GAM run 03-12

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REQUESTOR:

Ms. Luana Buckner, Medina County Groundwater Conservation District

DESCRIPTION OF REQUEST:

Ms. Buckner requested the following information from the Hill Country Trinity and Southern Carrizo-Wilcox aquifer Groundwater Availability Models (GAM) for the Medina County Groundwater Conservation District (GCD):

- Water Budget,
- Storage information, and
- Water level drawdown to 2050.

METHODS:

To address the request, we:

- Ran the predictive (2000-2050) models for the Hill Country Trinity (Mace and others, 2001) and Southern Carrizo-Wilcox aquifer Groundwater Availability Models (Deeds and others, 2003) and queried the budget files for each aquifer layer in Medina County for a year with long-term average recharge and a year with drought of record recharge.
- Estimated storage by calculating layer thickness for each model cell (layer top elevation minus bottom elevation), multiplying by cell area (1 mi^2) and specific yield, and summing all of the model cells within Medina County.
- Extracted maps of predicted drawdown or water level decline for the period 2000-2050 from the final Southern Carrizo-Wilcox model report.
- Extracted water level drawdowns from 1997 to 2050 from the Trinity model results and created plots of drawdown.

PARAMETERS AND ASSUMPTIONS:

None: Data request.

RESULTS:

Recharge and Water budget

Table 1 shows the water budget in Medina County for the Southern Carrizo-Wilcox and Hill Country Trinity GAMs. The drought of record for the Trinity model was included in the last seven years of the 2050 run and the drought of record for the Carrizo-Wilcox model was included in the last three years of the 2050 run ending with February 2050. Therefore, the year with drought of record conditions for the Carrizo-Wilcox model was selected as 2049 and for the Trinity model was selected as 2050. The simulation year selected for average conditions for the Trinity model was 2043 and for the Carrizo-Wilcox model was 2045. It should be noted that in these budgets the recharge represents average conditions or drought of record conditions. However, the pumpage input during the predictive period is based on the Regional Water Planning Group predictions.

Recharge values from the model are marked in bold text in the table.

Aquifer Storage

The total volume of storage in Medina County for each layer in the Trinity aquifer model is shown in Table 2. The total volume of storage in Medina County for each layer in the Carrizo-Wilcox aquifer model is also shown in Table 2.

2050 Drawdown

Predicted water level declines from 1997 to 2050 in the Middle Trinity aquifer are shown in Figures 1 and 2 following drought conditions and average conditions respectively. Predicted water-level declines from 2000 to 2050 for the Carrizo and Lower Wilcox aquifers are shown in Figures 3 and 4, respectively. Drought of record conditions were used in the last three years of the model run for Figure 3 and 4. It should also be noted that in Figures 3 and 4 positive numbers indicate water level decline and negative numbers indicate water level rebound.

REFERENCES:

Deeds, N., Kelley, V., Fryar, D., and Jones, T., 2003, Groundwater Availability Model for the Southern Carrizo-Wilcox Aquifer: Final Report prepared for the Texas Water Development Board.

Mace, R. E., Chowdhury, A. H., Anaya, R., and Way, S.-C., 2000, Groundwater availability of the Middle Trinity aquifer, Hill Country area, Texas- Numerical simulations through 2050: Texas Water Development Board Report 353, 117 p.

Table 1. Medina County flow budget for the Hill Country Trinity and Southern Carrizo-Wilcox aquifer models in acre-feet per year.

