GAM Run 08-22 Revision

by Wade A. Oliver
Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-3132
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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 groundwater management plans includes:

(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 revised information to the Gonzales County Underground Water Conservation District for its groundwater management plan. This groundwater availability model run has been revised to include areas in the district within Caldwell County (Figure 1) and should replace previous model runs. The groundwater management plan for the Gonzales County Underground Water Conservation District is due for approval by the Executive Administrator of the Texas Water Development Board before September 15, 2008.

This report discusses the methods, assumptions, and results from model run using the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers. Table 1 summarizes the groundwater availability model data required by statute for the Gonzales County Underground Water Conservation District's groundwater management plan.

METHODS:

We ran the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers and (1) extracted water budgets for each year of the 1980 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 Carrizo-Wilcox, Queen City, and Sparta aquifers located within the district.

PARAMETERS AND ASSUMPTIONS:

- We used Version 2.01 of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers. See Deeds and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.

- The groundwater availability model includes eight layers, representing:

    1. the Sparta Aquifer (Layer 1),
    2. the Weches Confining Unit (Layer 2),
    3. the Queen City Aquifer (Layer 3),
    4. the Reklaw Confining Unit (Layer 4),
    5. the Carrizo Aquifer (Layer 5),
    6. the Upper Wilcox Aquifer (Calvert Bluff Formation—Layer 6),
    7. the Middle Wilcox Aquifer (Simsboro Formation—Layer 7), and
    8. the Lower Wilcox Aquifer (Hooper Formation—Layer 8).

- The root mean squared error (a measure of the difference between simulated and actual water levels during model calibration) in the groundwater availability model is 23 feet for the Sparta Aquifer, 18 feet for the Queen City Aquifer, and 33 feet for the Carrizo Aquifer for the calibration period (1980 to 1989) and 19, 22, and 48 feet for the same aquifers, respectively, in the verification period (1990 to 1999) (Kelley others, 2004). These root mean squared errors are between seven and ten percent of the range of measured water levels (Kelley others, 2004)

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

RESULTS:

A groundwater budget summarizes water entering and leaving the aquifer according to input parameters assigned in the model to simulate the groundwater flow system. The annual average of the various components of groundwater flow for the southern parts of the Carrizo-Wilcox, Queen City, and Sparta aquifers (1980 to 1999) in the district are 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.

- Flow between aquifers—This describes the vertical flow, or leakage, between aquifers or confining units. This flow is controlled by the relative 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. The grid cells used to extract the information for Table 1 are shown in Figure 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.

Groundwater in the Carrizo-Wilcox, Queen City, and Sparta aquifers ranges from fresh to brackish in composition (Kelley and others, 2004). Groundwater with total dissolved solids of less than 1,000 milligrams per liter are considered fresh and total dissolved solids of 1,000 to 10,000 milligrams per liter are considered brackish.

Although the Yegua-Jackson Aquifer also occurs in Gonzales County, a groundwater availability model has not been developed at this time for this minor aquifer. If Gonzales County Underground Water Conservation District would like information for the Yegua-Jackson Aquifer, they may request it from the Groundwater Technical Assistance Section of the Texas Water Development Board.

REFERENCES:

Deeds, N., Kelley, V.A., Fryar, D., Jones, T., Whallon, A.J., and Dean, K.E., 2003, Groundwater availability model for the Southern Carrizo-Wilcox Aquifer: Contract report to the Texas Water Development Board, 452 p.

