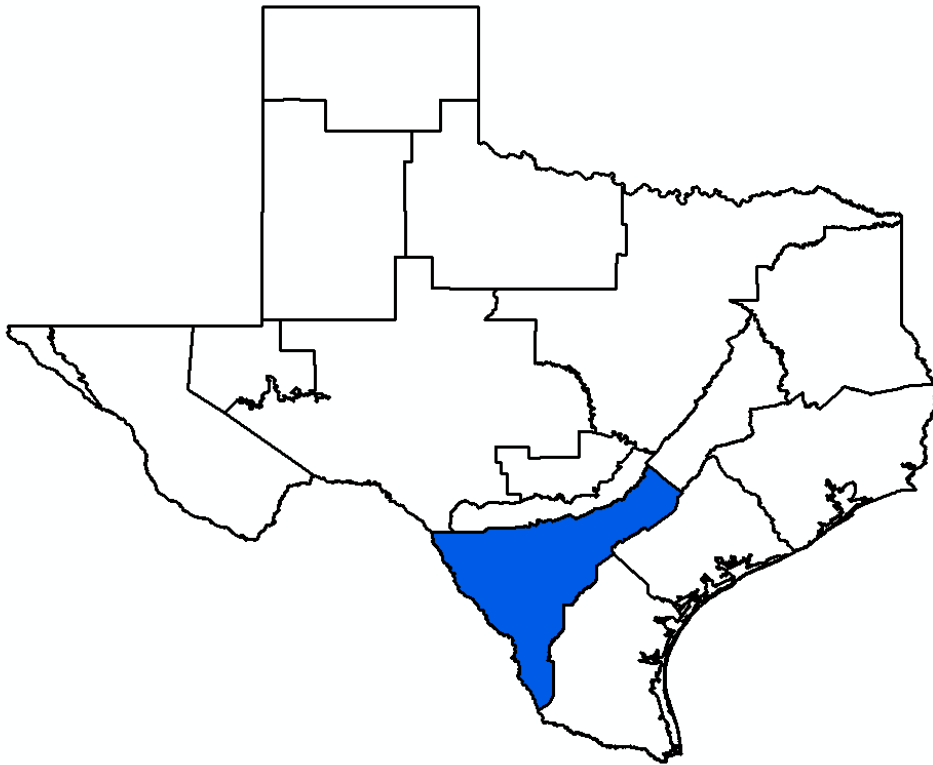


***GMA 13 Technical Memorandum 16-01
Draft 1***

**Sparta, Queen City, and Carrizo-Wilcox Aquifers
GAM Predictive Scenarios 9 to 12
Region L Strategies**



Prepared for:
Groundwater Management Area 13

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Appendices

- A – Location Maps of 12 Water Management Strategies Contained in Region L IPP**
- B – Tabluar Summaries of Pumping and Drawdown for Scenarios 9 to 12**

1.0 Introduction and Objective

1.1 Review of Scenarios 1 to 8

As part of this round of joint planning, GMA 13 has been reviewing GAM predictive simulations. Scenarios 1 to 7 were completed and reviewed at the GMA 13 meeting on October 13, 2013. A base case (Scenario 4) was developed based on input from the groundwater conservation districts in GMA 13 as follows:

- Pumping in the Carrizo Aquifer in Bexar County was increased as compared to the MAG that was developed from the DFC that was adopted in 2010 in response to a request from SAWS
- Pumping in the Carrizo Aquifer in Gonzales County was increased as compared to the MAG that was developed from the DFC that was adopted in 2010 in response to a request from Gonzales County UWCD
- Pumping the Wilcox Aquifer in Gonzales County was decreased as compared to the MAG that was developed from the DFC that was adopted in 2010 in response to a request from Gonzales County UWCD
- Pumping in the Carrizo Aquifer in McMullen County was increased as compared to the MAG that was developed from the DFC that was adopted in 2010 in response to a request from McMullen GCD

Scenarios 1 to 3 represented incremental reductions of Scenario 4, and Scenarios 4 to 7 represented incremental increases of Scenario 4.

After reviewing the results, Scenario 8 was completed which represented the following changes to Scenario 4:

- Gonzales County UWCD requested that pumping be revised to match the current MAG
- Guadalupe County GCD requested increases in both the Carrizo and Wilcox aquifers

Results of Scenario 8 were completed and reviewed at the GMA 13 meeting of March 13, 2014. As a result of the comments received at the March 13, 2014 meeting, additional pumping was to be included in the next simulation that reflected additional pumping by SAWS. However, due to changes in the administration in GMA 13, the work was left pending.

1.2 Regional Planning Strategies

In considering the request of SAWS to simulate additional pumping, and the potential incremental effect of each entity in GMA 13 requesting similar simulations in the future, a more comprehensive approach was taken to consider all recommended and alternative water management strategies from the Region L plan. Sam Vaughn of HDR provided the initial data on August 22, 2014. However, due to the imminent release of the Region L IPP, it was decided to wait until the IPP was released to ensure that all strategies were current.

A meeting with HDR was held on May 27, 2015 to clarify the strategies and the data contained in the IPP. The IPP contained 12 strategies that were relevant to GMA 13. One of these was a collective strategy called “Local Carrizo Wells” that covered several areas in GMA 13. The pumping for all other strategies totaled 116,000 AF/yr in 2020, and 222,000 AF/yr in 2070.

The IPP distinguished between recommended and alternative strategies in areas where future pumping exceeded the MAG that was set in 2010 on the basis of the DFC that was established by GMA 13. Water management strategies are developed to meet deficits between current supply and future demand as part of the regional planning process. TWDB considers the MAG to be a hard limit, and recommended water management strategies cannot result in pumping that exceeds the MAG. Thus, Region L has included strategies that exceed the MAG as alternative strategies.

The heavy-handed approach of TWDB to the interaction between the joint planning process and the regional planning discounts the fact that DFCs and MAGs are updated every five years. If a strategy is identified that requires groundwater in excess of the MAG in 30 to 50 years, it should be a recommended strategy, which would then provide a signal to the joint planning process to consider revising the DFC to accommodate such a strategy in the next round of joint planning.

This technical memorandum documents four simulations that focus on simulating the recommended and alternative water management strategies in the 2015 Region L plan. Scenario 9 includes all pumping from Scenario 8 described above, and all recommended and alternative water management strategies. Scenarios 10 to 12 simulate reductions in all Wilcox Aquifer strategies in order to understand the interaction between the Wilcox and the overlying Carrizo Aquifer.

2.0 Description of Simulations

Appendix A includes maps of the locations of the 12 strategies that were taken from the Region L IPP. Table 1 summarizes the pumping amounts for all strategies except the Local Carrizo strategy. Please note that nearly all require the same amount of pumping in 2020 and in 2070. Only a few require increases in pumping during the planning period.

Table 1. Summary of Pumping for Strategies

Strategy	Project	2020	2030	2040	2050	2060	2070
2	SSLGC Brackish Wilcox	5,556	5,556	5,556	5,556	5,556	5,556
3	SSLGC Expanded Carrizo Project	6,500	6,500	6,500	6,500	6,500	6,500
4	Brackish Wilcox for SS WSC	1,244	1,244	1,244	1,244	1,244	1,244
5	CVLGC Carrizo Project	10,000	10,000	10,000	10,000	10,000	10,000
6	CRWA Wells Ranch - Phase 2	10,629	10,629	10,629	10,629	10,629	10,629
7	Brackish Wilcox Groundwater for CRWA	0	16,333	16,333	16,333	16,333	16,333
8	Brackish Wilcox Groundwater for SAWS	37,334	37,334	37,334	37,334	37,334	37,334
9	SAWS Expanded Brackish Project	0	53,853	53,853	53,853	53,853	53,853
10	SAWS Expanded Local Carrizo	30,000	30,000	30,000	30,000	30,000	30,000
11	Hays/Caldwell PUA Project	10,300	15,000	15,000	35,690	35,690	35,690
12	TWA Carrizo Project	5,000	15,000	15,000	15,000	15,000	15,000

Table 2 summarizes a comparison of Region L strategies, the calibrated GAM (1999 pumping), the current MAG (GAM Run 09-34), and Scenario 8 described above.

