GAM Run 7-26

by Ali H. Chowdhury Ph.D., P.G.
Texas Water Development Board
Groundwater Resources Division
(512) 936-0834

September 25, 2007

EXECUTIVE SUMMARY

We used the groundwater availability model for the central part of the Gulf Coast Aquifer to estimate average annual groundwater flow conditions in the San Patricio County Groundwater Conservation District. We averaged the monthly and annual water budget results for 1980 through 1999 to estimate baseline groundwater flow conditions. We observed that about 32,000 acre-feet of groundwater annually flows through the San Patricio County Groundwater Conservation District. Most of this flow occurs in the form of recharge, flow to and from the aquifer to the river, inter-aquifer flow, and lateral flow from in and out of the district.

REQUESTOR:

Rima Petrossian on behalf of the San Patricio County Groundwater Conservation District.

DESCRIPTION OF REQUEST:

Estimate average groundwater flow conditions through the central part of the Gulf Coast Aquifer in the San Patricio County Groundwater Conservation District for the period 1980 through 1999.

METHODS:

We used the groundwater availability model for the central part of the Gulf Coast Aquifer (Chowdhury and others, 2004) to estimate average annual groundwater flow through the San Patricio County Groundwater Conservation District. We identified the model cells representing the geographic area covered by the District using a unique identifier. We used this identifier to determine the water budget results for the District area from the model. Where necessary, we averaged the monthly stress period water budget results into annual water budgets and then averaged all the annual water budget results that may represent baseline groundwater flow condition for the period 1980 through 1999. We compared these water budget values with values from the model for adjacent counties.

PARAMETERS AND ASSUMPTIONS:

- 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 transient portion of the model has a total of 87 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 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.

RESULTS:

Estimated average annual groundwater flow through the central parts of the Gulf Coast Aquifer for the San Patricio County Groundwater Conservation District is presented in Table 1.

In the description of the water budget, all flow components are considered with respect to the aquifer. For example, water that enters an aquifer (recharge) is considered positive and water that discharges from an aquifer through artificial withdrawal (pumping) or natural processes (baseflow, evapotranspiration, springs) is considered negative. Various components of flow from the water budget (Table 1 and 2) are further described below:

- Surface water inflow and outflow—This is the total surface water entering the aquifer (inflow) through streams or reservoirs, or total surface water exiting the aquifer (outflow) to streams, reservoirs, and drains (springs).

- Recharge—Recharge from precipitation is the areally distributed recharge due to precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the District. Recharge is always positive as water is added to the aquifer. The information needed for the District's management plan is summarized in Table 2.

- Net inter-aquifer flow (upper and lower)—Describes amount of cross-formational flow along the contacts of the model layers between two aquifers. This flow is controlled by the relative water level elevations and aquifer properties of each

aquifer. “Inflow” to an aquifer from an overlying or underlying aquifer will always equal the “Outflow” from the other aquifer.

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

Table 1: Selected flow terms for each aquifer into and out of the San Patricio County Groundwater Conservation District, averaged for the years1980 to 1999 from the groundwater availability model for the central part of the Gulf Coast Aquifer. Flows are in acre-feet per year. Note: a negative sign indicates that flow is out of the District. All numbers are rounded to the nearest acre-foot.

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)	1,467	16,471	10,054	-1,069	0	869
Evangeline (Layer 2)	1,668	2,388	3,178	-821	-869	458
Burkeville Confining System (Layer 3)	0	0	17	-1	-459	403
Jasper (Layer 4)	0	0	401	-32	-408	21

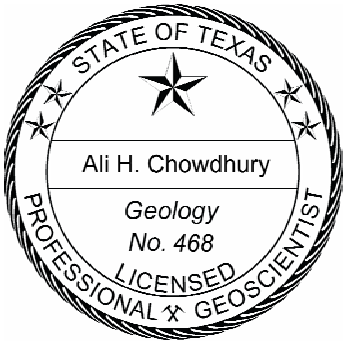
Table 2: Summarized information for the District’s management plan. All values are reported in acre-feet per year. All numbers are rounded to the nearest acre-foot.

Management Plan Requirement	Aquifer	Results from model simulation
Estimated annual amount of recharge from precipitation to the district	Aquifers are both unconfined and confined	13,102
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Chicot, Evangeline and Jasper aquifers, and the Burkeville Confining System	19,206
Estimated annual volume of flow into the district within each aquifer in the district	Chicot Aquifer	10,054
	Evangeline Aquifer	3,178
	Burkeville Confining System	17
	Jasper Aquifer	401
Estimated annual volume of flow out of the district within each aquifer in the district	Chicot Aquifer	1,069
	Evangeline Aquifer	821
	Burkeville Confining System	1
	Jasper Aquifer	32
Estimated annual volume of flow between each aquifer in the district	Chicot Aquifer	869
	Evangeline Aquifer	458
	Burkeville Confining System	403
	Jasper Aquifer	21

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 TWDB report, 114p. http://www.twdb.state.tx.us /gam /glfc_c/glfc_c_TWDB_SummaryReport.pdf

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, unpublished report, variously paginated.



The seal appearing on this document was authorized by Ali H. Chowdhury, P.G. on September 21, 2007.