GAM Run 10-008 Addendum

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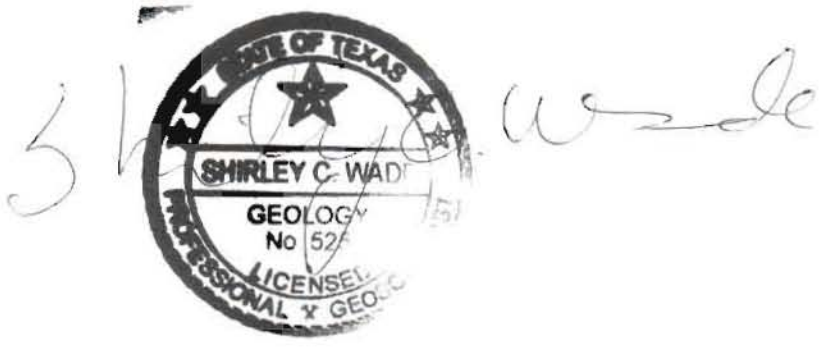

EXECUTIVE SUMMARY:

The groundwater availability model for the central part of the Gulf Coast Aquifer System was used with a constant specified annual pumpage for a 60-year predictive simulation using average recharge rates, evapotranspiration rates, and initial streamflows. A baseline pumping run results in an overall average drawdown of 11.4 feet with approximately 479,000 acre-feet per year of pumping in Groundwater Management Area 15. Additional model runs indicate that approximately 456,000, 471,000, and 488,000 acre-feet per year can be pumped from the Gulf Coast Aquifer in Groundwater Management Area 15 to achieve overall average drawdowns of 10, 11, and 12 feet respectively within GMA 15.

REQUESTOR:

This GAM Run Addendum is a follow-up to a run requested by Mr. Neil Hudgins of the Coastal Bend Groundwater Conservation District acting on behalf of Groundwater Management Area 15.

DESCRIPTION OF REQUEST:

In GAM Run 10-008 Mr. Neil Hudgins requested model runs using the groundwater availability model for the central part of the Gulf Coast Aquifer. In that model run and in the baseline run (Hutchison, 2010 and Anaya, 2010) the amount of pumping reported for Fayette County was less than the requested amount, 8,700 acree-feet per year, partly due to model cells going dry. Mr. David Van Dresar of the Fayette County Groundwater Conservation District requested that the amount of pumping for Fayette County in the model run be kept at 8,700 acre-feet per year. The baseline run (GAM Run 09-010; Anaya, 2010) and adjusted pumping runs (GAM Run 10-008; Hutchison, 2010) were repeated with the baseline pumping in Fayette County maintained at 8,700 acre-feet per year. The model runs are 60-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 60-year predictive simulation along with the requsted pumpage volumes.

For Fayette County, pumping was increased uniformly so that even with dry cells the amount would not be less than 8,700 acre-feet per year. In addition it was observed that 333 acre-feet per year of pumping in Fayette County is located in Groundwater Management Area 12 so it did not appear in the GMA 15 pumpage totals in the previous runs. The pumpage total for GMA 12 is listed separately for this run. The total GMA 15 and GMA 12 baseline pumping in Fayette County for this run is 8,710 acre-feet per year.

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.

- With the exception of Fayette County, 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:

Groundwater Management Area 15 overall drawdown is 11.4 feet for the revised baseline pumping run. The county-averaged groundwater level drawdowns are listed in Table 1 and the corresponding pumping amounts are listed in Table 2.

The county-averaged groundwater level drawdowns for the 10 feet average overall drawdown are listed in Table 3 and the corresponding pumping amounts are listed in Table 4. Ten feet of overall drawdown allows a total pumping amount of 455,679 acre-feet per year in the Gulf Coast Aquifer in Groundwater Management Area 15. The county-averaged groundwater level drawdowns for the 11 feet average overall drawdown are listed in Table 5 and the corresponding pumping amounts are listed in Table 6. Eleven feet of overall drawdown allows a total pumping amount of 471,492 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 7 and the corresponding pumping amounts are listed in Table 8. Twelve feet of overall drawdown allows a total pumping amount of 487,567 acre-feet per year in the Gulf Coast Aquifer in Groundwater Management Area 15.

REFERENCES:

Anaya, R., 2010, GAM Run 09-010, Texas Water Development Board GAM Run Report, 30 p.