Table 2. Comparison of Strategies, 1999 Pumping, Current MAG, and Scenario 8

Strategy	Project	Region L IPP		Calibrated GAM	GAM Run 09-34		Scenario 8	
		2020	2070	1999	2000	2060	2012	2070
1	Local Carrizo		9,151	25,039	31,679	28,443	31,677	28,360
2	SSLGC Brackish Wilcox	5,556	5,556	0	235	235	235	235
3	SSLGC Expanded Carrizo Project	6,500	6,500	49	64	2,071	232	2,730
4	Brackish Wilcox for SS WSC	1,244	1,244	0	0	0	0	0
5	CVLGC Carrizo Project	10,000	10,000	37	143	174	143	160
6	CRWA Wells Ranch - Phase 2	10,629	10,629	20	3,108	5,106	3,364	6,153
7	Brackish Wilcox Groundwater for CRWA	0	16,333	35	35	35	37	117
8	Brackish Wilcox Groundwater for SAWS	37,334	37,334	87	16,989	16,989	33,601	33,601
9	SAWS Expanded Brackish Project	0	53,853	0	0	0	0	0
10	SAWS Expanded Local Carrizo	30,000	30,000	422	6,615	6,615	19,613	20,350
11	Hays/Caldwell PUA Project	10,300	35,690	101	22,646	22,646	22,647	22,647
12	TWA Carrizo Project	5,000	15,000	47	38	16,390	38	16,389
13	Other Pumping Areas	N/A	N/A	263,119	361,783	340,706	382,993	362,069

Please note that within many of the areas of these strategies, Scenario 8 included substantial pumping. These areas simply required adjustment to pumping input. Two strategy areas had no pumping in Scenario 8: Brackish Wilcox for SSWSC and SAWS Expanded Brackish Project (Strategies 4 and 9). New wells were included in these areas based on the locations as shown in Appendix A. Please note that Table 2 includes “Strategy 13” which is simply all the pumping in the model that is not within the boundaries of the 12 strategies as noted in Appendix A.

For purposes of these simulations, strategy pumping was assumed to be equal for the entire simulation period (2012 to 2070) and set based on the 2070 numbers in Table 2 (i.e. scheduled increases were not simulated to avoid problems in MAG caps in future regional planning sessions if there are changes in the timing of strategy implementation).

Scenarios 9 to 12 were developed as follows:

- Scenario 9 includes all of Scenario 8 pumping plus all strategy pumping as presented in Table 2 and discussed above.
- Scenario 10 includes all of Scenario 8 pumping, all Carrizo Aquifer strategy pumping, and 67 percent of Wilcox Aquifer strategy pumping.
- Scenario 11 includes all of Scenario 8 pumping, all Carrizo Aquifer strategy pumping, and 33 percent of Wilcox Aquifer strategy pumping.
- Scenario 12 includes all of Scenario 8 pumping, all Carrizo Aquifer strategy pumping, and no Wilcox Aquifer strategies.

Scenarios 10 to 12 were designed to understand the drawdown and water budget impacts of Wilcox Aquifer pumping on the overlying Carrizo Aquifer.

A summary of the pumping in Scenarios 9 to 12 by strategy is presented in Table 3. Please note that pumping in a strategy area in Table 3 may be higher than listed in Table 2 to account for other pumping that had already been included in Scenario 8.

Table 3. Summary of Pumping in Scenarios 9 to 12

Strategy Number	Project	Scenario 9		Scenario 10		Scenario 11		Scenario 12	
		2012	2070	2012	2070	2012	2070	2012	2070
1	Local Carrizo	40,222	40,222	40,222	40,222	40,222	40,222	40,222	40,222
2	SSLGC Brackish Wilcox	6,122	6,122	4,096	4,096	2,020	2,020	0	0
3	SSLGC Expanded Carrizo Project	7,140	7,140	7,140	7,140	7,140	7,140	7,140	7,140
4	Brackish Wilcox for SS WSC	1,243	1,243	835	835	409	409	0	0
5	CVLGC Carrizo Project	10,960	10,960	10,960	10,960	10,960	10,960	10,960	10,960
6	CRWA Wells Ranch - Phase 2	11,697	11,697	11,697	11,697	11,697	11,697	11,697	11,697
7	Brackish Wilcox Groundwater for CRWA	17,954	17,954	12,034	12,034	5,929	5,929	0	0
8	Brackish Wilcox Groundwater for SAWS	41,067	41,067	27,476	27,476	13,558	13,558	0	0
9	SAWS Expanded Brackish Project	53,879	53,879	36,115	36,115	17,764	17,764	0	0
10	SAWS Expanded Local Carrizo	32,987	32,987	32,987	32,987	32,987	32,987	32,987	32,987
11	Hays/Caldwell PUA Project	39,262	39,262	39,262	39,262	39,262	39,262	39,262	39,262
12	TWA Carrizo Project	16,487	16,487	16,487	16,487	16,487	16,487	16,487	16,487
13	Other Pumping Areas	383,001	362,021	383,001	362,021	383,001	362,021	383,001	362,021

3.0 Predictive Simulation Results

3.1 Overall Pumping and Drawdown Results

Summary drawdown and pumping results on a county scale and at the GMA 13 scale were extracted from the simulation output files. Additional detailed results for outcrop, downdip, and GCD areas were not extracted for this draft, but will be included once a proposed DFC is agreed upon.

Figure 1 is a time-series plot of average drawdown from 2012 to 2070 for GMA 13. This plot shows that after 59 years of pumping, drawdown is not flattening in any of the scenarios, which suggests that storage depletion is a dominant supply of the pumped water (i.e. pumping induced inflows and decreased outflows are not sufficient to supply the increased pumping).

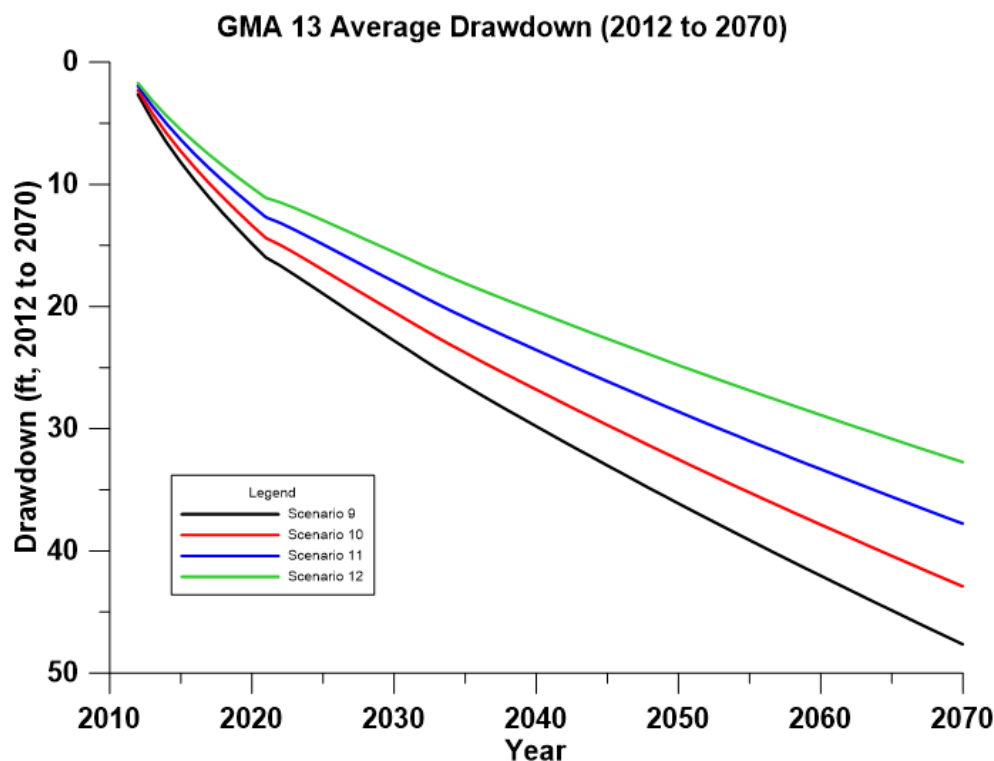


Figure 1. GMA 13 Average Drawdown Time Series

Figure 2 is an update of the pumping versus drawdown relationship of the current DFC and MAG and all 12 scenarios completed to date at the scale of GMA 13. Pumping is for all of GMA 13 (all layers), and the drawdown is the average drawdown for all layers over the entirety of GMA 13. This is a summary graph intended to provide regional perspective.

