GAM Run 08-03

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EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h), states that in developing its groundwater management plan, groundwater conservation districts shall use groundwater availability modeling information provided by the executive administrator in conjunction with any available site-specific information provided by the district and acceptable to the executive administrator. Information derived from groundwater availability models that shall be included in groundwater management plans include:

(1) the annual amount of recharge from precipitation, if any, to the groundwater resources within the district;
(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 groundwater availability model run is to provide information to the Corpus Christi ASR Conservation District needed for its groundwater management plan. The groundwater management plan for the Corpus Christi ASR Conservation District is due for approval by the TWDB before June 18, 2008.

This report discusses the method, assumptions, and results from the groundwater availability model run for the central part of the Gulf Coast Aquifer. Table 2 summarizes the groundwater availability model data required by statute for the Corpus Christi ASR Conservation Districts groundwater management plan.

METHODS:

We ran the groundwater availability model for the central part of the Gulf Coast Aquifer (Chowdhury and others, 2004) and (1) extracted annual water budgets from 1981 through 1999 and (2) averaged the annual water budget values for recharge, surface water inflow, surface water outflow, groundwater inflow to the district, groundwater 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 part 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 part of the Gulf Coast Aquifer.

- The model simulates groundwater flow through four hydrostratigraphic layers. From top to bottom, these layers are: the Chicot Aquifer, Evangeline Aquifer, Burkeville Confining System, and the Jasper 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 transient portion of the model has a total of 85 stress periods. Of these, monthly stress periods were assigned for 1987 through 1989 and 1996 through 1998. Monthly stress periods were assigned to better simulate possible effects of drought on the groundwater flow system. The remainders of the stress periods represent annual stress periods.

- We used Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) as the interface to process model output results.

RESULTS:

Water budget results describe water entering and leaving the aquifer. Water budget values from the model using annual average recharge from 1981 to 1999 is shown in Table 1. The components of the water budgets shown in Table 1 include:

- Surface water inflow and outflow—Total surface water entering the aquifer (inflow) through streams or reservoirs, or total surface water exiting the aquifer (outflow) to streams, reservoirs, drains (springs), or through evapotranspiration (return of moisture to the air through both evaporation from the soil and transpiration or loss of water vapor by plants).

- Lateral flow into and out of district—This component describes lateral flow within the aquifer between the district and adjacent counties.

- Net inter-aquifer flow—This describes the vertical flow, or leakage, between aquifers or confining units. This flow is controlled by the relative water levels in each aquifer and aquifer properties of each aquifer that define the amount of leakage that can occur. “Inflow” to an aquifer from an overlying or underlying aquifer will always equal the “Outflow” from the other aquifer.

- 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.

The information needed for the district's management plan is summarized in Table 2.

It is important to note that sub-regional water budgets for individual districts, such as the Corpus Christi ASR Conservation District, are not exact. This is due to the one-mile spacing of the model grid and because we assumed each model cell is assigned to a single district or county. The water budgets for an individual cell containing a district or county boundary are assigned to just one district or county combination and therefore minor variations in the district or county-wide budgets may occur.

As described by Kalaswad and Arroyo (2006), groundwater in the Texas Gulf Coast Aquifer ranges from fresh to saline in composition. The reported values in this report for flow terms include fresh (less than 1,000 milligrams per liter total dissolved solids), brackish (1,000 to 10,000 milligrams per liter total dissolved solids), to saline (greater than 10,000 milligrams per liter total dissolved solids) groundwater.

REFERENCES:

Chowdhury, A.H., Wade, S.W., Mace, R.E., and Ridgeway, C., 2004, Groundwater availability model of the central Gulf Coast Aquifer system—Numerical simulations through 1999: Unpublished Texas Water Development Board report, 114 p. http://www.twdb.state.tx.us/gam/glfc_c/glfc_c_TWDB_SummaryReport.pdf

Environmental Simulations, Inc. 2007, Guide to Using Groundwater Vistas Version 5, 381 p.

Kalaswad, S., and Arroyo, J., 2006, Status report on brackish groundwater and desalination in the Gulf Coast Aquifer of Texas *in* Mace, R.E., Davison, S.C., Angle, E.S., and Mullican, III, W.F., eds., Aquifers of the Gulf Coast of Texas: Texas Water Development Board Report 365, p. 231–240.

Waterstone Environmental Hydrology and Engineering Inc. and Parsons, 2003, Groundwater availability of the Central Gulf Coast Aquifer: Numerical Simulations to 2050, Central Gulf Coast, Texas: Contract report to the Texas Water Development Board, 157 p.

Table 1: Selected flow terms for each aquifer layer, into and out of the Corpus Christi ASR Conservation District, averaged for the years 1981 to 1999 from the groundwater availability model of the central part of the Gulf Coast Aquifer. Flows are reported in acre-feet per year. Note: a negative sign refers to flow out of the aquifer in the district. A positive sign refers to flow into the aquifer in the district. All numbers are rounded to the nearest acre-foot. Flows include fresh, brackish, and saline waters. Due to the brackish characteristics of groundwater, the model dose not apply to the Corpus Christi ASR Conservation District in Jasper (Layer 4).

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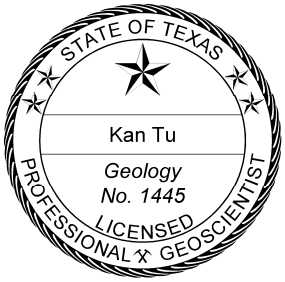
Aquifer	Surface water inflow	Surface water outflow	Lateral inflow into district	Lateral outflow from district	Net inter-aquifer flow (upper)	Net inter-aquifer flow (lower)
Chicot (Layer 1)	4	2,900	7,086	-2,256	0	176
Evangeline (Layer 2)	0	0	544	-237	-176	2
Burkeville (Layer 3)	0	0	-1	0	-2	0
Jasper (Layer 4)	--	--	--	--	--	--

Table 2: Summarized information needed for Corpus Christi ASR Conservation District's groundwater management plan. All values are reported in acre-feet per year. All numbers are rounded to the nearest acre-foot.

Management plan requirement	**Aquifer**	**Results**
Estimated annual amount of recharge from precipitation to the district	Chicot (Layer 1)	368
	Evangeline (Layer 2)	0
	Burkeville (Layer 3)	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Chicot (Layer 1)	2,900
	Evangeline (Layer 2)	0
	Burkeville (Layer 3)	0

Estimated annual volume of flow into the district within each aquifer in the district	Chicot (Layer 1)	7,086
	Evangeline (Layer 2)	544
	Burkeville (Layer 3)	1
Estimated annual volume of flow out of the district within each aquifer in the district	Chicot (Layer 1)	2,256
	Evangeline (Layer 2)	237
	Burkeville (Layer 3)	0



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