Hutchison, W.R., 2010, GAM Run 10-008, Texas Water Development Board GAM Run Report, 9 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 GMA 15 Baseline Drawdown in 60 years (in feet, 1999 Starting Conditions)

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	-0.1	25.0	0.5	--	--	0.5	0.5
Bee	3.0	13.6	10.0	9.4	4.8	8.5	8.1
Calhoun	-1.0	9.1	1.9	2.6	--	1.9	1.9
Colorado	5.2	8.9	7.3	14.1	20.7	12.6	12.0
DeWitt	0.2	5.4	4.6	14.5	22.3	14.8	14.9
Fayette	--	13.8	13.8	41.6	48.4	41.4	41.4
Goliad	-1.3	3.4	2.4	7.2	9.1	5.8	5.2
Jackson	12.5	15.5	14.0	11.4	19.1	14.1	15.0
Karnes	--	-0.4	-0.4	15.7	15.4	13.9	13.4
Lavaca	4.7	5.1	5.0	14.1	28.7	15.5	16.0
Matagorda	3.2	17.7	7.6	14.4	--	8.2	7.6
Refugio	0.5	31.4	14.7	12.5	--	14.4	14.7
Victoria	-9.4	3.4	-2.7	3.2	7.4	0.6	-0.4
Wharton	11.7	3.8	7.7	18.4	21.1	13.5	11.8
Overall	**3.3**	**9.9**	**6.7**	**13.0**	**20.6**	**11.4**	**10.9**

Table 2 Baseline Pumping (AF/yr)

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	1,826	--	1,826	--	--	1,826	1,826
Bee	3,635	5,321	8,956	17	283	9,256	9,239
Calhoun	2,881	62	2,943	--	--	2,943	2,943
Colorado	24,448	22,649	47,097	900	--	47,997	47,997
DeWitt	999	6,933	7,932	122	6,282	14,336	14,214
Fayette (GMA 15)	--	888	888	156	7,333	8,377	8,221
Fayette (GMA 12)	--	--	--	--	333	333	333
Goliad	700	10,375	11,075	300	100	11,475	11,175
Jackson	54,678	20,211	74,889	--	--	74,889	74,889
Karnes	--	103	103	244	2,713	3,060	2,816
Lavaca	3,034	12,399	15,433	138	4,408	19,979	19,841
Matagorda	35,673	9,327	45,000	--	--	45,000	45,000
Refugio	6,254	22,501	28,755	--	--	28,755	28,755
Victoria	7,999	26,999	34,998	--	--	34,998	34,998
Wharton	108,649	66,349	174,998	--	--	174,998	174,998
Overall	**250,776**	**204,117**	**454,893**	**1,877**	**21,452**	**478,889**	**476,912**

Table 3 GMA 15 10 feet scenario
Drawdown after 60 years (in feet, 1999 Starting Conditions)

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	-0.1	23.7	0.5	--	--	0.5	0.5
Bee	2.0	12.3	8.8	8.7	4.2	7.6	7.1
Calhoun	-1.0	7.7	1.4	2.5	--	1.4	1.4
Colorado	3.8	6.7	5.4	12.6	19.1	10.9	10.9
DeWitt	-0.2	4.8	4.1	13.3	20.7	13.6	13.7
Fayette	--	13.0	13.0	39.5	46.3	39.5	39.5
Goliad	-1.6	2.9	2.0	6.8	8.6	5.3	4.7
Jackson	10.3	11.8	11.0	9.7	18.1	11.8	12.4
Karnes	--	-0.9	-0.9	15.0	14.8	13.3	12.8
Lavaca	3.5	4.0	3.8	13.0	26.8	14.1	14.6
Matagorda	2.8	14.6	6.4	13.4	--	7.1	6.4
Refugio	0.4	29.7	13.9	11.8	--	13.6	13.9
Victoria	-9.6	1.8	-3.7	2.3	6.5	-0.3	-1.3
Wharton	9.2	-1.0	4.1	16.4	20.0	10.9	9.0
Overall	**2.4**	**7.7**	**5.1**	**11.8**	**19.3**	**10.0**	**9.6**

Table 4 Pumping (AF/yr) for 10 feet scenario

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	1,741	--	1,741	--	--	1,741	1,741
Bee	3,465	5,073	8,538	16	270	8,824	8,808
Calhoun	2,746	59	2,805	--	--	2,805	2,805
Colorado	23,306	21,591	44,897	--	858	45,755	45,755
DeWitt	952	6,609	7,561	117	5,989	13,667	13,550
Fayette (GMA 15)	--	847	847	156	6,991	7,994	7,838
Fayette (GMA 12)	--	--	--	--	317	317	317
Goliad	667	9,890	10,557	286	95	10,938	10,652
Jackson	52,125	19,267	71,392	--	--	71,392	71,392
Karnes	--	98	98	240	2,678	3,016	2,776
Lavaca	2,892	11,820	14,712	134	4,202	19,048	18,914
Matagorda	34,007	8,891	42,898	--	--	42,898	42,898
Refugio	5,962	21,450	27,412	--	--	27,412	27,412
Victoria	7,625	25,738	33,363	--	--	33,363	33,363
Wharton	103,575	63,251	166,826	--	--	166,826	166,826
Overall (GMA 15)	**239,063**	**194,584**	**433,647**	**949**	**21,400**	**455,679**	**454,730**

