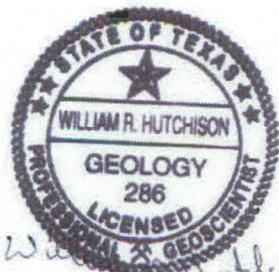


GAM Run 10-008

by William R. Hutchison, Ph.D., P.E., P.G.
Texas Water Development Board
Groundwater Resources Division
(512) 463-5067
June 30, 2010



William R. Hutchison
6/30/10



William R. Hutchison
6/30/10

The seal appearing on this document was authorized by William R. Hutchison, P.E. 96287 and P.G. 286, on June 30, 2010.

EXECUTIVE SUMMARY:

The groundwater availability model for the central part of the Gulf Coast Aquifer System was used with a constant specified annual pumpage for a 61-year predictive simulation using average recharge rates, evapotranspiration rates, and initial streamflows. Based on the model runs we determined that approximately 455,000, 471,000, and 486,000 acre-feet per year can be pumped from the Gulf Coast Aquifer in Groundwater Management 15 to achieve overall average drawdowns of 10, 11, and 12 feet respectively within GMA 15.

REQUESTOR:

Mr. Neil Hudgins of the Coastal Bend Groundwater Conservation District acting on behalf of Groundwater Management Area 15.

DESCRIPTION OF REQUEST:

Mr. Hudgins requested model runs using the groundwater availability model for the central part of the Gulf Coast Aquifer. Mr. Hudgins requested runs to determine the amount of pumping that would result in 10, 11, and 12 feet overall average drawdown for the Gulf Coast Aquifer located within Groundwater Management Area 15. The model runs are 61-year predictive simulations using initial water levels from the end of the 1999 historical calibration period and average recharge conditions.

METHODS:

Recharge, evapotranspiration rates, and initial streamflows were averaged for the historic calibration-verification runs, representing 1981 to 1999. These averages were then used for each year of the 61-year predictive simulation along with the requested pumpage volumes.

PARAMETERS AND ASSUMPTIONS:

The groundwater availability model for the central part of the Gulf Coast Aquifer was used for this model run. The parameters and assumptions for this model are described below:

- Version 1.01 of the groundwater availability model for the central part of the Gulf Coast Aquifer was used. This model assumes partial penetrating wells in the Evangeline Aquifer due to a lack of data for aquifer properties in the lower portion of the aquifer.
- See Chowdhury and others (2004) and Waterstone and others (2003) for assumptions and limitations of the groundwater availability model for the central part of the Gulf Coast Aquifer.
- The mean absolute error (a measure of the difference between simulated and actual water levels during model calibration) in the entire model for 1999 is 26 feet, which is 4.6 percent of the hydraulic head drop across the model area (Chowdhury and others, 2004).
- The model includes four layers representing: the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the Burkeville Confining Unit (Layer 3), and the Jasper Aquifer (Layer 4).

- Recharge rates, evapotranspiration rates, and initial streamflows are averages from the 1981 to 1999 calibration and verification time period.
- The pumpage distribution was specified for GAM Run 09-010 (Anaya, 2010) and the amounts were scaled uniformly to achieve the desired overall average drawdowns.

RESULTS:

The county-averaged groundwater level drawdowns for the 10 feet average overall drawdown are listed in Table 1 and the corresponding pumping amounts are listed in Table 2. Ten feet of overall drawdown allows a total pumping amount of 455,132 acre-feet per year in the Gulf Coast Aquifer in Groundwater Management Area 15. The overall drawdown average by county is also shown in Figure 1. The county-averaged groundwater level drawdowns for the 11 feet average overall drawdown are listed in Table 3 and the corresponding pumping amounts are listed in Table 4. Eleven feet of overall drawdown allows a total pumping amount of 470,944 acre-feet per year in the Gulf Coast Aquifer in Groundwater Management Area 15. The overall drawdown average by county is also shown in Figure 2. Twelve feet of overall drawdown allows a total pumping amount of 486,432 acre-feet per year in the Gulf Coast Aquifer in Groundwater Management Area 15. The county-averaged groundwater level drawdowns for the 12 feet average overall drawdown are listed in Table 5 and the corresponding pumping amounts are listed in Table 6. The overall drawdown average by county is also shown in Figure 3.