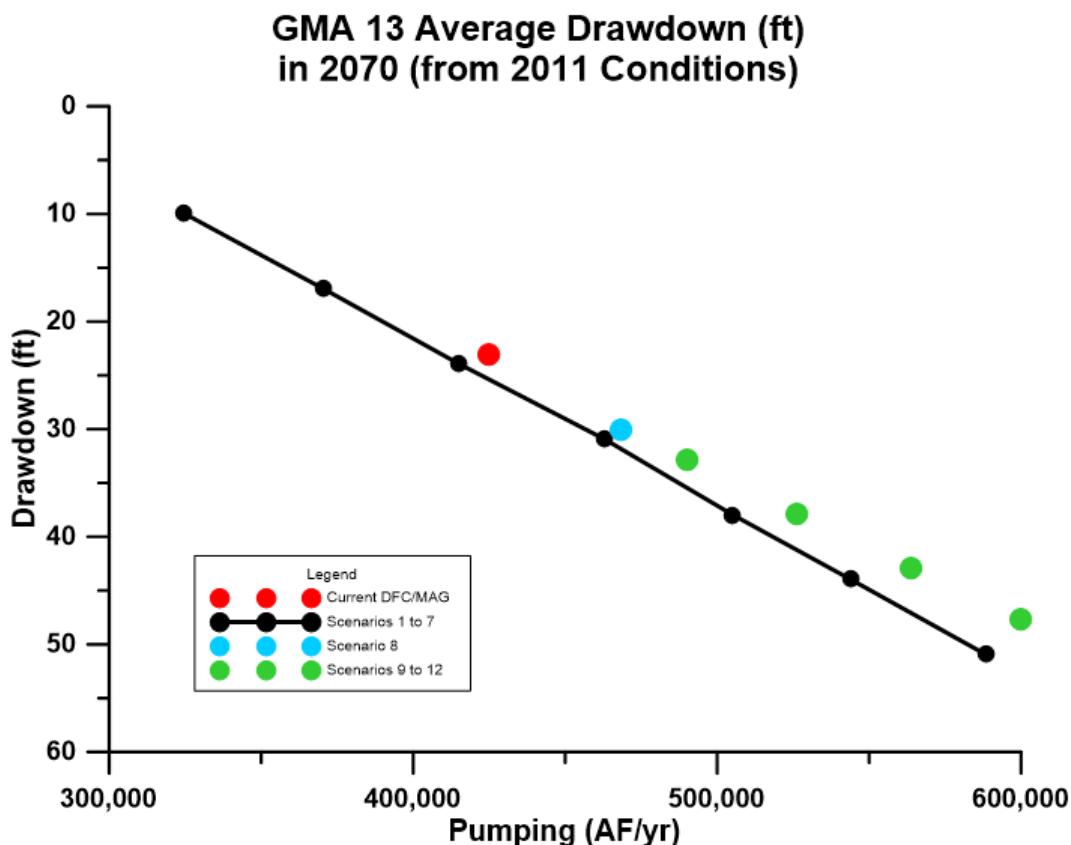


Figure 2. GMA 13 Pumping versus Drawdown for all Scenarios

3.2 County Level Pumping and Drawdown Results

Summary tables of pumping and drawdown for each county are presented in Appendix B.

Of note is the drawdown impact in the Carrizo Aquifer (Layer 5) as a result of changes in Wilcox Aquifer pumping. Recall that Scenario 9 included all Wilcox Aquifer strategies, and Scenarios 10 and 11 represented reductions in Wilcox Aquifer strategy pumping, and Scenario 12 included no Wilcox Aquifer strategies.

Bexar, Gonzales, Guadalupe, and Wilson counties are the locations of these Wilcox Aquifer strategies, and Figures 3 to 6 summarize the drawdown in the Carrizo Aquifer (Layer 5) and the Wilcox Aquifer (Layer 8). Please note that in each case, Wilcox Aquifer drawdown is highest in Scenario 9 and lowest in Scenario 12 as a result of differences in pumping. However, the changes in Carrizo Aquifer drawdown are minimal across all scenarios in each of these counties. This suggests that, according to this GAM, the Wilcox is relatively isolated from the Carrizo, and pumping in the Wilcox will result in minimal drawdown in the Carrizo Aquifer.