Table 5 GMA 15 11 feet scenario
Drawdown after 60 years (in feet, 1999 Starting Conditions)

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	-0.1	24.6	0.5	--	--	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	2.5	--	1.8	1.8
Colorado	4.8	8.3	6.7	13.7	20.2	12.1	11.5
DeWitt	0.1	5.2	4.5	14.2	21.9	14.4	14.5
Fayette	--	13.6	13.6	41.1	47.8	40.9	40.8
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	--	-0.6	-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	7.2	14.1	--	7.9	7.2
Refugio	0.5	31.0	14.5	12.3	--	14.1	14.5
Victoria	-9.4	3.0	-3.0	2.9	7.1	0.3	-0.7
Wharton	11.0	2.4	6.7	17.9	20.8	12.8	11.0
Overall	**3.1**	**9.3**	**6.2**	**12.7**	**20.2**	**11.0**	**10.5**

Table 6 Pumping (AF/yr) 11 feet scenario

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	1,802	--	1,802	--	--	1,802	1,802
Bee	3,586	5,250	8,836	16	279	9,131	9,115
Calhoun	2,842	61	2,903	--	--	2,903	2,903
Colorado	24,120	22,345	46,465	--	888	47,353	47,353
DeWitt	986	6,840	7,826	121	6,198	14,145	14,024
Fayette (GMA 15)	--	876	876	157	7,235	8,268	8,111
Fayette (GMA 12)	--	--	--	--	328	328	328
Goliad	691	10,236	10,927	296	99	11,322	11,026
Jackson	53,946	19,940	73,886	--	--	73,886	73,886
Karnes	--	102	102	245	2,676	3,023	2,778
Lavaca	2,993	12,233	15,226	136	4,349	19,711	19,575
Matagorda	35,195	9,202	44,397	--	--	44,397	44,397
Refugio	6,170	22,199	28,369	--	--	28,369	28,369
Victoria	7,892	26,637	34,529	--	--	34,529	34,529
Wharton	107,193	65,460	172,653	--	--	172,653	172,653
Overall (GMA 15)	**247,416**	**201,381**	**448,797**	**971**	**22,052**	**471,492**	**470,521**

Table 7 GMA 15 12 feet scenario
Drawdown after 60 years (in feet, 1999 Starting Conditions)

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	0.0	25.6	0.6	--	--	0.6	0.6
Bee	3.3	14.2	10.5	9.7	5.1	8.9	8.5
Calhoun	-0.9	9.7	2.1	2.6	--	2.1	2.1
Colorado	5.9	9.8	8.1	14.7	21.3	13.3	12.8
DeWitt	0.3	5.6	4.8	15.0	23.0	15.3	15.4
Fayette	--	14.2	14.2	42.4	49.3	42.2	42.1
Goliad	-1.2	3.7	2.6	7.4	9.3	6.0	5.4
Jackson	13.4	17.1	15.2	12.1	19.6	15.1	16.1
Karnes	--	-0.2	-0.2	16.1	15.7	14.3	13.7
Lavaca	5.3	5.6	5.5	14.7	29.4	16.1	16.7
Matagorda	3.3	19.0	8.1	14.8	--	8.7	8.1
Refugio	0.6	32.2	15.1	12.8	--	14.7	15.1
Victoria	-9.2	4.1	-2.3	3.5	7.8	1.0	0.0
Wharton	12.7	5.8	9.3	19.3	21.6	14.7	13.1
Overall	**3.7**	**10.8**	**7.4**	**13.5**	**21.1**	**12.0**	**11.5**

Pumping (AF/yr) 12 feet scenario

County	Chicot	Evangeline	Chicot+ Evangeline	Burkeville	Jasper	Overall	Overall (without Burkeville)
Aransas	1,863	--	1,863	--	--	1,863	1,863
Bee	3,707	5,480	9,187	17	289	9,493	9,476
Calhoun	2,939	63	3,002	--	--	3,002	3,002
Colorado	24,937	23,102	48,039	--	918	48,957	48,957
DeWitt	1,019	7,071	8,090	128	6,408	14,626	14,498
Fayette (GMA 15)	--	906	906	157	7,408	8,490	8,314
Fayette (GMA 12)	--	--	--	--	339	339	339
Goliad	714	10,582	11,296	306	102	11,704	11,398
Jackson	55,772	20,615	76,387	--	--	76,387	76,387
Karnes	--	105	105	261	2,865	3,231	2,970
Lavaca	3,095	12,647	15,742	151	4,496	20,389	20,238
Matagorda	36,386	9,513	45,899	--	--	45,899	45,899
Refugio	6,379	22,951	29,330	--	--	29,330	29,330
Victoria	8,159	27,539	35,698	--	--	35,698	35,698
Wharton	110,822	67,676	178,498	--	--	178,498	178,498
Overall (GMA 15)	**255,792**	**208,250**	**464,042**	**1,039**	**22,486**	**487,567**	**486,528**