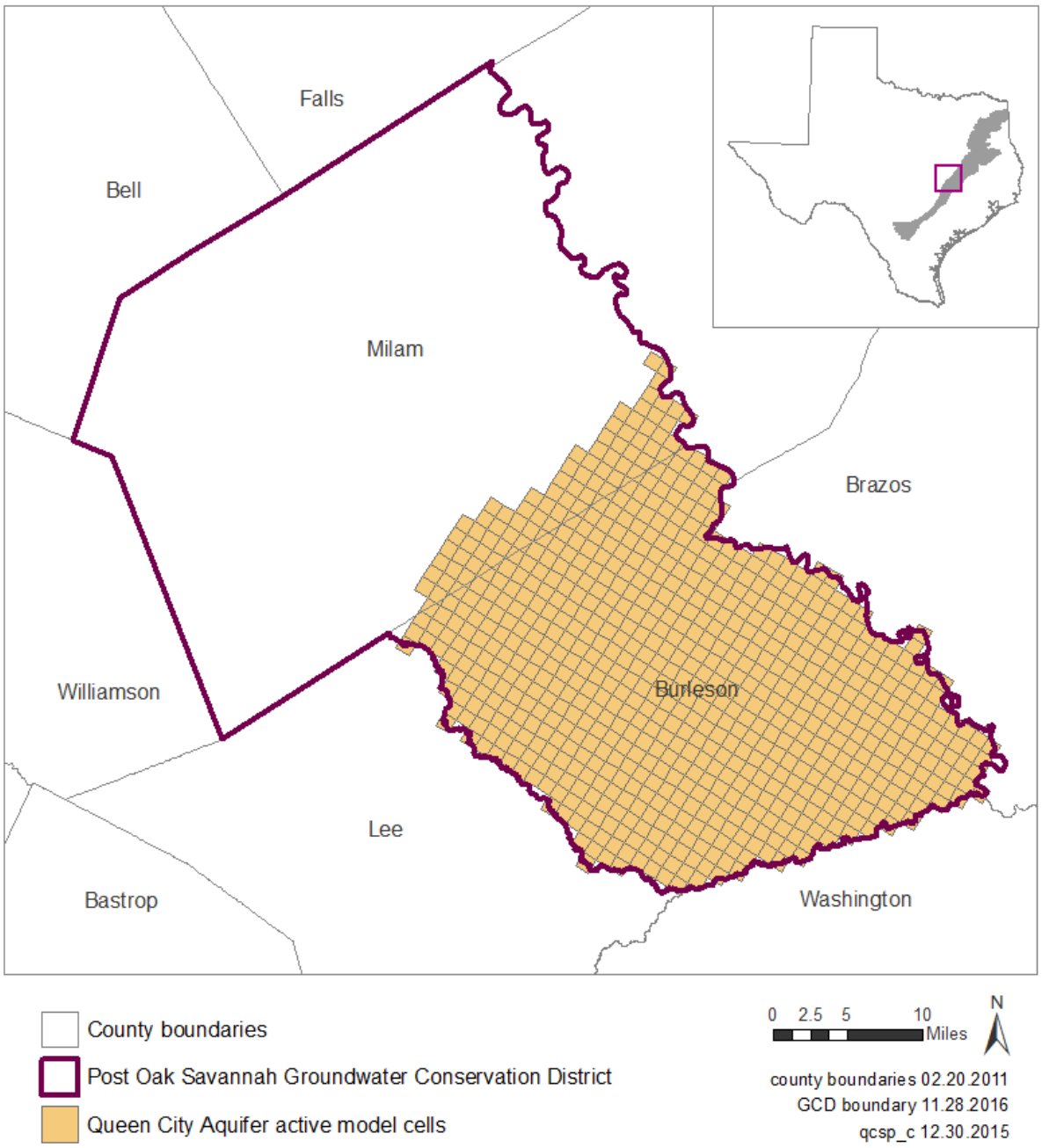

FIGURE 3. AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE QUEEN CITY AQUIFER FROM WHICH THE INFORMATION IN TABLE 3 WAS EXTRACTED (THE AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 4. SUMMARIZED INFORMATION FOR THE SPARTA AQUIFER FOR POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Sparta Aquifer	7,423
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Sparta Aquifer	4,808
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	763
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	1,228
Estimated net annual volume of flow between each aquifer in the district	Weches Confining Unit and adjacent underlying areas into the Sparta Aquifer	1,583

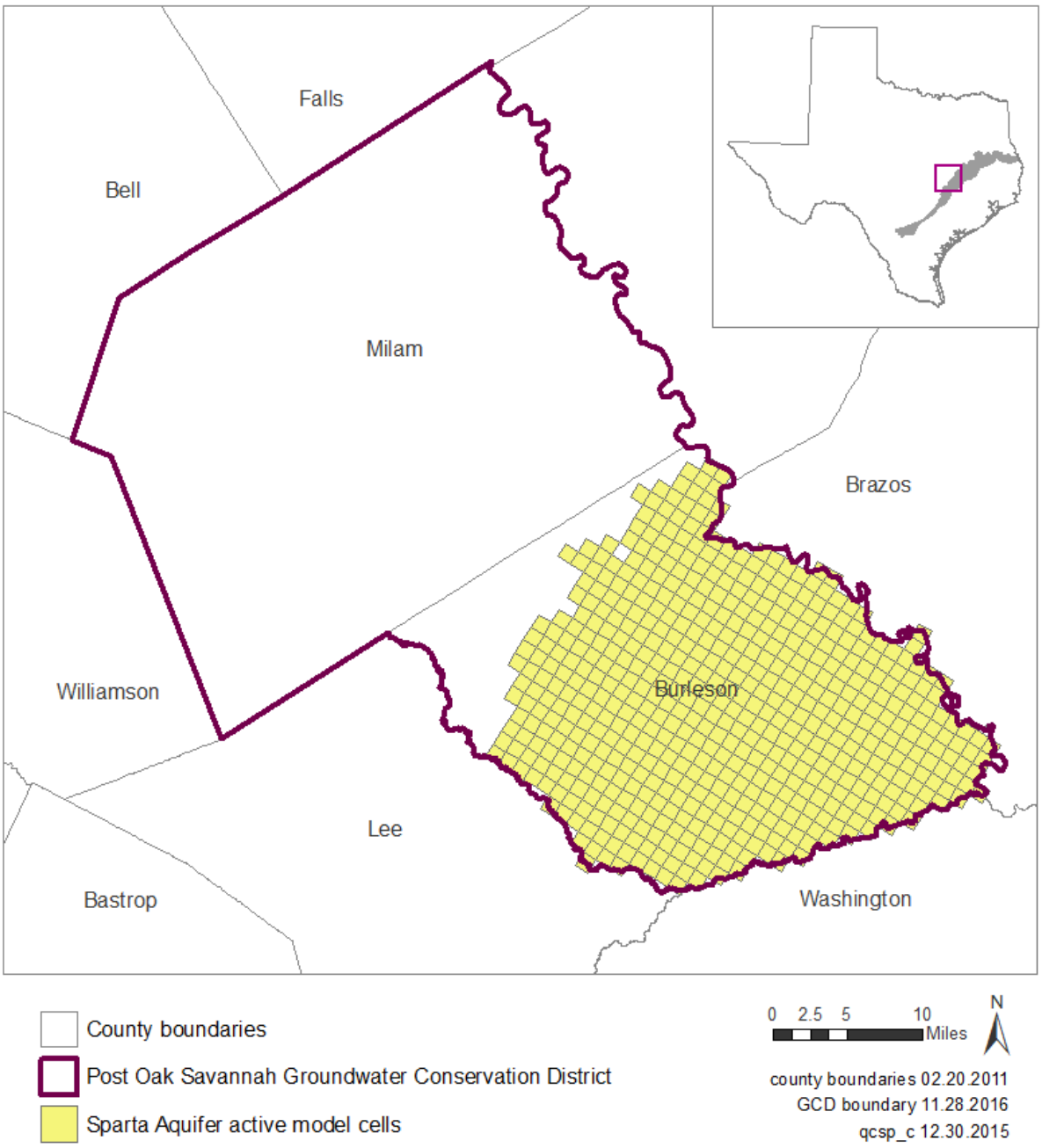

FIGURE 4. AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE SPARTA AQUIFER FROM WHICH THE INFORMATION IN TABLE 4 WAS EXTRACTED (THE AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 5. SUMMARIZED INFORMATION FOR THE YEGUA-JACKSON AQUIFER FOR POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	22,459
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	13,932
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	5,087
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	8,690
Estimated net annual volume of flow between each aquifer in the district	Yegua-Jackson Aquifer	NA[2]

[2] Not available because the model assumes a no-flow boundary condition at the base.

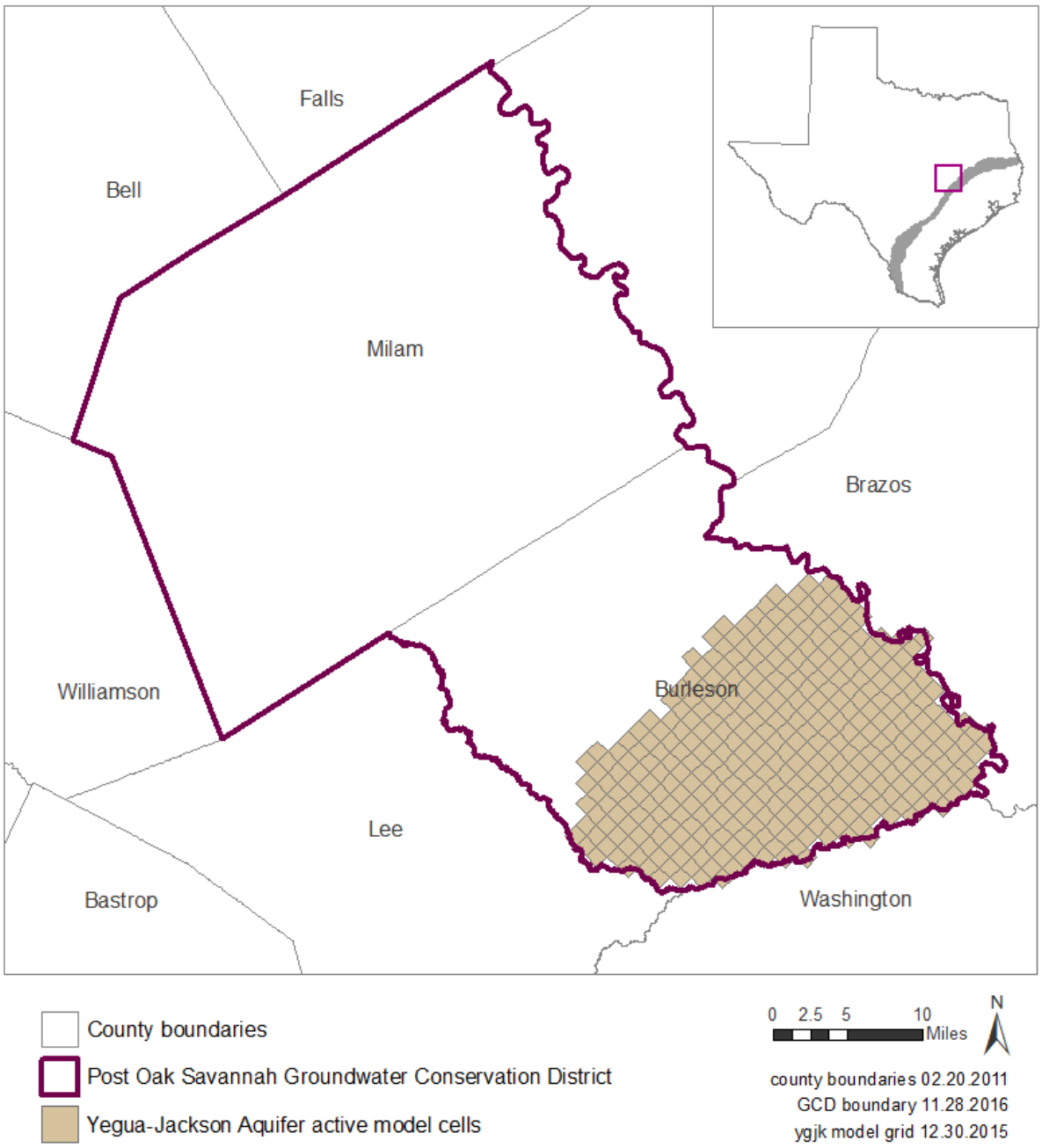

FIGURE 5. AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE YEGUA-JACKSON AQUIFER FROM WHICH THE INFORMATION IN TABLE 5 WAS EXTRACTED (THE AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

TABLE 6. SUMMARIZED INFORMATION FOR THE BRAZOS RIVER ALLUVIUM AQUIFER FOR POST OAK SAVANNAH GROUNDWATER CONSERVATION DISTRICT'S GROUNDWATER MANAGEMENT PLAN. ALL VALUES ARE REPORTED IN ACRE-FEET PER YEAR AND ROUNDED TO THE NEAREST 1 ACRE-FOOT.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Brazos River Alluvium Aquifer	15,510
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Brazos River Alluvium Aquifer	25,447
Estimated annual volume of flow into the district within each aquifer in the district	Brazos River Alluvium Aquifer	15,181
Estimated annual volume of flow out of the district within each aquifer in the district	Brazos River Alluvium Aquifer	19,706
Estimated net annual volume of flow between each aquifer in the district	Flow into the Brazos River Alluvium Aquifer from underlying formations and geological units	9,532

