GAM Run 08-76

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EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the Executive Administrator of the Texas Water Development Board in conjunction with any available site-specific information provided by the district for review and comment to the Executive Administrator. Information derived from groundwater availability models that shall be included in the groundwater management plan includes:

(1) the annual amount of recharge from precipitation to the groundwater resources within the district, if any;
(2) for each aquifer within the district, the annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers; and
(3) the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

The purpose of this model run is to provide information to Coastal Plains Groundwater Conservation District for its groundwater management plan. The groundwater management plan for Coastal Plains Groundwater Conservation District is due for approval by the Executive Administrator of the Texas Water Development Board before September 10, 2009.

This report discusses the methods, assumptions, and results from model runs using the groundwater availability model for the central portion of the Gulf Coast Aquifer. Table 1 summarizes the groundwater availability model data required by statute for Coastal Plains Groundwater Conservation District's groundwater management plan. Figure 1 shows the area of the model from which the values in Table 1 were extracted.

METHODS:

We ran the groundwater availability model for the central portion of the Gulf Coast Aquifer and (1) extracted water budgets for each year of the 1981 through 1999 period and (2) averaged the annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper), and net

inter-aquifer flow (lower) for the portions of the Gulf Coast Aquifer located within the district.

PARAMETERS AND ASSUMPTIONS:

- We used version 1.01 of the groundwater availability model for the central portion of the Gulf Coast Aquifer. See Chowdhury and others (2004) and Waterstone and others (2003) for assumptions and limitations of the groundwater availability model for the central portion of the Gulf Coast Aquifer.

- The model for the central portion of the Gulf Coast Aquifer assumes partially penetrating wells in the Evangeline Aquifer due to a lack of data for aquifer properties in the lower portion of the aquifer.

- The model includes four layers representing: the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the Burkeville Confining System (Layer 3), and the Jasper Aquifer (Layer 4). However, no results are presented in Table 1 for the Jasper Aquifer (Layer 4) because the district is located in the downdip portion of the aquifer, lies at considerable depth, and is not used for groundwater extraction. Therefore, the model cells for this district were made inactive for this aquifer.

- The mean absolute error (a measure of the difference between simulated and measured water levels) 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).

- We used Processing Modflow for Windows (PMWIN) version 5.3 (Chiang and Kinzelbach, 2001) as the interface to process model output.

RESULTS:

A groundwater budget summarizes the water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater flow components were extracted from the water budget for the aquifers located within the district and averaged over the duration of the calibrated portion of the model run (1981 to 1999) in the district, as shown in Table 1. The components of the water budgets shown in Table 1 include:

- Precipitation recharge—This is the areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.

- Surface water outflow—This is the total water exiting the aquifer (outflow) to surface water features such as streams, reservoirs, and drains (springs).

- Flow into and out of district—This component describes lateral flow within the aquifer between the district and adjacent counties. Also, since the district lies on the coast, flows between the Chicot Aquifer and the Gulf of Mexico were

included as lateral flows in Table 1. The interaction between the Chicot Aquifer and the Gulf of Mexico was modeled as a general head boundary in the groundwater availability model.

- Flow between aquifers—This describes the vertical flow, or leakage, between the top or bottom surfaces of the aquifers or confining units. This flow is controlled by the relative elevations of the water levels in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs. "Inflow" to an aquifer from an overlying or underlying aquifer will always equal the "Outflow" from the other aquifer.

The information needed for the district's management plan is summarized in Table 1. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.

Table 1:   Summarized information needed for Coastal Plains Groundwater
Conservation District's groundwater management plan. All values are
reported in acre-feet per year. All numbers are rounded to the nearest 1 acre-
foot.

Management Plan requirement	Aquifer or confining unit	Results[a]
Estimated annual amount of recharge from precipitation to the district	Chicot Aquifer	21,705
	Evangeline Aquifer	0
	Burkeville Confining Unit	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Chicot Aquifer	34,856
	Evangeline Aquifer	0
	Burkeville Confining Unit	0
Estimated annual volume of flow into the district within each aquifer in the district	Chicot Aquifer	12,805
	Evangeline Aquifer	1,526
	Burkeville Confining Unit	9
Estimated annual volume of flow out of the district within each aquifer in the district	Chicot Aquifer	33,100[b]
	Evangeline Aquifer	5,726
	Burkeville Confining Unit	8
Estimated net annual volume of flow between each aquifer in the district	Chicot Aquifer to the Evangeline Aquifer	8,700
	Burkeville Confining Unit to the Evangeline Aquifer	339