REFERENCES:

- Anaya, R., 2010, GAM Run 09-010, Texas Water Development Board GAM Run Report, 30 p.
- Chowdhury, A.H., Wade, S., Mace, R.E., and Ridgeway, C., 2004, Groundwater Availability Model of the Central Gulf Coast Aquifer System: Numerical Simulations through 1999, Texas Water Development Board, unpublished report, 114 p.
- Donnelly, A.C.A., 2007a, GAM Run 07-12, Texas Water Development Board GAM Run Report, 39 p.
- Waterstone Engineering, Inc., and Parsons, Inc., 2003, Groundwater Availability of the Central Gulf Coast Aquifer: Numerical Simulations to 2050 Central Gulf Coast, Texas- Final Report: contract report to the Texas Water Development Board, 158 p.

Table 1. Average water level drawdowns of the Gulf Coast Aquifer System for each aquifer in Groundwater Management Area (GMA) 15 for the 10 feet overall drawdown scenario. Drawdown values indicate water level declines in feet for the period between the end of 1999 and the end of 2060 with negative values indicating a rise in water levels.

GMA 15 10 feet scenario							
Drawdown in 2060 (in feet, 1999 Starting Conditions)							
County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	-0.1	23.7	0.5	0.0	0.0	0.5	0.5
Bee	2.0	12.3	8.8	8.7	4.1	7.6	7.1
Calhoun	-1.0	7.7	1.4	2.5	0.0	1.5	1.4
Colorado	3.8	6.7	5.4	12.5	18.9	10.8	10.2
DeWitt	-0.2	4.8	4.1	13.3	20.7	13.6	13.7
Fayette	0.0	12.6	12.6	37.5	44.3	37.7	37.8
Goliad	-1.6	2.9	2.0	6.8	8.6	5.3	4.7
Jackson	10.3	11.8	11.1	9.8	18.1	11.8	12.5
Karnes	0.0	-0.9	-0.9	15.0	14.8	13.3	12.8
Lavaca	3.5	4.0	3.8	12.9	26.8	14.1	14.5
Matagorda	2.9	14.6	6.5	13.4	0.0	7.2	6.5
Refugio	0.4	29.7	13.9	11.9	0.0	13.6	13.9
Victoria	-9.6	1.8	-3.7	2.3	6.5	-0.3	-1.3
Wharton	9.3	-1.0	4.2	16.5	20.0	10.9	9.0
Overall	2.4	7.7	5.1	11.7	19.1	10.0	9.4

Table 2. Pumpage used for each county in the 10 feet overall average drawdown scenario. Pumpage is reported in acre-feet per year (AF/yr).

Pumping in 2060 (AF/yr) for 10 feet scenario							
County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	1,740	0	1,740	0	0	1,740	1,740
Bee	3,464	5,062	8,526	16	270	8,812	8,796
Calhoun	2,746	59	2,805	0	0	2,805	2,805
Colorado	23,301	21,587	44,888	0	858	45,745	45,745
DeWitt	952	6,608	7,560	116	5,980	13,656	13,539
Fayette	0	846	846	112	6,690	7,648	7,536
Goliad	667	9,888	10,555	286	95	10,937	10,651
Jackson	52,114	19,263	71,377	0	0	71,377	71,377
Karnes	0	98	98	241	2,685	3,024	2,783
Lavaca	2,892	11,817	14,709	134	4,201	19,045	18,910
Matagorda	33,902	8,889	42,791	0	0	42,791	42,791
Refugio	5,961	21,445	27,406	0	0	27,406	27,406
Victoria	7,624	25,732	33,356	0	0	33,356	33,356
Wharton	103,553	63,237	166,790	0	0	166,790	166,790
Overall	238,916	194,533	433,448	905	20,778	455,132	454,227

Table 3. Average water level drawdowns of the Gulf Coast Aquifer System for each aquifer in Groundwater Management Area (GMA) 15 for the 11 feet overall drawdown scenario. Drawdown values indicate water level declines in feet for the period between the end of 1999 and the end of 2060 with negative values indicating a rise in water levels.