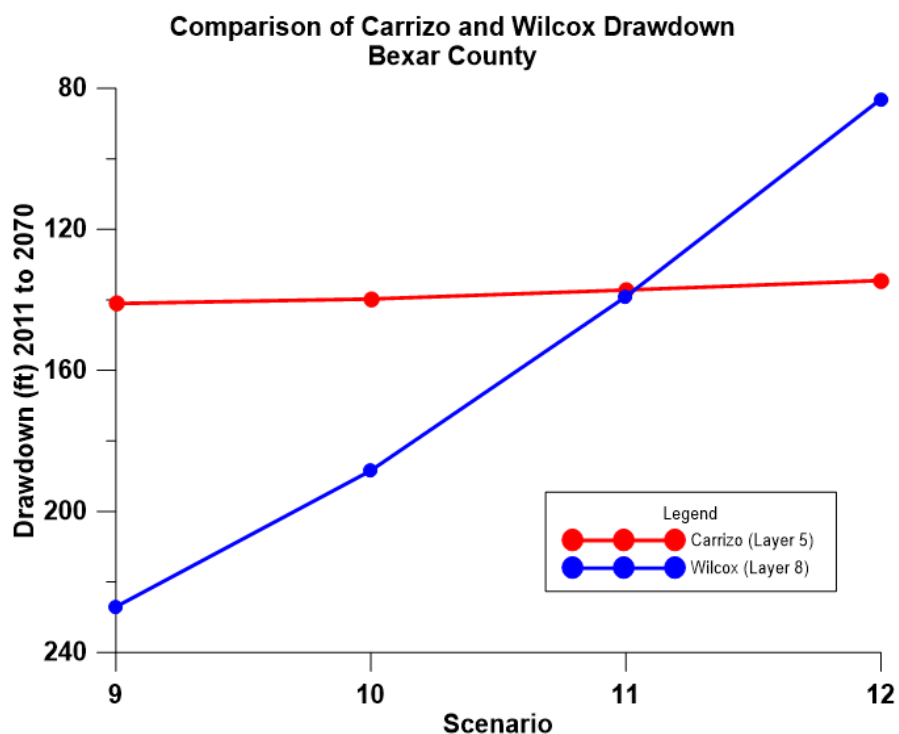


Figure 3. Bexar County Drawdown in Carrizo and Wilcox

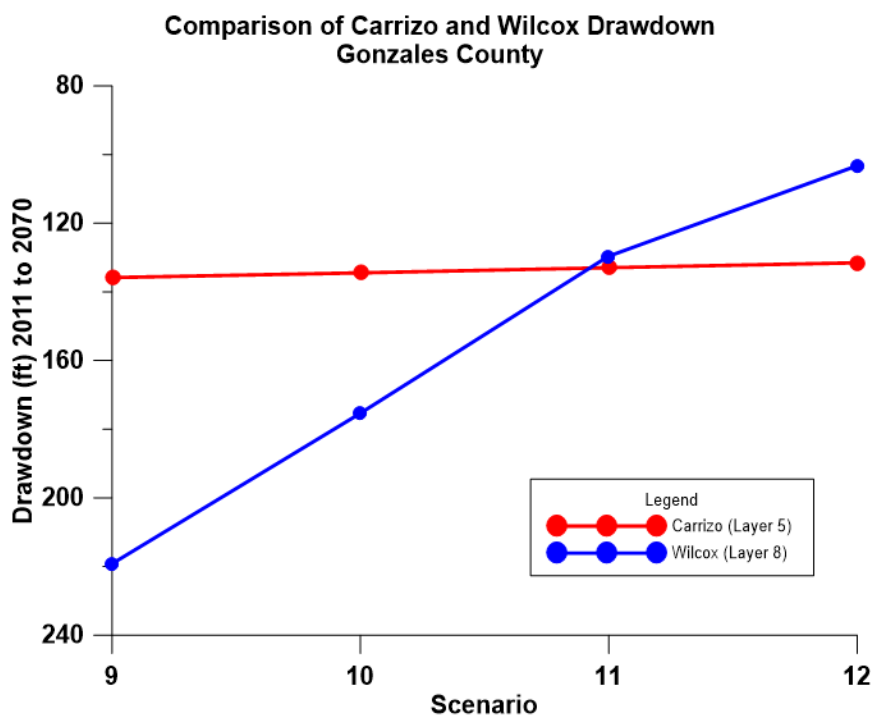


Figure 4. Gonzales County Drawdown in Carrizo and Wilcox

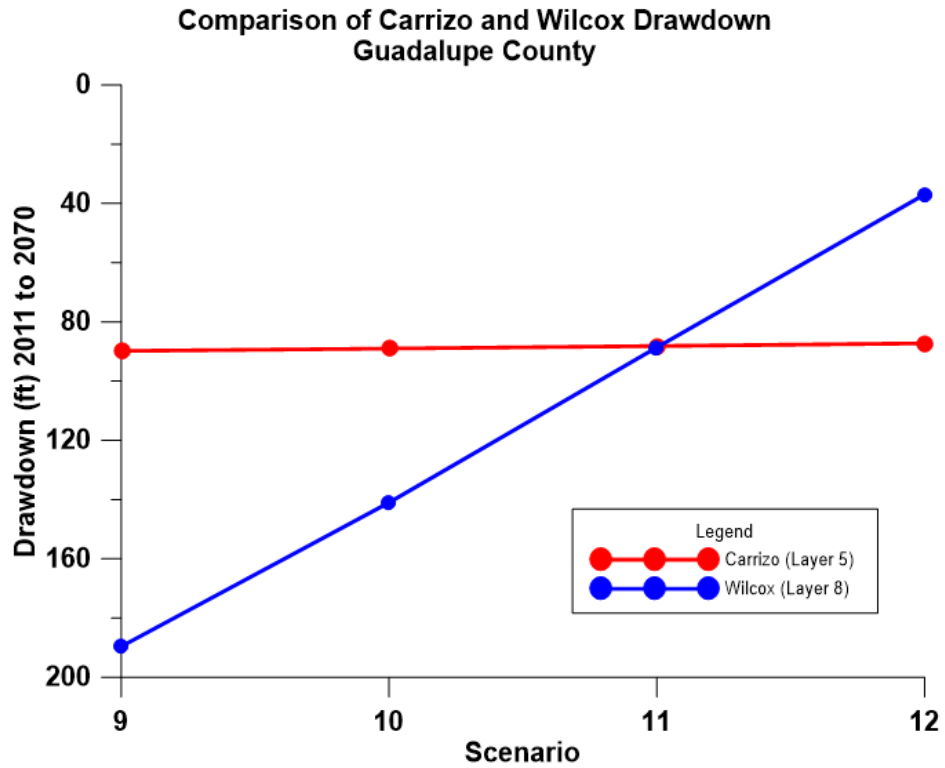


Figure 5. Guadalupe County Drawdown in Carrizo and Wilcox

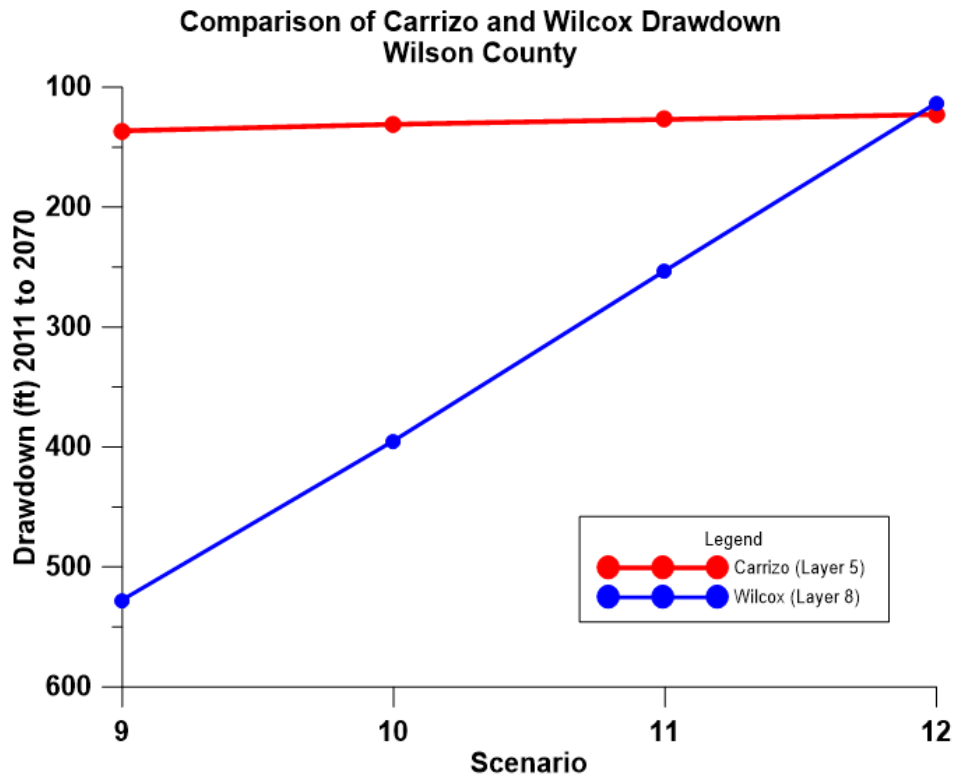


Figure 6. Wilson County Drawdown in Carrizo and Wilcox

3.3 Wilcox Aquifer Water Budget

Increases in pumping will result in three impacts: 1) reduction in storage, 2) increased or induced inflow, and 3) decreased outflow. A water budget is an accounting of all inflows, outflows and storage changes in an area, and can be useful to evaluate the impacts of pumping increases.

Water budgets for the Wilcox Aquifer (Layers 6, 7 and 8) for the updated calibration period (2000 to 2011) and for Scenario 9 are presented to understand the impacts of increasing Wilcox pumping. These water budgets are presented in Table 4. The water budget comparison for Scenario 12 is presented in Table 5.

Please note that Scenario 9 represents an increase in Wilcox Aquifer pumping of about 164,000 AF/yr. In response, storage declines increase about 95,000 AF/yr. Thus, after 59 years of pumping (2012 to 2070), storage declines supply only about 58 percent of the pumping.

Induced inflow and decreased outflow account for the other 42 percent of the pumping. Significant among these components is the induced inflow from GMA 12 and GMA 15, which, together, supply over 20 percent of the pumping. Induced flow from rivers and stream supply about 21 percent of the pumping.