[a]Though the Jasper Aquifer is also part of the groundwater availability model for the central portion of the Gulf Coast Aquifer, this aquifer is not considered in the model simulation because it lies at considerable depth and is not used for groundwater extraction. Therefore, no simulation results are presented for the Jasper Aquifer in Table 1.
[b]Since the district lies on the coast, flows between the Chicot Aquifer and the Gulf of Mexico were included as lateral flows in Table 1. The interaction between the Chicot Aquifer and the Gulf of Mexico was modeled as a general head boundary in the groundwater availability model.

Figure 1: Area of the groundwater availability model for the central portion of the Gulf Coast Aquifer from which the information in Table 1 was extracted. Note that model grid cells that straddle a political boundary were assigned to one side of the boundary based on the centroid of the model cell as described above.
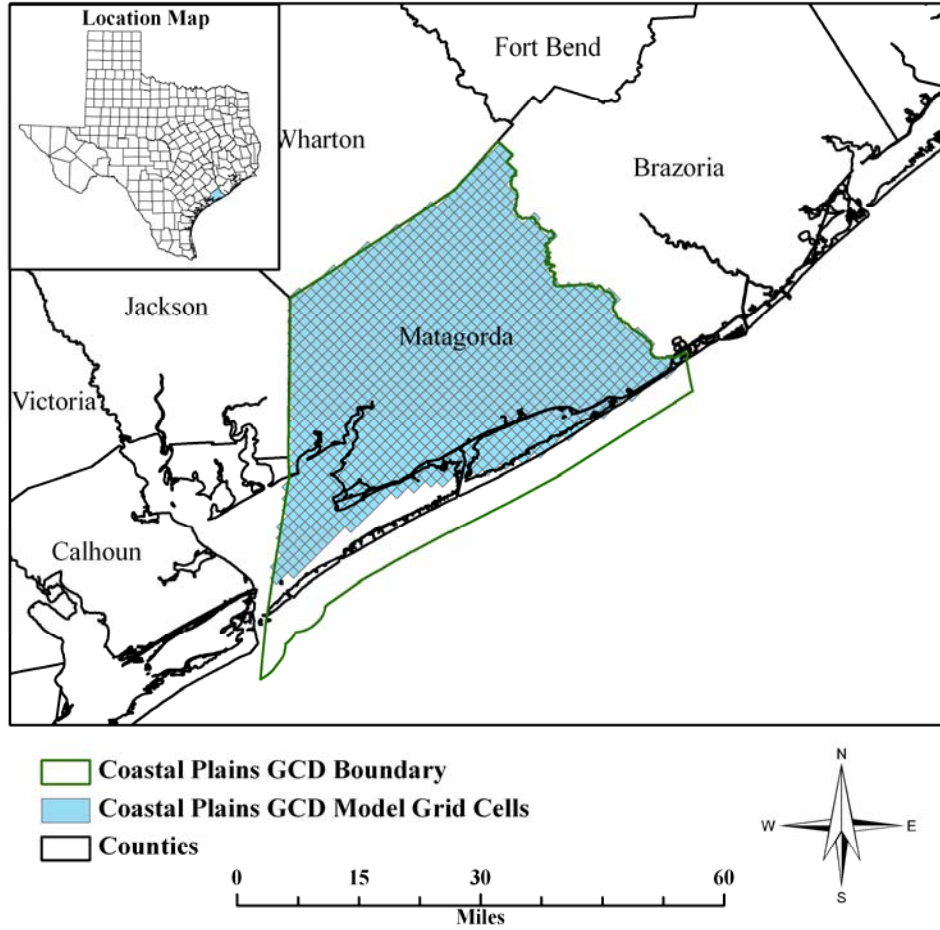
REFERENCES:

Chiang, W., and Kinzelbach, W., 2001, Groundwater Modeling with PMWIN, 346 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- Model Report, 114 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.

Cynthia K. Ridgeway is Manager of the Groundwater Availability Modeling Section and is responsible for oversight of work performed by employees under her direct supervision. The seal appearing on this document was authorized by Cynthia K. Ridgeway, P.G., on December 9, 2008.