

GAM Run 08-74

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Groundwater Availability Modeling Section
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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 Kimble County Groundwater Conservation District for its groundwater management plan. The groundwater management plan for Kimble County Groundwater Conservation District is due for approval by the Executive Administrator of the Texas Water Development Board before August 18, 2009.

This report discusses the method, assumptions, and results from model runs using the groundwater availability model for the Edwards-Trinity (Plateau) Aquifer. Table 1 summarizes the groundwater availability model data required by statute for Kimble County 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 Edwards-Trinity (Plateau) Aquifer and (1) extracted water budgets for each year of the 1980 through 2000 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 Edwards-Trinity (Plateau) Aquifer located within the district.

PARAMETERS AND ASSUMPTIONS:

- We used version 1.01 of the groundwater availability model for the Edwards-Trinity (Plateau) Aquifer. See Anaya and Jones (2004) for assumptions and limitations of this model.
- The Edwards-Trinity (Plateau) Aquifer model includes two layers representing the Edwards Group and equivalent limestone hydrostratigraphic units (Layer 1) and the undifferentiated Trinity Group hydrostratigraphic units (Layer 2) in the district.
- The root mean square error (a measure of the difference between simulated and measured water levels) of the Edwards-Trinity (Plateau) groundwater availability model for the period of 1980 to 2000 is 143 feet, or six percent of the range of measured water levels (Anaya and Jones, 2004).
- We decided to use the groundwater availability model for the Edwards-Trinity (Plateau) Aquifer instead of the groundwater availability model for the Hill Country portion of the Trinity Aquifer, because the model for the Edwards-Trinity (Plateau) Aquifer covers the entire district and the groundwater model for the Hill Country covers only a small portion of the district. Because the two models are aligned in slightly different orientations, we could not combine the results from each without either double accounting or omitting important information.
- We used Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) as the interface to process model output.

RESULTS:

A groundwater budget summarizes the amount of 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 (1980 to 2000) in the district, as shown in Table 1. The components of the 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.

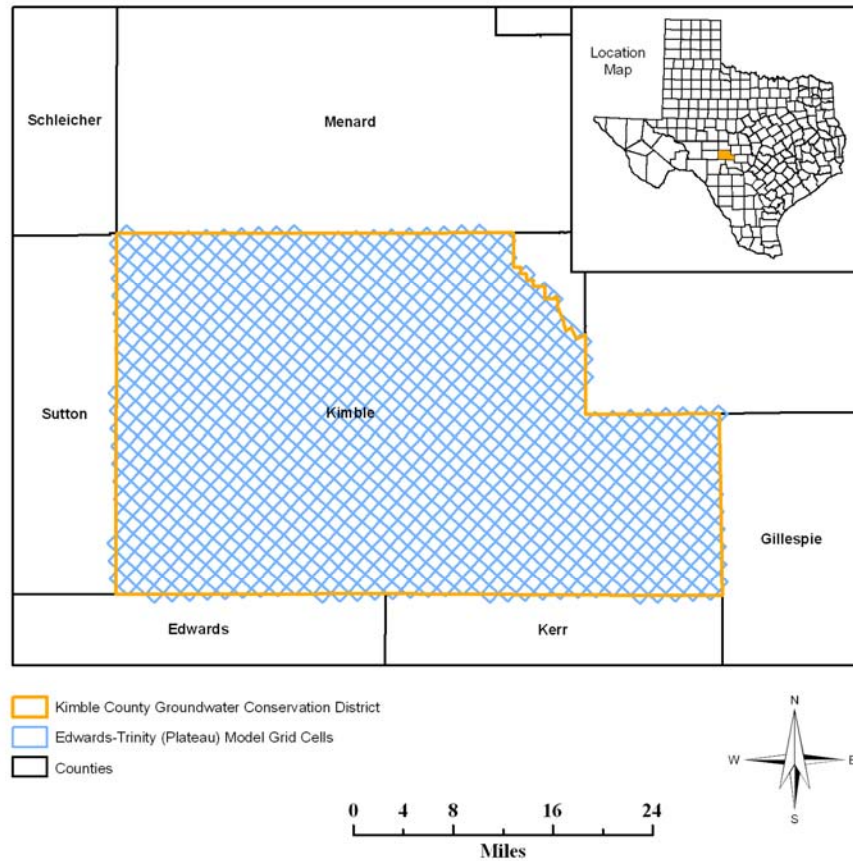
- Flow between aquifers—This describes the vertical flow, or leakage, between the upper and lower faces of the aquifers or confining units. This flow is controlled by the relative water level elevations in each aquifer or confining unit and aquifer properties of each aquifer or confining unit that define 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 district or county boundaries, 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 (see Figure 1).

Table 1: Summarized information needed for Kimble County 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
Estimated annual amount of recharge from precipitation to the district	Edwards and associated limestones	24,731
	undifferentiated Trinity units	6,871
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards and associated limestones	26,982
	undifferentiated Trinity units	30,913
Estimated annual volume of flow into the district within each aquifer in the district	Edwards and associated limestones	17,229
	undifferentiated Trinity units	12,670
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards and associated limestones	6,893
	undifferentiated Trinity units	3,960
Estimated net annual volume of flow between each aquifer in the district	Edwards and associated limestones flowing into undifferentiated Trinity units	8,828

Figure 1: Area of the groundwater availability model for the Edwards-Trinity (Plateau) Aquifer from which the information in Table 1 was extracted (the aquifer extent within the Kimble County Groundwater Conservation District boundary).



REFERENCES:

Anaya, R., and Jones, I., 2004, Groundwater availability model for the Edwards-Trinity (Plateau) and Cenozoic Pecos Alluvium aquifer systems, Texas: Texas Water Development Board, GAM Report, 208 p., http://www.twdb.state.tx.us/gam/eddt_p/eddt_p.htm.

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