From 2000 to 2011, groundwater flowed from the Wilcox upward to the Carrizo at a rate of 1,380 AF/yr. Note that in Scenario 9, the rate increased to 6,437 AF/yr, which suggests that increased pumping in the Carrizo associated with Scenario 9 is inducing additional flow from the Wilcox to the Carrizo. As presented in Table 5, Scenario 12 (no Wilcox strategy pumping) has a flow rate from the Wilcox to the Carrizo of about 19,000 AF/yr, which appears to be a primary factor in the relatively flat drawdown curves in the Carrizo Aquifer, previously presented in Figures 3 through 6.

Table 4. Groundwater Budgets for the Wilcox Aquifer in GMA 13 – Scenario 9

All Values in AF/yr

	Calibrated Model (Average 2000 to 2011)	Scenario 9 (2070)	Difference
Inflow			
River and Stream	1,950	36,405	34,455
Recharge	39,200	41,715	2,515
From Mexico	20	15	-5
From GMA 10	1,208	1,238	29
From GMA 12	189	10,454	10,265
From GMA 15	0	22,641	22,641
From GMA 16	0	2,559	2,559
Total Inflow	42,568	115,027	72,459
Outflow			
Wells	67,097	231,543	164,446
Drains	244	380	136
ET	1,009	1,468	460
To Overlying Carrizo	1,380	6,437	5,057
To GMA 15	2,725	0	-2,725
To GAM 16	298	0	-298
Total Outflow	72,752	239,828	167,076
Inflow-Outflow	-30,184	-124,801	-94,617
Storage	-30,169	-124,789	-94,620
Model Error	-14	-12	2

Table 5. Groundwater Budgets for the Wilcox Aquifer in GMA 13 – Scenario 13

All Values in AF/yr

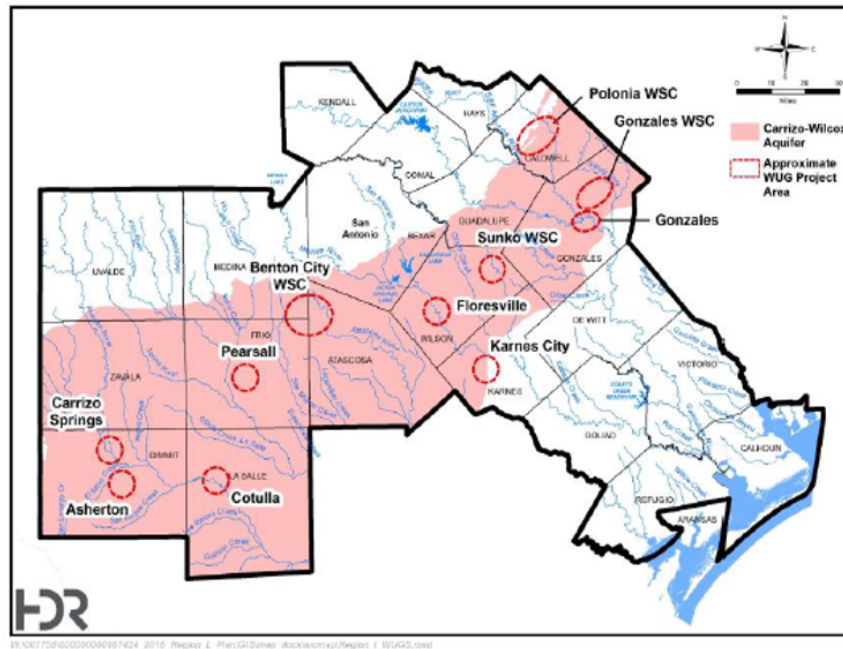
	Calibrated Model (Average 2000 to 2011)	Scenario 12 (2070)	Difference
Inflow			
River and Stream	1,950	25,100	23,150
Recharge	39,200	41,642	2,442
From Mexico	20	15	-5
From GMA 10	1,208	1,225	16
From GMA 12	189	9,167	8,978
From GMA 15	0	7,920	7,920
From GMA 16	0	1,169	1,169
Total Inflow	42,568	86,239	43,671
Outflow			
Wells	67,097	111,709	44,612
Drains	244	436	192
ET	1,009	1,475	466
To Overlying Carrizo	1,380	19,967	18,587
To GMA 15	2,725	0	-2,725
To GMA 16	298	0	-298
Total Outflow	72,752	133,587	60,835
Inflow-Outflow	-30,184	-47,348	-17,164
Storage	-30,169	-47,336	-17,167
Model Error	-14	-12	2

Appendix A

**Location Maps of 12 Water Management Strategies
Contained in Region L IPP**

1. Local Carrizo

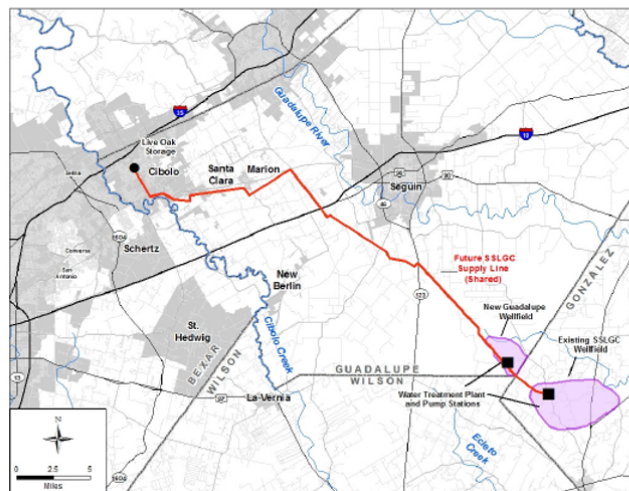
Figure 5.2.7-1. Local Carrizo-Wilcox Aquifer Projects



2. SSLGC Brackish Wilcox (Gonzales County)

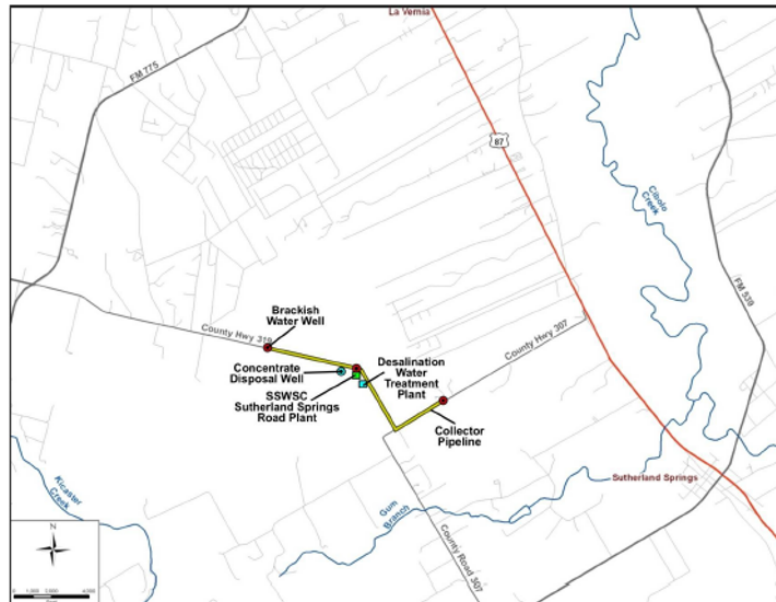
3. SSLGC Expanded Carrizo Project (Guadalupe County)

