

GAM run 04-01

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Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-7847
April 22, 2004

REQUESTOR:

Mid-East Texas Groundwater Conservation District

DESCRIPTION OF REQUEST:

The Mid-East Texas Groundwater Conservation District (GCD) requested that the Carrizo Wilcox Groundwater Availability Model (GAM) be run to obtain information regarding the total recharge amounts for recharge areas within the district (Freestone, Leon, and Madison counties, Texas). The district also requested modeling runs to determine the maximum annual pumpage rates consistent with the maintenance of current aquifer levels. This is a follow up to GAM run 03-31 dated December 9, 2003.

PARAMETERS AND ASSUMPTIONS:

The following assumptions were used to answer the request:

- The Central Carrizo-Wilcox GAM model was used with average recharge rates through the year 2050.
- Pumpage was scaled upward by 100 and 200 percent in Freestone, Leon, and Madison counties to determine the drawdown impact on water levels in the model layers representing the Carrizo, Calvert Bluff, Simsboro, and Hooper aquifers.
- For this report, the year 2000 reflects current aquifer levels.
- The drawdowns are relative to the modeled 2000 water levels from the calibrated transient model.

All other parameters and assumptions were unchanged from the original model (Dutton and others, 2003).

METHODS:

- The total county basin pumpage input for the Central Carrizo-Wilcox predictive model was extracted from the MODFLOW well discharge file.
- The well discharge rates for Freestone, Leon, and Madison counties were scaled upward by 100 per cent in one run and 200 per cent in the second run. All other well discharge rates in adjacent counties were unchanged from the original model.
- Water level drawdowns predicted by the models were extracted for the years 2020 and 2050 for the Carrizo, Calvert Bluff, Simsboro, and Hooper aquifers. The

original model drawdowns for 2020 and 2050 were then subtracted from the 100 per cent and 200 per cent discharge scenario drawdowns.

- Water budgets for Freestone, Leon, and Madison counties were extracted from the model output for the years 2020 and 2050. County basin storage change, stream discharge, well discharge and recharge rates in acre-feet per year were tabulated separately for each model layer.

RESULTS:

Recharge

The total county recharge rates are summed up for each model layer in Table 1 below. Groundwater recharge rates, storativity change, well discharge, and stream discharge for individual basins are given in budget summaries in Tables 2, 3, and 4. Table 2 is the original model. The results are given for each model layer representing the Carrizo aquifer (layer 3), the Calvert Bluff aquifer (layer 4), the Simsboro aquifer (layer 5), and the Hooper aquifer (layer 6). As expected, the recharge rates are the same for each of the model pumping scenarios and simulation times.

Table 1. Total county recharge estimates by aquifer for the Mid-East Texas GCD. Average recharge rates are assumed. The recharge listed is an estimate from direct infiltration and does not include cross formational flow.

Aquifer	County	Total Recharge (acre-feet/year)
Carrizo	Freestone	14,123
	Leon	7,187
	Madison	0
Calvert Bluff	Freestone	10,165
	Leon	998
	Madison	0
Simsboro	Freestone	9,115
	Leon	0
	Madison	0
Hooper	Freestone	3,549
	Leon	0
	Madison	0

The full water budgets for all of the model scenarios are given in Tables 5 through 11. For reference, the original model water budgets are given in Tables 9, 10, and 11. No recharge is applied to Madison County because it is downdip of the Carrizo-Wilcox

outcrop. Recharge is applied only to the outcrop portion of the Carrizo and Calvert Bluff aquifers (layers 3 and 4) in Leon County. Recharge is applied to all four model layers in Freestone County since all four units outcrop in Freestone County. It should be noted that there is a very small difference between the recharge values reported in GAM run 03-31 Table 1 and those given here. Previously, zones in the model were outlined from raster graphics to extract the water budget information. Since the previous report, a more efficient means of extracting the information was developed and implemented here.

Groundwater Assessment

The GAM run 03-31 report presents production rates in acre-feet/year for 1995 through 2000 for the counties in the district (GAM run 03-31, Table 2). The year 2000 production rates were 2887, 2641, and 48 acre-feet/year for Freestone, Leon, and Madison counties respectively. The original central Carrizo-Wilcox predictive model already has higher specified pumpage rates. From Table 9, the 2004 model total production rates were 3251, 5987, and 1696 acre-feet/year for Freestone, Leon, and Madison Counties respectively. Therefore, the modeling results presented here represent a significant increase in production.

The model results indicate that the Carrizo-Wilcox aquifer in the Mid East Texas GCD can sustain some additional pumpage if drawdowns less than 35 feet are acceptable by the GCD. Figures 1 through 16 provide drawdown contours of water levels calculated by the model for 2020 and 2050. The contours represent the increase in drawdown above that calculated by the original predictive model when pumpage is increased by 100 per cent and 200 per cent in Freestone, Leon, and Madison counties. Well discharge increases of 100 per cent to 200 per cent over the current projected rates result in modest regional drawdown increases of approximately 2 to 15 feet with some localized drawdown increasing near major pumpage centers in the 25 to 35 feet range.

For the Carrizo aquifer, the greatest additional drawdown occurs in Leon and Madison counties where the pumpage is the greatest. Pumpage is only from the Carrizo aquifer in Madison County (Tables 2 through 11). As expected, both the 2020 and 2050 results show that drawdown is doubled near major pumpage centers for the 200 per cent increase case when compared to the 100 per cent increase results.

For the Calvert Bluff aquifer, the greatest added drawdown occurs at the Leon and Freestone county border. There is no pumpage from the Calvert Bluff in Madison County.

The majority of the Simsboro pumpage is from Freestone County. Additional drawdown of up to 34 feet was calculated for Freestone County near main pumpage centers for the 2050 200 per cent increase run. There is no pumpage from the Simsboro aquifer in Madison County.

For the Hooper aquifer, the majority of the additional drawdown was again calculated in Freestone County. Tables 2 through 11 show that there is no pumpage from the Hooper aquifer in Leon or Madison Counties.

Discussion

One would assume that there would be abundant recharge in wet years. However, it should be noted that recharge may not be immediately available for discharge from an aquifer. This is because groundwater movement is slow (on the order of feet per year) and it may take significant time for the recharge water to travel to the point of discharge. In the outcrop recharge zone, groundwater is unconfined, and infiltrating recharge waters may take tens of years to reach the water table. In confined, down-dip portions of the aquifer, it may take hundreds to thousands of years for recharge to reach the point of discharge.

Regarding the water budget, increased well discharge must be accounted for elsewhere from a change in storage, decreased streamflow, or decreased evapotranspiration. It is also possible that pumpage can introduce or increase vertical and lateral hydraulic gradients. In the case of vertical gradients, groundwater can be induced to flow across formations downward or upward. These terms are represented in the budget Tables 5 through 11 as the upper and lower flows into and out of the model. Increased lateral hydraulic gradients can increase groundwater flow rates in the down-gradient direction. This term is included in the x flow terms in the budget tables.

These concepts are illustrated in Figures 17 through 21 which graphically portray some of the information presented in Tables 2 through 11. From the figures, it can be seen that increased pumpage results in less evapotranspiration, lower stream discharge, increased lateral flow (x direction), increased vertical flow (upper and lower terms), and an increase in the amount of water released from storage.

From Tables 3 and 4, a greater amount of water comes from storage in the 200 per cent pumpage increase scenario. Inspection of the results from the 2020 and 2050 runs shows that, over time, the amount of groundwater produced from storage decreases. This is to be expected, as there is a finite amount of water in the aquifer.

REFERENCE:

Dutton, A. R., R., Nicot, J. P., and O'Rourke, D., 2003, Groundwater availability model for the central part of the Carrizo-Wilcox aquifer in Texas: Final Report prepared for the Texas Water Development Board by the Bureau of Economic Geology, R.W. Harden and Associates, and HDR Engineering Service, Inc.

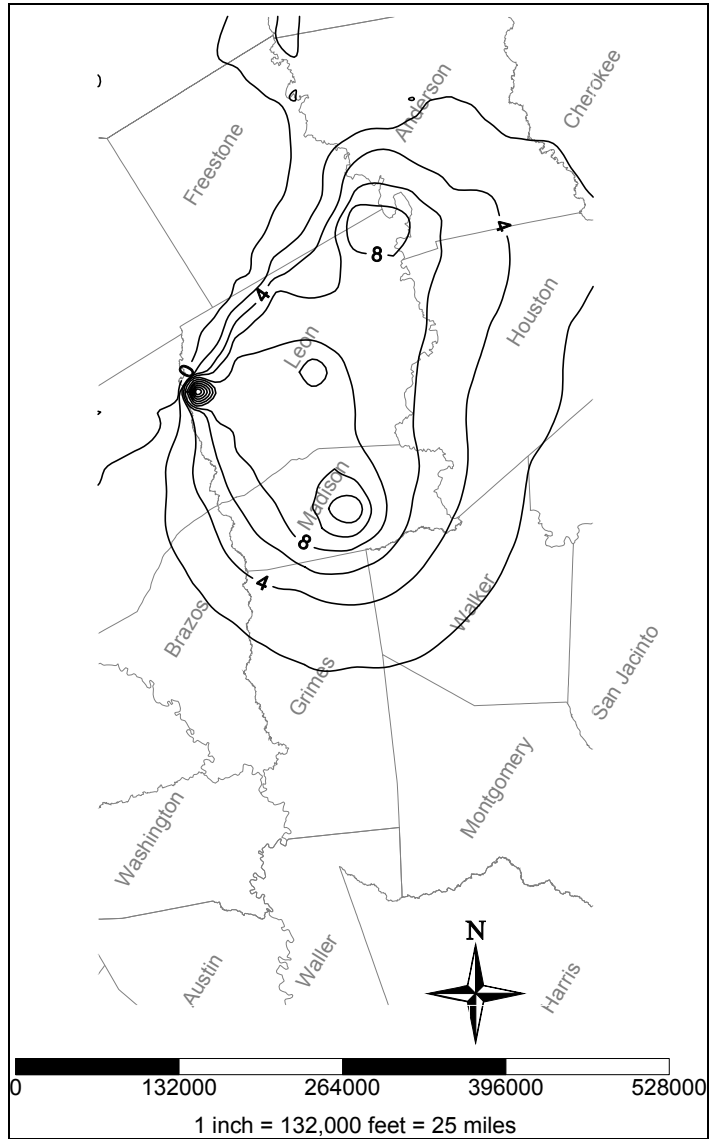


Figure 1. Year 2020 Carrizo predicted drawdown increase (feet) above that calculated by the original model. Scenario is 100 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

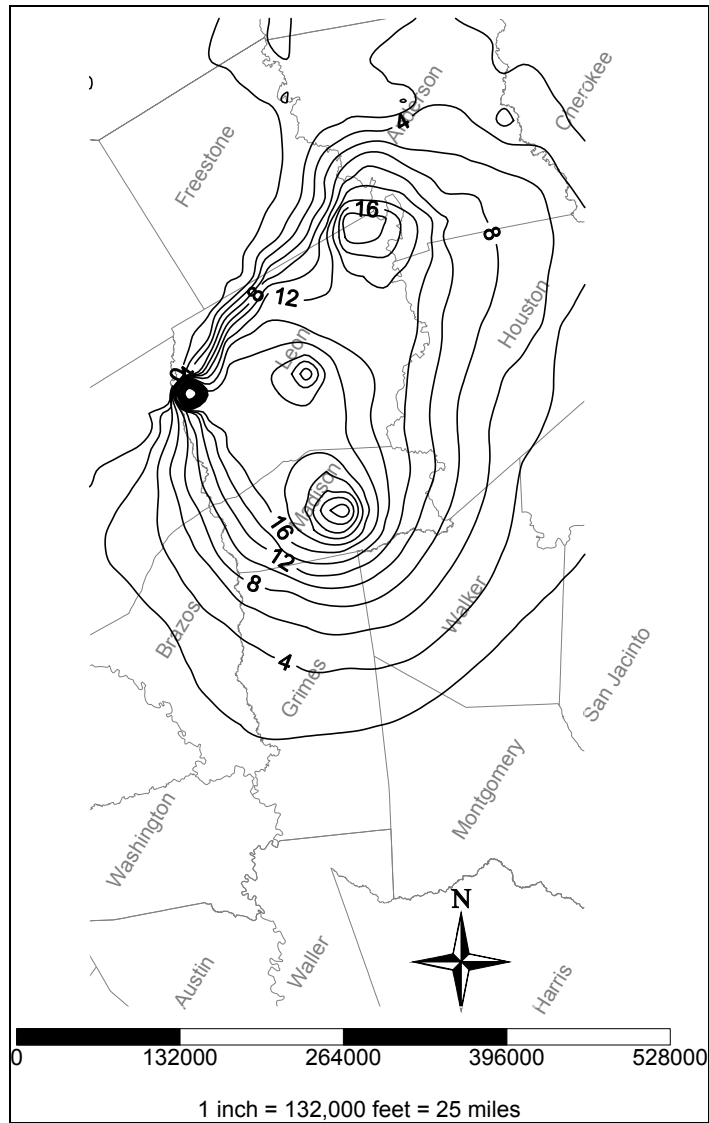


Figure 2. Year 2020 Carrizo predicted drawdown increase (feet) above that calculated by the original model. Scenario is 200 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