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

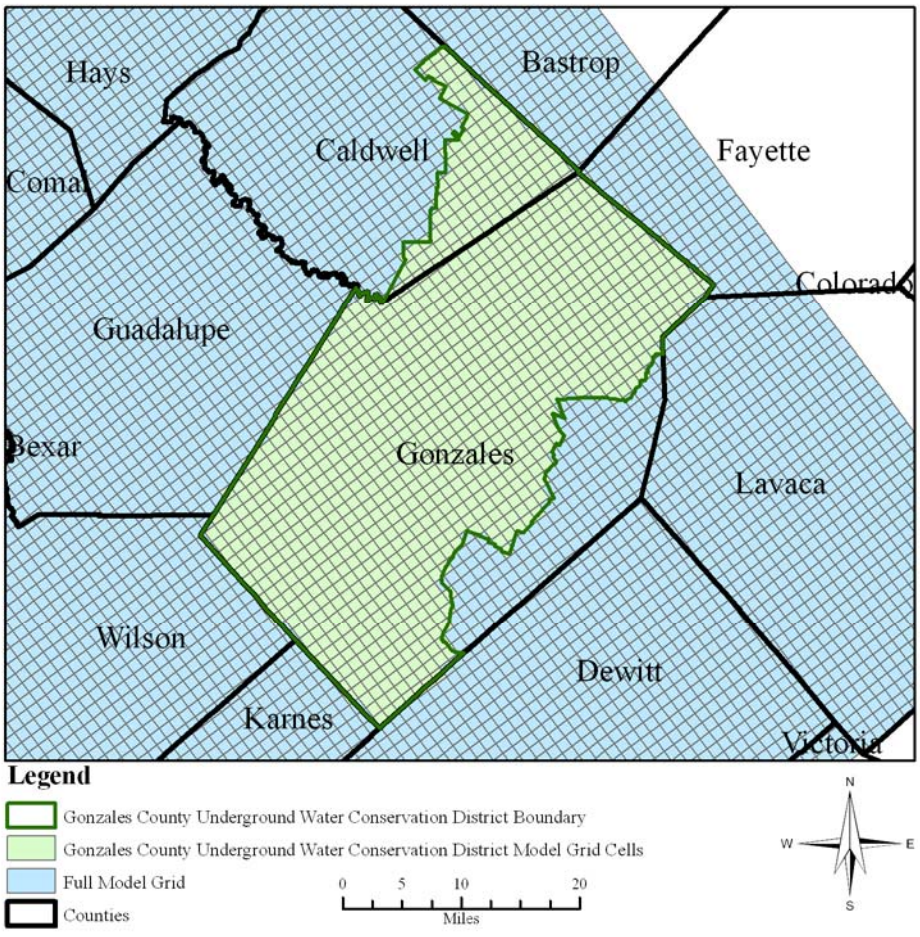
Kelley, V.A., Deeds, N.E., Fryar, D.G., and Nicot, J.P., 2004, Groundwater availability models for the Queen City and Sparta aquifers: Contract report to the Texas Water Development Board, 867 p.

Table 1: Summarized information needed for the Gonzales County Underground Water 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. Reported values may include both fresh and brackish waters.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Sparta	3,105
	Weches	808
	Queen City	7,291
	Reklaw	2,168
	Carrizo	6,927
	Wilcox (upper)	0
	Wilcox (middle)	921
	Wilcox (lower)	0
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta	2,127
	Weches	521
	Queen City	3,583
	Reklaw	1,935
	Carrizo	6,896
	Wilcox (upper)	0
	Wilcox (middle)	31
	Wilcox (lower)	0
Estimated annual volume of flow into the district within each aquifer in the district	Sparta	386
	Weches	117
	Queen City	1,172
	Reklaw	170
	Carrizo	8,897
	Wilcox (upper)	30
	Wilcox (middle)	2,031
	Wilcox (lower)	4,052
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta	70
	Weches	35
	Queen City	126
	Reklaw	156
	Carrizo	5,732
	Wilcox (upper)	48
	Wilcox (middle)	3,488
	Wilcox (lower)	2,506

Management plan requirement	Aquifer or confining unit	Results
Estimated annual net volume of flow between each aquifer in the district	Weches into Sparta	4,511
	Queen City into Weches	4,183
	Reklaw into Queen City	3,190
	Carrizo into Reklaw	1,945
	Carrizo into Wilcox (upper)	649
	Wilcox (upper) to Wilcox (middle)	194
	Wilcox (lower) to Wilcox (middle)	190

Figure 1: Grid cells of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers 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.



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 August 14, 2008.