Figure 5.2.11-1 Schertz-Seguin Water Supply Project



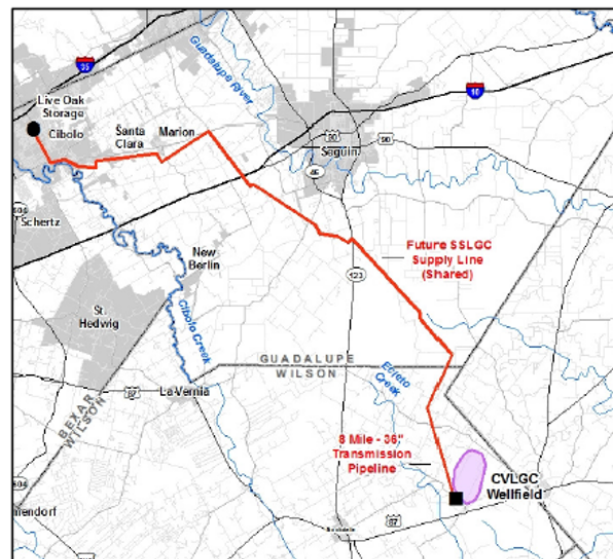
4. Brackish Wilcox for SS WSC

Figure 5.2.13-2 Brackish Wilcox Groundwater for SSWSC Project Location



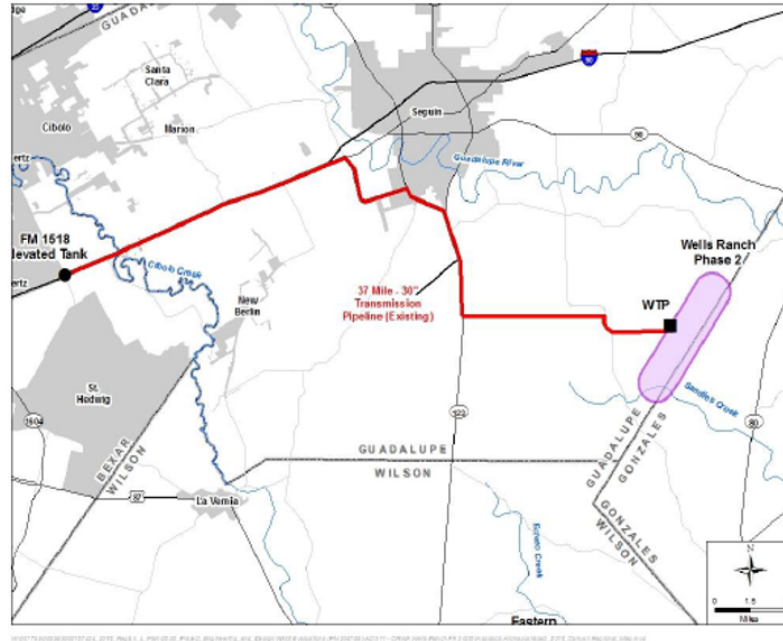
5. CVLGC Carrizo Project

Figure 14-1 Carrizo for Cibolo Valley Location Map



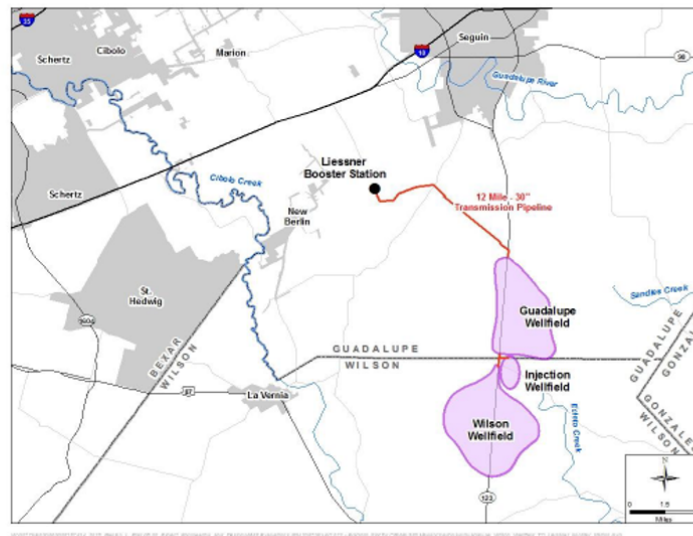
6. CRWA Wells Ranch - Phase 2

Figure 5.2.16-1 Wells Ranch Project Location Map



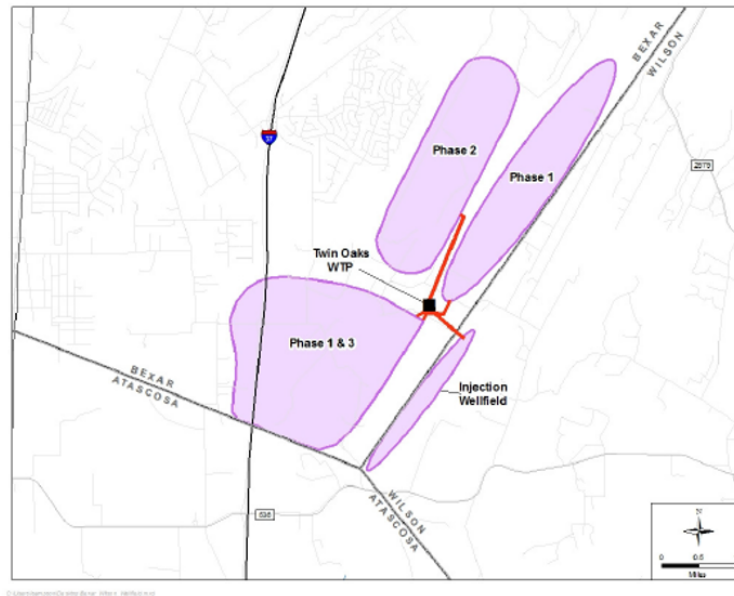
7. Brackish Wilcox Groundwater for CRWA

Figure 5.2.18-1 Project Location



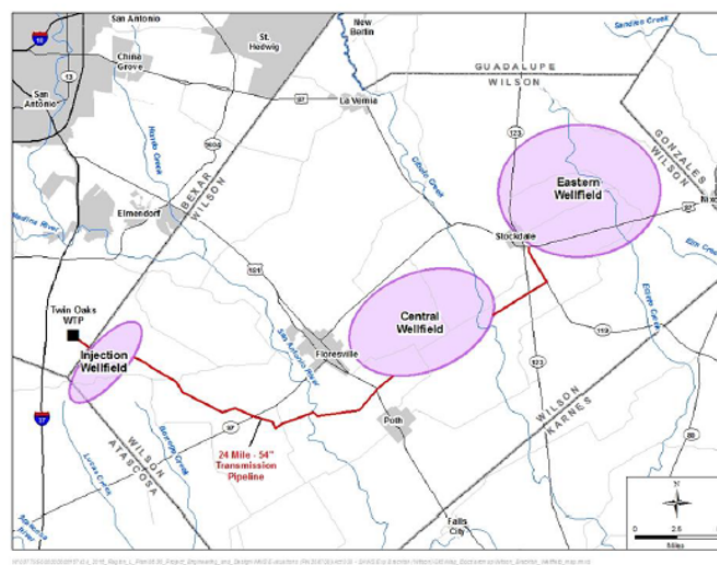
8. Brackish Wilcox Groundwater Desalination Project for SAWS