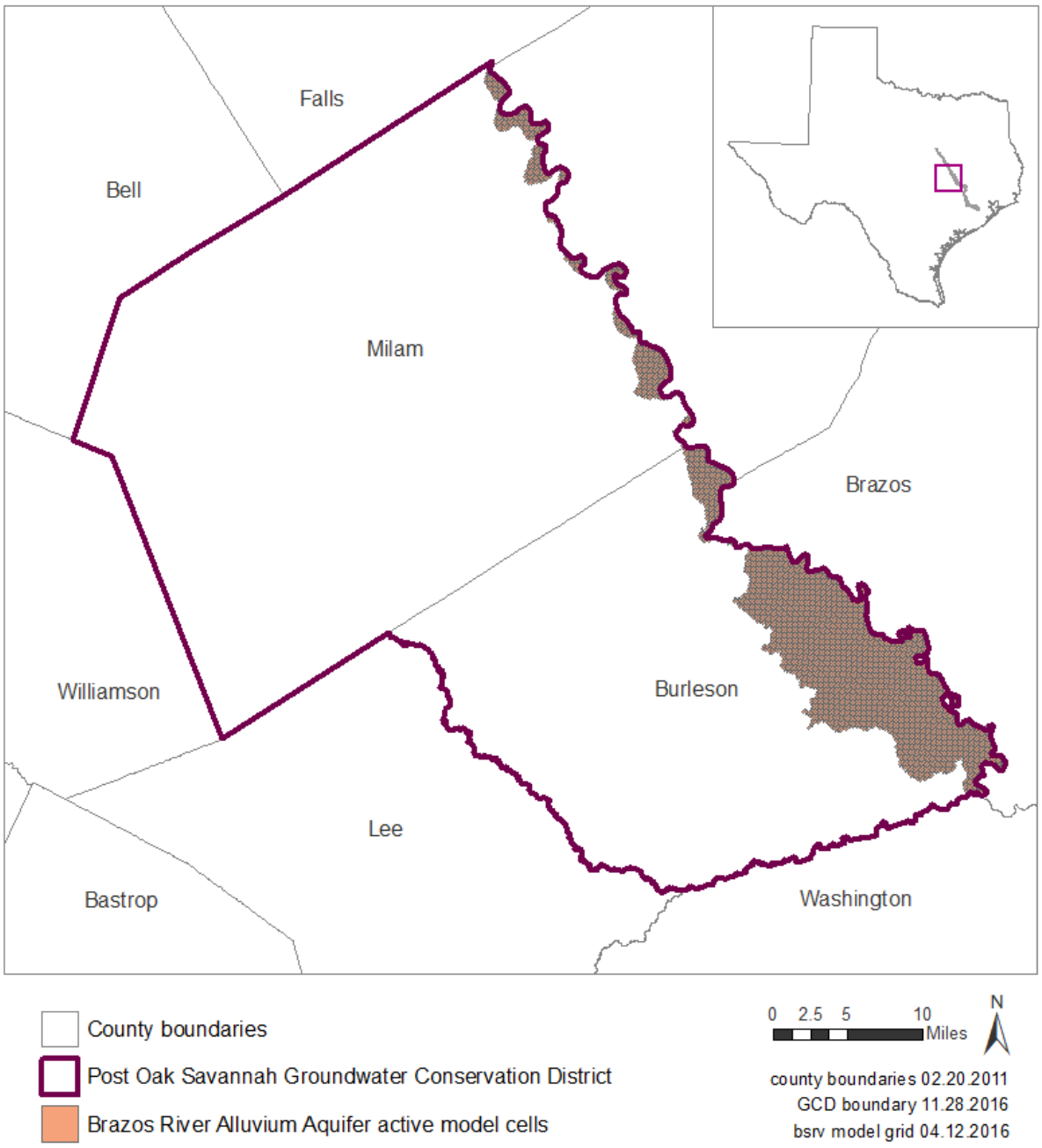

FIGURE 6. AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE BRAZOS RIVER ALLUVIUM AQUIFER FROM WHICH THE INFORMATION IN TABLE 6 WAS EXTRACTED (THE AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

LIMITATIONS:

The groundwater models used in completing this analysis are the best available scientific tools that can be used to meet the stated objectives. To the extent that this analysis will be used for planning purposes and/or regulatory purposes related to pumping in the past and into the future, it is important to recognize the assumptions and limitations associated with the use of the results. In reviewing the use of models in environmental regulatory decision making, the National Research Council (2007) noted:

> *"Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."*

A key aspect of using the groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historic pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and interaction with streams are specific to particular historic time periods.

Because the application of the groundwater models was designed to address regional-scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations related to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and overall conditions of the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

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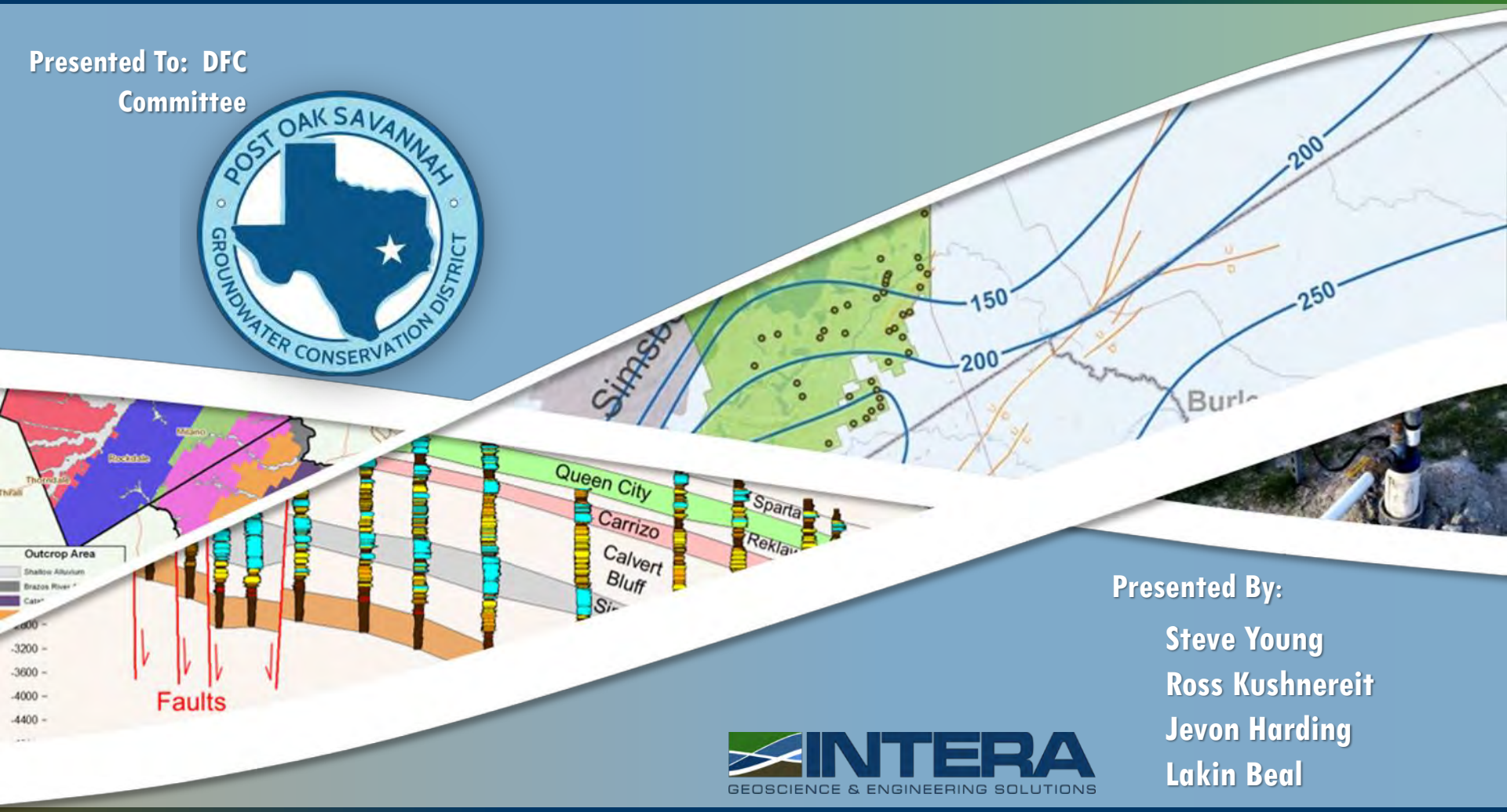
Desired Future Committee Update

Presented To: DFC Committee



Presented By:

Steve Young
Ross Kushnereit
Jevon Harding
Lakin Beal

INTERA
GEOSCIENCE & ENGINEERING SOLUTIONS

December 4, 2020

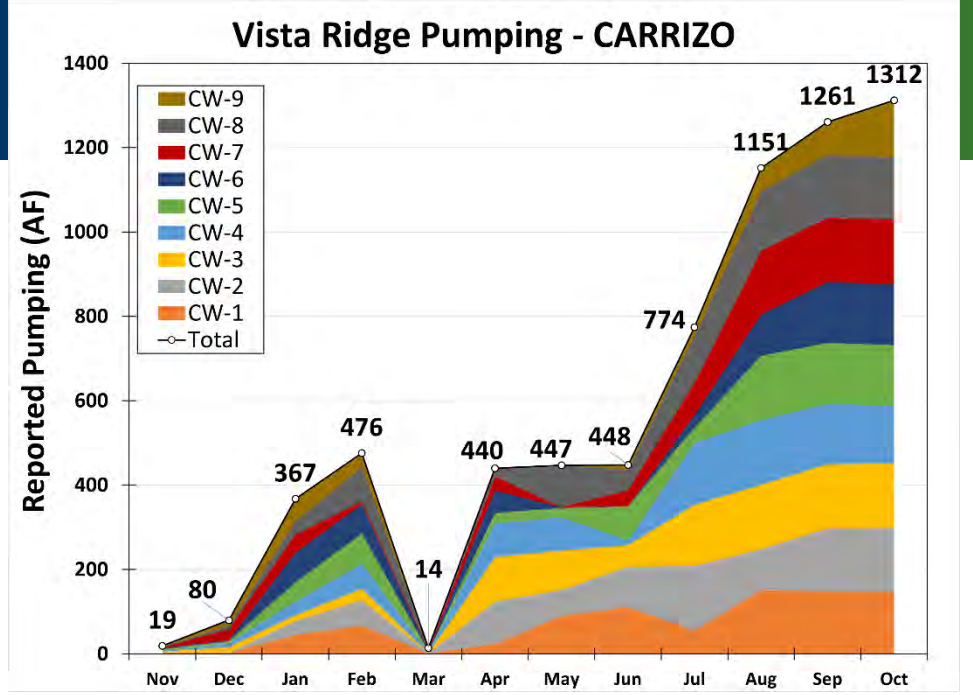
Outline

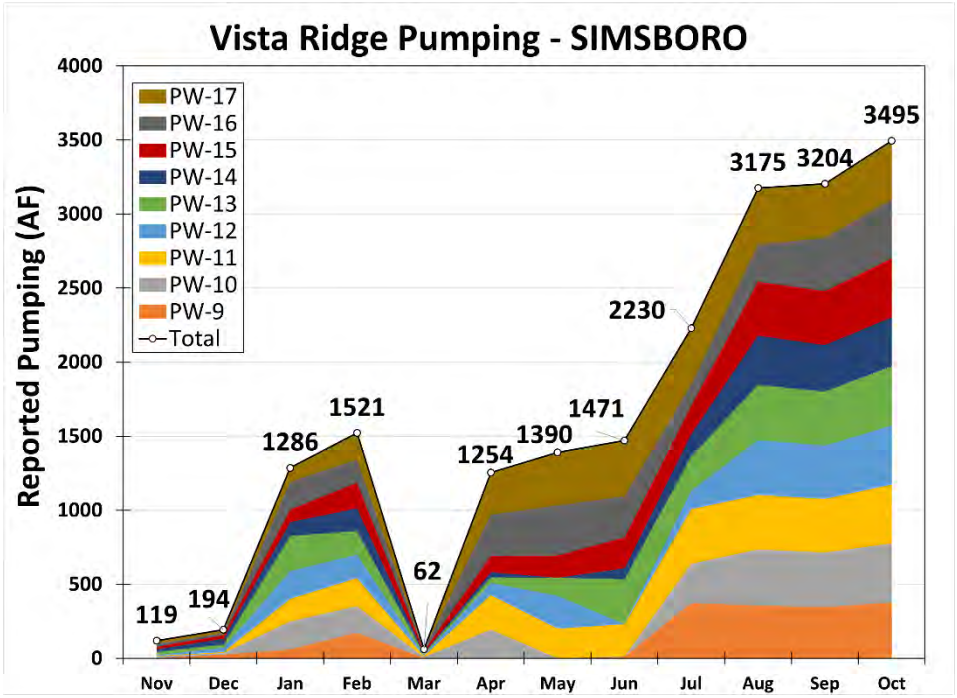
- Vista Ridge Modeling Update
- GWAP Annual Needs Assessment Report
- Compliance for DFCs and PDLs
- Update on Rule 16.4 Thresholds
- Sparta/Queen City/Carrizo-Wilcox GAM Runs and Options for DFC consideration

Vista Ridge Modeling Update

Vista Ridge Pumping Through October 2020

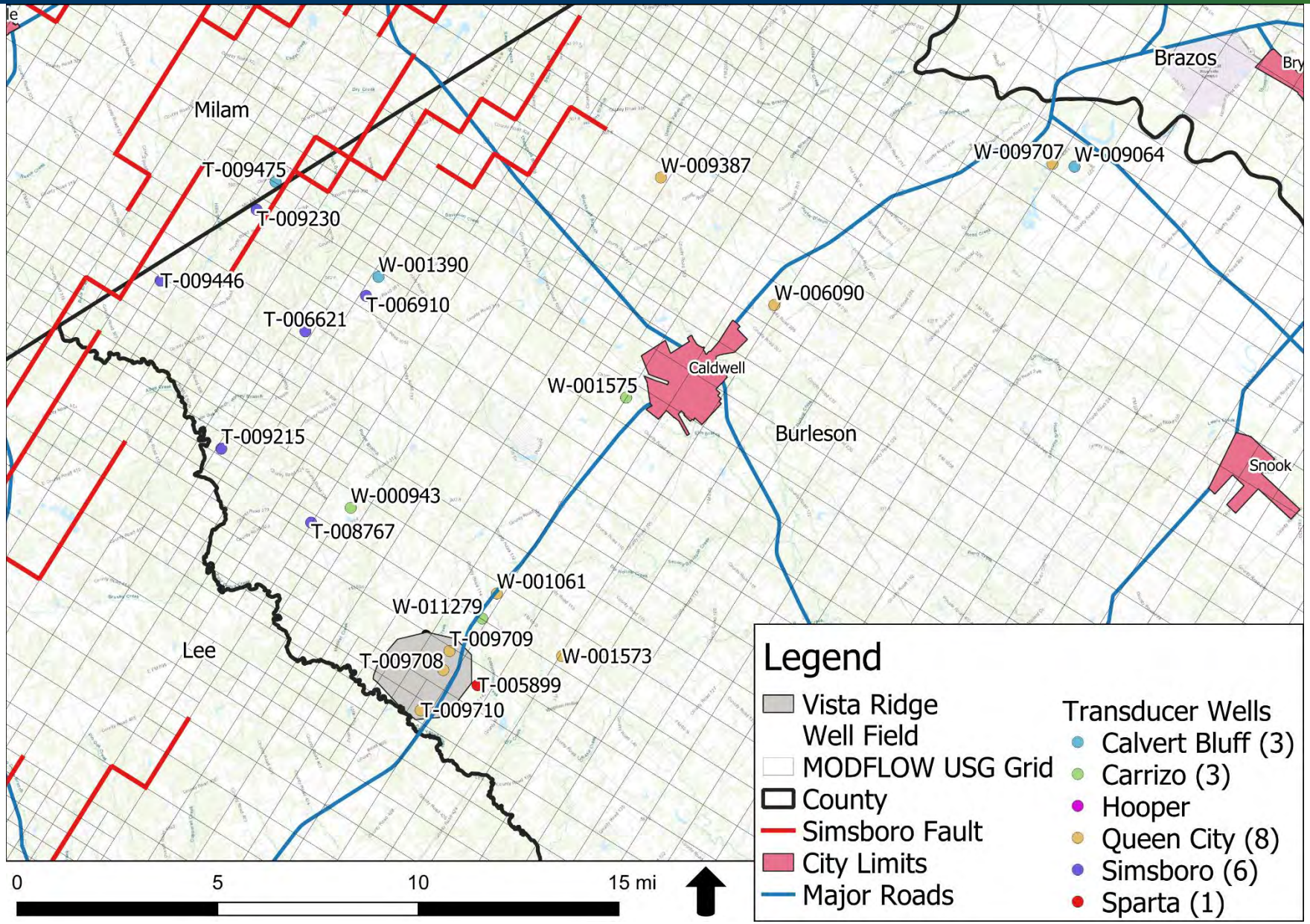
Month	Monthly acre-feet		
	Carrizo	Simsboro	Total
Nov 2019	19	119	138
Dec 2019	80	194	274
Jan 2020	367	1,286	1,653
Feb 2020	476	1,521	1,997
Mar 2020	14	62	76
Apr 2020	440	1,254	1,694
May 2020	447	1,390	1,837
Jun 2020	448	1,471	1,919
Jul 2020	774	2,230	3,004
Aug 2020	1,151	3,175	4,326
Sept 2020	1261	3204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