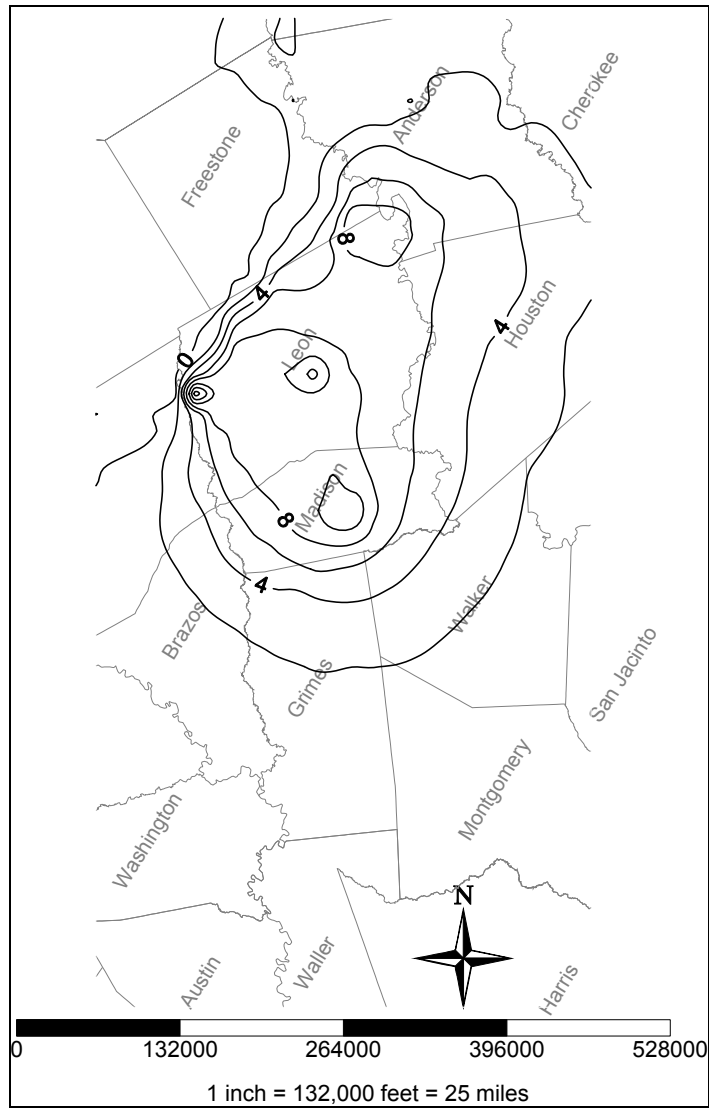


Figure 3. Year 2050 Carrizo predicted drawdown increase (feet) above that calculated by the original model. Scenario is 100 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

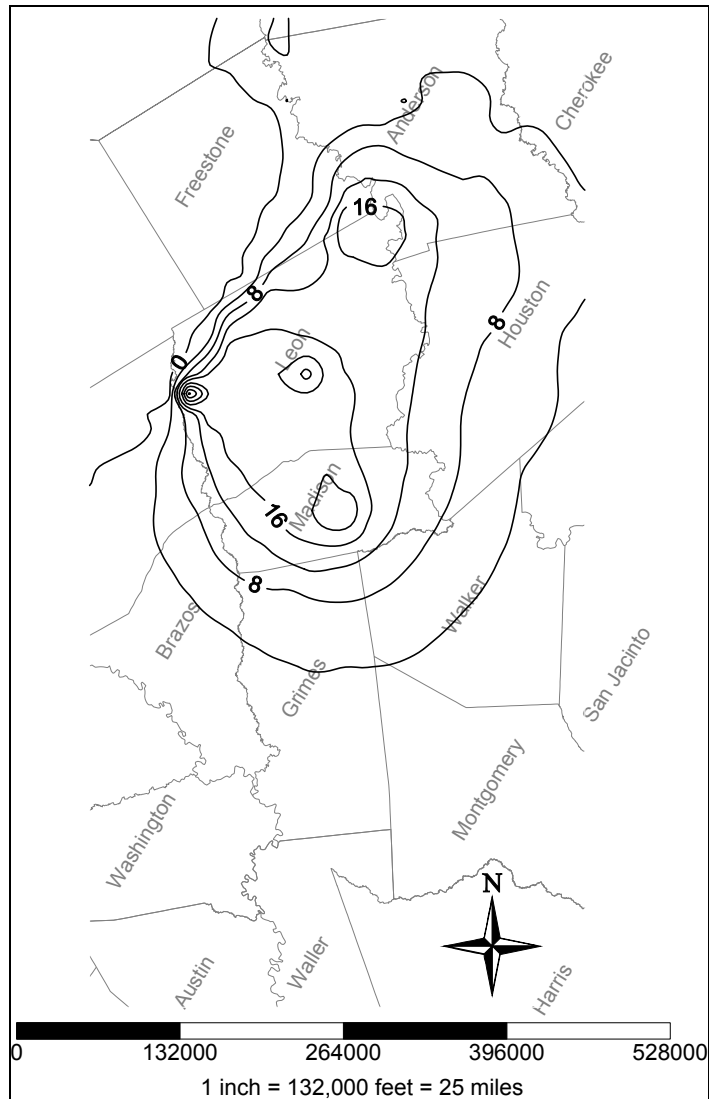


Figure 4. Year 2050 Carrizo predicted drawdown increase (feet) above that calculated by the original model. Scenario is 200 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

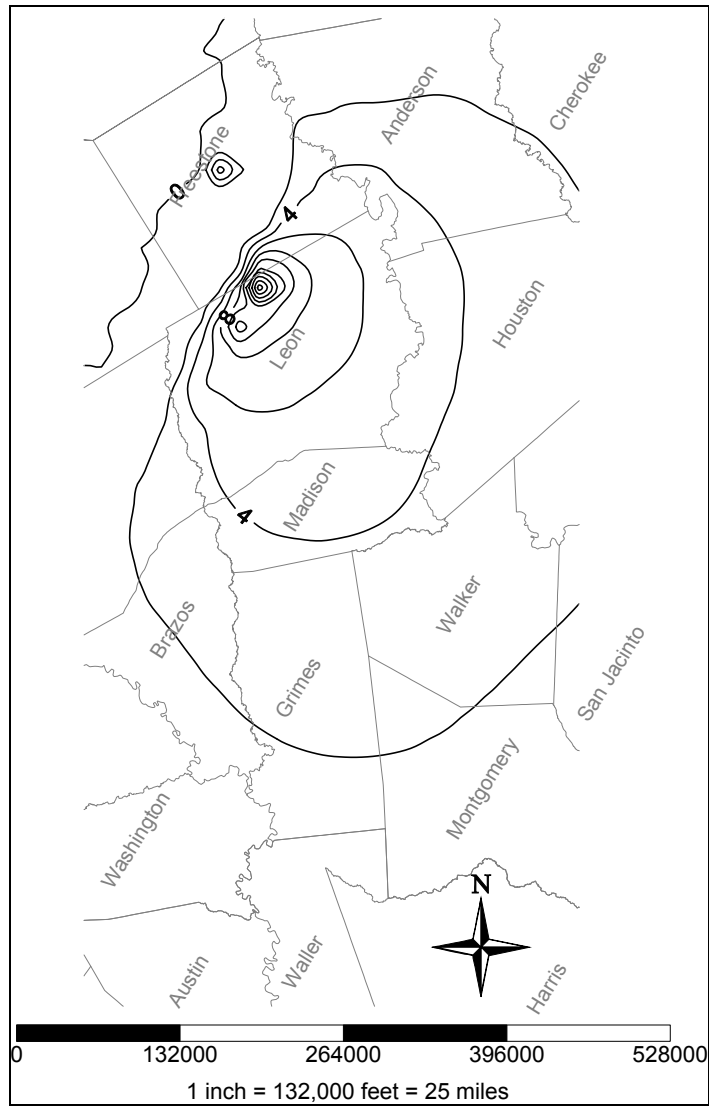


Figure 5. Year 2020 Calvert Bluff predicted drawdown increase (feet) above that calculated by the original model. Scenario is 100 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

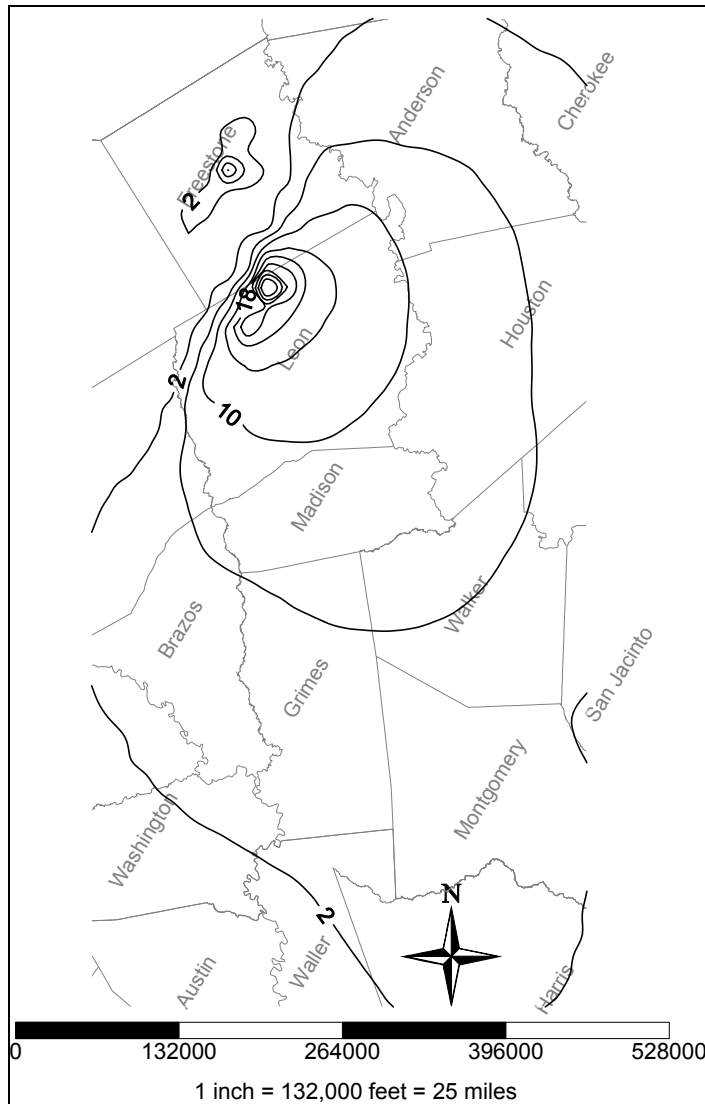


Figure 6. Year 2020 Calvert Bluff predicted drawdown increase (feet) above that calculated by the original model. Scenario is 200 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

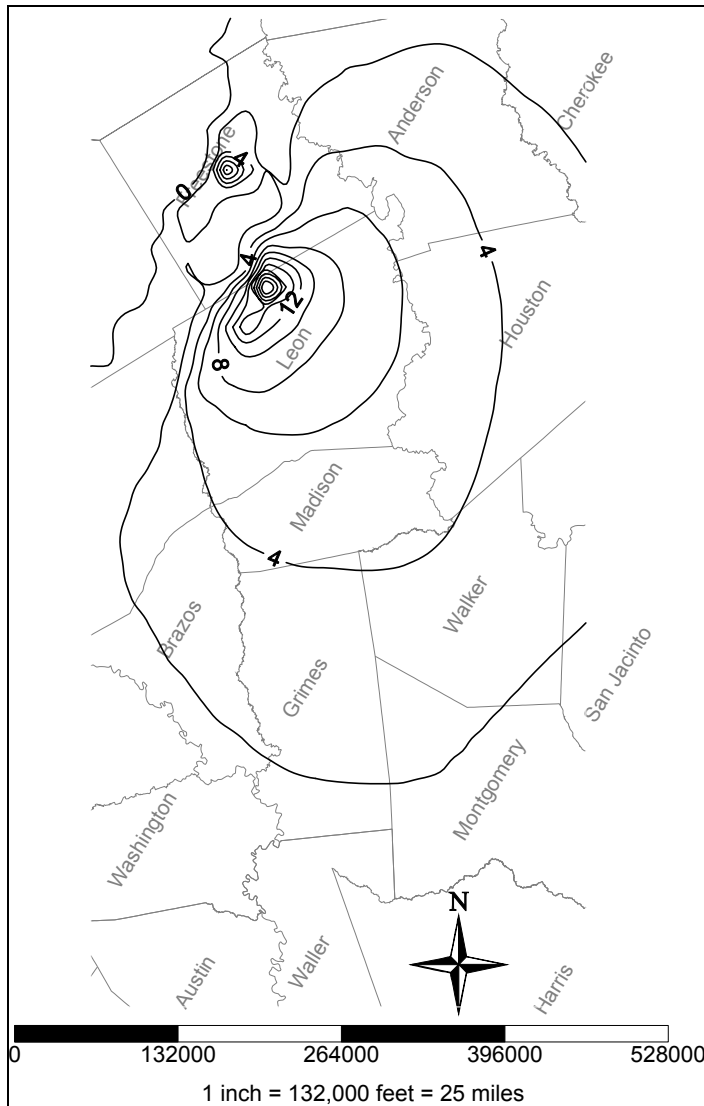


Figure 7. Year 2050 Calvert Bluff predicted drawdown increase (feet) above that calculated by the original model. Scenario is 100 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

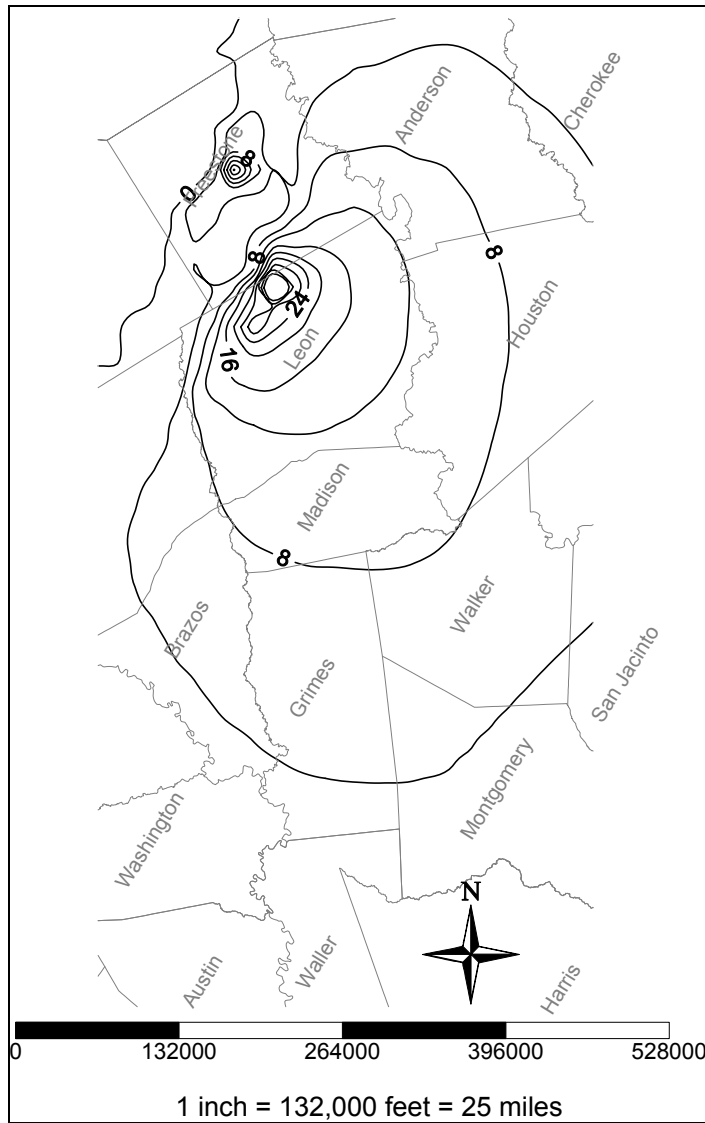


Figure 8. Year 2050 Calvert Bluff predicted drawdown increase (feet) above that calculated by the original model. Scenario is 200 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