Figure 5.2.19-1 Brackish Wilcox Groundwater Desalination Project for SAWS



9. SAWS Expanded Brackish Project

Figure 5.2.20-1 Brackish Wilcox Groundwater Desalination Project for SAWS



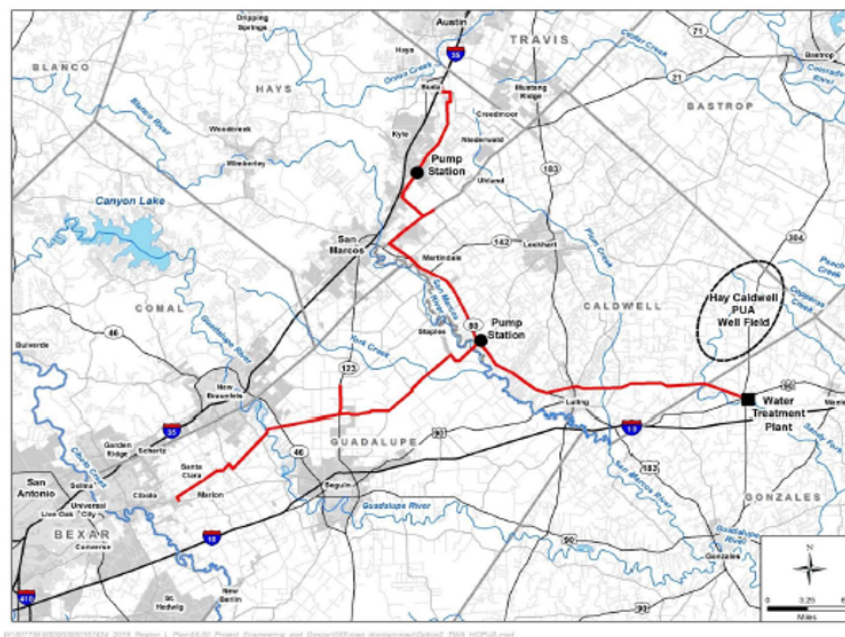
10. SAWS Expanded Local Carrizo

Figure 5.2.21-1 Local Carrizo Groundwater Project Location



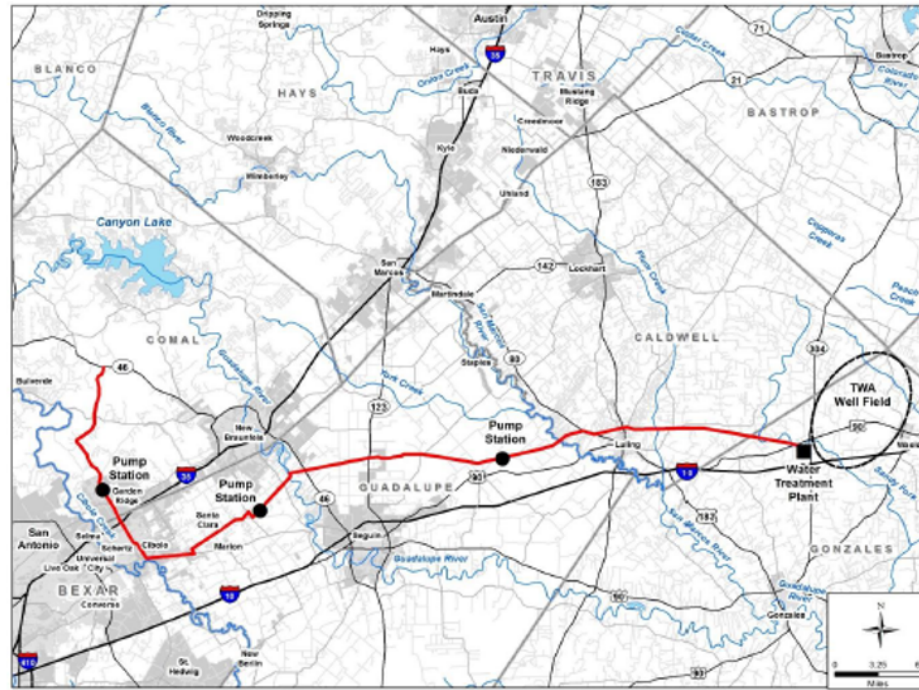
11. Hays/Caldwell PUA Project

Figure 5.2.25-1 HCPUA Project Conceptual Layout



12. TWA Carrizo Project

Figure 5.2.26-1 TWA Regional Carrizo Conceptual Layout



Appendix B

Tabluar Summaries of Pumping and Drawdown for Scenarios 9 to 12

Scenario 9 Pumping (AF/yr)

County	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7	Layer 8	Total
Atascosa	1,012	0	4,299	0	58,331	249	249	16,993	81,135
Bexar	0	0	0	0	37,686	0	0	41,067	78,753
Caldwell	0	0	307	0	33,353	0	7,389	13,409	54,458
Dimmit	0	0	0	0	2,810	1,073	205	38	4,126
Frio	623	0	4,110	0	77,299	0	0	0	82,032
Gonzales	3,551	0	5,063	0	54,319	0	9,545	22,132	94,610
Guadalupe	0	0	0	0	16,851	0	8,218	22,723	47,792
Karnes	0	0	0	0	1,295	0	0	0	1,295
LaSalle	983	0	2	0	4,669	1,952	188	50	7,843
Maverick	0	0	0	0	143	136	259	1,004	1,543
McMullen	89	0	134	0	4,402	0	0	0	4,626
Medina	0	0	0	0	534	0	1,247	863	2,644
Uvalde	0	0	0	0	828	0	0	0	828
Webb	0	0	0	0	895	13	6	1	915
Wilson	156	0	944	0	38,639	125	121	62,434	102,417
Zavala	0	0	0	0	24,504	6,230	3,610	328	34,672
GMA 13	6,415	0	14,859	0	356,554	9,777	31,036	181,039	599,702

Scenario 9 Drawdown (ft, 2012 to 2070)

County	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7	Layer 8	Total
Atascosa	14.45	19.61	22.14	70.92	121.98	122.27	139.88	254.59	104.51
Bexar	0	0	0	11.76	141.15	72.66	64.46	227.09	154.53
Caldwell	0	0	8.53	25.51	133.76	130.48	56.45	85.47	82.28
Dimmit	-1.39	2.79	-4.06	-4.06	-3.39	-2.61	-5.65	-4.77	-3.87
Frio	4.26	3.98	-0.93	31.23	51.71	50.35	49.32	55.86	36.14
Gonzales	28.76	36.74	46.07	87.77	135.67	135.6	136.92	219.14	108.68
Guadalupe	0	0	-10.05	5.46	89.9	88.83	79.47	189.7	128.05
Karnes	28.29	44.59	57.39	102.53	145.08	145.54	185.01	393.45	137.74
LaSalle	7.9	10.1	12.53	21.98	29.13	29.93	8.6	1.79	15.25
Maverick	0	0	0	0.36	-7.39	-10.11	-9.92	-2.1	-5.93
McMullen	32.79	38.57	44.02	63.37	80.32	77.97	24.58	26.96	48.57
Medina	0	0	0	-0.84	25.93	26.54	28.91	31.09	28.81
Uvalde	0	0	0	0	0.59	3.74	11.12	26.41	17.13
Webb	-5.71	-4.01	-8.58	-4.13	-1.87	-1.12	-0.88	-3.42	-3.55
Wilson	10.16	20.38	22.6	74.33	135.08	136.69	210.35	527.56	172.25
Zavala	-5.79	-5.01	-12.01	-3.98	10.26	9.85	11.73	14.26	5.46
GMA 13	12.32	16.21	11.65	32.59	54.64	54.32	53.85	101.97	47.59

Scenario 10 Pumping (AF/yr)

County	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7	Layer 8	Total
Atascosa	1,012	0	4,299	0	58,331	249	249	16,993	81,135
Bexar	0	0	0	0	37,950	0	0	27,476	65,425
Caldwell	0	0	307	0	33,353	0	7,389	13,409	54,458
Dimmit	0	0	0	0	2,810	1,073	205	38	4,126
Frio	623	0	4,110	0	77,299	0	0	0	82,032
Gonzales	3,551	0	5,063	0	54,319	0	9,545	20,106	92,583
Guadalupe	0	0	0	0	16,851	0	8,429	16,803	42,083
Karnes	0	0	0	0	1,295	0	0	0	1,295
LaSalle	983	0	2	0	4,669	1,952	188	50	7,843
Maverick	0	0	0	0	143	136	259	1,004	1,543
McMullen	89	0	134	0	4,402	0	0	0	4,626
Medina	0	0	0	0	534	0	1,247	863	2,644
Uvalde	0	0	0	0	828	0	0	0	828
Webb	0	0	0	0	895	13	6	1	915
Wilson	156	0	944	0	38,639	125	121	47,458	87,442
Zavala	0	0	0	0	24,504	6,230	3,610	328	34,672
GMA 13	6,415	0	14,859	0	356,817	9,777	31,247	144,527	563,660

Scenario 10 Draw down (ft, 2012 to 2070)