GMA 15 11 feet scenario							
Drawdown in 2060 (in feet, 1999 Starting Conditions)							
County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	-0.1	24.7	0.5	0.0	0.0	0.5	0.5
Bee	2.7	13.2	9.6	9.1	4.6	8.2	7.8
Calhoun	-1.0	8.7	1.8	2.6	0.0	1.8	1.8
Colorado	4.8	8.3	6.7	13.5	19.9	12.0	11.4
DeWitt	0.1	5.2	4.5	14.2	21.9	14.4	14.6
Fayette	0.0	13.2	13.2	38.9	45.8	39.1	39.2
Goliad	-1.4	3.3	2.3	7.1	8.9	5.7	5.0
Jackson	11.8	14.4	13.1	10.9	18.8	13.4	14.3
Karnes	0.0	-0.6	-0.6	15.6	15.2	13.8	13.2
Lavaca	4.4	4.8	4.6	13.8	28.1	15.1	15.6
Matagorda	3.1	16.8	7.4	14.1	0.0	8.1	7.4
Refugio	0.5	31.0	14.5	12.3	0.0	14.2	14.5
Victoria	-9.4	3.0	-3.0	2.9	7.2	0.3	-0.7
Wharton	11.0	2.5	6.7	17.9	20.8	12.8	11.0
Overall	3.1	9.3	6.3	12.6	20.0	11.0	10.4

Table 4. Pumpage used for each county in the 11 feet overall average drawdown scenario. Pumpage is reported in acre-feet per year (AF/yr).

Pumping in 2060 (AF/yr) 11 feet scenario							
County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	1,801	0	1,801	0	0	1,801	1,801
Bee	3,585	5,239	8,824	16	279	9,120	9,103
Calhoun	2,842	61	2,903	0	0	2,903	2,903
Colorado	24,116	22,341	46,457	0	888	47,345	47,345
DeWitt	985	6,839	7,824	120	6,189	14,133	14,013
Fayette	0	876	876	113	6,924	7,912	7,800
Goliad	690	10,234	10,925	296	99	11,319	11,023
Jackson	53,937	19,937	73,873	0	0	73,873	73,873
Karnes	0	102	102	245	2,684	3,031	2,786
Lavaca	2,993	12,231	15,223	136	4,348	19,708	19,572
Matagorda	35,088	9,200	44,288	0	0	44,288	44,288
Refugio	6,169	22,195	28,364	0	0	28,364	28,364
Victoria	7,890	26,632	34,523	0	0	34,523	34,523
Wharton	107,175	65,449	172,624	0	0	172,624	172,624
Overall	247,271	201,336	448,607	926	21,410	470,944	470,017

Table 5. Average water level drawdowns of the Gulf Coast Aquifer System for each aquifer in Groundwater Management Area (GMA) 15 for the 12 feet overall drawdown scenario. Drawdown values indicate water level declines in feet for the period between the end of 1999 and the end of 2060 with negative values indicating a rise in water levels.

GMA 15 12 feet scenario							
Drawdown in 2060 (in feet, 1999 Starting Conditions)							
County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	-0.1	25.6	0.6	0.0	0.0	0.6	0.6
Bee	3.3	14.2	10.5	9.7	5.1	8.9	8.5
Calhoun	-0.9	9.6	2.1	2.6	0.0	2.1	2.1
Colorado	5.8	9.8	8.0	14.5	21.0	13.1	12.6
DeWitt	0.3	5.6	4.8	15.0	23.0	15.2	15.4
Fayette	0.0	13.8	13.8	40.4	47.2	40.4	40.4
Goliad	-1.2	3.7	2.6	7.4	9.3	6.0	5.4
Jackson	13.3	17.1	15.2	12.0	19.6	15.1	16.1
Karnes	0.0	-0.2	-0.2	16.1	15.8	14.3	13.7
Lavaca	5.3	5.6	5.5	14.6	29.4	16.0	16.6
Matagorda	3.4	19.0	8.2	14.8	0.0	8.9	8.2
Refugio	0.6	32.2	15.1	12.8	0.0	14.7	15.1
Victoria	-9.3	4.1	-2.3	3.5	7.8	1.0	0.0
Wharton	12.7	5.8	9.2	19.3	21.6	14.6	13.0
Overall	3.7	10.8	7.4	13.5	20.9	12.0	11.5

Table 6. Pumpage used for each county in the 12 feet overall average drawdown scenario. Pumpage is reported in acre-feet per year (AF/yr).

Pumping in 2060 (AF/yr) 12 feet scenario							
County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	1,860	0	1,860	0	0	1,860	1,860
Bee	3,703	5,411	9,115	17	288	9,420	9,403
Calhoun	2,935	63	2,999	0	0	2,999	2,999
Colorado	24,910	23,077	47,986	0	917	48,903	48,903
DeWitt	1,018	7,064	8,081	124	6,392	14,598	14,474
Fayette	0	905	905	113	7,151	8,169	8,056
Goliad	713	10,571	11,284	306	102	11,692	11,386
Jackson	55,711	20,593	76,304	0	0	76,304	76,304
Karnes	0	105	105	249	2,772	3,126	2,877
Lavaca	3,091	12,633	15,724	140	4,492	20,356	20,216
Matagorda	36,242	9,503	45,745	0	0	45,745	45,745
Refugio	6,372	22,926	29,298	0	0	29,298	29,298
Victoria	8,150	27,509	35,659	0	0	35,659	35,659
Wharton	110,701	67,603	178,304	0	0	178,304	178,304
Overall	255,407	207,961	463,368	949	22,115	486,432	485,483