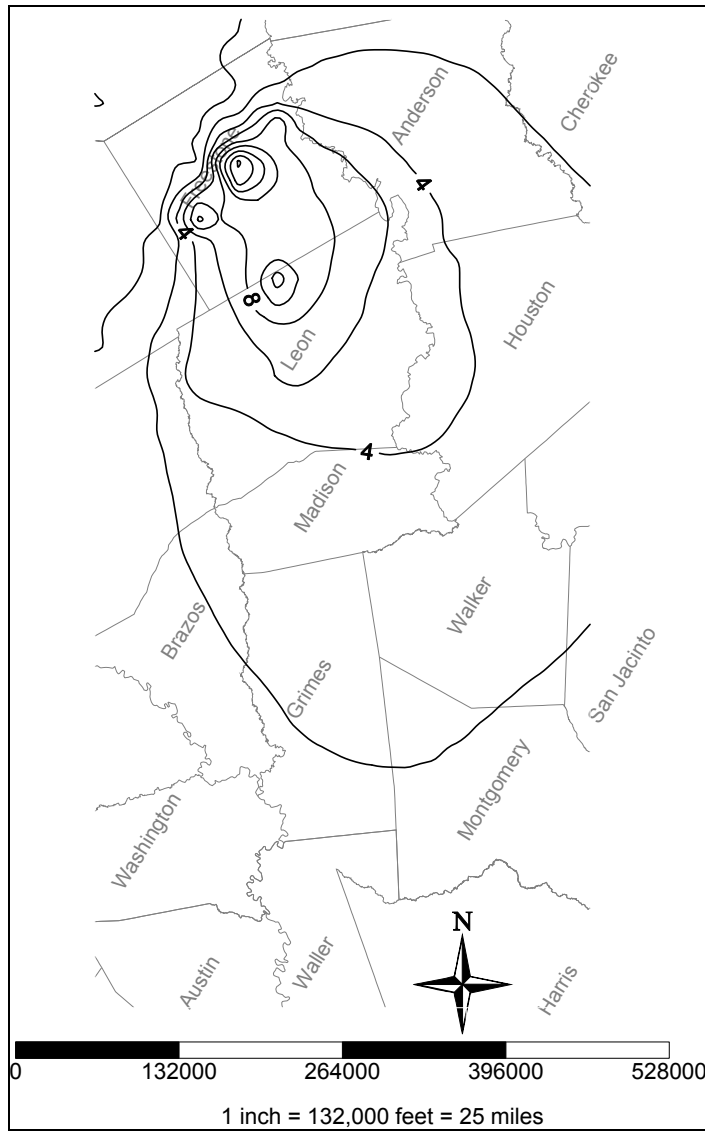


Figure 9. Year 2020 Simsboro predicted drawdown increase (feet) above that calculated by the original model. Scenario is 100 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

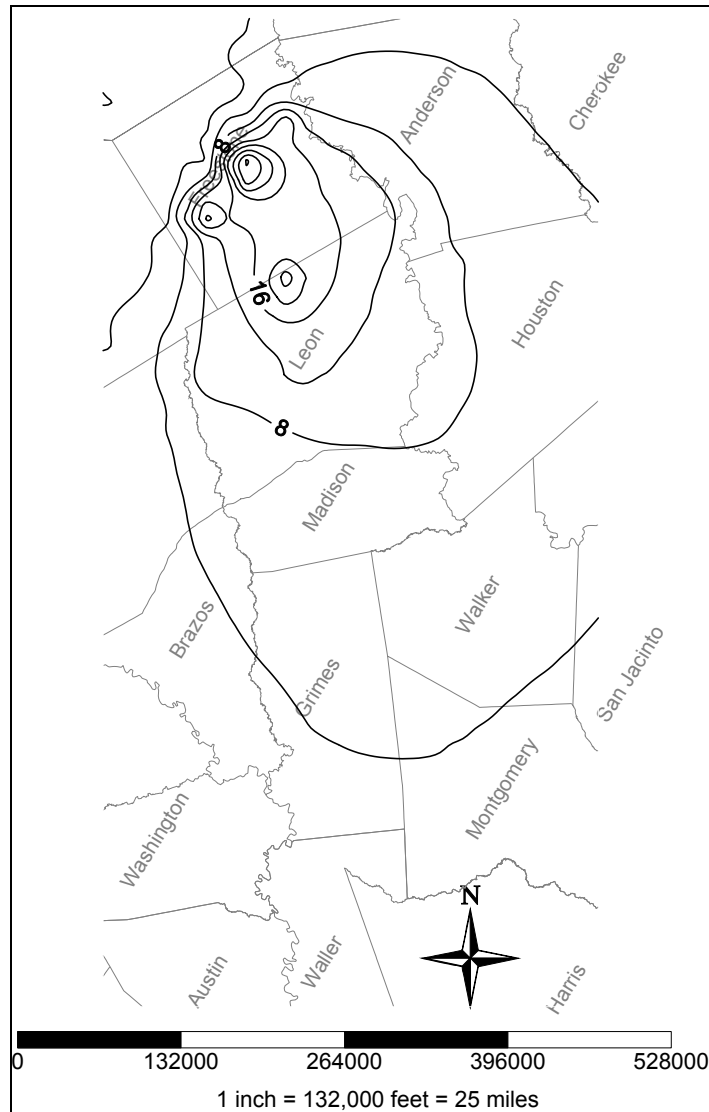


Figure 10. Year 2020 Simsboro predicted drawdown increase (feet) above that calculated by the original model. Scenario is 200 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

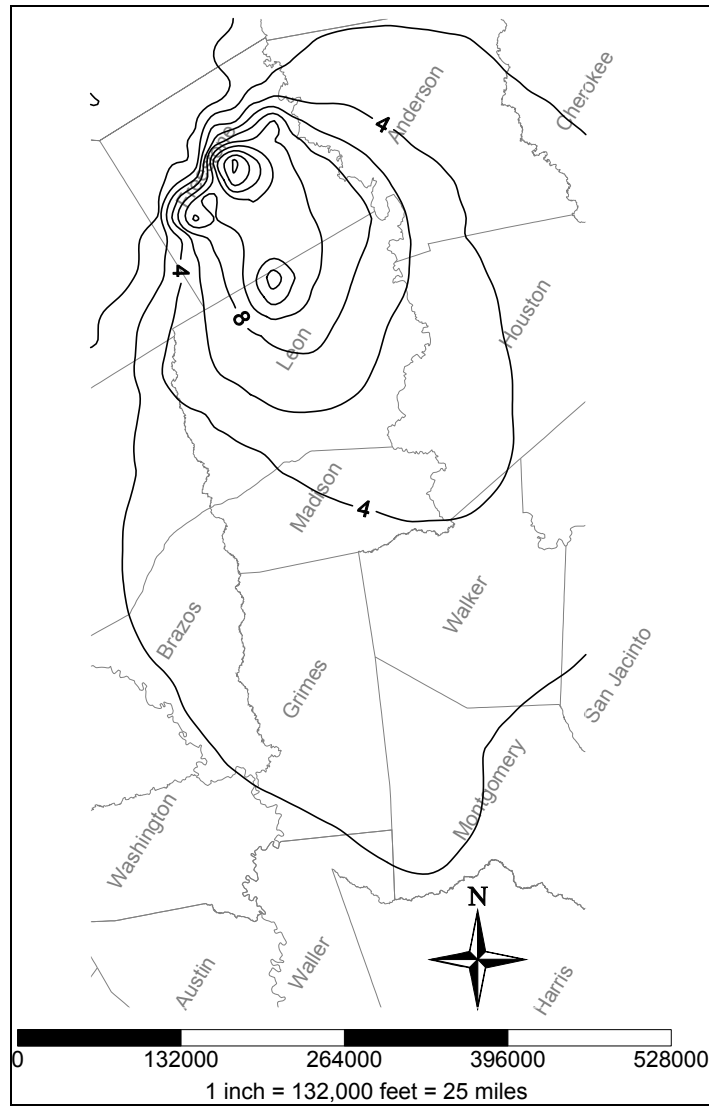


Figure 11. Year 2050 Simsboro predicted drawdown increase (feet) above that calculated by the original model. Scenario is 100 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

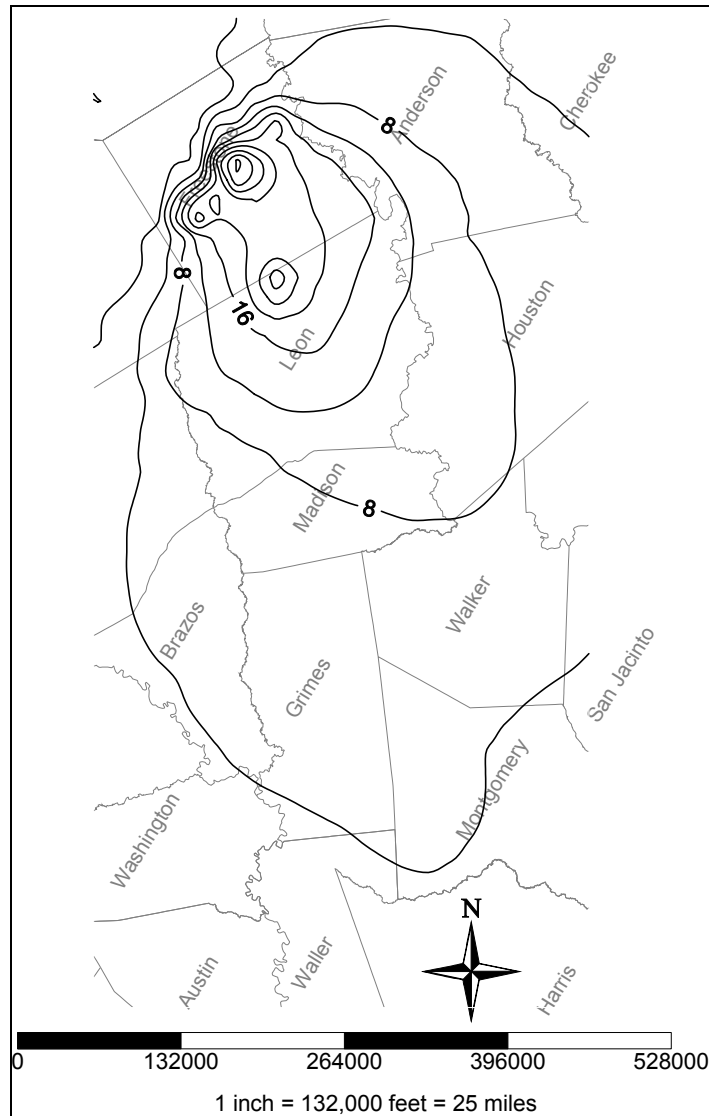


Figure 12. Year 2050 Simsboro predicted drawdown increase (feet) above that calculated by the original model. Scenario is 200 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

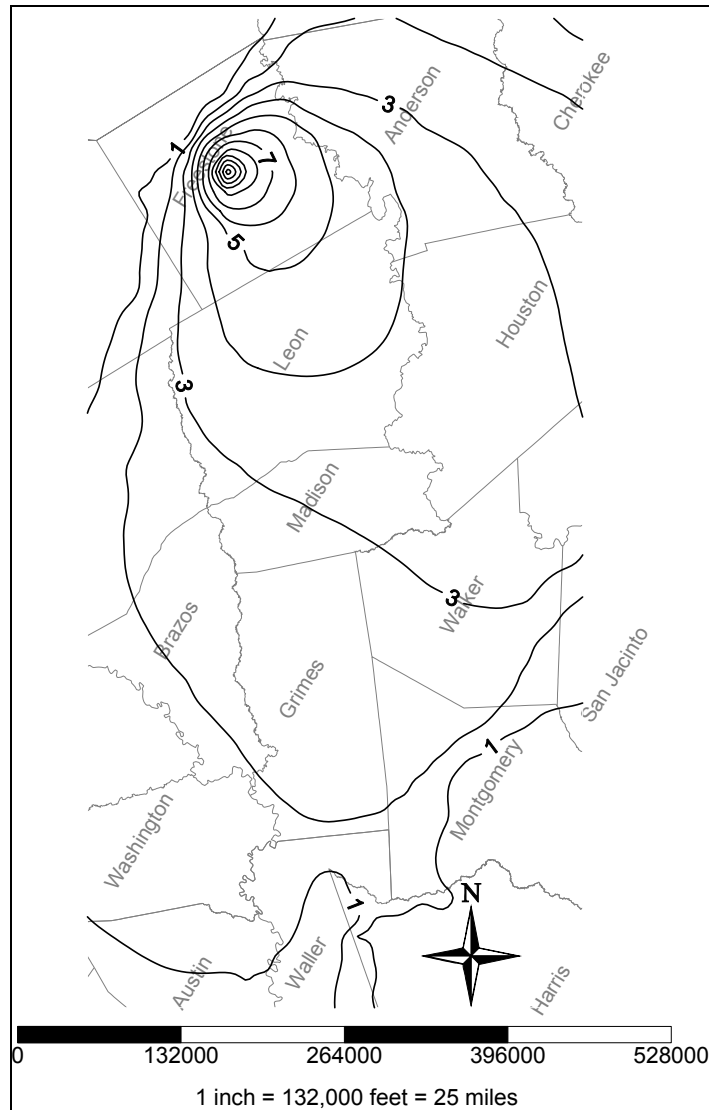


Figure 13. Year 2020 Hooper predicted drawdown increase (feet) above that calculated by the original model. Scenario is 100 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