Aquifer	Lyr	Storage	X-flow in	X-flow out	upper Z flow in	upper Z flow out	lower Z flow in	lower Z flow out	Wells	Recharge	ET	GHB	Streams	Total In	Total Out	% diff
Average Recharge Conditions																
Hill Country Trinity	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	-9	11,169	-5,621	0	0	34	-2,521	-1,185	15,955	0	-13,718	-4,104	21,503	-21,503	0
	3	203	14,933	-4,971	2,521	-34	0	0	-7,540	1,257	0	-6,392	0	13,909	-13,932	0
	All	194	26,102	-10,592	2,521	-34	34	-2,521	-8,724	**17,212**	0	-20,110	-4,104	35,403	-35,426	0
Carrizo-Wilcox	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	-3,634	1,180	-10,004	0	0	1,400	-271	-1,103	11,061	0	0	1,441	15,083	-15,011	0
	4	-343	22	-203	271	-1,400	1,039	-86	-26	655	0	0	0	1,987	-2,059	-4
	5	-3,598	271	-1,330	86	-1,039	269	-2,774	-478	9,165	-686	0	116	9,907	-9,904	0
	6	-2,997	543	-4,773	2,774	-269	0	0	-492	5,925	-602	0	-107	9,242	-9,241	0
	All	-10,573	2,016	-16,310	3,130	-2,709	2,709	-3,130	-2,099	**26,806**	-1,288	0	1,450	36,112	-36,108	0
Drought Conditions																
Hill Country Trinity	1	0	0	0	0	0	0	0	0	0		0	0	0	0	0
	2	810	6,300	-2,766	0	0	11	-1,587	-727	6,233	0	-5,878	-2,396	13,354	-13,353	0
	3	217	11,196	-4,633	1,587	-11	0	0	-5,033	819	0	-4,143	0	13,819	-13,820	0
	All	1,028	17,496	-7,400	1,587	-11	11	-1,587	-5,760	**7,052**	0	-10,021	-2,396	27,173	-27,173	0
Carrizo-Wilcox	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	6,278	1,127	-9,146	0	0	1,474	-190	-1,119	1,378	0	0	301	10,559	-10,455	1
	4	402	22	-199	190	-1,474	1,064	-86	-27	5	0	0	0	1,683	-1,786	-6
	5	3,056	262	-1,313	86	-1,064	278	-2,644	-488	2,180	-300	0	-51	5,862	-5,860	0
	6	591	532	-4,699	2,644	-278	0	0	-502	2,090	-320	0	-57	5,857	-5,856	0
	All	10,327	1,944	-15,357	2,920	-2,817	2,817	-2,920	-2,135	**5,652**	-620	0	194	23,854	-23,849	0

Notes:

For Hill Country Trinity Model

1. Layer 1: Edwards plateau aquifer.
2. Layer 2: upper Trinity aquifer.
3. Layer 3: middle Trinity aquifer.

4. All: sum of layers 1,2, and 3.

For Southern Carrizo-Wilcox model

5. Layer 1: Queen City aquifer
6. Layer 2: Reklaw unit
7. Layer 3: Carrizo aquifer
8. Layer 4: Upper Wilcox aquifer
9. Layer 5: Middle Wilcox aquifer
10. Layer 6: Lower Wilcox aquifer
11. All: sum of layers 1,2, 3, 4, 5, and 6

For both models

12. **GHB** refers to flow into or out of the top of the Queen City.
13. **ET** refers to groundwater extraction due to evapotranspiration.
14. **Reserv. Leakage** Refers to leakage from reservoirs (or lakes) into groundwater or from groundwater into reservoirs.
15. **X-flow in** refers to lateral flow into the county.
16. **X-flow out** refers to lateral flow out of the county.
17. **upper - Z-flow in** refers to flow into the layer from the layer above.
18. **upper - Z-flow out** refers to flow out of the layer into the layer above.
19. **lower - Z-flow in** refers to flow into the layer from the layer below.
20. **lower - Z-flow out** refers to flow out of the layer into the layer below.
21. **Wells** is for pumping input.
22. A negative sign refers to flow out of the layer in the county.
23. A positive sign refers to flow into the layer in the county.
24. The numbers are rounded to the nearest 1 acre-ft.

Table 2. Total aquifer storage based on Hill Country Trinity and Southern Carrizo-Wilcox Groundwater Availability Models

GAM	Layer	Aquifer Storage acre-feet
Hill Country Trinity	**1**	7,000
	2	13,000
	3	34,000
	Total	54,000
Southern Carrizo-Wilcox	**1**	0
	2	0
	3	4,230,000
	4	401,000
	5	5,541,000
	6	7,172,000
	Total	17,344,000

Note:
For Hill Country Trinity Model
Layer 1: Edwards plateau aquifer.
Layer 2: upper Trinity aquifer.
Layer 3: middle Trinity aquifer.
All: sum of layers 1,2, and 3.

For the Southern Carrizo-Wilcox model
Layer 1: Queen City aquifer
Layer 2: Reklaw unit
Layer 3: Carrizo aquifer
Layer 4: Upper Wilcox aquifer
Layer 5: Middle Wilcox aquifer
Layer 6: Lower Wilcox aquifer