Drawdowns for the Gulf Coast Aquifer by County

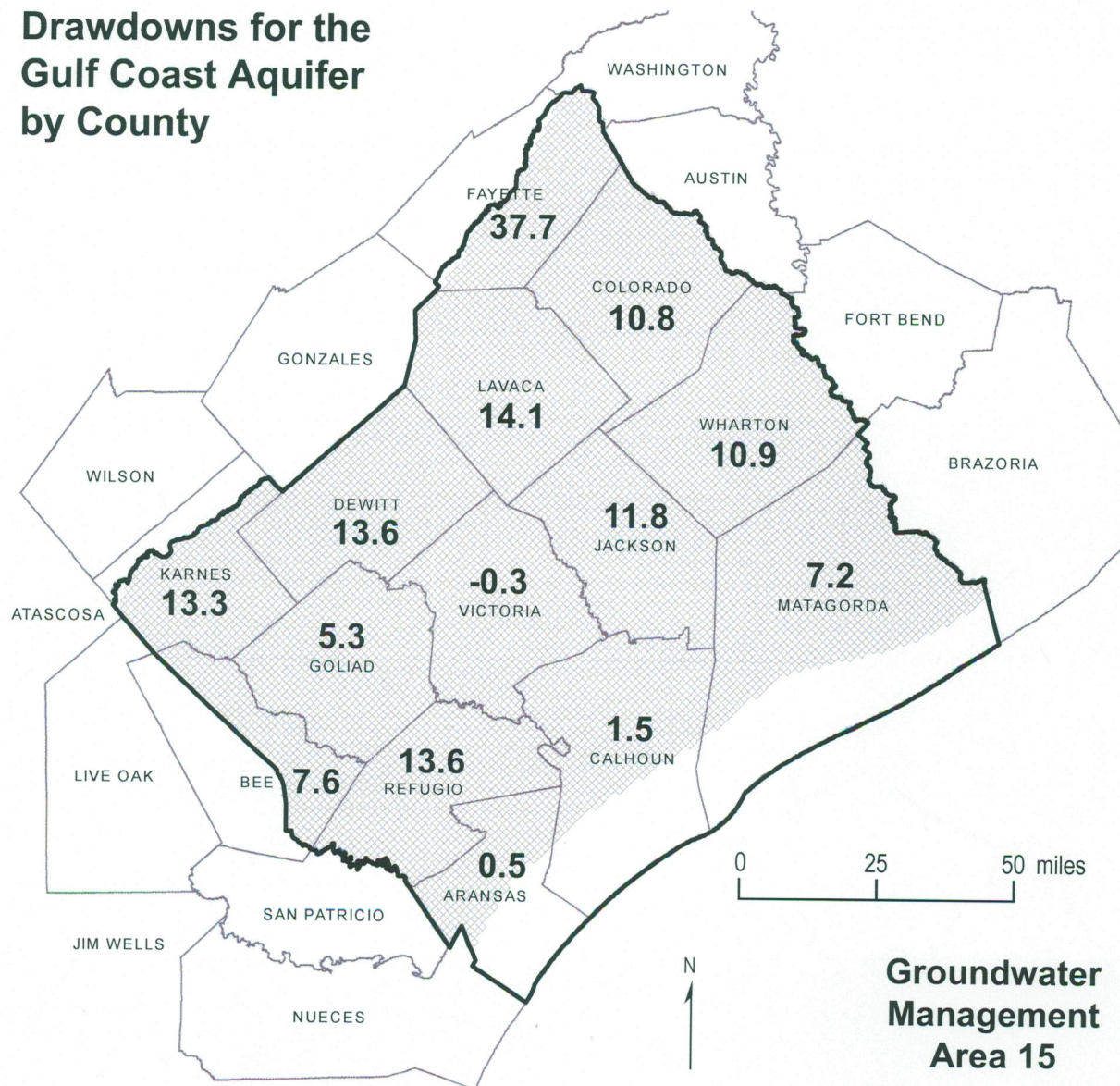


Figure 1. Average drawdown for the Gulf Coast Aquifer in each county of Groundwater Management Area 15 for the 10 feet overall average drawdown scenario. The drawdown values are based on modeling 455,132 acre-feet per year pumpage. The bold font values indicate the water level declines in feet for the period between the end of 1999 and the end of 2060 with negative values indicating a rise in water levels.