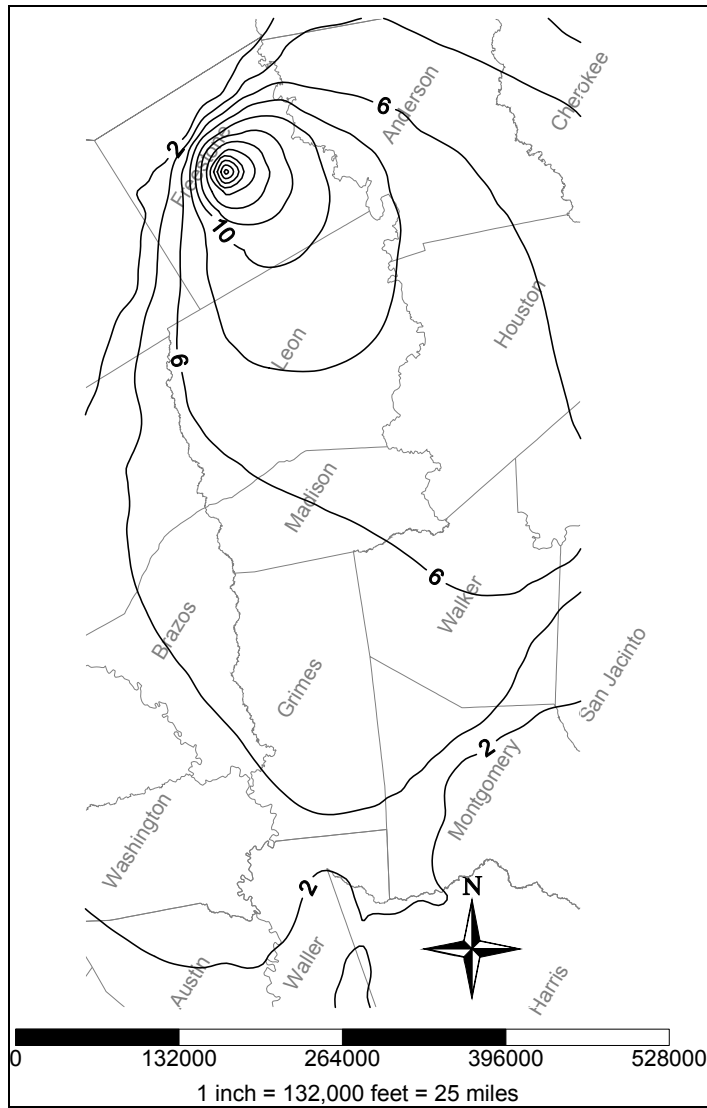


Figure 14. Year 2020 Hooper predicted drawdown increase (feet) above that calculated by the original model. Scenario is 200 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

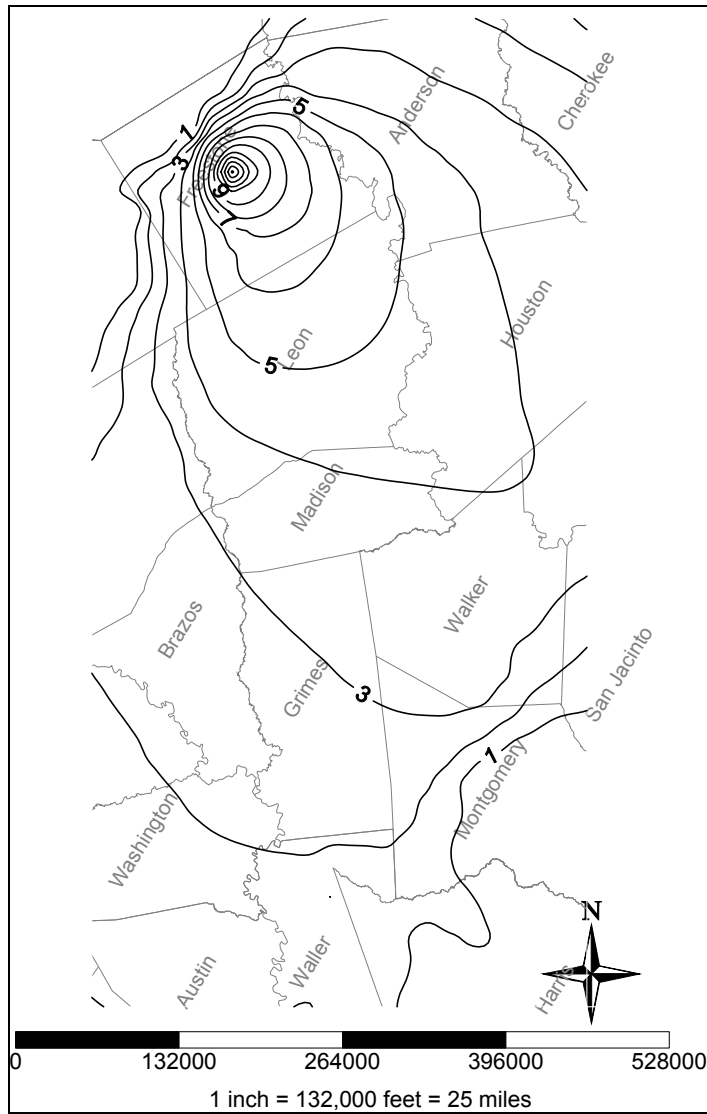


Figure 15. Year 2050 Hooper predicted drawdown increase (feet) above that calculated by the original model. Scenario is 100 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

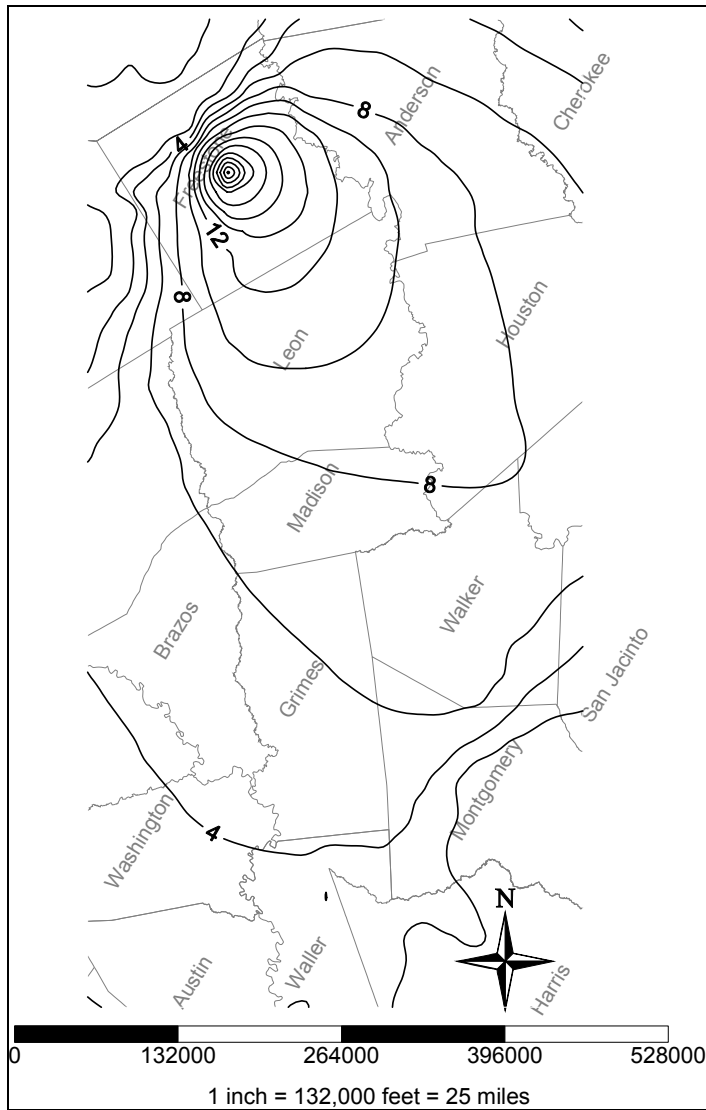


Figure 16. Year 2050 Hooper predicted drawdown increase (feet) above that calculated by the original model. Scenario is 200 per cent well discharge increase in Freestone, Leon, and Madison counties with average recharge conditions.

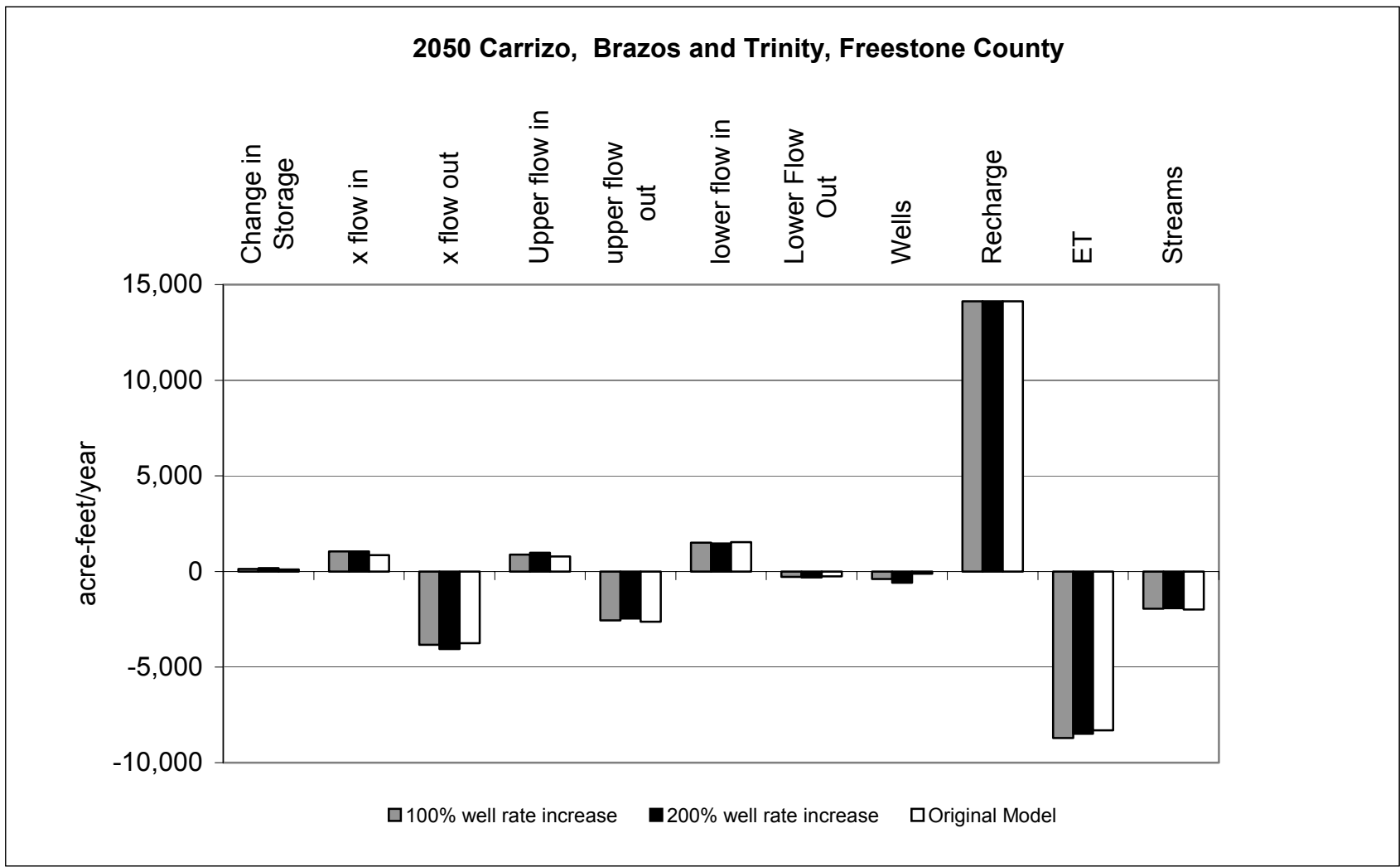


Figure 17. Water budget comparison for 2050 in the Carrizo aquifer, Freestone County.

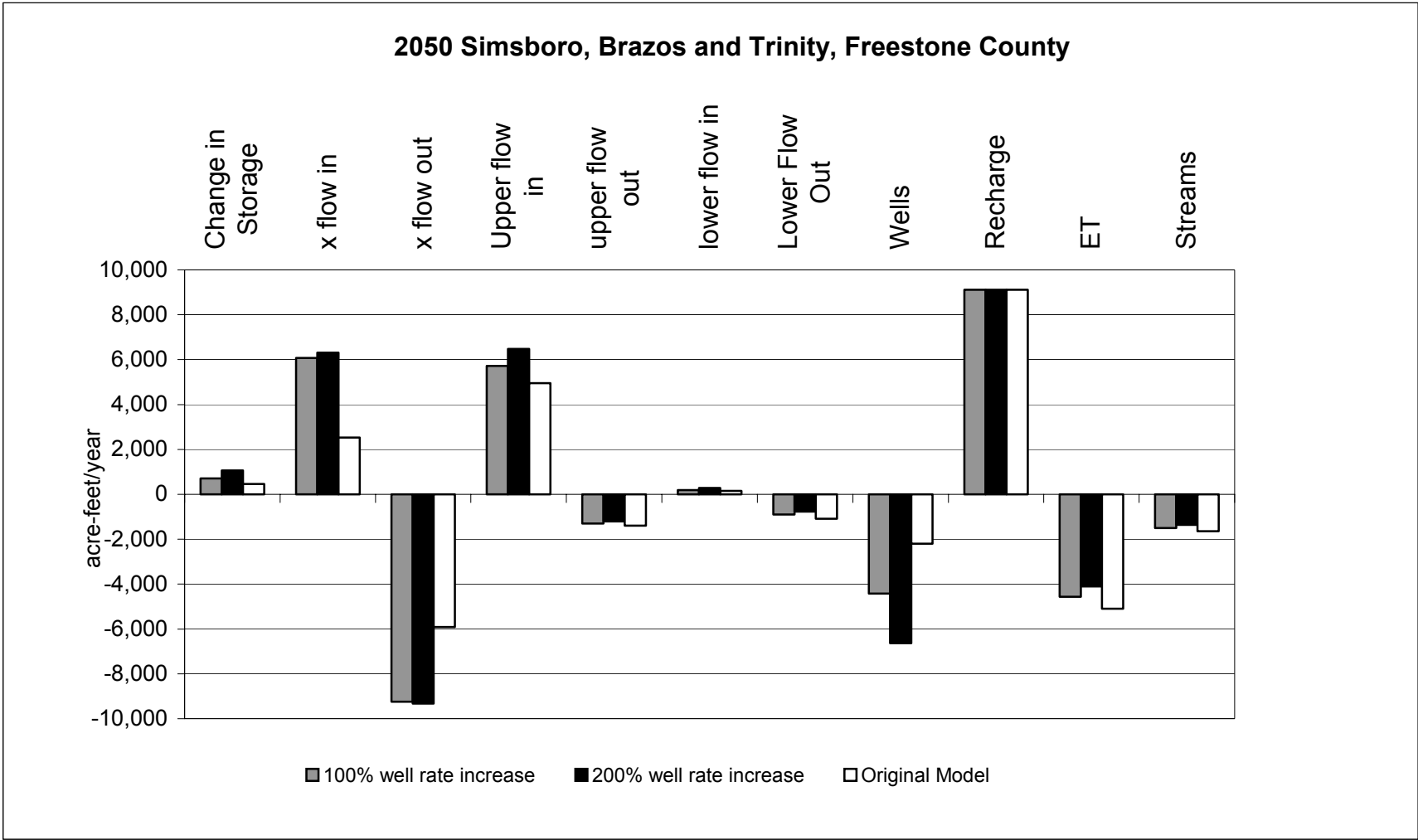


Figure 18. Water budget comparison for 2050 in the Simsboro aquifer, Freestone County.