Total storage rounded to the nearest 1,000 acre-ft

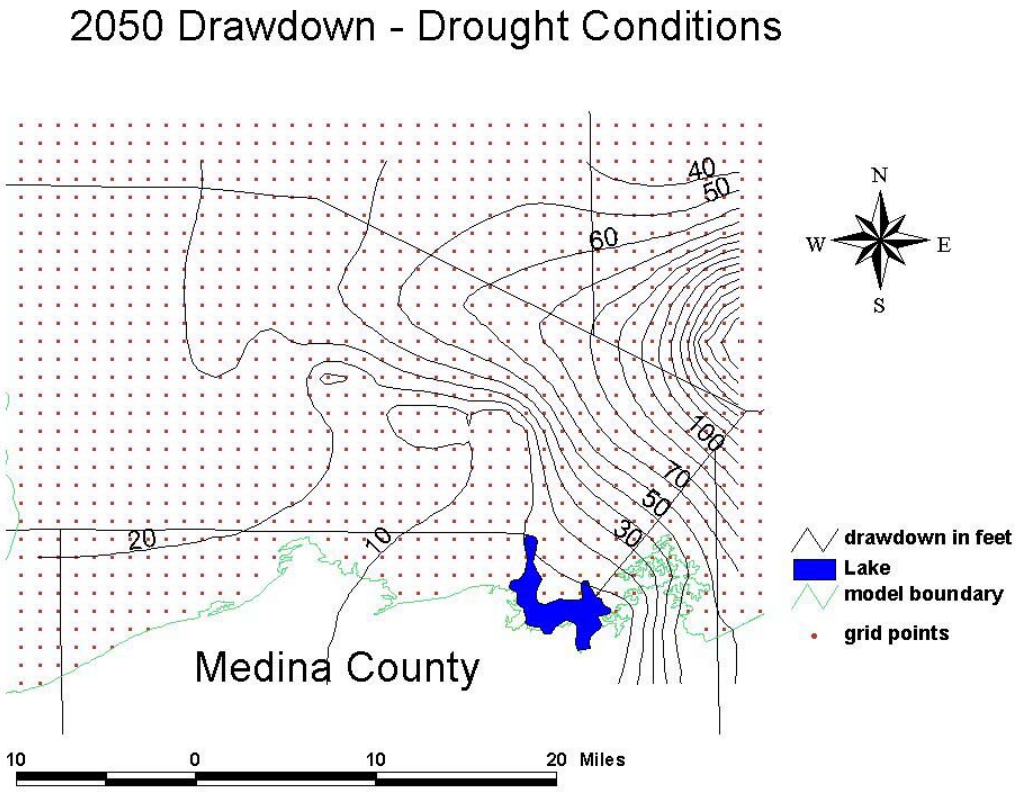

Figure 1. Model calculated water-level declines in the Middle Trinity aquifer between 1997 and 2050 following seven years of drought conditions from 2043 to 2050 (derived from Mace and others, 2001).