Drawdowns for the Gulf Coast Aquifer by County

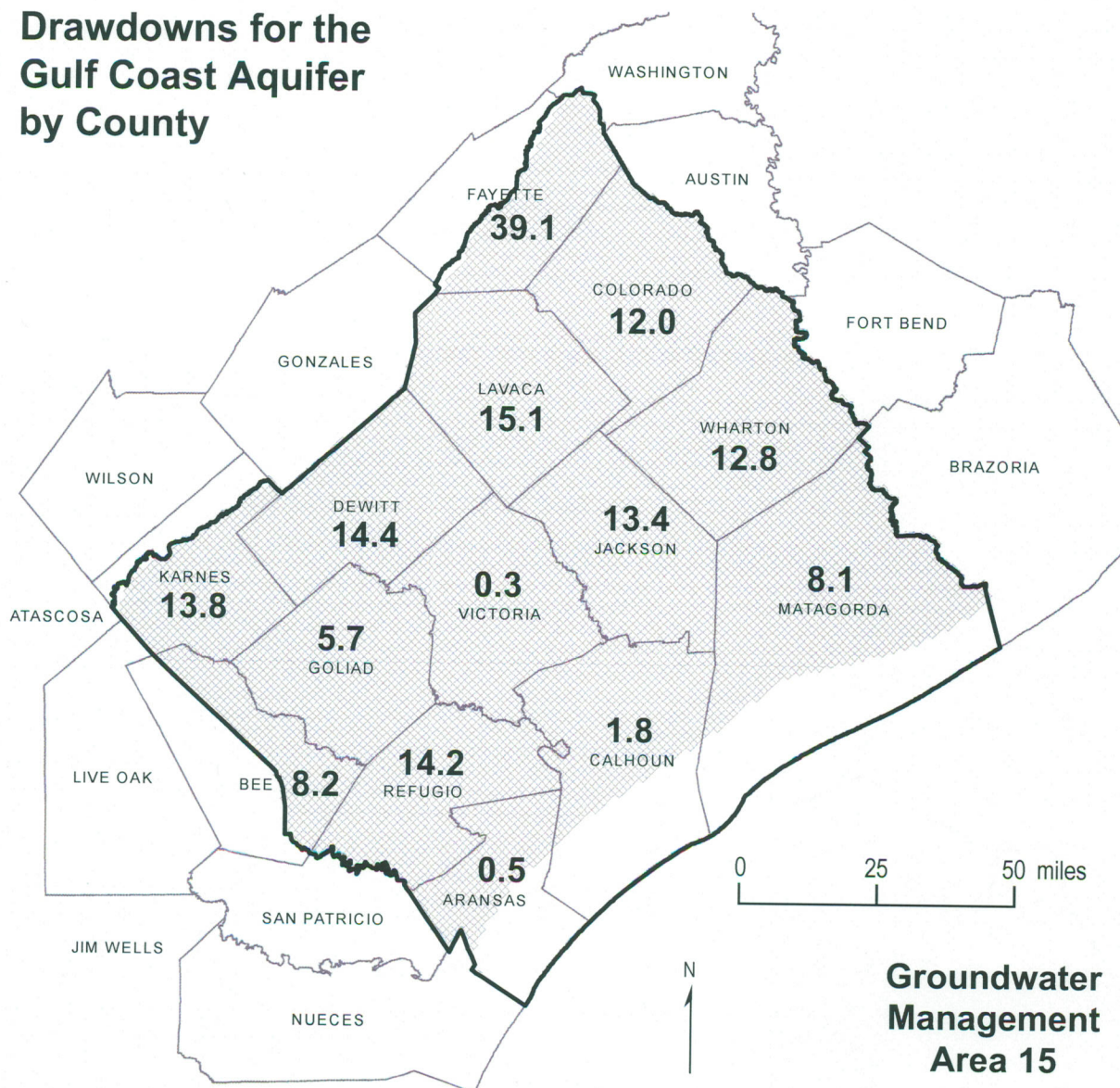


Figure 2. Average drawdown for the Gulf Coast Aquifer in each county of Groundwater Management Area 15 for the 11 feet overall average drawdown scenario. The drawdown values are based on modeling 470,944 acre-feet per year pumpage. The bold font values indicate the water level declines in feet for the period between the end of 1999 and the end of 2060 with negative values indicating a rise in water levels.