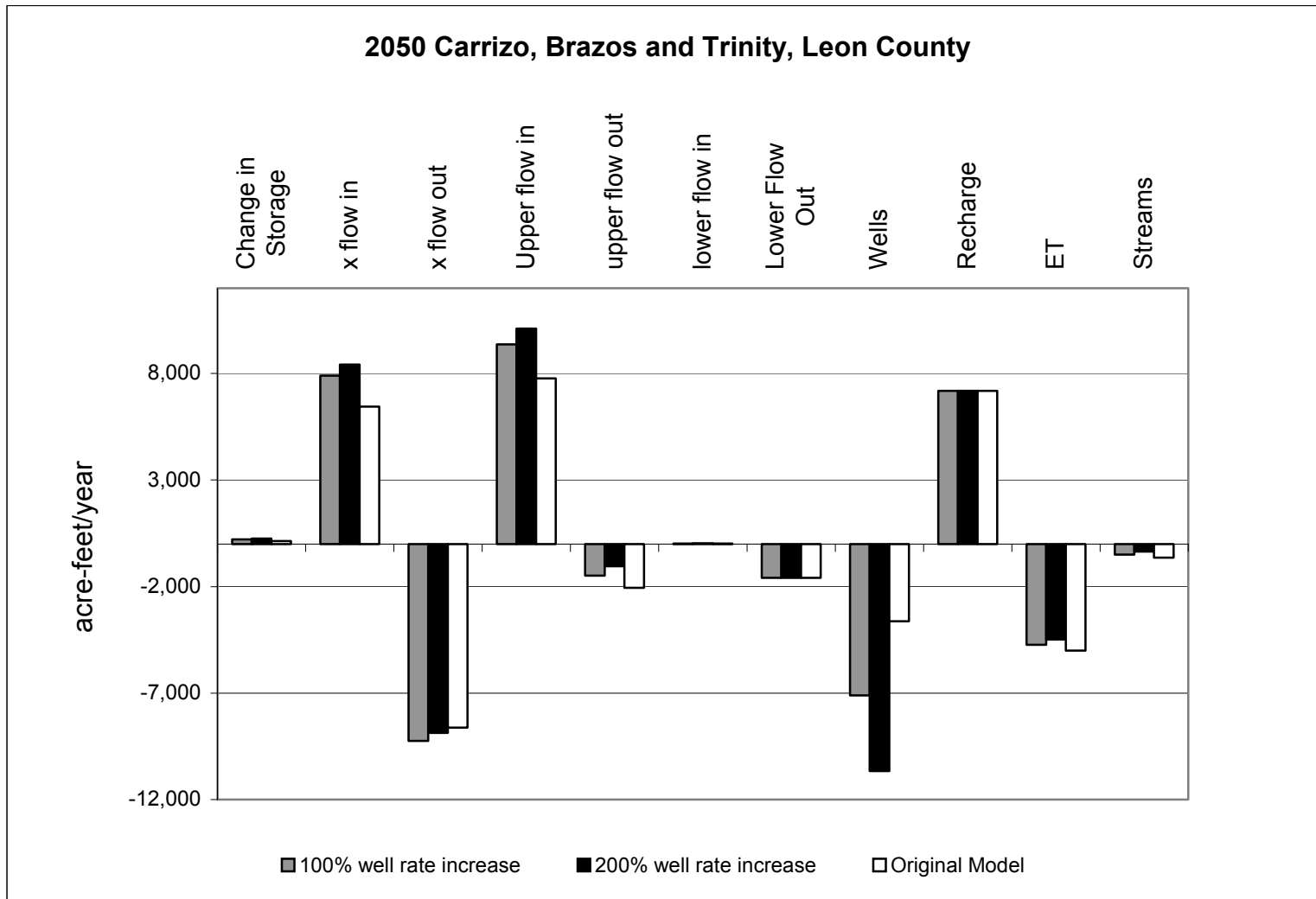


Figure 19. Water budget comparison for 2050 in the Carrizo aquifer, Leon County.

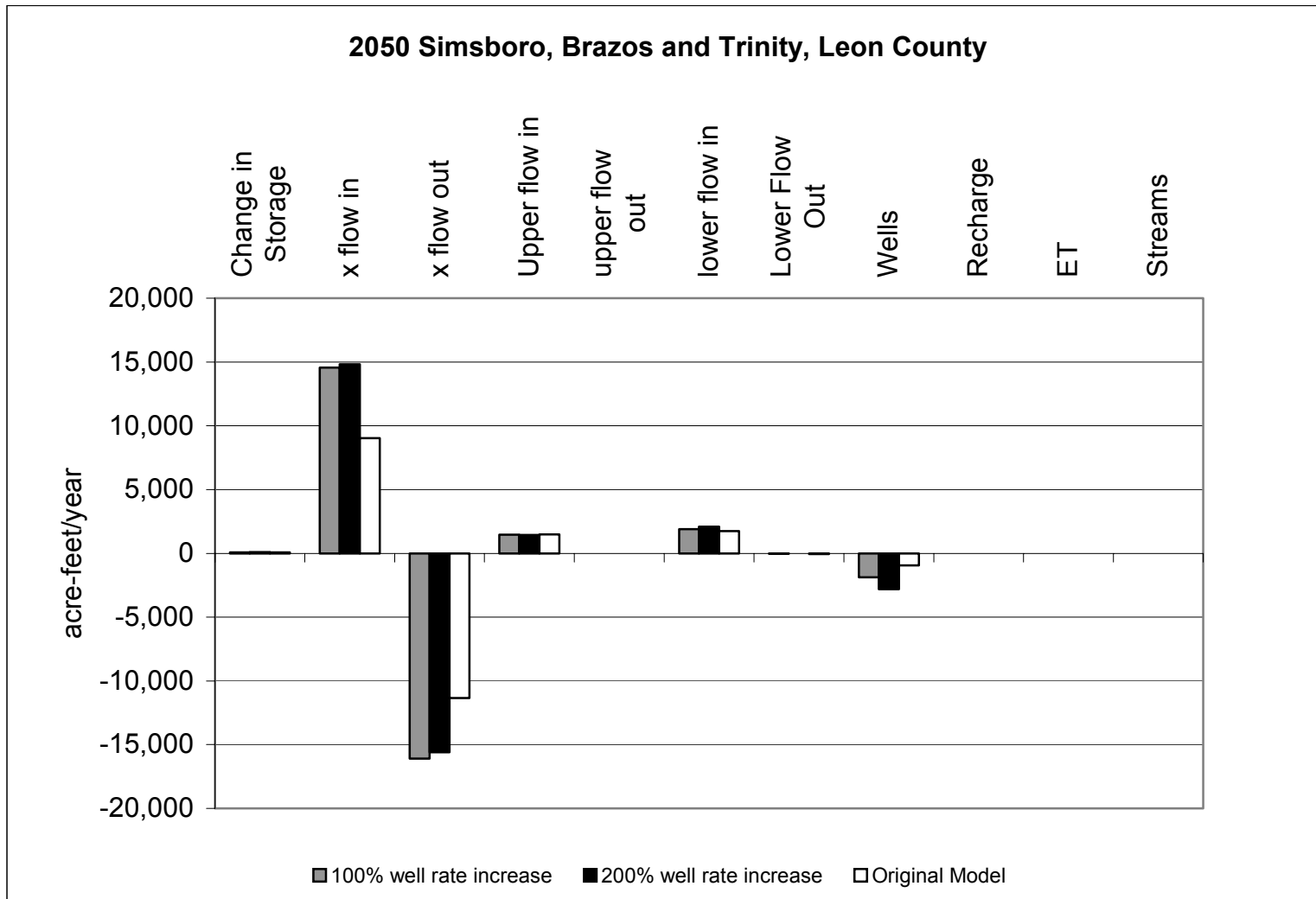


Figure 20. Water budget comparison for 2050 in the Simsboro aquifer, Freestone County.

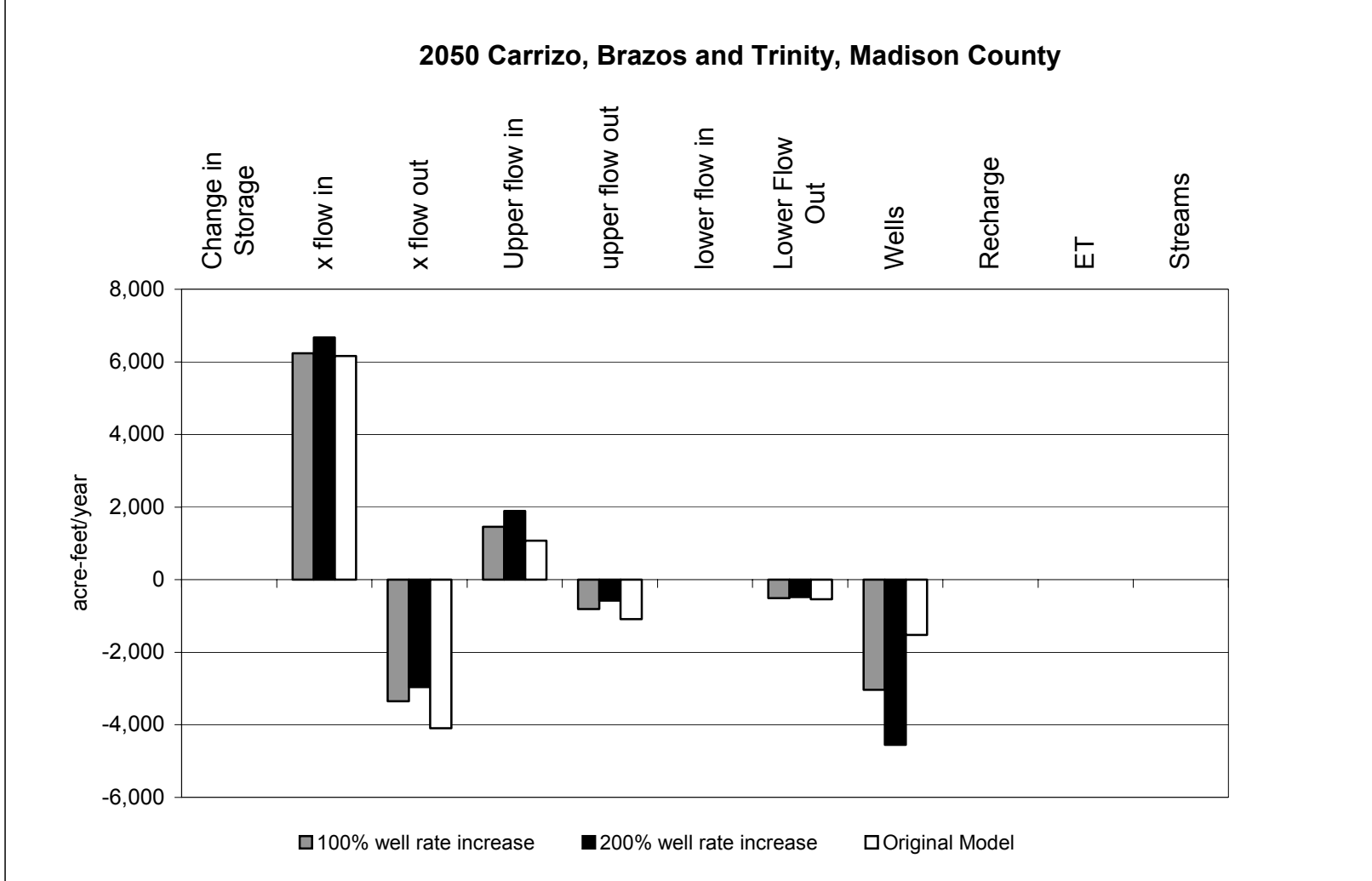


Figure 21. Water budget comparison for 2050 in the Carrizo aquifer, Madison County.

Table 2. Selected Water Budget Terms for 2020 and 2050. Original model with average recharge.

County	Basin	layer	2020 Change in Storage	2050 Change in Storage	2020 wells	2050 wells	2020 recharge	2050 recharge	2020 stream out	2050 stream out
Freestone	Trinity	3	161	102	-198	-193	13,929	13,929	-2,012	-1,985
Freestone	Trinity	4	2,055	1,933	-399	-388	8,345	8,345	-1,781	-1,638
Freestone	Trinity	5	416	311	-1,684	-1,761	6,425	6,425	-653	-639
Freestone	Trinity	6	<u>356</u>	351	<u>-417</u>	-447	<u>2,833</u>	2,833	<u>-1,515</u>	-1,462
TOTAL			2,988	2,697	-2,699	-2,789	31,533	31,533	-5,960	-5,724
Freestone	Brazos	3	1	0	0	0	194	194	0	0
Freestone	Brazos	4	546	599	-40	-40	1,824	1,824	-32	-29
Freestone	Brazos	5	222	153	-447	-448	2,686	2,686	-1,153	-1,006
Freestone	Brazos	6	<u>352</u>	365	<u>-49</u>	-49	<u>716</u>	716	<u>0</u>	0
TOTAL			1,121	1,117	-537	-536	5,421	5,421	-1,185	-1,035
Leon	Trinity	3	31	22	-2,325	-2,484	1,557	1,557	0	0
Leon	Trinity	4	94	87	-591	-711	0	0	0	0
Leon	Trinity	5	60	55	-735	-869	0	0	0	0
Leon	Trinity	6	<u>45</u>	41	<u>0</u>	0	<u>0</u>	0	<u>0</u>	0
TOTAL			230	204	-3,651	-4,064	1,557	1,557	0	0
Leon	Brazos	3	102	110	-1,163	-1,071	5,625	5,625	-575	-641
Leon	Brazos	4	647	613	-220	-236	998	998	-524	-464
Leon	Brazos	5	29	27	-62	-69	0	0	0	0
Leon	Brazos	6	<u>25</u>	23	<u>0</u>	0	<u>0</u>	0	<u>0</u>	0
TOTAL			803	772	-1,445	-1,377	6,623	6,623	-1,099	-1,106
Madison	Trinity	3	2	2	-1,586	-1,437	0	0	0	0
Madison	Trinity	4	22	20	0	0	0	0	0	0
Madison	Trinity	5	33	31	0	0	0	0	0	0
Madison	Trinity	6	<u>26</u>	24	<u>0</u>	0	<u>0</u>	0	<u>0</u>	0
TOTAL			83	77	-1,586	-1,437	0	0	0	0
Madison	Brazos	3	1	1	-83	-80	0	0	0	0
Madison	Brazos	4	6	6	0	0	0	0	0	0
Madison	Brazos	5	9	9	0	0	0	0	0	0
Madison	Brazos	6	<u>6</u>	6	<u>0</u>	0	<u>0</u>	0	<u>0</u>	0
TOTAL			23	21	-83	-80	0	0	0	0

- Notes
1. All budget values are in acre-feet/year. Positive values are input to the model. Negative values are discharge out of the model.
 2. Layer 3 = Carrizo aquifer, Layer 4 = Calvert Bluff aquifer, Layer 5 = Simsboro aquifer, Layer 6 = Hooper aquifer
 3. Change in storage is the yearly volume of water coming out of storage (positive value) as input to the budget.
 4. Recharge is for average conditions.