County	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7	Layer 8	Total
Atascosa	14.2	19.25	21.73	69.4	119.11	119.23	124.72	210.58	95.02
Bexar	0	0	0	11.68	139.86	74.39	55.3	188.46	132.13
Caldwell	0	0	8.52	25.48	133.57	130.28	55.59	79.99	79.76
Dimmit	-1.39	2.79	-4.06	-4.1	-3.45	-2.67	-5.73	-4.89	-3.93
Frio	4.23	3.93	-0.97	30.87	50.9	49.51	47.13	51.47	34.83
Gonzales	28.6	36.49	45.71	86.91	134.28	134.16	125.97	175.27	100.69
Guadalupe	0	0	-10.05	5.46	89.11	87.85	68.78	141.09	103.15
Karnes	27.64	43.52	55.99	99.75	140.85	140.88	149.88	289.62	118.52
LaSalle	7.85	10.03	12.44	21.76	28.76	29.56	8.13	0.49	14.88
Maverick	0	0	0	0.36	-7.39	-10.11	-9.92	-2.1	-5.93
McMullen	32.5	38.2	43.59	62.56	79.19	76.84	22.94	20.81	47.08
Medina	0	0	0	-0.84	25.74	26.28	28.15	29.58	27.95
Uvalde	0	0	0	0	0.59	3.74	11.11	26.39	17.13
Webb	-5.71	-4.01	-8.58	-4.14	-1.89	-1.14	-0.89	-3.45	-3.56
Wilson	9.97	19.95	22.09	72.43	131.28	132.13	172.25	394.94	143.63
Zavala	-5.79	-5.01	-12.02	-4.02	10.18	9.77	11.64	14.14	5.39
GMA 13	12.19	16.01	11.46	32.03	53.65	53.26	47.65	81.01	42.9

Scenario 11 Pumping (AF/yr)

County	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7	Layer 8	Total
Atascosa	1,012	0	4,299	0	58,331	249	249	16,993	81,135
Bexar	0	0	0	0	37,950	0	0	13,558	51,507
Caldwell	0	0	307	0	33,353	0	7,389	13,409	54,458
Dimmit	0	0	0	0	2,810	1,073	205	38	4,126
Frio	623	0	4,110	0	77,299	0	0	0	82,032
Gonzales	3,551	0	5,063	0	54,319	0	9,545	18,030	90,507
Guadalupe	0	0	0	0	16,851	0	8,465	10,698	36,014
Karnes	0	0	0	0	1,295	0	0	0	1,295
LaSalle	983	0	2	0	4,669	1,952	188	50	7,843
Maverick	0	0	0	0	143	136	259	1,004	1,543
McMullen	89	0	134	0	4,402	0	0	0	4,626
Medina	0	0	0	0	534	0	1,247	863	2,644
Uvalde	0	0	0	0	828	0	0	0	828
Webb	0	0	0	0	895	13	6	1	915
Wilson	156	0	944	0	38,639	125	121	31,985	71,969
Zavala	0	0	0	0	24,504	6,230	3,610	328	34,672
GMA13	6,415	0	14,859	0	356,817	9,777	31,283	106,954	526,096

Scenario 11 Draw down (ft, 2012 to 2070)

County	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7	Layer 8	Total
Atascosa	13.93	18.86	21.28	67.74	115.97	115.9	108.02	162.33	84.6
Bexar	0	0	0	11.6	137.32	71.45	42.94	139.12	102.71
Caldwell	0	0	8.52	25.45	133.36	130.07	54.67	74.17	77.09
Dimmit	-1.39	2.78	-4.06	-4.13	-3.52	-2.74	-5.82	-5.03	-4
Frio	4.2	3.88	-1.02	30.48	50	48.59	44.7	46.6	33.39
Gonzales	28.43	36.23	45.34	86	132.81	132.63	114.42	129.49	92.32
Guadalupe	0	0	-10.06	5.45	88.24	86.75	55.27	88.71	75.88
Karnes	26.93	42.37	54.49	96.77	136.32	135.9	112.75	180.13	98.21
LaSalle	7.8	9.95	12.33	21.51	28.34	29.15	7.62	-0.92	14.47
Maverick	0	0	0	0.36	-7.39	-10.11	-9.92	-2.1	-5.93
McMullen	32.18	37.8	43.11	61.69	77.94	75.61	21.18	14.15	45.46
Medina	0	0	0	-0.84	25.53	25.99	27.3	27.87	26.96
Uvalde	0	0	0	0	0.59	3.74	11.11	26.38	17.12
Webb	-5.72	-4.02	-8.59	-4.15	-1.92	-1.17	-0.9	-3.48	-3.58
Wilson	9.78	19.49	21.54	70.37	127.17	127.19	130.68	253.12	112.87
Zavala	-5.79	-5.01	-12.02	-4.06	10.09	9.67	11.53	14.02	5.32
GMA13	12.04	15.79	11.25	31.43	52.56	52.08	40.85	58.35	37.81

Scenario 12 Pumping (AF/yr)

County	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7	Layer 8	Total
Atascosa	1,012	0	4,299	0	58,331	249	249	16,993	81,135
Bexar	0	0	0	0	37,950	0	0	0	37,950
Caldwell	0	0	307	0	33,353	0	7,389	13,409	54,458
Dimmit	0	0	0	0	2,810	1,073	205	38	4,126
Frio	623	0	4,110	0	77,299	0	0	0	82,032
Gonzales	3,551	0	5,063	0	54,319	0	9,545	16,011	88,488
Guadalupe	0	0	0	0	16,851	0	8,649	4,769	30,269
Karnes	0	0	0	0	1,295	0	0	0	1,295
LaSalle	983	0	2	0	4,669	1,952	188	50	7,843
Maverick	0	0	0	0	143	136	259	1,004	1,543
McMullen	89	0	134	0	4,402	0	0	0	4,626
Medina	0	0	0	0	534	0	1,247	863	2,644
Uvalde	0	0	0	0	828	0	0	0	828
Webb	0	0	0	0	895	13	6	1	915
Wilson	156	0	944	0	38,639	125	121	17,010	56,995
Zavala	0	0	0	0	24,504	6,230	3,610	328	34,672
GMA 13	6,415	0	14,859	0	356,817	9,777	31,468	70,472	489,793

Scenario 12 Draw down (ft, 2012 to 2070)

County	Layer 1	Layer 2	Layer 3	Layer 4	Layer 5	Layer 6	Layer 7	Layer 8	Total
Atascosa	13.66	18.46	20.83	66.06	112.77	112.5	91	113.53	74.04
Bexar	0	0	0	11.52	134.62	67.84	27.59	83.11	68.94
Caldwell	0	0	8.51	25.41	133.16	129.87	53.79	68.59	74.53
Dimmit	-1.39	2.78	-4.06	-4.17	-3.59	-2.81	-5.9	-5.16	-4.06
Frio	4.17	3.83	-1.07	30.07	49.07	47.64	42.22	41.64	31.92
Gonzales	28.26	35.97	44.96	85.1	131.35	131.12	103.14	85.02	84.17
Guadalupe	0	0	-10.06	5.44	87.34	85.6	40.86	37.02	48.66
Karnes	26.23	41.22	52.99	93.8	131.8	130.95	76.24	72.69	78.24
LaSalle	7.74	9.88	12.23	21.26	27.92	28.73	7.11	-2.36	14.06
Maverick	0	0	0	0.36	-7.39	-10.11	-9.92	-2.1	-5.93
McMullen	31.85	37.4	42.63	60.8	76.68	74.37	19.4	7.45	43.82
Medina	0	0	0	-0.84	25.31	25.69	26.4	26.07	25.92
Uvalde	0	0	0	0	0.59	3.74	11.11	26.36	17.11
Webb	-5.72	-4.03	-8.59	-4.17	-1.94	-1.19	-0.91	-3.51	-3.59
Wilson	9.58	19.02	20.99	68.3	123.05	122.24	89.55	113.28	82.49
Zavala	-5.79	-5.01	-12.02	-4.1	10	9.58	11.42	13.89	5.24
GMA 13	11.89	15.58	11.04	30.83	51.46	50.88	34.01	35.74	32.72