Drawdowns for the Gulf Coast Aquifer by County

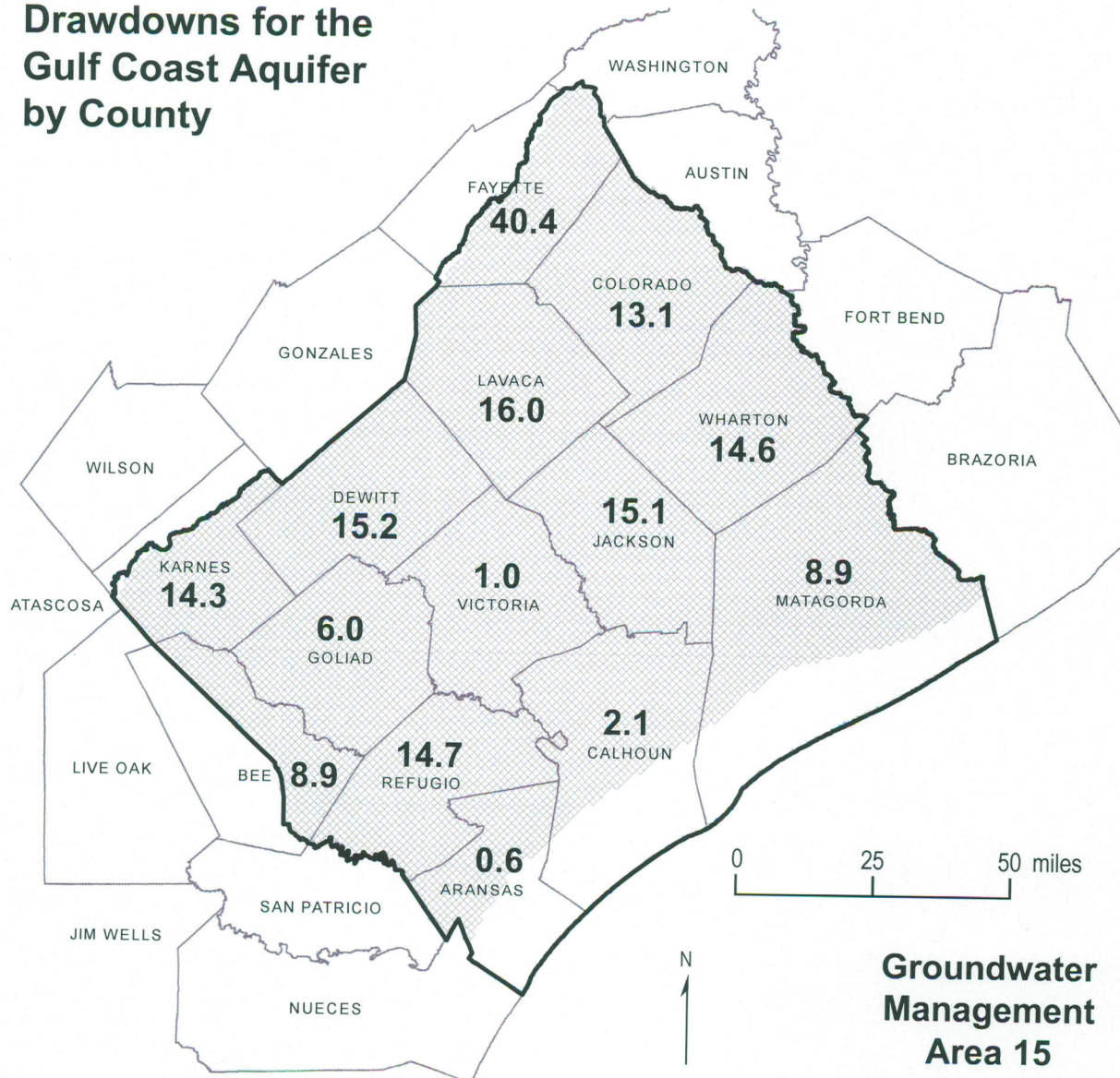


Figure 3. Average drawdown for the Gulf Coast Aquifer in each county of Groundwater Management Area 15 for the 12 feet overall average drawdown scenario. The drawdown values are based on modeling 486,432 acre-feet per year pumpage. The bold font values indicate the water level declines in feet for the period between the end of 1999 and the end of 2060 with negative values indicating a rise in water levels.