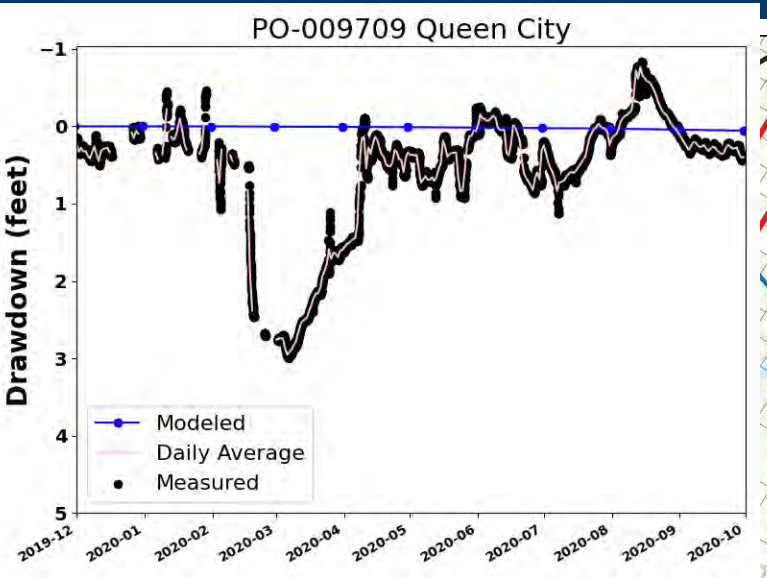


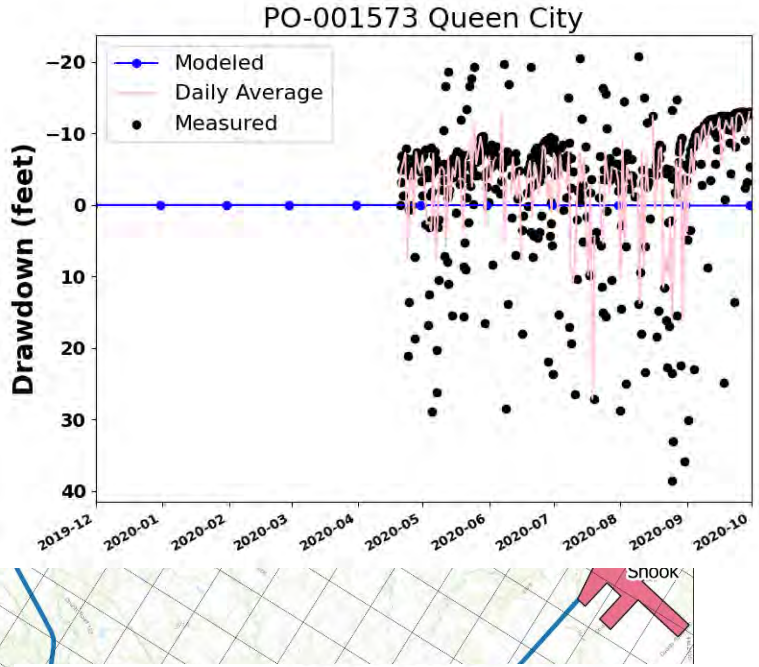
*1000 af/month = 7,428 gpm

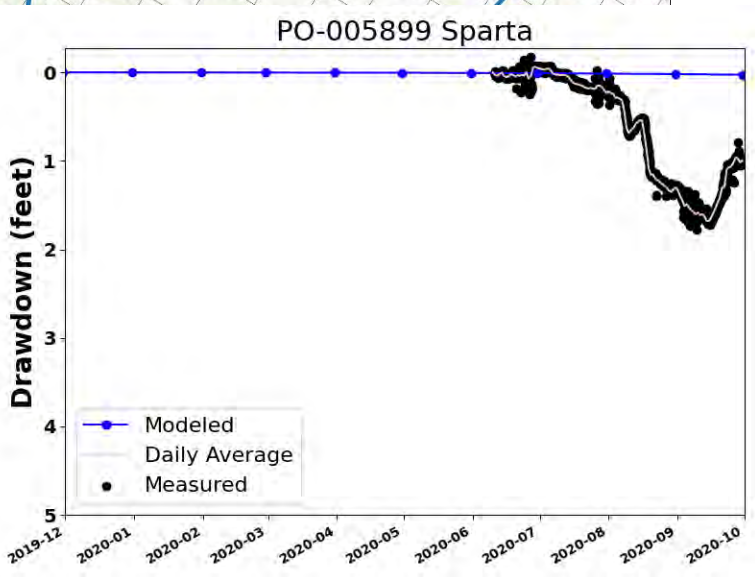
Location of Transducers



Sparta & Queen City (Dec 2019 to October 2020)







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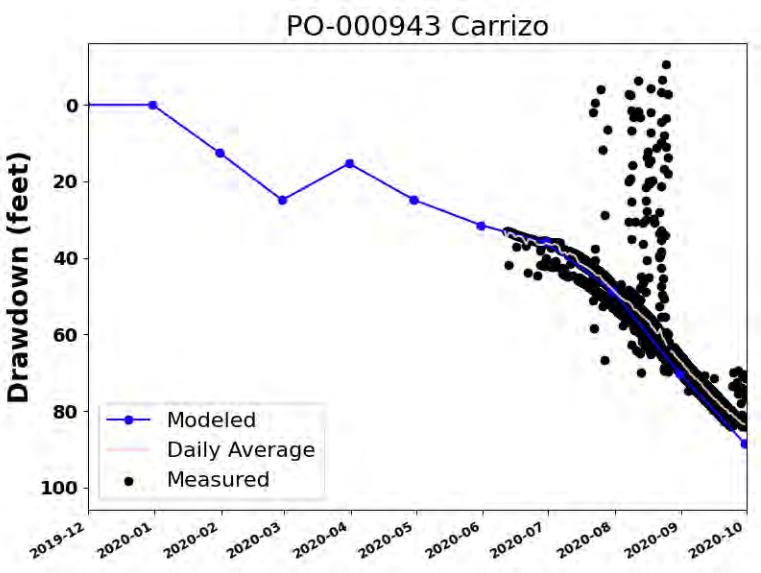
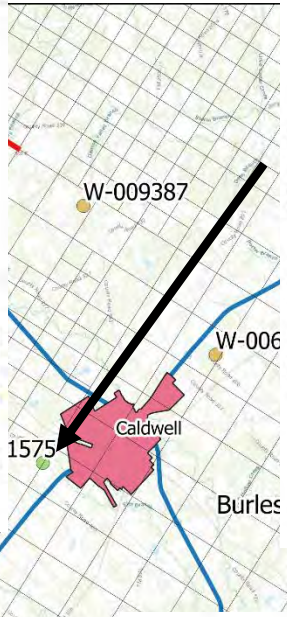
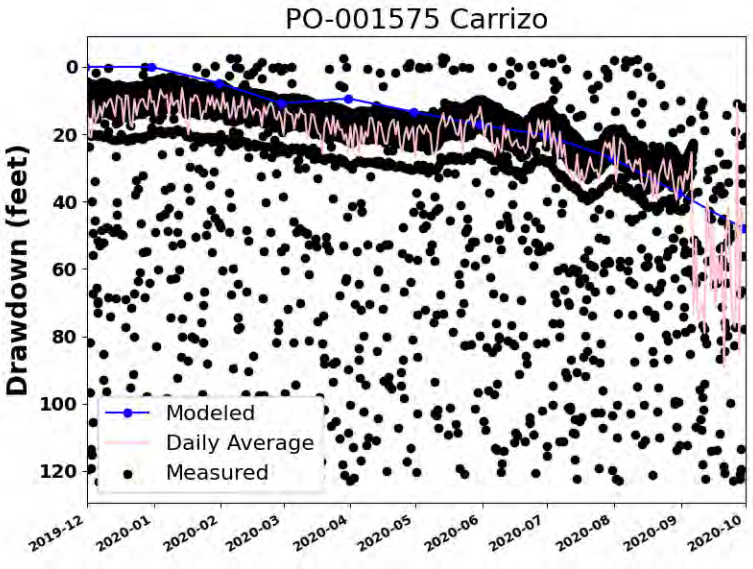
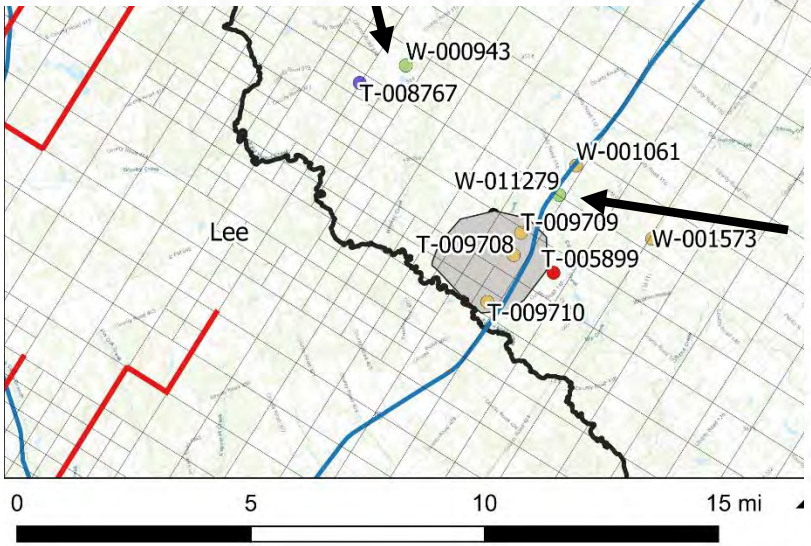
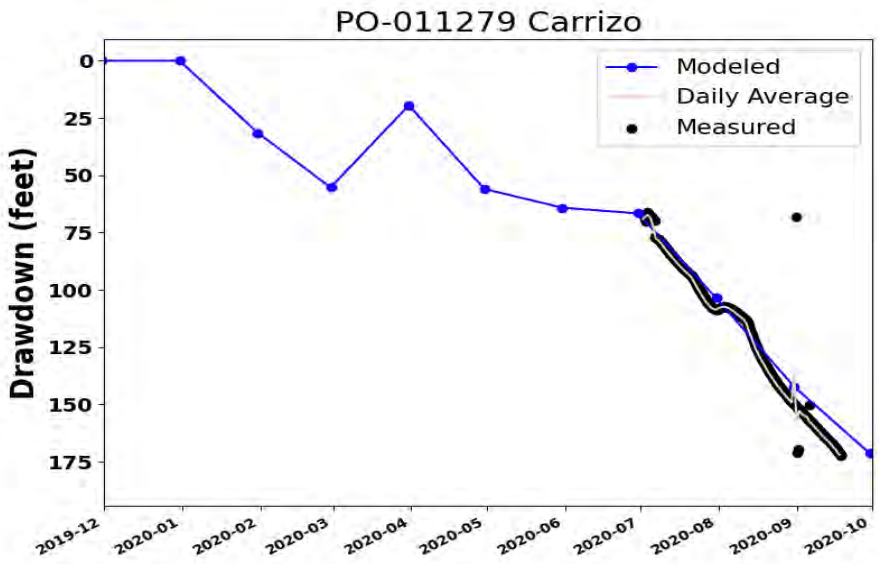


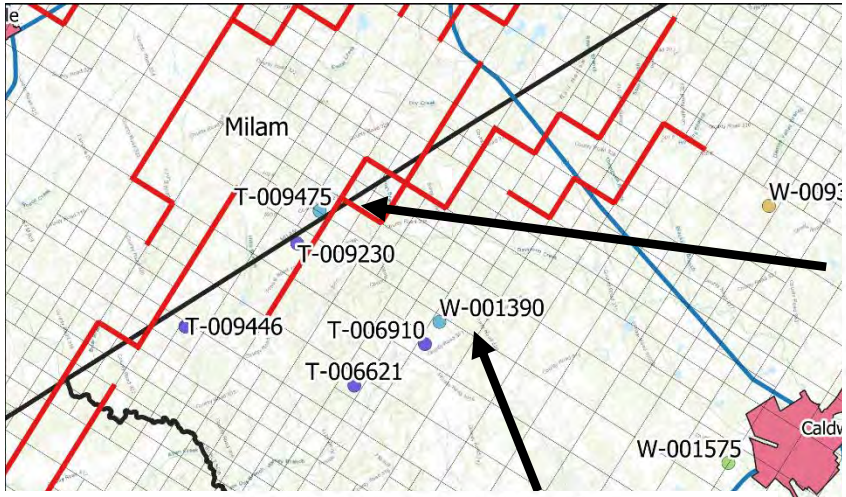


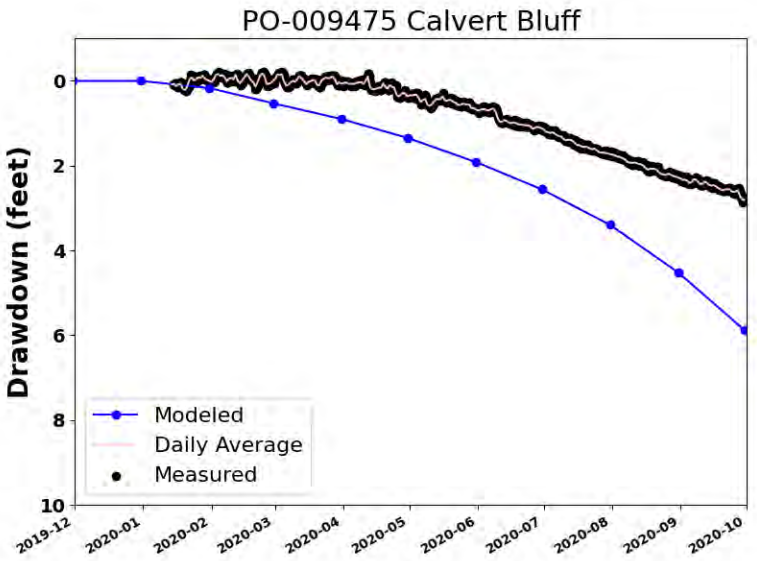


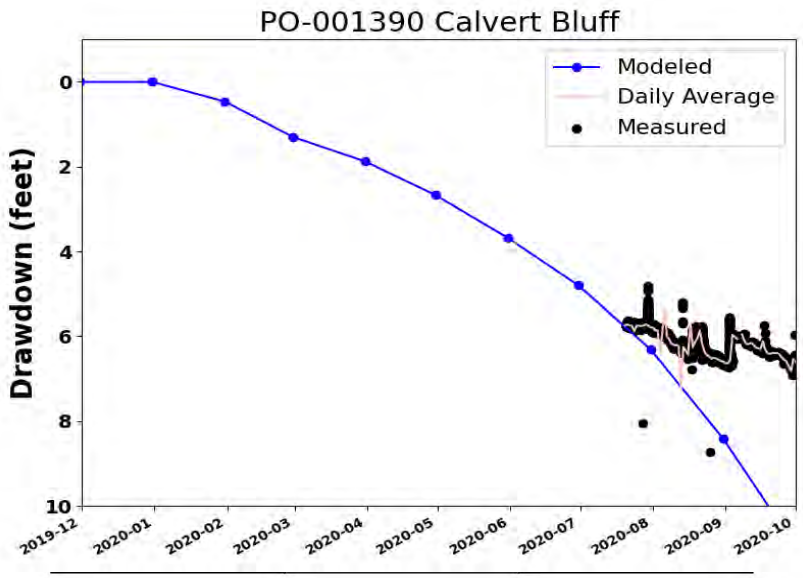


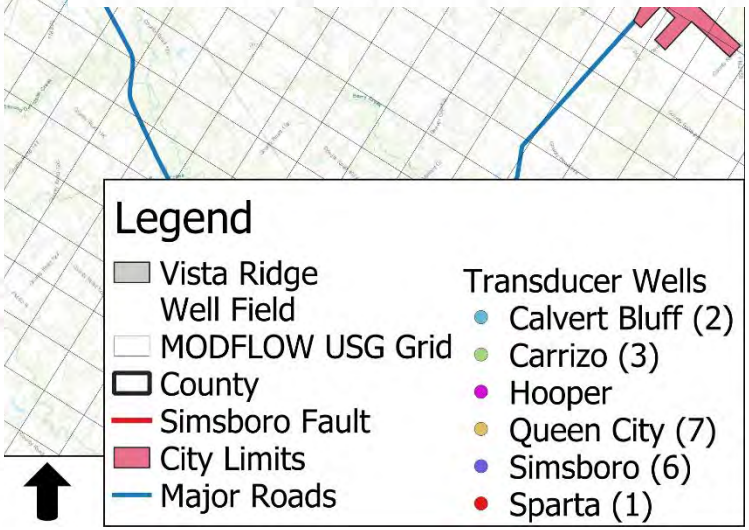


Calvert Bluff (Dec 2019 to October 2020)