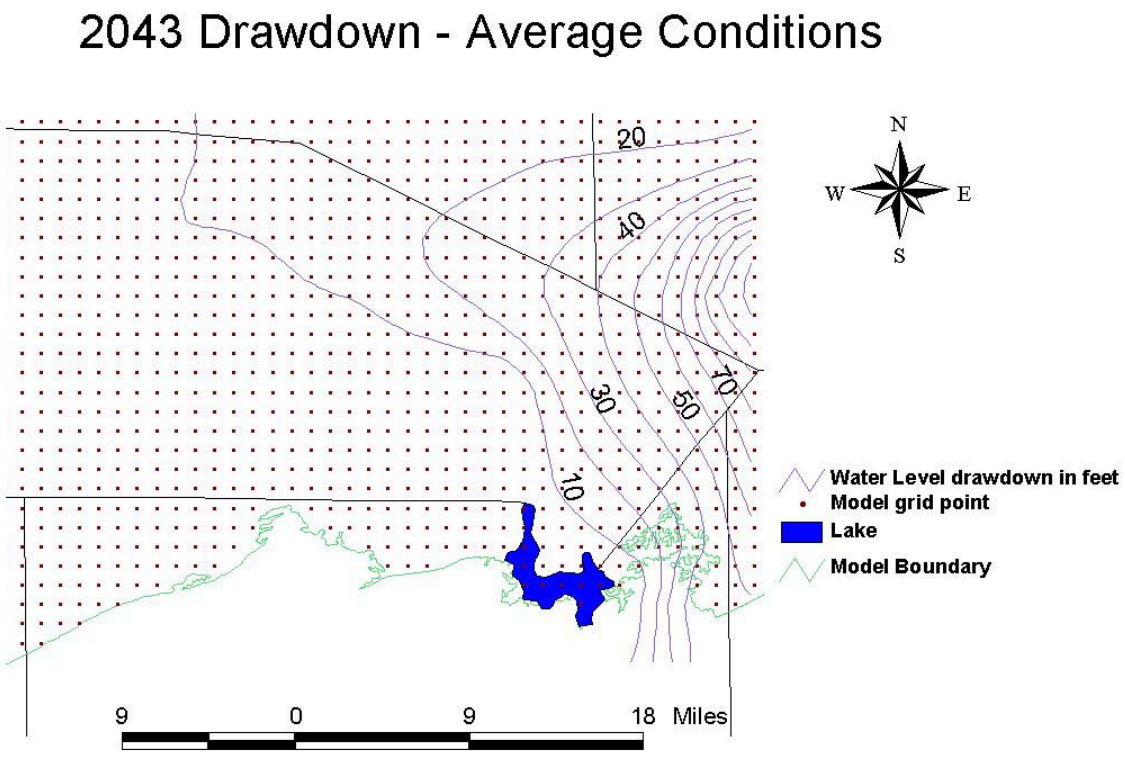

Figure 2. Model calculated water-level declines in the Middle Trinity aquifer between 1997 and 2043. Average recharge conditions were used throughout the simulation (derived from Mace and others, 2001).

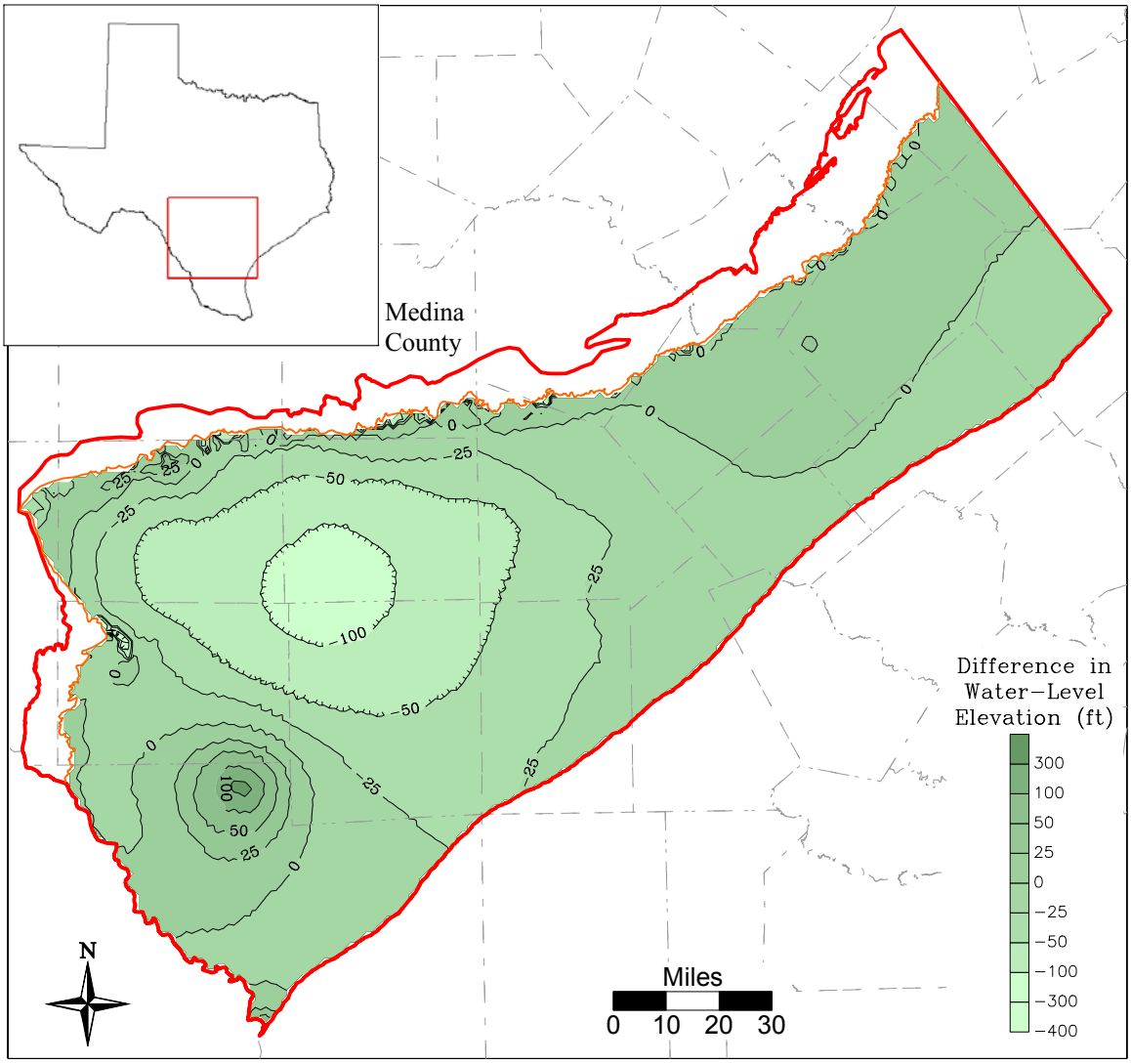

Figure 3. Model calculated water-level changes in the Carrizo aquifer between 2000 and 2050. Positive numbers refer to decline in feet, negative numbers refer to increase in feet. (Deeds and others, 2003; Figure 10.2.4)