Table 3. Selected Water Budget Terms for 2020 and 2050. 100 per cent increase in well discharge.

County	Basin	Layer	2020 Storage Change	2050 Storage Change	2020 wells	2050 wells	2020 recharge	2050 recharge	2020 stream out	2050 stream out
Freestone	Trinity	3	251	136	-397	-385	13,929	13,929	-1,986	-1,947
Freestone	Trinity	4	3,032	2,753	-799	-777	8,345	8,345	-1,733	-1,545
Freestone	Trinity	5	766	497	-3,368	-3,522	6,425	6,425	-643	-623
Freestone	Trinity	6	<u>531</u>	<u>475</u>	<u>-834</u>	<u>-893</u>	<u>2,833</u>	<u>2,833</u>	<u>-1,482</u>	<u>-1,402</u>
TOTAL			4,580	3,862	-5,398	-5,578	31,533	31,533	-5,843	-5,517
Freestone	Brazos	3	1	0	-1	-1	194	194	0	0
Freestone	Brazos	4	703	750	-81	-80	1,820	1,824	-31	-28
Freestone	Brazos	5	364	206	-895	-896	2,690	2,686	-1,060	-877
Freestone	Brazos	6	<u>434</u>	<u>438</u>	<u>-99</u>	<u>-98</u>	<u>716</u>	<u>716</u>	<u>0</u>	<u>0</u>
TOTAL			1,502	1,394	-1,075	-1,075	5,420	5,421	-1,091	-906
Leon	Trinity	3	53	31	-4,651	-4,967	1,557	1,557	0	0
Leon	Trinity	4	114	102	-1,181	-1,423	0	0	0	0
Leon	Trinity	5	63	57	-1,469	-1,739	0	0	0	0
Leon	Trinity	6	<u>47</u>	<u>42</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			277	232	-7,301	-8,129	1,557	1,557	0	0
Leon	Brazos	3	189	178	-2,330	-2,143	5,630	5,625	-360	-499
Leon	Brazos	4	868	794	-440	-471	998	998	-511	-437
Leon	Brazos	5	30	28	-124	-139	0	0	0	0
Leon	Brazos	6	<u>25</u>	<u>23</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			1,113	1,023	-2,894	-2,753	6,628	6,623	-871	-936
Madison	Trinity	3	2	2	-3,173	-2,875	0	0	0	0
Madison	Trinity	4	22	21	0	0	0	0	0	0
Madison	Trinity	5	33	32	0	0	0	0	0	0
Madison	Trinity	6	<u>26</u>	<u>24</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			83	79	-3,173	-2,875	0	0	0	0
Madison	Brazos	3	1	1	-167	-159	0	0	0	0
Madison	Brazos	4	6	6	0	0	0	0	0	0
Madison	Brazos	5	9	9	0	0	0	0	0	0
Madison	Brazos	6	<u>6</u>	<u>6</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			23	21	-167	-159	0	0	0	0

- Notes
1. All budget values are in acre-feet/year. Positive values are input to the model. Negative values are discharge out of the model.
 2. Layer 3 = Carrizo aquifer, Layer 4 = Calvert Bluff aquifer, Layer 5 = Simsboro aquifer, Layer 6 = Hooper aquifer
 3. Change in storage is the yearly volume of water coming out of storage (positive value) as input to the budget.
 4. Recharge is for average conditions.
 5. Well discharge is 100 per cent (increased by a factor of 2) greater than the discharge specified in the original model.

Table 4. Selected Water Budget Terms for 2020 and 2050. 200 per cent increase in well discharge.

County	Basin	Layer	2020 Storage Change	2050 Storage Change	2020 wells	2050 wells	2020 recharge	2050 recharge	2020 stream out	2050 stream out
Freestone	Trinity	3	340	173	-595	-578	13929	13929	-1960	-1910
Freestone	Trinity	4	4017	3593	-1198	-1165	8345	8345	-1686	-1454
Freestone	Trinity	5	1127	757	-5052	-5283	6425	6425	-633	-602
Freestone	Trinity	6	<u>712</u>	<u>628</u>	<u>-1251</u>	<u>-1340</u>	<u>2833</u>	<u>2833</u>	<u>-1447</u>	<u>-1343</u>
TOTAL			6,195	5,152	-8,096	-8,367	31,533	31,533	-5,725	-5,310
Freestone	Brazos	3	2	1	-1	-1	194	194	0	0
Freestone	Brazos	4	856	892	-121	-120	1824	1824	-31	-28
Freestone	Brazos	5	533	307	-1342	-1344	2686	2686	-979	-755
Freestone	Brazos	6	<u>514</u>	<u>515</u>	<u>-148</u>	<u>-146</u>	<u>716</u>	<u>716</u>	<u>0</u>	<u>0</u>
TOTAL			1,905	1,714	-1,613	-1,612	5,421	5,421	-1,010	-783
Leon	Trinity	3	74	45	-6976	-7451	1557	1557	0	0
Leon	Trinity	4	133	151	-1772	-2134	0	0	0	0
Leon	Trinity	5	66	59	-2204	-2608	0	0	0	0
Leon	Trinity	6	<u>49</u>	<u>43</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			322	298	-10,952	-12,193	1,557	1,557	0	0
Leon	Brazos	3	360	232	-3489	-3214	5625	5625	-157	-352
Leon	Brazos	4	1102	957	-660	-707	998	998	-498	-410
Leon	Brazos	5	31	28	-186	-208	0	0	0	0
Leon	Brazos	6	<u>26</u>	<u>24</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			1,519	1,241	-4,335	-4,130	6,623	6,623	-655	-762
Madison	Trinity	3	2	2	-4759	-4312	0	0	0	0
Madison	Trinity	4	22	21	0	0	0	0	0	0
Madison	Trinity	5	34	32	0	0	0	0	0	0
Madison	Trinity	6	<u>26</u>	<u>25</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			84	80	-4,759	-4,312	0	0	0	0
Madison	Brazos	3	1	1	-250	-239	0	0	0	0
Madison	Brazos	4	6	6	0	0	0	0	0	0
Madison	Brazos	5	9	9	0	0	0	0	0	0
Madison	Brazos	6	<u>6</u>	<u>6</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			23	22	-250	-239	0	0	0	0

- Notes
1. All budget values are in acre-feet/year. Positive values are input to the model. Negative values are discharge out of the model.
 2. Layer 3 = Carrizo aquifer, Layer 4 = Calvert Bluff aquifer, Layer 5 = Simsboro aquifer, Layer 6 = Hooper aquifer
 3. Change in storage is the yearly volume of water coming out of storage (positive value) as input to the budget.
 4. Recharge is for average conditions.
 5. Well discharge is 200 per cent (increased by a factor of 3) greater than the discharge specified in the original model.

Table 5. Water budget for 2020. 100 per cent increase in well discharge. Average recharge conditions.

County	Basin	Layer	Change in Storage	x flow in	x flow out	upper flow in	upper flow out	lower flow in	lower flow out	wells	recharge	ET	ghb in	ghb out	stream in	stream out	Reser-voir
Freestone	Trinity	3	251	1,066	-3,559	864	-2,681	1,625	-221	-397	13,929	-8,893	0	0	0	-1,986	0
Freestone	Trinity	4	3,032	905	-1,973	221	-1,625	1,394	-3,860	-799	8,345	-4,037	0	0	0	-1,733	129
Freestone	Trinity	5	766	2,984	-3,728	3,860	-1,394	252	-573	-3,368	6,425	-4,711	0	0	0	-643	130
Freestone	Trinity	6	<u>531</u>	<u>2,621</u>	<u>-2,857</u>	<u>573</u>	<u>-252</u>	<u>0</u>	<u>0</u>	<u>-834</u>	<u>2,833</u>	<u>-1,133</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>-1,482</u>	<u>0</u>
TOTAL			4,580	7,576	-12,117	5,518	-5,951	3,270	-4,654	-5,398	31,533	-18,773	0	0	0	-5,843	259
Freestone	Brazos	3	1	0	-194	0	0	0	-1	-1	194	0	0	0	0	0	0
Freestone	Brazos	4	703	182	-1,150	1	0	11	-1,400	-81	1,820	-63	0	0	0	-31	0
Freestone	Brazos	5	364	2,630	-4,550	1,400	-11	6	-165	-895	2,690	-401	0	0	0	-1,060	0
Freestone	Brazos	6	<u>434</u>	<u>1,420</u>	<u>-2,630</u>	<u>165</u>	<u>-6</u>	<u>0</u>	<u>0</u>	<u>-99</u>	<u>716</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			1,502	4,232	-8,524	1,566	-17	17	-1,566	-1,075	5,420	-464	0	0	0	-1,091	0
Leon	Trinity	3	53	5,693	-5,976	6,782	-1,551	94	-638	-4,651	1,557	-1,362	0	0	0	0	0
Leon	Trinity	4	114	2,665	-1,798	638	-94	10	-355	-1,181	0	0	0	0	0	0	0
Leon	Trinity	5	63	5,591	-5,575	355	-10	1,057	-10	-1,469	0	0	0	0	0	0	0
Leon	Trinity	6	<u>47</u>	<u>4,476</u>	<u>-3,476</u>	<u>10</u>	<u>-1,057</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			277	18,424	-16,826	7,786	-2,712	1,161	-1,003	-7,301	1,557	-1,362	0	0	0	0	0
Leon	Brazos	3	189	2,200	-3,280	2,030	-136	1	-547	-2,330	5,630	-3,400	0	0	0	-360	0
Leon	Brazos	4	868	1,520	-1,960	547	-1	0	-588	-440	998	-781	0	0	33	-511	315
Leon	Brazos	5	30	5,880	-7,080	588	0	700	-1	-124	0	0	0	0	0	0	0
Leon	Brazos	6	<u>25</u>	<u>3,460</u>	<u>-2,790</u>	<u>1</u>	<u>-700</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			1,113	13,060	-15,110	3,166	-837	701	-1,136	-2,894	6,628	-4,181	0	0	33	-871	315
Madison	Trinity	3	2	5,202	-1,966	969	-878	9	-166	-3,173	0	0	0	0	0	0	0
Madison	Trinity	4	22	956	-720	166	-9	0	-415	0	0	0	0	0	0	0	0
Madison	Trinity	5	33	3,904	-4,885	415	0	533	0	0	0	0	0	0	0	0	0
Madison	Trinity	6	<u>26</u>	<u>2,627</u>	<u>-2,119</u>	<u>0</u>	<u>-533</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			83	12,689	-9,691	1,550	-1,420	543	-580	-3,173	0	0	0	0	0	0	0
Madison	Brazos	3	1	1,280	-1,360	367	0	0	-124	-167	0	0	0	0	0	0	0
Madison	Brazos	4	6	532	-471	124	0	0	-192	0	0	0	0	0	0	0	0
Madison	Brazos	5	9	4,880	-5,300	192	0	219	0	0	0	0	0	0	0	0	0
Madison	Brazos	6	<u>6</u>	<u>1,190</u>	<u>-978</u>	<u>0</u>	<u>-219</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			23	7,882	-8,109	683	-219	219	-316	-167	0	0	0	0	0	0	0

- All budget values are in acre-feet/year. Positive values are input to the model. Negative values are discharge out of the model.
- Layer 3 = Carrizo aquifer, Layer 4 = Calvert Bluff aquifer, Layer 5 = Simsboro aquifer, Layer 6 = Hooper aquifer
- Change in storage is the yearly volume of water coming out of storage (positive value) as input to the budget.
- x flow in is the volume of water entering the model from updip. X flow out is the amount of water exiting the downdip model boundary.
- Upper flow in is the rate of water entering the layer from the layer above. Upper flow out is the discharge rate upward to the next layer.
- Lower flow in is the rate of water entering the layer from the layer below. Lower flow out is the discharge rate downward to the next layer.
- Recharge is for average conditions. 8. Well discharge is 100 per cent (increased by a factor of 2) greater than the discharge specified in the original model.
- ghb = budget term representing flow into or out of the Recklaw confining layer imposed by model boundary conditions.
- Reservoir is input to the model from surface reservoirs or lakes.

Table 6. Water budget for 2020. 200 per cent increase in well discharge. Average recharge conditions.