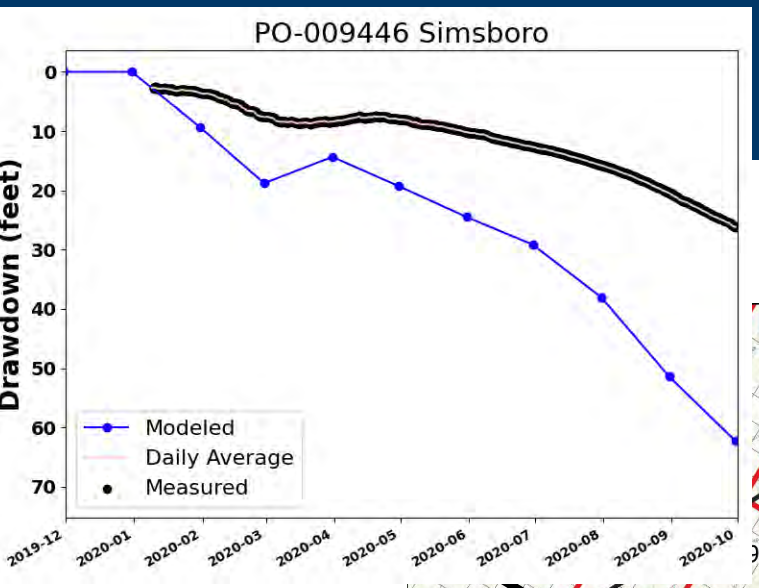


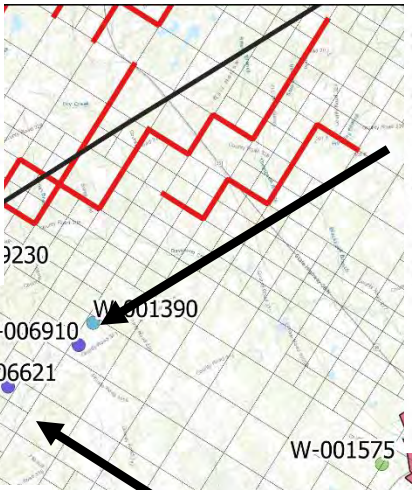


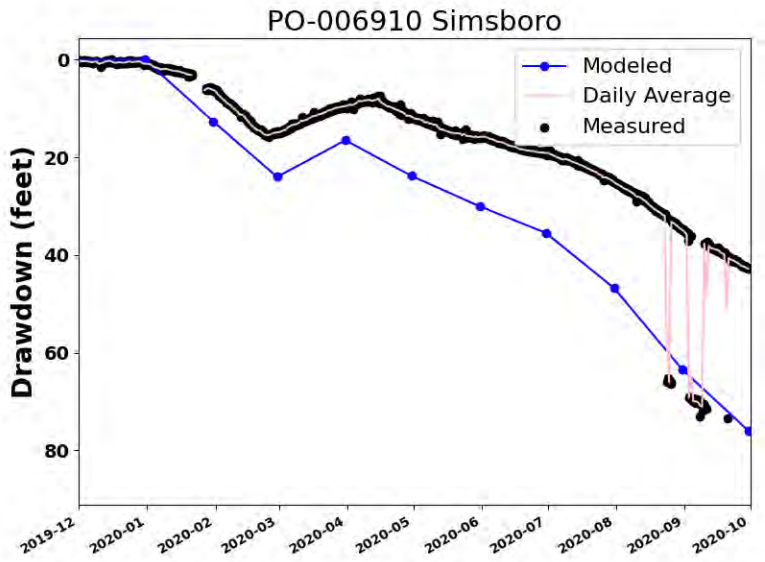


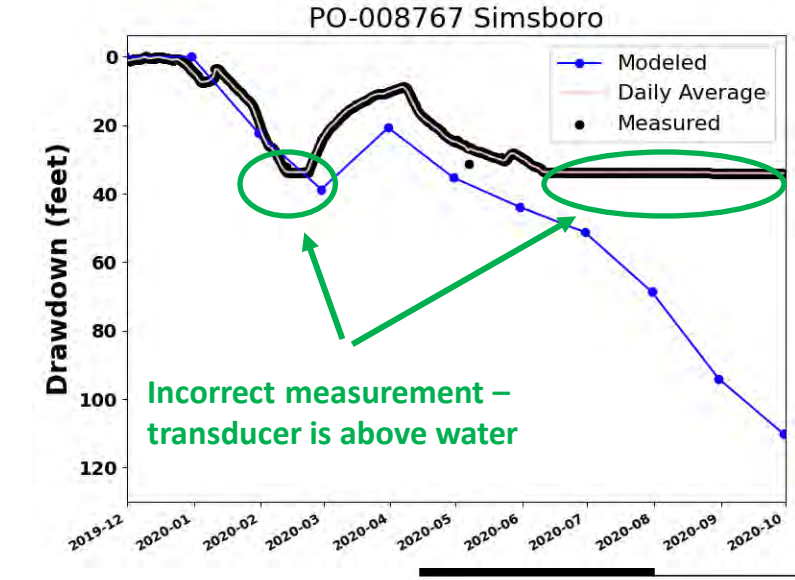


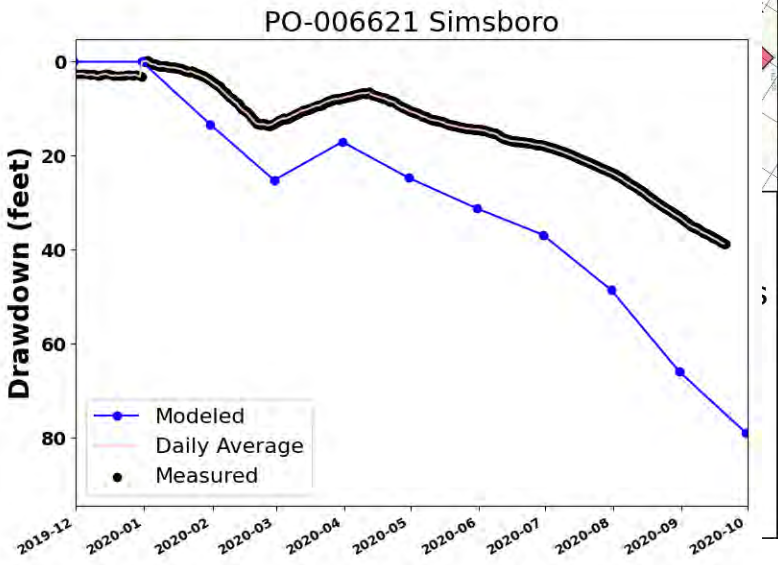
Simsboro (Dec 2019 to October 2020)











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

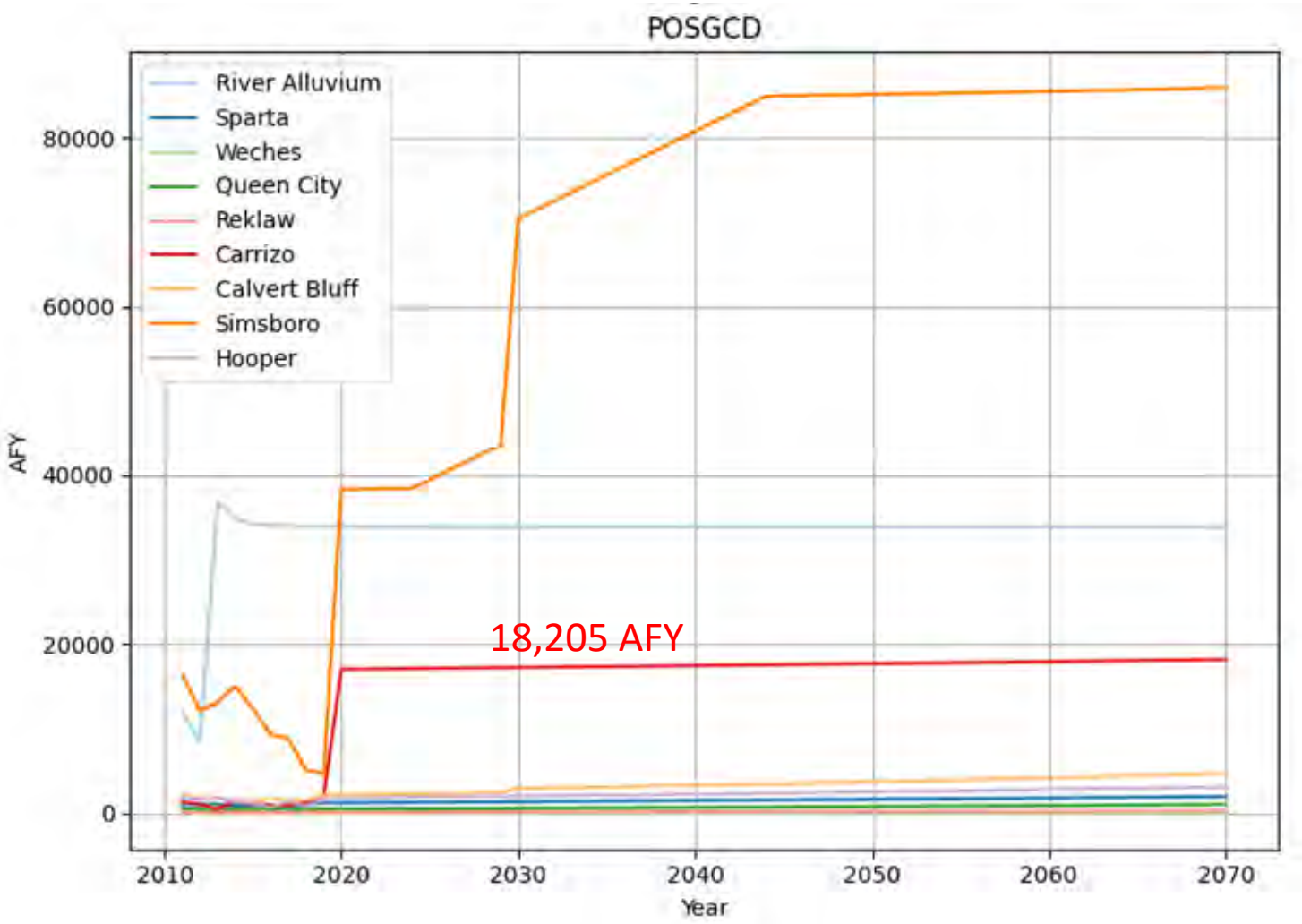
The objective of the GANA is to identify eligible wells where water levels are likely to decline below the elevation of the pump setting as a result of regional groundwater production in GMA 12 within the next 10 years.

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

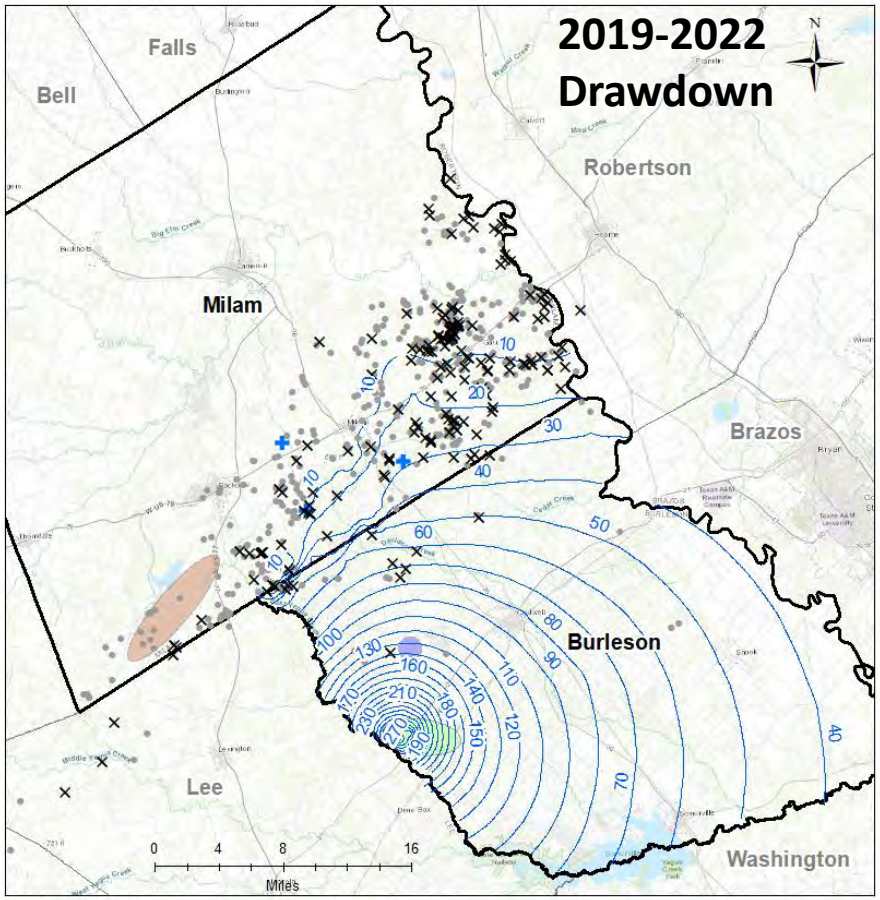
high-priority well meet the following two conditions:

