GAM Task 10-033

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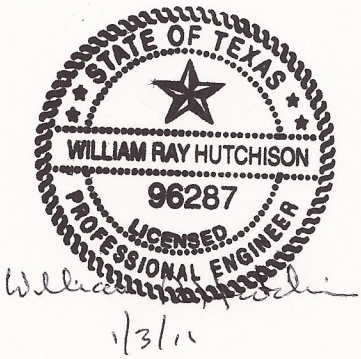

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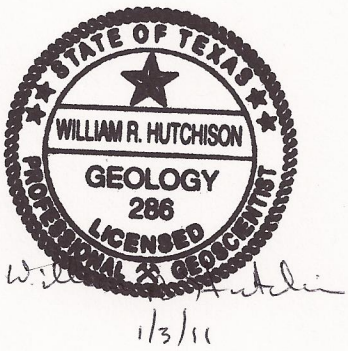

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EXECUTIVE SUMMARY:

Middle Pecos Groundwater Conservation District is considering the designation of three management zones within the district, and requested that average drawdown associated with the desired future conditions in for each of these zones be estimated based on Scenarios 10 and 11 of GAM Run 09-035, Version 2 (Hutchison, 2010).

REQUESTOR:

Randy Williams of Bar-W Groundwater Exploration on behalf of the Middle Pecos Groundwater Conservation District requested the drawdown summary for the three proposed management zones.

DESCRIPTION OF REQUEST:

Middle Pecos Groundwater Conservation District is considering the designation of three management zones within the district, and requested that average drawdown associated with the desired future conditions in for each of these zones be estimated based on Scenarios 10 and 11 of GAM Run 09-035, Version 2 (Hutchison, 2010). As described in GAM Run 09-035, Version 2, the adopted desired future condition for the for the Edwards-Trinity (Plateau) and Pecos Valley aquifers in Groundwater Management Area 7 were based on Scenario 10, and the desired future condition for the Edwards-Trinity (Plateau) and Pecos Valley aquifers in Groundwater Management Area 3 were based on Scenario 11. Because proposed management zones 1 and 2 are wholly located in Groundwater Management Area 7, results from Scenario 10 were used to estimate average drawdown in each zone. Because proposed management zone 3 is wholly located in Groundwater Management Area 3, results from Scenario 11 were used to estimate average drawdown in this zone.

METHODS:

Mr. Randy Williams of Bar-W Groundwater Exploration on behalf of the Middle Pecos Groundwater Conservation District provided Excel files with the model row and column number for cells within each zone. The file named Zone1_Grids_Export_10182010.xls contained the cells within Zone 1. The file named Zone2_Grids_Export_10182010.xls contained the cells within Zone 2. The file named Zone3_Grids_Export_10182010.xls contained the cells within Zone 3. These files were then combined to a single file that contained the 700 model grid cells that constituted the three zones.

A FORTRAN code (*getmpzndd.for*) was written to read the management zone file and head output files from Scenarios 10 and 11, calculate annual average drawdown in each of the three zones, and write a file that summarized average annual drawdown for each of the three zones.

PARAMETERS AND ASSUMPTIONS:

- The recently modified and calibrated groundwater flow model of the Edwards Trinity (Plateau) and Pecos Valley aquifers (Hutchison and Jones, 2010) was used for these simulations. The model was calibrated based on groundwater elevation data from 1930 to 2005. Scenarios 1 to 10 used the calibrated model. As discussed in Hutchison (2010), specific storage values were modified in Crane, Ward, and Winkler counties for Scenario 11.

- The model has one layer which represents the Pecos Valley Aquifer in the northwest portion of the model area, the Edwards-Trinity (Plateau) Aquifer in the southeast portion of the model area, and a lumped representation of both aquifers in the relatively narrow area where the Pecos Valley Aquifer overlies the Edwards-Trinity (Plateau) Aquifer.

- As further detailed in the model report (Hutchison and Jones, 2010), model calibration statistics for the entire model domain for groundwater elevation is summarized below. Note that the calibrated model statistics are presented as well as the statistics for the modified model used in Scenario 11.

Statistic	**Calibrated Model Used in Scenarios 1 to 10**	**Modified Model Used in Scenario 11**
Average residual	-1.3 feet	-2.9 feet
Standard deviation	70 feet	70 feet
Range of measurements	3058 feet	3058 feet
Standard deviation divided by range	0.02	0.02

- Eleven different pumping scenarios were used as described in Hutchison (2010).

- Each simulation consisted of 55 annual stress periods. Pumping for the first five stress periods (2006 to 2010) was set equal to pumping estimated during model calibration for 2005. Pumping in stress periods 6 to 55 (2011 to 2060) was set equal to the values previously presented in Tables 1, 2 and 3, based on the scenario.

- Drawdown for each proposed management zone was calculated based on the difference between an initial condition at the end of 2010 (stress period 5) and the end of each stress period (2011 to 2060).

- Recharge in each stress period was assumed to be equal to average recharge during the calibration period (1930 to 2005).

- Other model inputs were based on average recharge conditions and did not vary during the simulations.

- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

RESULTS:

Average annual drawdown for each zone is summarized in Table 1.

Table 1: Average annual drawdown from 2010 conditions for each proposed management zone. Drawdown values in feet and rounded to the nearest foot.

Year	Drawdown (feet) from 2010		
	Zone 1	Zone 2	Zone 3
2011	1	0	0
2012	1	1	1
2013	2	1	1
2014	3	1	2
2015	3	1	2
2016	4	1	2
2017	5	1	3
2018	6	1	3
2019	6	2	4
2020	7	2	4
2021	8	2	4
2022	8	2	4
2023	9	2	5
2024	10	2	5
2025	10	2	5
2026	11	2	6
2027	11	2	6
2028	12	2	6
2029	13	2	6
2030	13	2	7
2031	14	2	7
2032	15	2	7
2033	15	2	8
2034	16	2	8
2035	17	2	8

Year	Drawdown (feet) from 2010		
	Zone 1	Zone 2	Zone 3
2036	17	2	8
2037	18	3	9
2038	19	3	9
2039	19	3	9
2040	20	3	9
2041	20	3	10
2042	21	3	10
2043	22	3	10
2044	22	3	11
2045	23	3	11
2046	24	3	11
2047	24	3	11
2048	25	3	12
2049	25	3	12
2050	26	3	12
2051	27	3	12
2052	27	3	13
2053	28	3	13
2054	29	3	13
2055	29	3	13
2056	30	3	14
2057	30	3	14
2058	31	3	14
2059	32	3	14
2060	32	3	15

REFERENCES:

Harbaugh, A.W., Banta, E.R., Hill, M.C., and McDonald, M.G., 2000, MODFLOW-2000, The U.S. Geological Survey modular ground-water model-user guide to modularization concepts and the ground-water flow process: U.S. Geological Survey Open-File Report 00-92, 121 p.

Hutchison, William R. (2010). GAM Run 09-035, Version 2, Model Run Report. Texas Water Development Board, August 7, 2010, 10p.

Hutchison, William R., and Jones, Ian, 2010 (in preparation). Evaluation of Groundwater Flow in Groundwater Management Areas 3 and 7 Using a MODFLOW-2000 Model. Texas Water Development Board Unpublished Report.