County	Basin	Layer	Change in Storage	x flow in	x flow out	upper flow in	upper flow out	lower flow in	lower flow out	wells	recharge	ET	ghb in	ghb out	stream in	stream out	Reser-voir
Freestone	Trinity	3	340	1088	-3794	947	-2611	1595	-241	-595	13929	-8699	0	0	0	-1960	0
Freestone	Trinity	4	4017	915	-2209	241	-1595	1303	-4491	-1198	8345	-3774	0	0	0	-1686	131
Freestone	Trinity	5	1127	3114	-3724	4491	-1303	348	-496	-5052	6425	-4427	0	0	0	-633	130
Freestone	Trinity	6	<u>712</u>	<u>2717</u>	<u>-2695</u>	<u>496</u>	<u>-348</u>	<u>0</u>	<u>0</u>	<u>-1251</u>	<u>2833</u>	<u>-1017</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>-1447</u>	<u>0</u>
TOTAL			6,195	7,834	-12,422	6,175	-5,857	3,247	-5,228	-8,096	31,533	-17,917	0	0	0	-5,725	261
Freestone	Brazos	3	2	0	-194	0	0	0	-1	-1	194	0	0	0	0	0	0
Freestone	Brazos	4	856	192	-1179	1	0	10	-1495	-121	1824	-57	0	0	0	-31	0
Freestone	Brazos	5	533	2725	-4615	1495	-10	9	-152	-1342	2686	-349	0	0	0	-979	0
Freestone	Brazos	6	<u>514</u>	<u>1468</u>	<u>-2694</u>	<u>152</u>	<u>-9</u>	<u>0</u>	<u>0</u>	<u>-148</u>	<u>716</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			1,905	4,385	-8,681	1,648	-19	19	-1,648	-1,613	5,421	-406	0	0	0	-1,010	0
Leon	Trinity	3	74	5920	-5633	7998	-1116	111	-641	-6976	1557	-1293	0	0	0	0	0
Leon	Trinity	4	133	3079	-1642	641	-111	13	-342	-1772	0	0	0	0	0	0	0
Leon	Trinity	5	66	5822	-5208	342	-13	1198	-3	-2204	0	0	0	0	0	0	0
Leon	Trinity	6	<u>49</u>	<u>4451</u>	<u>-3305</u>	<u>3</u>	<u>-1198</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			322	19,272	-15,788	8,985	-2,439	1,322	-987	-10,952	1,557	-1,293	0	0	0	0	0
Leon	Brazos	3	360	2533	-3381	2362	-109	4	-531	-3489	5625	-3216	0	0	0	-157	0
Leon	Brazos	4	1102	1581	-2065	531	-4	0	-588	-660	998	-746	0	0	33	-498	315
Leon	Brazos	5	31	5868	-7027	588	0	726	0	-186	0	0	0	0	0	0	0
Leon	Brazos	6	<u>26</u>	<u>3463</u>	<u>-2763</u>	<u>0</u>	<u>-726</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			1,519	13,445	-15,236	3,481	-840	730	-1,119	-4,335	6,623	-3,961	0	0	33	-655	315
Madison	Trinity	3	2	5538	-1363	1336	-633	16	-137	-4759	0	0	0	0	0	0	0
Madison	Trinity	4	22	896	-633	137	-16	0	-406	0	0	0	0	0	0	0	0
Madison	Trinity	5	34	3842	-4819	406	0	536	0	0	0	0	0	0	0	0	0
Madison	Trinity	6	<u>26</u>	<u>2564</u>	<u>-2054</u>	<u>0</u>	<u>-536</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			84	12,840	-8,868	1,880	-1,185	552	-543	-4,759	0	0	0	0	0	0	0
Madison	Brazos	3	1	1479	-1544	434	0	0	-119	-250	0	0	0	0	0	0	0
Madison	Brazos	4	6	495	-432	119	0	0	-190	0	0	0	0	0	0	0	0
Madison	Brazos	5	9	4826	-5243	190	0	218	0	0	0	0	0	0	0	0	0
Madison	Brazos	6	<u>6</u>	<u>1163</u>	<u>-950</u>	<u>0</u>	<u>-218</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			23	7,962	-8,169	742	-218	218	-309	-250	0	0	0	0	0	0	0

1. All budget values are in acre-feet/year. Positive values are input to the model. Negative values are discharge out of the model.
2. Layer 3 = Carrizo aquifer, Layer 4 = Calvert Bluff aquifer, Layer 5 = Simsboro aquifer, Layer 6 = Hooper aquifer
3. Change in storage is the yearly volume of water coming out of storage (positive value) as input to the budget.
4. x flow in is the volume of water entering the model from updip. X flow out is the amount of water exiting the downdip model boundary.
5. Upper flow in is the rate of water entering the layer from the layer above. Upper flow out is the discharge rate upward to the next layer.
6. Lower flow in is the rate of water entering the layer from the layer below. Lower flow out is the discharge rate downward to the next layer.
7. Recharge is for average conditions. 8. Well discharge is 200 per cent (increased by a factor of 3) greater than the discharge specified in the original model.
9. ghb = budget term representing flow into or out of the Recklaw confining layer imposed by model boundary conditions.
10. Reservoir is input to the model from surface reservoirs or lakes.

Table 7. Water Budget for 2050. 100 per cent increase in well discharge. Average recharge conditions.

County	Basin	Layer	Change in Storage	x flow in	x flow out	upper flow in	upper flow out	lower flow in	lower flow out	wells	recharge	ET	ghb in	ghb out	stream in	stream out	Reservoir
Freestone	Trinity	3	136	1,045	-3,631	891	-2,551	1,513	-283	-385	13,929	-8,717	0	0	0	-1,947	0
Freestone	Trinity	4	2,753	854	-2,208	283	-1,513	1,295	-4,235	-777	8,345	-3,387	0	0	0	-1,545	134
Freestone	Trinity	5	497	3,113	-4,191	4,235	-1,295	189	-696	-3,522	6,425	-4,264	0	0	0	-623	131
Freestone	Trinity	6	475	2,828	-3,399	696	-189	0	0	-893	2,833	-949	0	0	0	-1,402	0
TOTAL			3,862	7,841	-13,428	6,105	-5,547	2,996	-5,214	-5,578	31,533	-17,317	0	0	0	-5,517	265
Freestone	Brazos	3	0	0	-193	0	0	0	-1	-1	194	0	0	0	0	0	0
Freestone	Brazos	4	750	202	-1,144	1	0	7	-1,492	-80	1,824	-39	0	0	0	-28	0
Freestone	Brazos	5	206	2,957	-5,058	1,492	-7	4	-207	-896	2,686	-300	0	0	0	-877	0
Freestone	Brazos	6	438	1,561	-2,820	207	-4	0	0	-98	716	0	0	0	0	0	0
TOTAL			1,394	4,720	-9,215	1,699	-11	11	-1,699	-1,075	5,421	-339	0	0	0	-906	0
Leon	Trinity	3	31	5,712	-6,009	7,230	-1,355	22	-911	-4,967	1,557	-1,310	0	0	0	0	0
Leon	Trinity	4	102	3,047	-1,969	911	-22	3	-649	-1,423	0	0	0	0	0	0	0
Leon	Trinity	5	57	7,093	-7,152	649	-3	1,114	-19	-1,739	0	0	0	0	0	0	0
Leon	Trinity	6	42	5,767	-4,714	19	-1,114	0	0	0	0	0	0	0	0	0	0
TOTAL			232	21,619	-19,844	8,810	-2,494	1,139	-1,580	-8,129	1,557	-1,310	0	0	0	0	0
Leon	Brazos	3	178	2,185	-3,240	2,128	-125	0	-681	-2,143	5,625	-3,427	0	0	0	-499	0
Leon	Brazos	4	794	1,715	-2,163	681	0	0	-815	-471	998	-654	0	0	33	-437	319
Leon	Brazos	5	28	7,465	-8,954	815	0	788	-3	-139	0	0	0	0	0	0	0
Leon	Brazos	6	23	4,295	-3,533	3	-788	0	0	0	0	0	0	0	0	0	0
TOTAL			1,023	15,660	-17,890	3,628	-913	788	-1,499	-2,753	6,623	-4,081	0	0	33	-936	319
Madison	Trinity	3	2	5,012	-2,054	1,052	-804	0	-331	-2,875	0	0	0	0	0	0	0
Madison	Trinity	4	21	1,241	-963	331	0	0	-629	0	0	0	0	0	0	0	0
Madison	Trinity	5	32	5,363	-6,658	629	0	634	0	0	0	0	0	0	0	0	0
Madison	Trinity	6	24	3,746	-3,136	0	-634	0	0	0	0	0	0	0	0	0	0
TOTAL			79	15,361	-12,812	2,012	-1,438	634	-961	-2,875	0	0	0	0	0	0	0
Madison	Brazos	3	1	1,224	-1,297	408	0	0	-176	-159	0	0	0	0	0	0	0
Madison	Brazos	4	6	674	-589	176	0	0	-268	0	0	0	0	0	0	0	0
Madison	Brazos	5	9	6,350	-6,898	268	0	272	0	0	0	0	0	0	0	0	0
Madison	Brazos	6	6	1,672	-1,407	0	-272	0	0	0	0	0	0	0	0	0	0
TOTAL			21	9,921	-10,191	852	-272	272	-445	-159	0	0	0	0	0	0	0

1. All budget values are in acre-feet/year. Positive values are input to the model. Negative values are discharge out of the model.
2. Layer 3 = Carrizo aquifer, Layer 4 = Calvert Bluff aquifer, Layer 5 = Simsboro aquifer, Layer 6 = Hooper aquifer
3. Change in storage is the yearly volume of water coming out of storage (positive value) as input to the budget.
4. x flow in is the volume of water entering the model from updip. X flow out is the amount of water exiting the downdip model boundary.
5. Upper flow in is the rate of water entering the layer from the layer above. Upper flow out is the discharge rate upward to the next layer.
- 6 Lower flow in is the rate of water entering the layer from the layer below. Lower flow out is the discharge rate downward to the next layer.
7. Recharge is for average conditions. 8. Well discharge is 100 per cent (increased by a factor of 2) greater than the discharge specified in the original model.
9. ghb = budget term representing flow into or out of the Recklaw confining layer imposed by model boundary conditions.
10. Reservoir is input to the model from surface reservoirs or lakes.

Table 8. Water Budget for 2050. 200 per cent increase in well discharge. Average recharge conditions.

County	Basin	Layer	Change in Storage	x flow in	x flow out	upper flow in	upper flow out	lower flow in	lower flow out	wells	recharge	ET	ghb in	ghb out	stream in	stream out	Reser-voir
Freestone	Trinity	3	173	1054	-3855	980	-2458	1463	-312	-578	13929	-8487	0	0	0	-1910	0
Freestone	Trinity	4	3593	863	-2491	312	-1463	1195	-4898	-1165	8345	-2974	0	0	0	-1454	138
Freestone	Trinity	5	757	3268	-4221	4898	-1195	278	-580	-5283	6425	-3878	0	0	0	-602	131
Freestone	Trinity	6	<u>628</u>	<u>2951</u>	<u>-3208</u>	<u>580</u>	<u>-278</u>	<u>0</u>	<u>0</u>	<u>-1340</u>	<u>2833</u>	<u>-822</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>-1343</u>	<u>0</u>
TOTAL			5,152	8,135	-13,775	6,769	-5,395	2,936	-5,789	-8,367	31,533	-16,161	0	0	0	-5,310	269
Freestone	Brazos	3	1	0	-193	0	0	0	-1	-1	194	0	0	0	0	0	0
Freestone	Brazos	4	892	221	-1180	1	0	5	-1583	-120	1824	-31	0	0	0	-28	0
Freestone	Brazos	5	307	3042	-5102	1583	-5	7	-191	-1344	2686	-228	0	0	0	-755	0
Freestone	Brazos	6	<u>515</u>	<u>1611</u>	<u>-2879</u>	<u>191</u>	<u>-7</u>	<u>0</u>	<u>0</u>	<u>-146</u>	<u>716</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			1,714	4,873	-9,354	1,774	-12	12	-1,774	-1,612	5,421	-259	0	0	0	-783	0
Leon	Trinity	3	45	5904	-5591	8605	-949	31	-929	-7451	1557	-1221	0	0	0	0	0
Leon	Trinity	4	151	3487	-1775	929	-31	7	-634	-2134	0	0	0	0	0	0	0
Leon	Trinity	5	59	7374	-6719	634	-7	1273	-6	-2608	0	0	0	0	0	0	0
Leon	Trinity	6	<u>43</u>	<u>5716</u>	<u>-4493</u>	<u>6</u>	<u>-1273</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			298	22,481	-18,578	10,174	-2,259	1,310	-1,569	-12,193	1,557	-1,221	0	0	0	0	0
Leon	Brazos	3	232	2518	-3285	2497	-98	0	-664	-3214	5625	-3258	0	0	0	-352	0
Leon	Brazos	4	957	1802	-2221	664	0	0	-812	-707	998	-625	0	0	33	-410	320
Leon	Brazos	5	28	7438	-8886	812	0	818	-1	-208	0	0	0	0	0	0	0
Leon	Brazos	6	<u>24</u>	<u>4285</u>	<u>-3492</u>	<u>1</u>	<u>-818</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			1,241	16,043	-17,883	3,974	-916	818	-1,477	-4,130	6,623	-3,883	0	0	33	-762	320
Madison	Trinity	3	2	5257	-1487	1416	-573	0	-302	-4312	0	0	0	0	0	0	0
Madison	Trinity	4	21	1166	-867	302	0	0	-622	0	0	0	0	0	0	0	0
Madison	Trinity	5	32	5289	-6580	622	0	636	0	0	0	0	0	0	0	0	0
Madison	Trinity	6	<u>25</u>	<u>3669</u>	<u>-3057</u>	<u>0</u>	<u>-636</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			80	15,381	-11,991	2,340	-1,209	636	-924	-4,312	0	0	0	0	0	0	0
Madison	Brazos	3	1	1413	-1477	475	0	0	-173	-239	0	0	0	0	0	0	0
Madison	Brazos	4	6	630	-543	173	0	0	-266	0	0	0	0	0	0	0	0
Madison	Brazos	5	9	6287	-6832	266	0	271	0	0	0	0	0	0	0	0	0
Madison	Brazos	6	<u>6</u>	<u>1634</u>	<u>-1369</u>	<u>0</u>	<u>-271</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
TOTAL			22	9,964	-10,221	913	-271	271	-438	-239	0	0	0	0	0	0	0

1. All budget values are in acre-feet/year. Positive values are input to the model. Negative values are discharge out of the model.
2. Layer 3 = Carrizo aquifer, Layer 4 = Calvert Bluff aquifer, Layer 5 = Simsboro aquifer, Layer 6 = Hooper aquifer
3. Change in storage is the yearly volume of water coming out of storage (positive value) as input to the budget.
4. x flow in is the volume of water entering the model from updip. X flow out is the amount of water exiting the downdip model boundary.
5. Upper flow in is the rate of water entering the layer from the layer above. Upper flow out is the discharge rate upward to the next layer.
6. Lower flow in is the rate of water entering the layer from the layer below. Lower flow out is the discharge rate downward to the next layer.
7. Recharge is for average conditions. 8. Well discharge is 200 per cent (increased by a factor of 3) greater than the discharge specified in the original model.
9. ghb = budget term representing flow into or out of the Recklaw confining layer imposed by model boundary conditions.
10. Reservoir is input to the model from surface reservoirs or lakes.