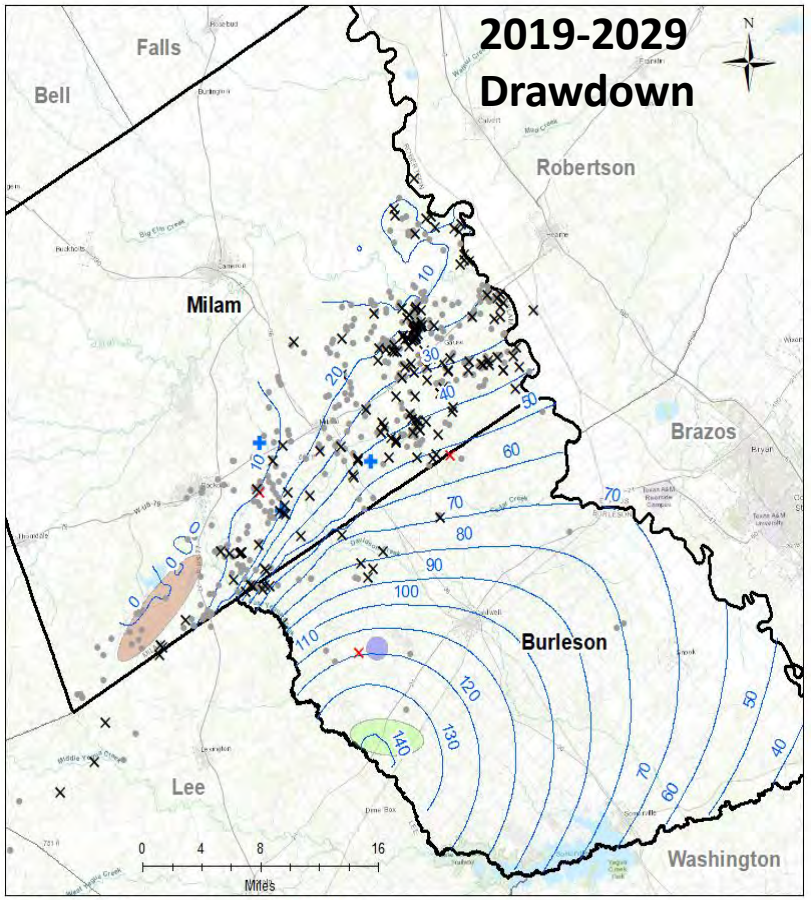
(1) the simulated water level is greater than 15 ft above the pump elevation in 2019, and
(2) the simulated water level is less than 15 ft above the pump elevation in 2029.

