GAM run 05-24

by Shirley Wade

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Groundwater Availability Modeling Section
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June 8, 2005

REQUESTOR:

Lonnie Stewart, Live Oak Underground Water Conservation District

DESCRIPTION OF REQUEST:

Mr. Stewart requested that we use the groundwater availability models (GAMs) for the central part of the Gulf Coast aquifer and the southern part of the Carrizo-Wilcox aquifers to estimate the total recoverable volume of water in the aquifers.

METHODS:

To address the request, we:

- ran the calibrated transient models and extracted water levels for 1992 (we chose 1992 because pumping for that year [7,100 acre feet] was closest to current pumping (9,000 acre feet) for Live Oak County);
- extracted aquifer top and bottom elevations from the models;
- compared water levels with the top elevation of the aquifer;
- calculated saturated thickness for each model cell (top elevation minus bottom elevation or aquifer water level minus aquifer bottom elevation if water levels were below aquifer top);
- multiplied saturated thickness times specific yield to estimate total water in storage for each model cell; and
- calculated total storage for all active model cells in Live Oak County in each aquifer.

PARAMETERS AND ASSUMPTIONS:

- We used uniform values of specific yield for all aquifer layers. The values are listed in Tables 1 and 2. The specific yield values are from the GAMs with the exception of the specific yield for the Evangeline aquifer. That value is from Carr and Meyer (1985) and is an upper limit on storage coefficients for the aquifer under water table conditions.
- The volume of water stored due to compression in the confined layers is insignificant compared with the drainable storage and is not included in the calculations.
- See Chowdhury and others (2004) for assumptions and limitations of the GAM for the central part of the Gulf Coast aquifer. Root mean squared error for the entire central Gulf Coast aquifer model is up to 46 feet. This error will have more of an effect on model results where the aquifer is thin. In addition, the model assumes that pumping in the Evangeline aquifer only occurs in the upper part of the Evangeline aquifer (Chowdhury and others, 2004).

- See Deeds and others (2003) for additional information concerning the Carrizo-Wilcox aquifer. Root mean squared error for the Carrizo layer is 33 feet.

RESULTS:

Table 1 lists the estimated total volume in storage for the Gulf Coast aquifer in Live Oak County, and Table 2 lists the estimated total volume in storage for the Carrizo aquifer. We did not list the storage volume for the Wilcox aquifer because it is very deep and the water quality is poor. The GAM report for the southern part of the Carrizo-Wilcox aquifer (Deeds and others, 2003) indicates that total dissolved solids exceed 1,000 ppm and the sodium hazard is high in Live Oak County. Although the Carrizo aquifer is quite deep in Live Oak County (up to 7,000 feet deep), there is some historical use; therefore, we calculated total volume in storage for that aquifer. Also listed in Tables 1 and 2 are the uniform values of specific yield in the model layers as well as the average layer thickness.

Two model cells in the Evangeline aquifer went dry during the simulation. Model cells go dry when the pumpage exceeds the ability of the cell to transmit water and water levels in that cell drop below the base of the aquifer. When a model cell goes dry, the pumpage from that cell turns off in the model. We did not consider these cells in our calculations.

The total storage volumes listed in Tables 1 and 2 are not likely to be 100 percent recoverable due to practical considerations such as the cost to drill wells and removing water from thin saturated thicknesses.

REFERENCES:

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: Texas Water Development Board, Model Summary Report, 113 p.

Carr, J.E., and Meyer, W. R., 1985, Digital Models for Simulation of Ground-Water Hydrology of the Chicot and Evangeline aquifers along the Gulf Coast of Texas.

Deeds, N., Kelley, V., Fryar, D., and Jones, T., 2003, Groundwater availability model for the Southern Carrizo-Wilcox aquifer: Final Report prepared for the Texas Water Development Board by INTERA Inc.

Table 1. Estimated total storage volume from the GAM for the central part of the Gulf Coast aquifer located in Live Oak County.

Aquifer	Specific yield[1]	Area (mile^2)	Average thickness	Volume (acre-feet)[3]
Evangeline	0.1[2]	284[4]	370	6,665,000
Burkeville	0.005	587	290	540,000
Jasper	0.05	869	433	12,040,000
Total	**-**	**-**	-	**19,245,000**

1 From GAM for the central part of the Gulf Coast aquifer.
2 Carr and Meyer (1985)
3 Rounded to the nearest 1,000 acre-feet
4 Does not include two cells that went dry in the model simulation.

Table 2. Estimated total storage volume from the GAM for the southern part of the Carrizo-Wilcox aquifers located in Live Oak County.

Aquifer	Specific yield[1]	Area (mile^2)	Average thickness	Volume (acre-feet)[2]
Carrizo	0.15	366	830	28,973,000

1From GAM for the southern part of Carrizo-Wilcox aquifers.
[2] Rounded to the nearest 1,000 acre-feet