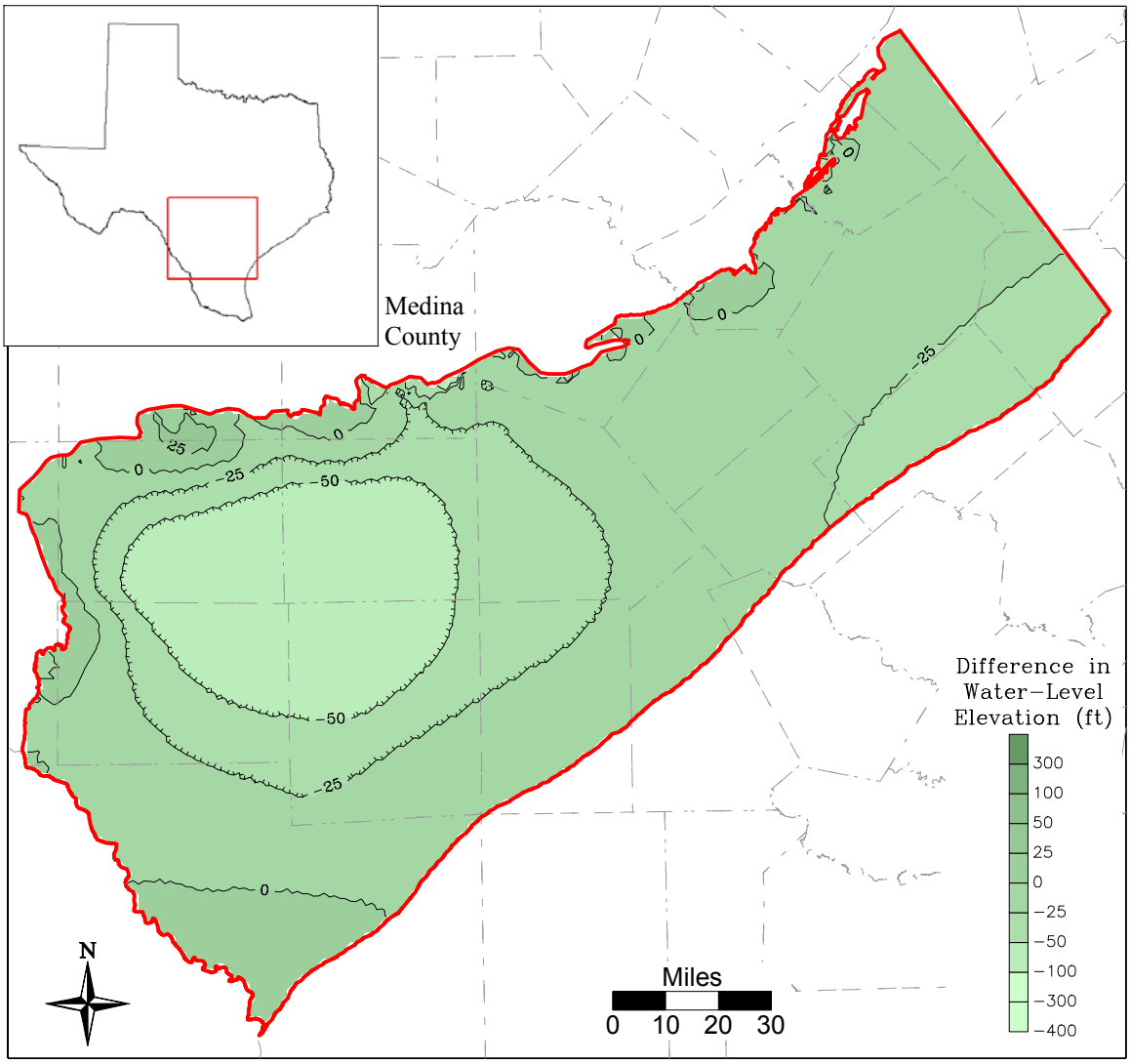

Figure 4. Model calculated water-level changes in the Lower-Wilcox aquifer between 2000 and 2050. Positive numbers refer to decline in feet, negative numbers refer to increase in feet. (Deeds and others, 2003; Figure 10.2.10)