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

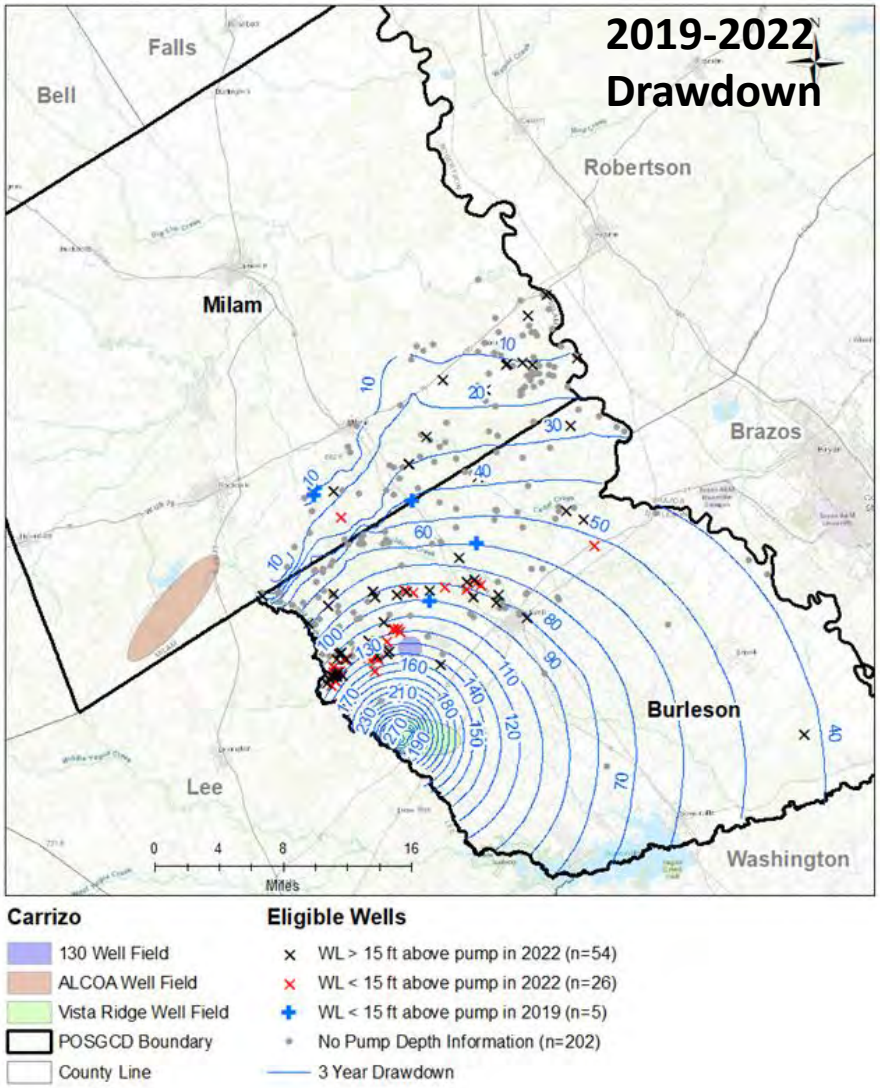


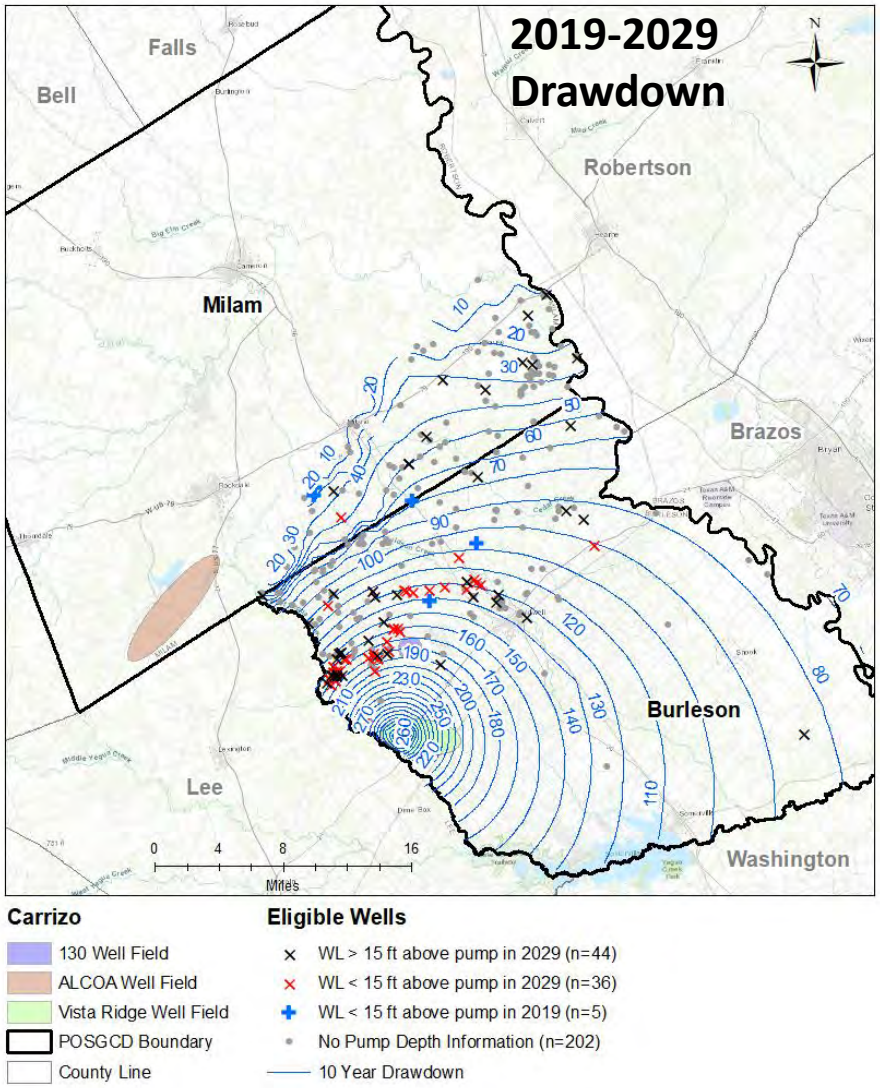


0 high-priority well

3 high-priority well

Carrizo



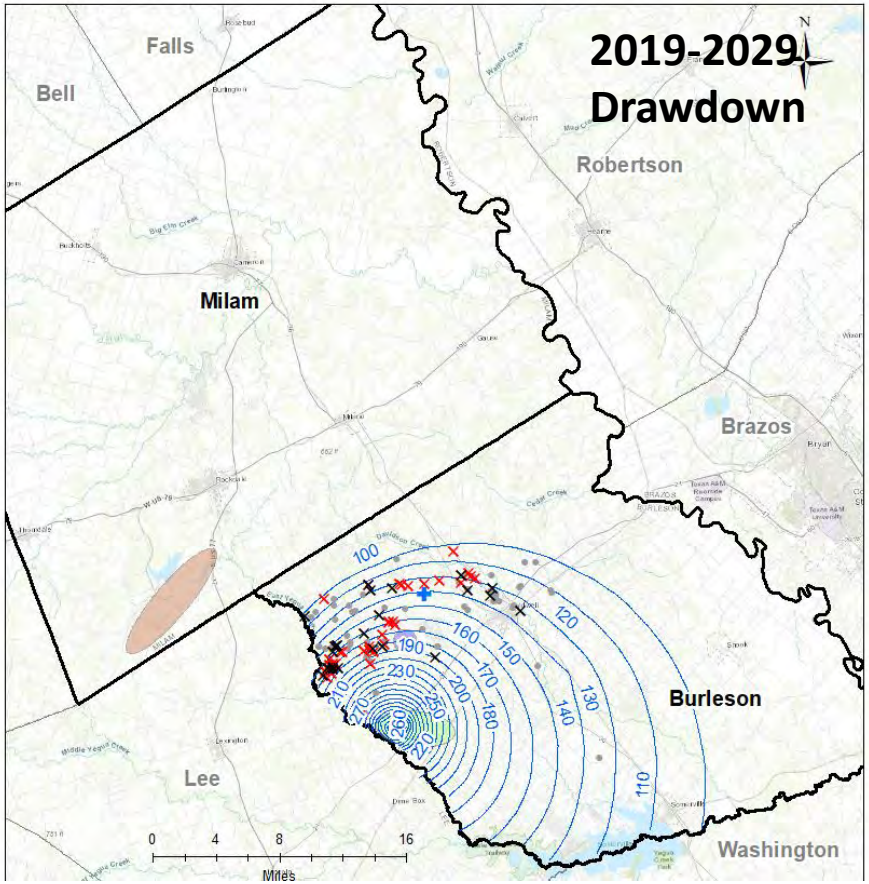


26 high-priority well

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



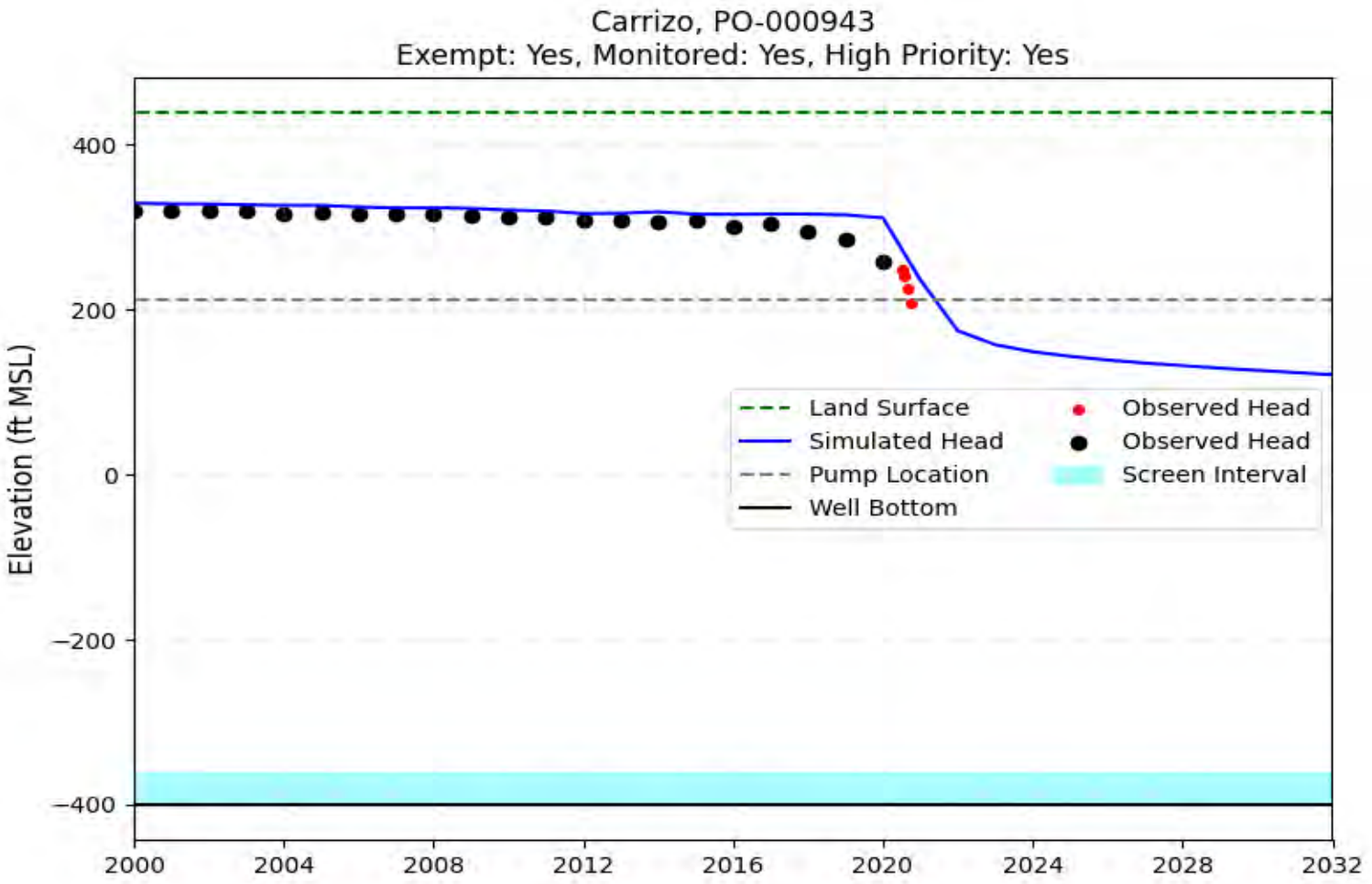
Carrizo

- 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

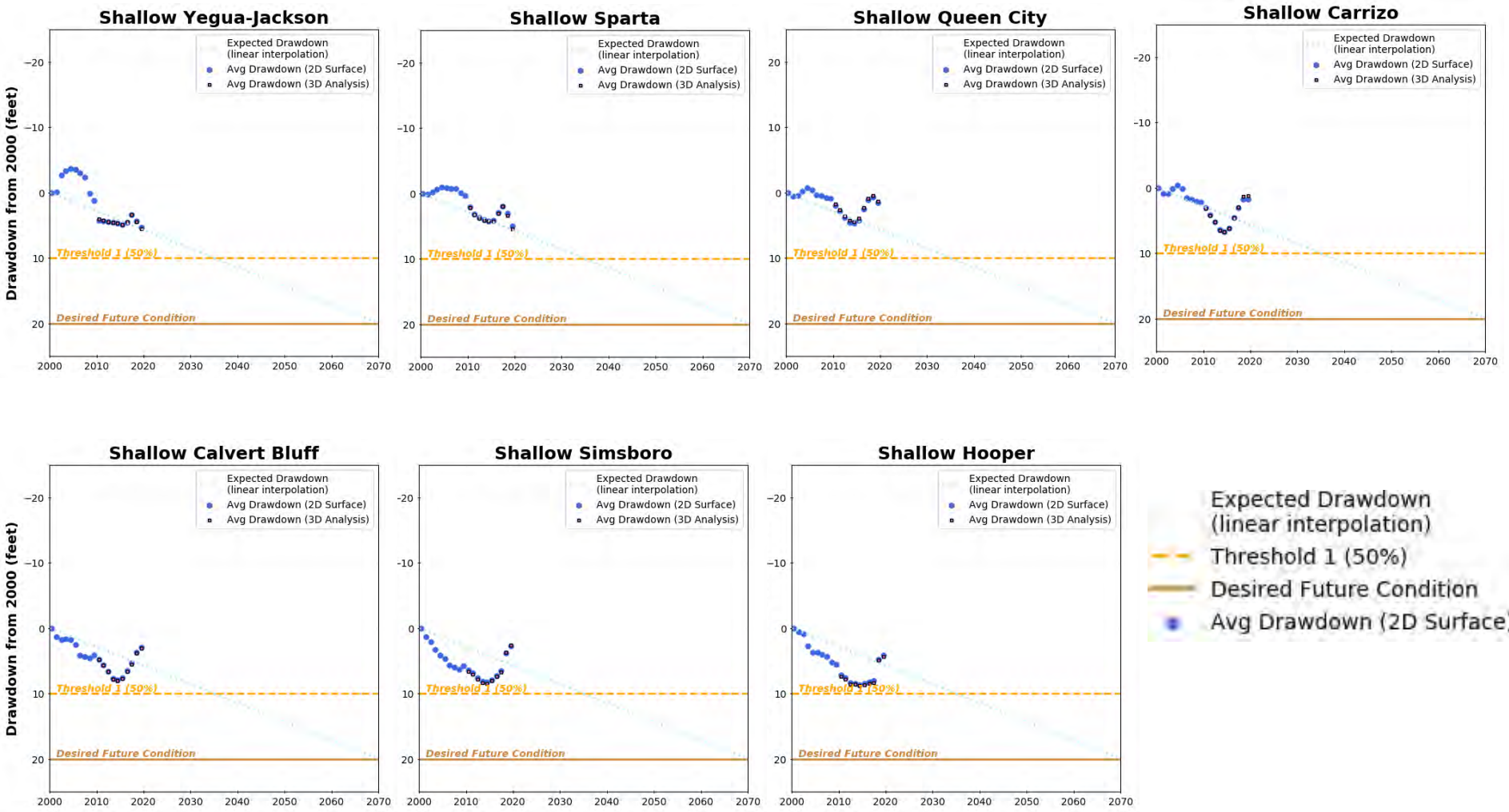


Summary of Carrizo Well Impacts

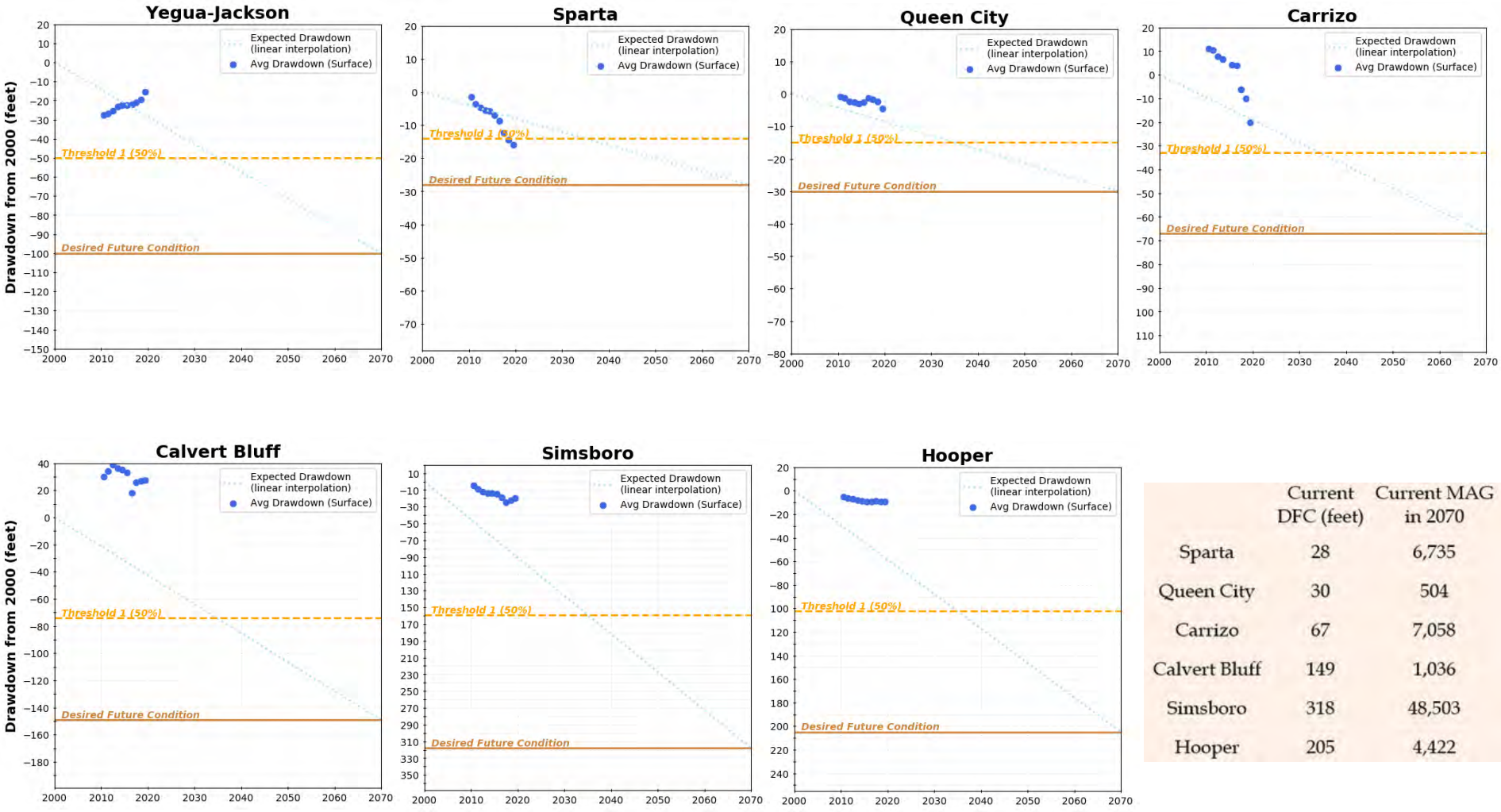
- Well with Pump Info
  - 36 high-priority wells (2029);
  - 26 estimated to have problems in 2022
- Wells without Pump Info
  - 56 wells with >100 ft drawdown from 2019 to 2029
  - 22 wells estimated to have low water levels in 2022
  - 33 wells estimated to have low water levels in 2029
- Total wells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

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.

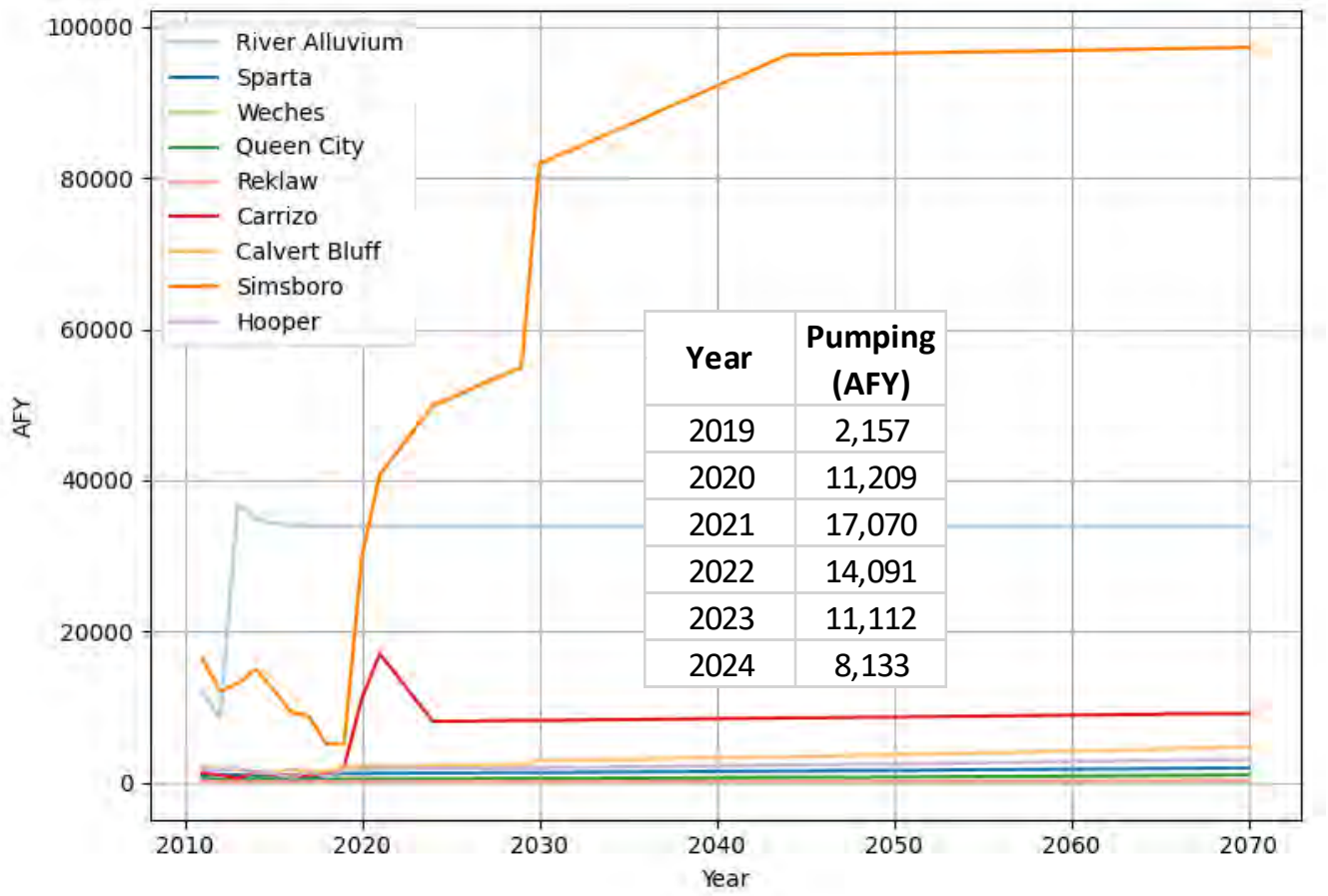
2. May reduce the maximum water production permitted per acre for the Management Zone and the water authorized to be produced under any permit issued by the District for that zone

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

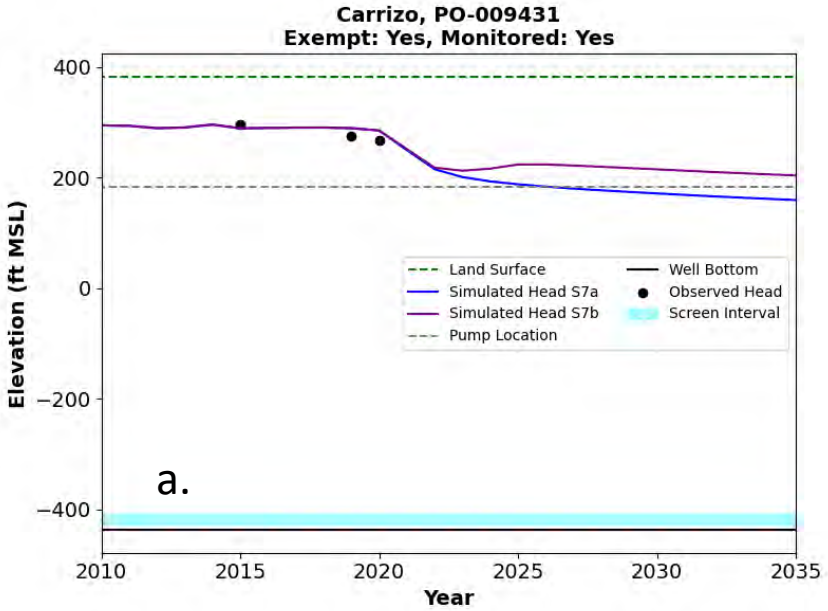
Summary of Actions: Curtailment Options

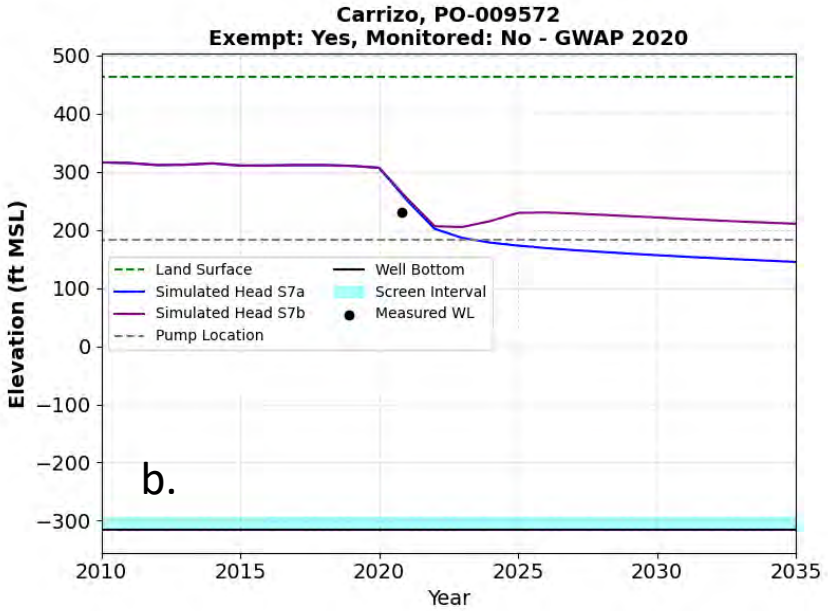
- Perform simulations investigating curtailment of permits in the Carrizo