Table 9. Water budget for 2004. Original model. Average recharge conditions.

County	Basin	layer	Change in Storage	x flow in	x flow out	upper flow in	upper flow out	lower flow in	lower flow out	wells	recharge	et	ghb in	ghb out	stream in	stream out
Freestone	Trinity	3	380	1,080	-3,343	768	-2,828	1,721	-166	-204	13,929	-9,300	0	0	0	-2,037
Freestone	Trinity	4	2,090	932	-1,634	166	-1,721	1,585	-2,945	-442	8,345	-4,627	0	0	0	-1,874
Freestone	Trinity	5	465	2,831	-3,413	2,945	-1,585	257	-561	-1,607	6,425	-5,225	0	0	0	-662
Freestone	Trinity	6	391	2,451	-2,583	561	-257	0	0	-444	2,833	-1,401	0	0	0	-1,549
TOTAL			3,326	7,293	-10,973	4,440	-6,391	3,563	-3,672	-2,698	31,533	-20,553	0	0	0	-6,122
Freestone	Brazos	3	2	0	-195	0	0	0	-1	0	194	0	0	0	0	0
Freestone	Brazos	4	460	165	-1,100	1	0	17	-1,170	-42	1,824	-123	0	0	0	-33
Freestone	Brazos	5	374	2,200	-3,985	1,170	-17	6	-150	-459	2,686	-522	0	0	0	-1,303
Freestone	Brazos	6	308	1,234	-2,350	150	-6	0	0	-52	716	0	0	0	0	0
TOTAL			1,144	3,600	-7,631	1,320	-23	23	-1,320	-553	5,421	-644	0	0	0	-1,336
Leon	Trinity	3	76	5,571	-6,295	5,441	-2,271	171	-445	-2,331	1,557	-1,473	0	0	0	0
Leon	Trinity	4	106	2,061	-1,813	445	-171	73	-150	-551	0	0	0	0	0	0
Leon	Trinity	5	72	4,109	-4,217	150	-73	939	-14	-967	0	0	0	0	0	0
Leon	Trinity	6	64	3,342	-2,481	14	-939	0	0	0	0	0	0	0	0	0
TOTAL			319	15,082	-14,805	6,050	-3,454	1,182	-609	-3,849	1,557	-1,473	0	0	0	0
Leon	Brazos	3	971	1,894	-3,205	1,567	-188	1	-457	-1,857	5,625	-3,688	0	0	0	-664
Leon	Brazos	4	625	1,323	-1,656	457	-1	0	-354	-222	998	-955	0	0	33	-560
Leon	Brazos	5	34	4,346	-5,250	354	0	575	0	-59	0	0	0	0	0	0
Leon	Brazos	6	35	2,581	-2,042	0	-575	0	0	0	0	0	0	0	0	0
TOTAL			1,666	10,145	-12,152	2,379	-765	577	-812	-2,138	6,623	-4,643	0	0	33	-1,225
Madison	Trinity	3	4	5,026	-2,678	559	-1,264	49	-84	-1,611	0	0	0	0	0	0
Madison	Trinity	4	28	806	-657	84	-49	1	-213	0	0	0	0	0	0	0
Madison	Trinity	5	34	2,458	-3,132	213	-1	429	0	0	0	0	0	0	0	0
Madison	Trinity	6	36	1,537	-1,144	0	-429	0	0	0	0	0	0	0	0	0
TOTAL			102	9,826	-7,612	855	-1,743	479	-296	-1,611	0	0	0	0	0	0
Madison	Brazos	3	1	1,156	-1,248	256	0	0	-80	-85	0	0	0	0	0	0
Madison	Brazos	4	8	391	-359	80	0	0	-120	0	0	0	0	0	0	0
Madison	Brazos	5	8	3,405	-3,697	120	0	165	0	0	0	0	0	0	0	0
Madison	Brazos	6	8	733	-576	0	-165	0	0	0	0	0	0	0	0	0
TOTAL			25	5,685	-5,881	455	-165	165	-199	-85	0	0	0	0	0	0

1. All budget values are in acre-feet/year. Positive values are input to the model. Negative values are discharge out of the model.
2. Layer 3 = Carrizo aquifer, Layer 4 = Calvert Bluff aquifer, Layer 5 = Simsboro aquifer, Layer 6 = Hooper aquifer
3. Change in storage is the yearly volume of water coming out of storage (positive value) as input to the budget.
4. x flow in is the volume of water entering the model from updip. X flow out is the amount of water exiting the downdip model boundary.
5. Upper flow in is the rate of water entering the layer from the layer above. Upper flow out is the discharge rate upward to the next layer.
6. Lower flow in is the rate of water entering the layer from the layer below. Lower flow out is the discharge rate downward to the next layer.
7. Recharge is for average conditions
8. ghb = budget term representing flow into or out of the Recklaw confining layer imposed by model boundary conditions.

Table 10. Water Budget for 2020. Original model. Average recharge conditions.

County	Basin	layer	Change in Storage	x flow in	x flow out	upper flow in	upper flow out	lower flow in	lower flow out	wells	recharge	et	ghb in	ghb out	stream in	stream out
Freestone	Trinity	3	161	1,068	-3,344	786	-2,757	1,657	-201	-198	13,929	-9,089	0	0	0	-2,012
Freestone	Trinity	4	2,055	906	-1,752	201	-1,657	1,500	-3,235	-399	8,345	-4,309	0	0	0	-1,781
Freestone	Trinity	5	416	2,922	-3,792	3,235	-1,500	198	-693	-1,684	6,425	-5,005	0	0	0	-653
Freestone	Trinity	6	356	2,535	-3,029	693	-198	0	0	-417	2,833	-1,258	0	0	0	-1,515
TOTAL			2,988	7,432	-11,917	4,915	-6,112	3,355	-4,129	-2,699	31,533	-19,661	0	0	0	-5,960
Freestone	Brazos	3	1	0	-194	0	0	0	-1	0	194	0	0	0	0	0
Freestone	Brazos	4	546	172	-1,115	1	0	12	-1,299	-40	1,824	-70	0	0	0	-32
Freestone	Brazos	5	222	2,551	-4,518	1,299	-12	5	-179	-447	2,686	-453	0	0	0	-1,153
Freestone	Brazos	6	352	1,379	-2,573	179	-5	0	0	-49	716	0	0	0	0	0
TOTAL			1,121	4,103	-8,400	1,479	-17	17	-1,479	-537	5,421	-522	0	0	0	-1,185
Leon	Trinity	3	31	5,518	-6,355	5,675	-2,112	79	-634	-2,325	1,557	-1,433	0	0	0	0
Leon	Trinity	4	94	2,280	-1,976	634	-79	9	-372	-591	0	0	0	0	0	0
Leon	Trinity	5	60	5,391	-5,977	372	-9	933	-36	-735	0	0	0	0	0	0
Leon	Trinity	6	45	4,506	-3,654	36	-933	0	0	0	0	0	0	0	0	0
TOTAL			230	17,695	-17,962	6,717	-3,133	1,021	-1,042	-3,651	1,557	-1,433	0	0	0	0
Leon	Brazos	3	102	1,869	-3,206	1,677	-170	1	-568	-1,163	5,625	-3,591	0	0	0	-575
Leon	Brazos	4	647	1,472	-1,881	568	-1	0	-588	-220	998	-819	0	0	33	-524
Leon	Brazos	5	29	5,899	-7,128	588	0	675	-2	-62	0	0	0	0	0	0
Leon	Brazos	6	25	3,462	-2,813	2	-675	0	0	0	0	0	0	0	0	0
TOTAL			803	12,702	-15,027	2,835	-846	675	-1,158	-1,445	6,623	-4,411	0	0	33	-1,099
Madison	Trinity	3	2	4,921	-2,621	648	-1,171	6	-198	-1,586	0	0	0	0	0	0
Madison	Trinity	4	22	1,029	-820	198	-6	0	-423	0	0	0	0	0	0	0
Madison	Trinity	5	33	3,969	-4,956	423	0	530	0	0	0	0	0	0	0	0
Madison	Trinity	6	26	2,692	-2,187	0	-530	0	0	0	0	0	0	0	0	0
TOTAL			83	12,611	-10,584	1,269	-1,708	537	-621	-1,586	0	0	0	0	0	0
Madison	Brazos	3	1	1,090	-1,179	300	0	0	-129	-83	0	0	0	0	0	0
Madison	Brazos	4	6	570	-510	129	0	0	-195	0	0	0	0	0	0	0
Madison	Brazos	5	9	4,930	-5,353	195	0	219	0	0	0	0	0	0	0	0
Madison	Brazos	6	6	1,220	-1,007	0	-219	0	0	0	0	0	0	0	0	0
TOTAL			23	7,810	-8,050	624	-219	219	-324	-83	0	0	0	0	0	0

1. All budget values are in acre-feet/year. Positive values are input to the model. Negative values are discharge out of the model.
2. Layer 3 = Carrizo aquifer, Layer 4 = Calvert Bluff aquifer, Layer 5 = Simsboro aquifer, Layer 6 = Hooper aquifer
3. Change in storage is the yearly volume of water coming out of storage (positive value) as input to the budget.
4. x flow in is the volume of water entering the model from updip. X flow out is the amount of water exiting the downdip model boundary.
5. Upper flow in is the rate of water entering the layer from the layer above. Upper flow out is the discharge rate upward to the next layer.
6. Lower flow in is the rate of water entering the layer from the layer below. Lower flow out is the discharge rate downward to the next layer.
7. Recharge is for average conditions.
8. ghb = budget term representing flow into or out of the Recklaw confining layer imposed by model boundary conditions.

Table 11. Water budget for 2050. Original model. Average recharge conditions.

County	Basin	layer	Change in Storage	x flow in	x flow out	upper flow in	upper flow out	lower flow in	lower flow out	wells	recharge	et	ghb in	ghb out	stream in	stream out
Freestone	Trinity	3	102	1,055	-3,425	806	-2,649	1,564	-256	-193	13,929	-8,949	0	0	0	-1,985
Freestone	Trinity	4	1,933	856	-1,928	256	-1,564	1,408	-3,565	-388	8,345	-3,845	0	0	0	-1,638
Freestone	Trinity	5	311	3,032	-4,228	3,565	-1,408	149	-867	-1,761	6,425	-4,709	0	0	0	-639
Freestone	Trinity	6	351	2,726	-3,609	867	-149	0	0	-447	2,833	-1,111	0	0	0	-1,462
TOTAL			2,697	7,669	-13,190	5,493	-5,770	3,121	-4,687	-2,789	31,533	-18,613	0	0	0	-5,724
Freestone	Brazos	3	0	0	-194	0	0	0	-1	0	194	0	0	0	0	0
Freestone	Brazos	4	599	183	-1,109	1	0	9	-1,388	-40	1,824	-50	0	0	0	-29
Freestone	Brazos	5	153	2,896	-5,052	1,388	-9	3	-226	-448	2,686	-384	0	0	0	-1,006
Freestone	Brazos	6	365	1,514	-2,770	226	-3	0	0	-49	716	0	0	0	0	0
TOTAL			1,117	4,593	-9,124	1,615	-12	12	-1,615	-536	5,421	-434	0	0	0	-1,035
Leon	Trinity	3	22	5,557	-6,468	5,997	-1,902	14	-892	-2,484	1,557	-1,400	0	0	0	0
Leon	Trinity	4	87	2,590	-2,177	892	-14	0	-667	-711	0	0	0	0	0	0
Leon	Trinity	5	55	6,840	-7,614	667	0	981	-59	-869	0	0	0	0	0	0
Leon	Trinity	6	41	5,817	-4,936	59	-981	0	0	0	0	0	0	0	0	0
TOTAL			204	20,804	-21,195	7,615	-2,897	995	-1,618	-4,064	1,557	-1,400	0	0	0	0
Leon	Brazos	3	110	1,870	-3,204	1,764	-157	0	-697	-1,071	5,625	-3,597	0	0	0	-641
Leon	Brazos	4	613	1,642	-2,097	697	0	0	-819	-236	998	-683	0	0	33	-464
Leon	Brazos	5	27	7,495	-9,025	819	0	759	-5	-69	0	0	0	0	0	0
Leon	Brazos	6	23	4,305	-3,574	5	-759	0	0	0	0	0	0	0	0	0
TOTAL			772	15,312	-17,901	3,286	-915	759	-1,522	-1,377	6,623	-4,281	0	0	33	-1,106
Madison	Trinity	3	2	4,795	-2,650	731	-1,080	0	-360	-1,437	0	0	0	0	0	0
Madison	Trinity	4	20	1,327	-1,071	360	0	0	-637	0	0	0	0	0	0	0
Madison	Trinity	5	31	5,438	-6,737	637	0	632	0	0	0	0	0	0	0	0
Madison	Trinity	6	24	3,823	-3,215	0	-632	0	0	0	0	0	0	0	0	0
TOTAL			77	15,382	-13,674	1,728	-1,711	632	-997	-1,437	0	0	0	0	0	0
Madison	Brazos	3	1	1,064	-1,146	341	0	0	-180	-80	0	0	0	0	0	0
Madison	Brazos	4	6	719	-634	180	0	0	-271	0	0	0	0	0	0	0
Madison	Brazos	5	9	6,413	-6,965	271	0	272	0	0	0	0	0	0	0	0
Madison	Brazos	6	6	1,711	-1,445	0	-272	0	0	0	0	0	0	0	0	0
TOTAL			21	9,908	-10,190	791	-272	272	-451	-80	0	0	0	0	0	0

1. All budget values are in acre-feet/year. Positive values are input to the model. Negative values are discharge out of the model.
2. Layer 3 = Carrizo aquifer, Layer 4 = Calvert Bluff aquifer, Layer 5 = Simsboro aquifer, Layer 6 = Hooper aquifer
3. Change in storage is the yearly volume of water coming out of storage (positive value) as input to the budget.
4. x flow in is the volume of water entering the model from updip. X flow out is the amount of water exiting the downdip model boundary.
5. Upper flow in is the rate of water entering the layer from the layer above. Upper flow out is the discharge rate upward to the next layer.
6. Lower flow in is the rate of water entering the layer from the layer below. Lower flow out is the discharge rate downward to the next layer.
7. Recharge is for average conditions.
8. ghb = budget term representing flow into or out of the Recklaw confining layer imposed by model boundary conditions.