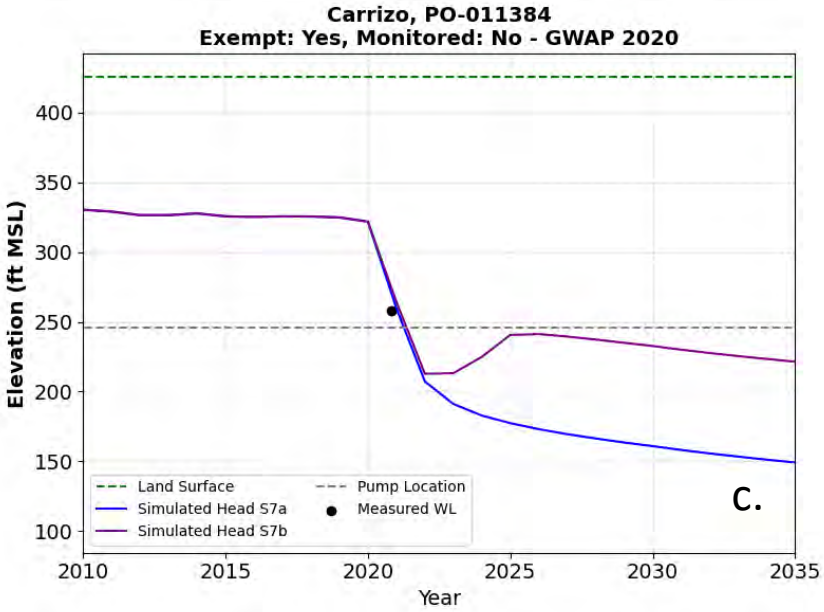


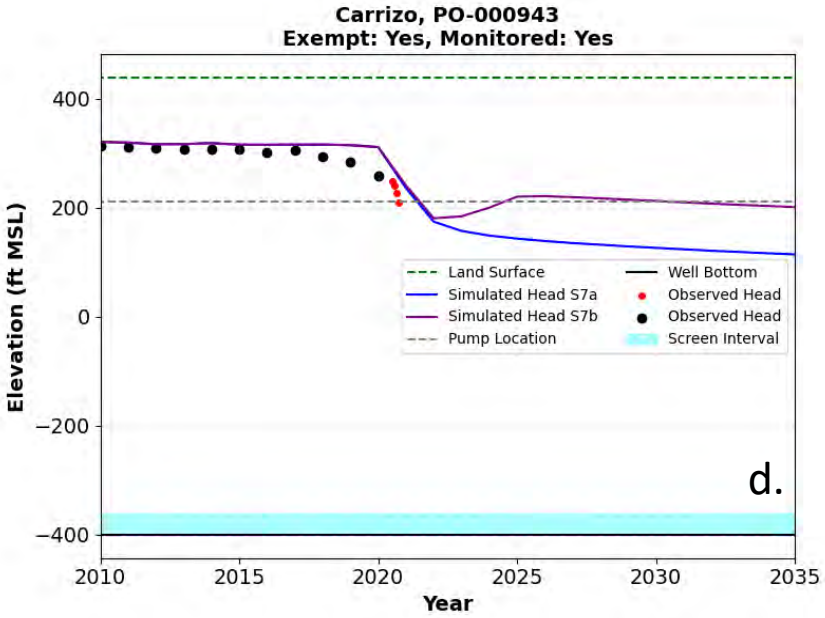
Year	Pumping (AFY)
2019	2,157
2020	11,209
2021	17,070
2022	14,091
2023	11,112
2024	8,133

Examples of Changes in Simulated Hydrographs

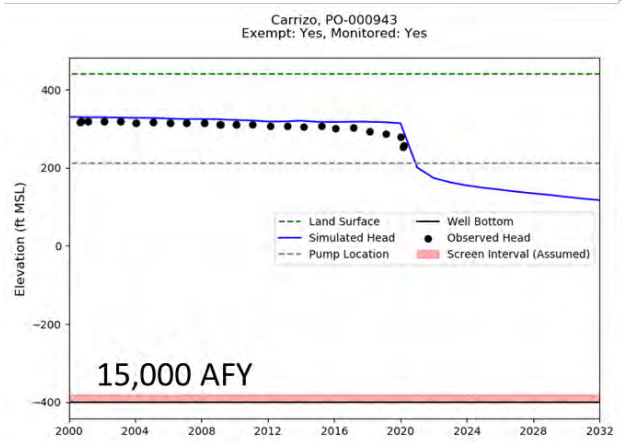


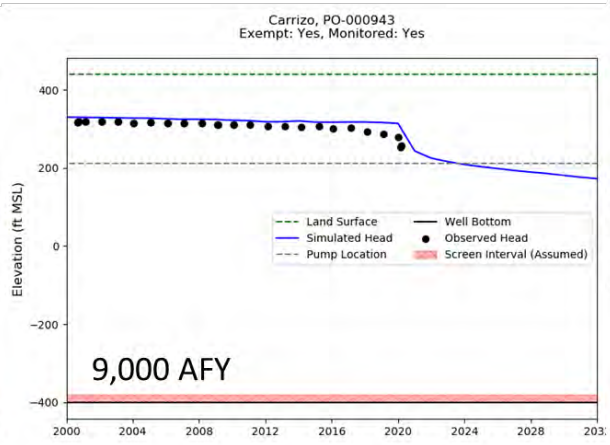


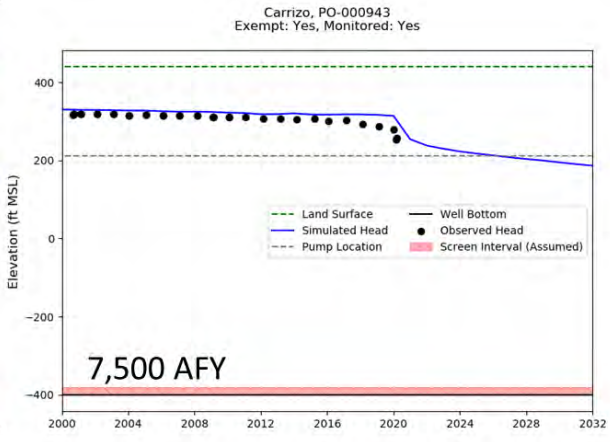


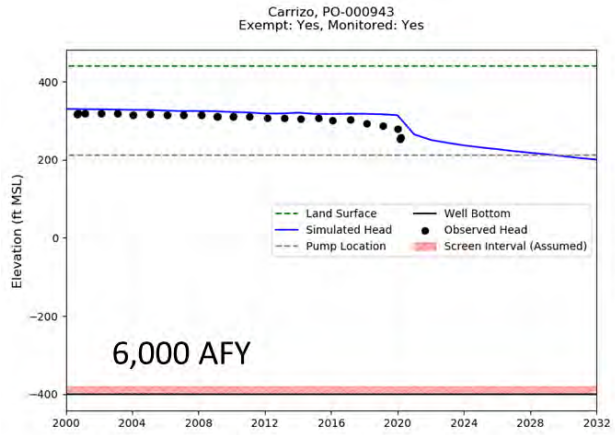


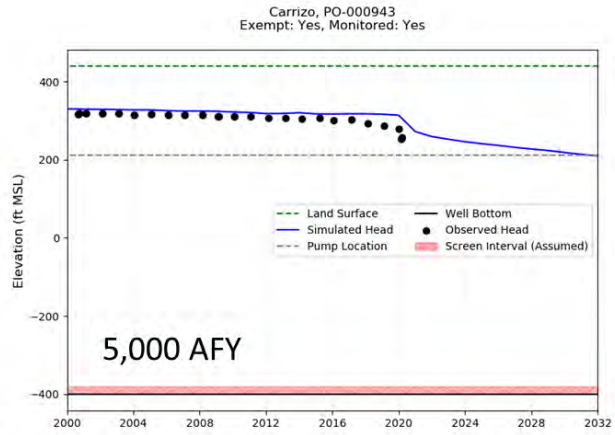
Summary of Actions: Curtailment Options

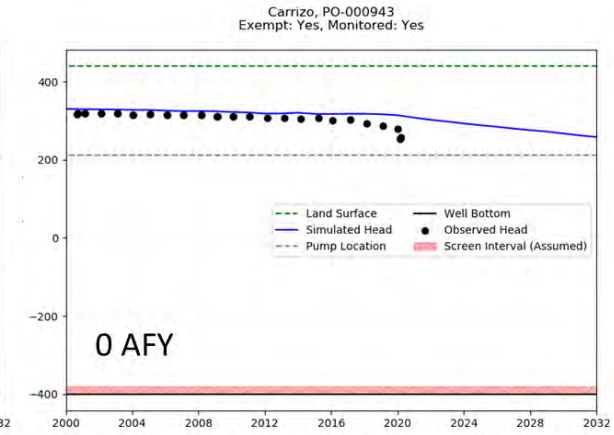










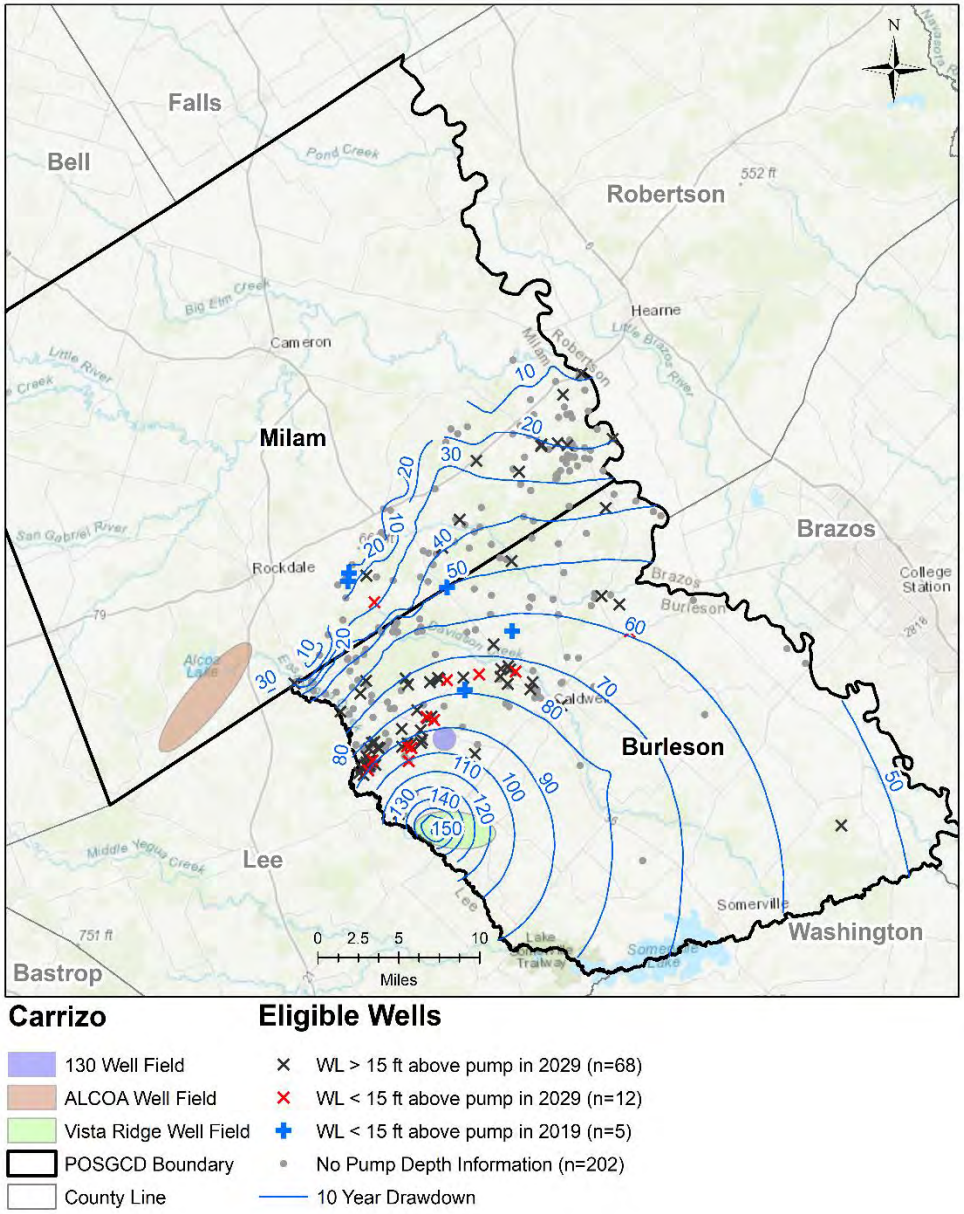


Summary of Actions: Curtailment Options

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

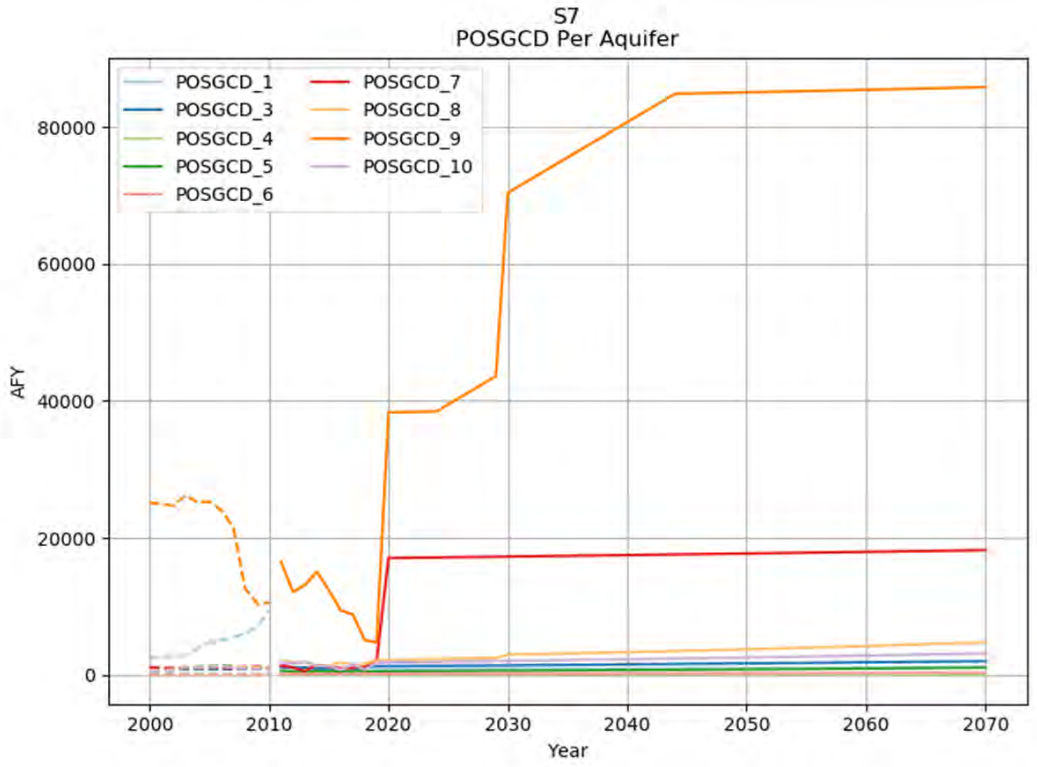
- DFC
  - 2070 DFC-drawdown from 172 ft to 123 ft
- PDL change
  - 2070 PDL-drawdown from 89 to 79
- Impacts to existing well owners
  - Wells likely to need corrective action is reduced from about 70 to 20 wells



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



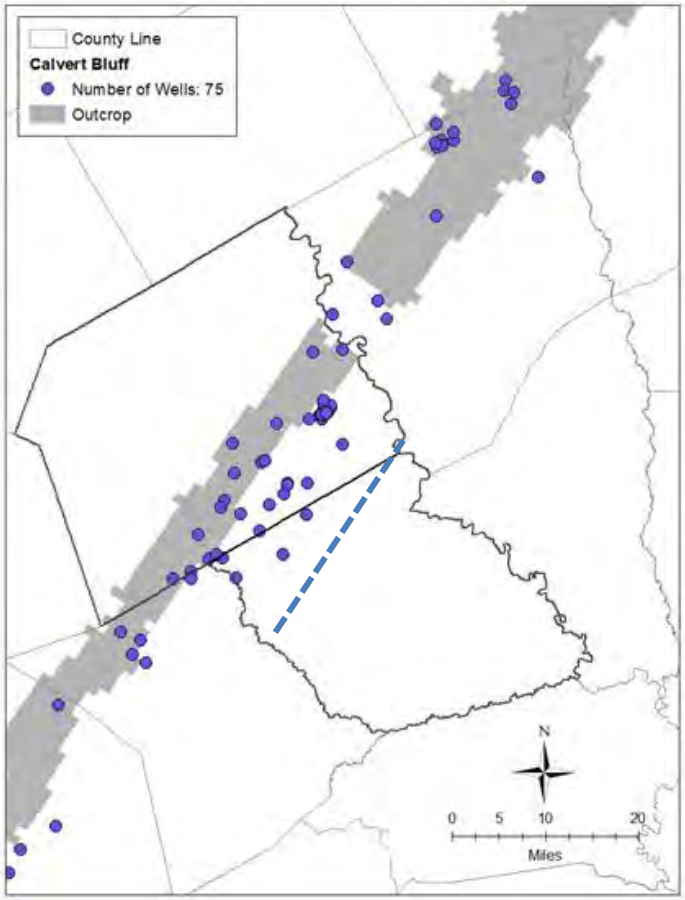
* Updated since Sept 2019

Consideration for Evaluating DFCs

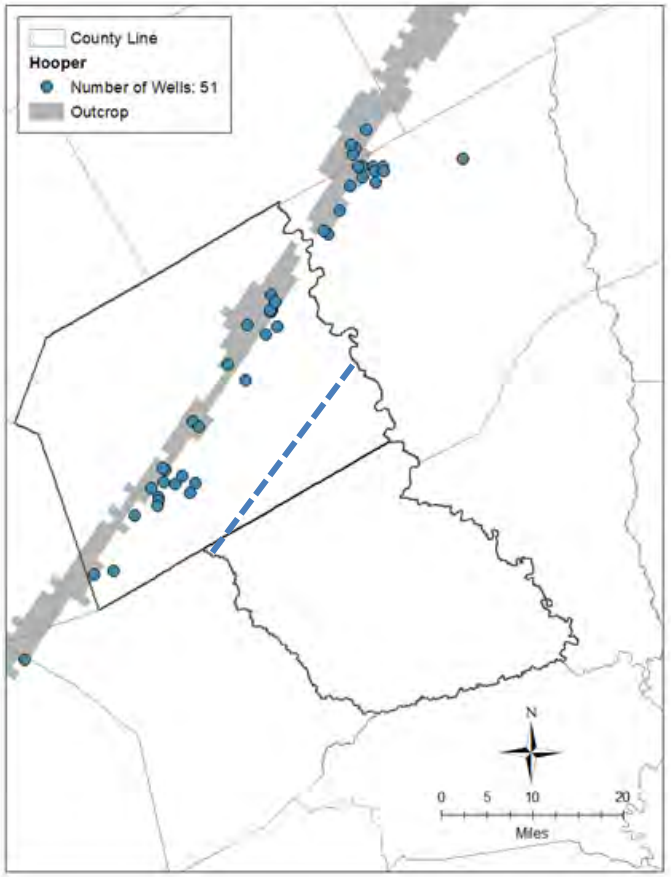
- Permitted Pumping
- Impact of Pumping on Water Levels at Existing Wells
- Compliance with existing DFCs and PDLs
- Existing Water Column above the Top of the Aquifer (Available drawdown)
- Impact on Pumping in Adjacent GCDs on DFCs in POSGCD
- Reported Pumping is Less than the Permitted Pumping
- Addition 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

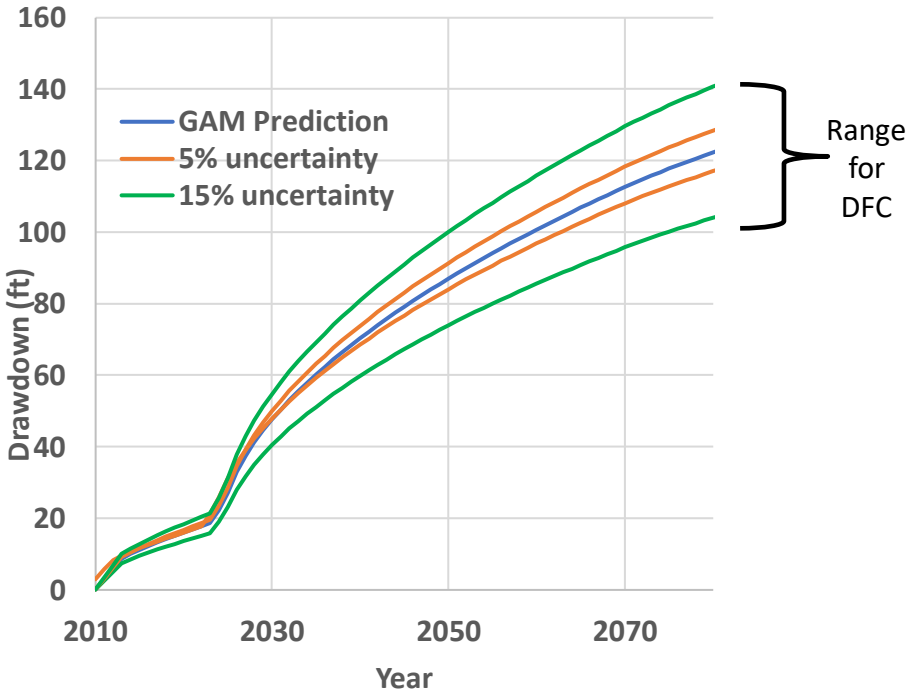


Uncertainty Associated with GAM Prediction

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 on POSGCD wells
- Area for DFCs
- Level of Uncertainty

	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
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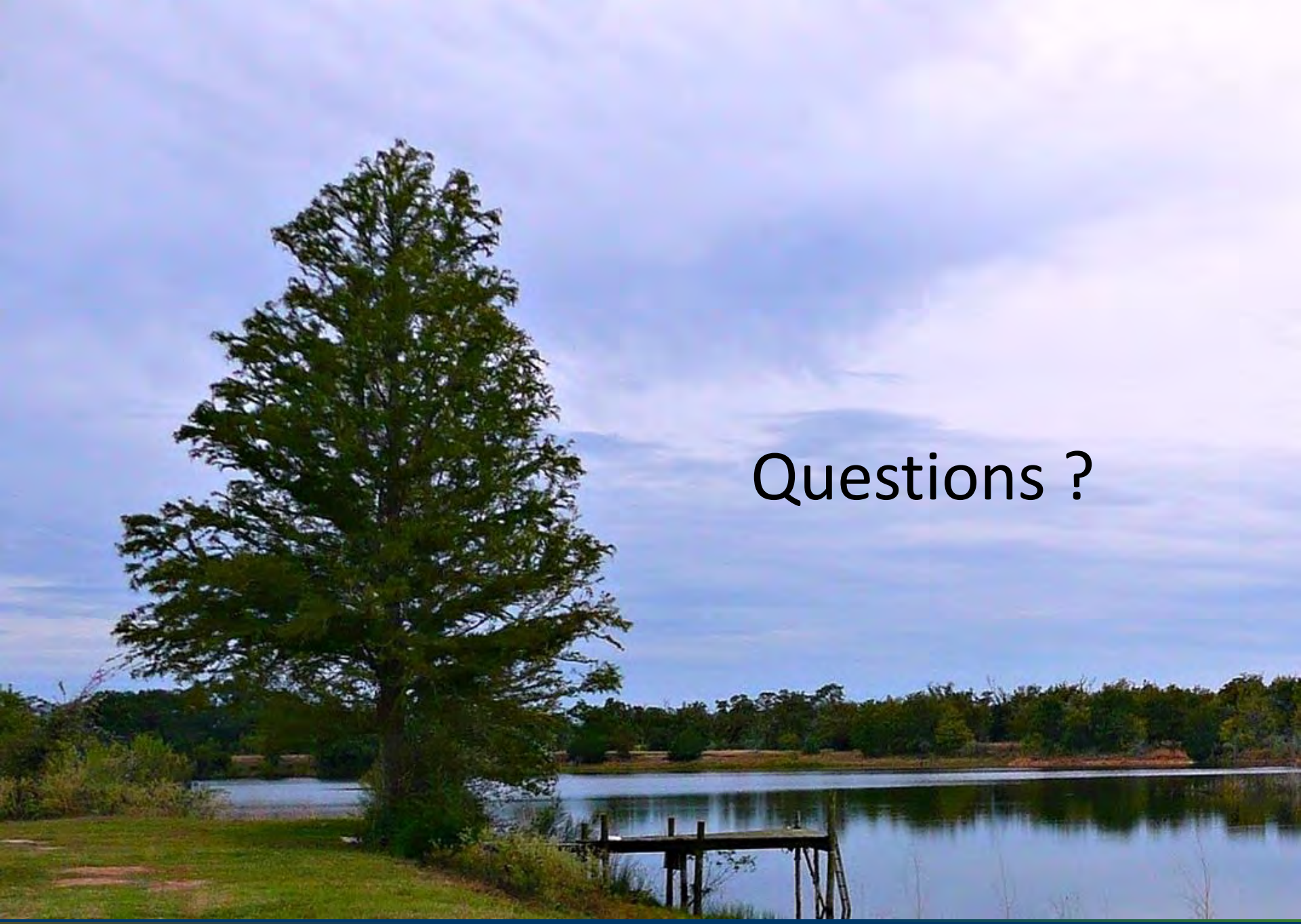
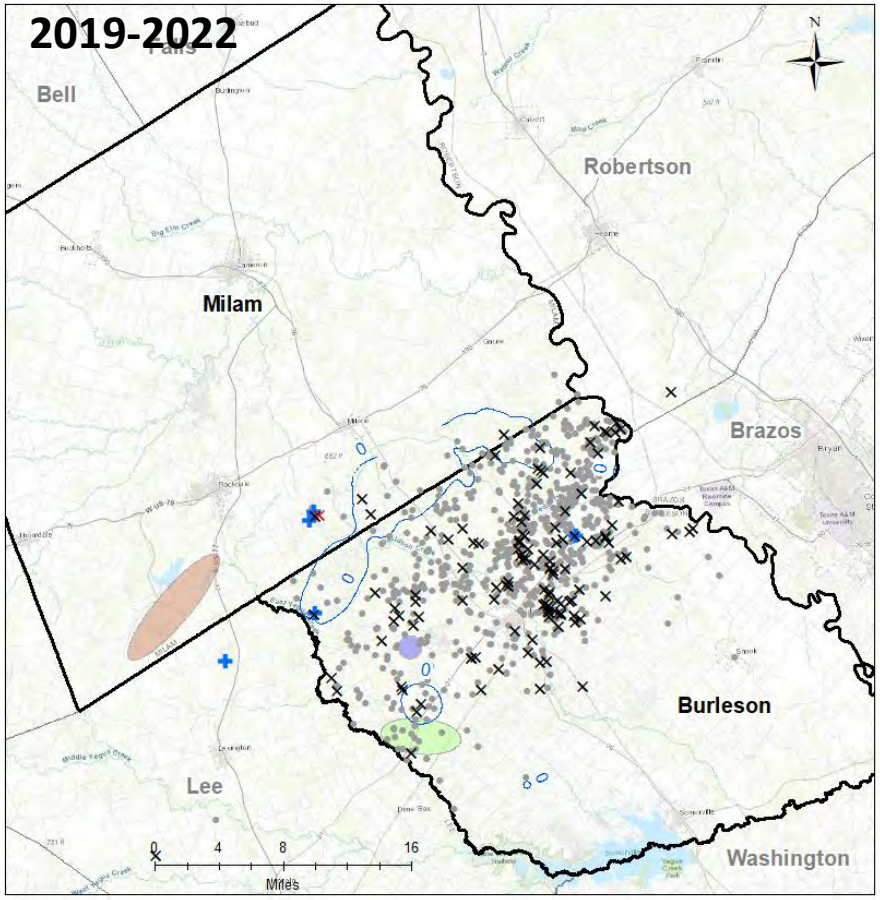

Questions ?

Queen City



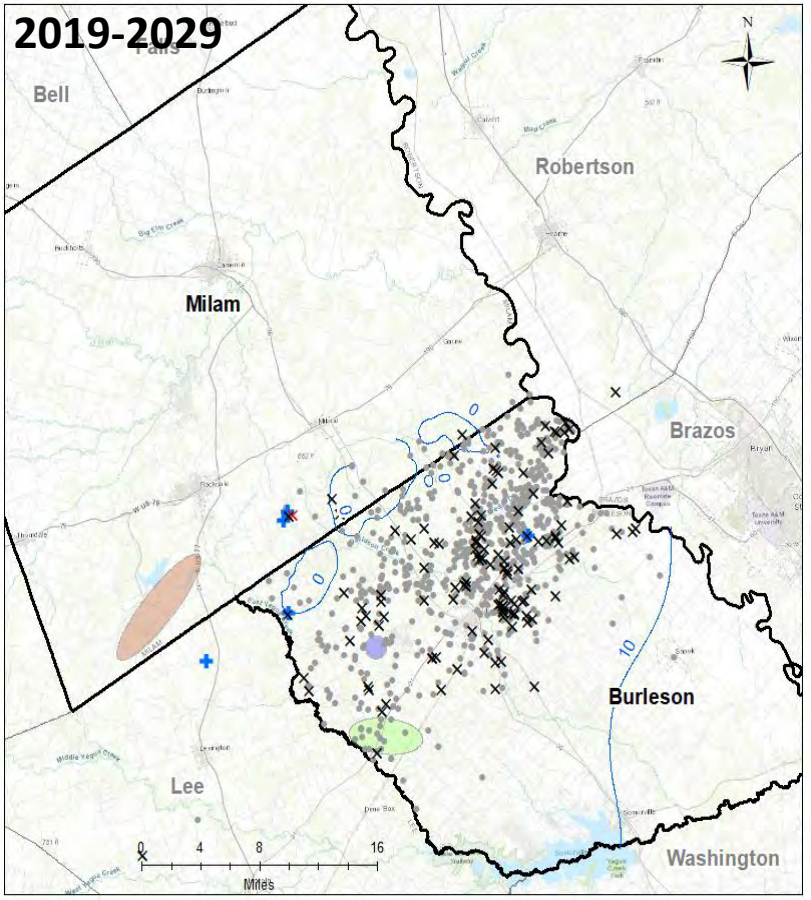
Queen City

- 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