GAM Run 07-24

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Groundwater Availability Modeling Section
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REQUESTOR:

Ms. Rima Petrossian of the Texas Water Development Board on behalf of the Cow Creek Groundwater Conservation District.

DESCRIPTION OF REQUEST:

The following information was requested for the District from the groundwater availability model for the Hill Country portion of the Trinity Aquifer:

1) estimated annual amount of recharge from precipitation to the District;
2) estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers; and
3) estimated annual volume of flow into and out of the District within each aquifer and between each aquifer in the District.

METHODS:

To address the request, we did the following:

- We ran the transient groundwater availability model for the Hill Country portion of the Trinity Aquifer and extracted water budgets for 1996 and 1997 and
- We calculated the average recharge, surface water inflow, surface water outflow, inflow to the district, outflow from the district, net inter-aquifer flow (upper) and net inter-aquifer flow (lower) over the two-year transient model run.

PARAMETERS AND ASSUMPTIONS:

- We used version 1.02 of the Hill Country portion of the Trinity Aquifer groundwater availability model.
- The model has three layers: layer 1 represents the Edwards Aquifer, layer 2 represents the Upper Trinity Aquifer, and layer 3 represents the Middle Trinity Aquifer.

- This report does consider flow into or out of the Lower Trinity Aquifer. Therefore, the estimates for flow into and out of the District are conservative values. Future updates to the Hill Country portion of the Trinity Aquifer will include this aquifer.

- The rivers, streams, and springs were simulated in the model using the MODFLOW Drain package.

- Reservoirs/lakes in the model area were simulated using constant heads.

- The transient model was calibrated for 1996 through 1997 when the climate varied from dry to wet period. This assumes that 1996 and 1997, when averaged, represent annual recharge from precipitation for the District.

- Minor changes to the bottom and top elevations in the model layers have occurred since the conception of the initial model; however, given that the structure surfaces were interpolated over one mile grid cells, from a limited number of known measured elevations, these minor changes probably lie within the interpolation error.

RESULTS:

Recharge and water budget

A groundwater budget summarizes how the model estimates water entering and leaving the aquifer. The groundwater budget for the average values from the transient model (1996 to 1997) is shown in Table 1. The components of the budgets shown in Table 1 include:

- 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).

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

- Net inter–aquifer flow—This term 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.

- 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. The information needed for the District’s management plan is summarized in Table 2.

REFERENCES:

Mace, R. E., Chowdhury, A. H., Anaya, R., and Shao-Chih (Ted) Way, 2000, Groundwater availability of the Trinity Aquifer , Hill Country Area, Texas: Numerical simulations through 2050, Texas Water Development Board Report 353, 119 p.

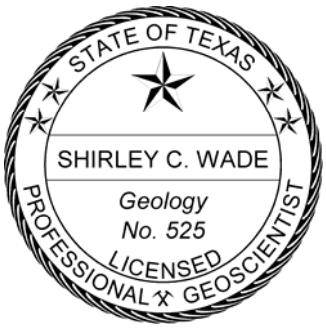

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Table 1: Selected flow terms for each aquifer layer, into and out of the Cow Creek Groundwater Conservation District, averaged for the years 1996 to 1997 from the groundwater availability model for the Trinity Hill Country Aquifer. Flows are in acre-feet 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. All numbers are rounded to the nearest acre-foot.

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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)
Edwards Plateau (Layer 1)	0	-5,788	106	-205	0	-30
Upper Trinity (Layer 2)	0	-7,108	2,115	-7,236	30	-15,567
Lower Trinity (Layer 3)	0	-25,738	7,109	-10,417	15,567	0

Table 2: Summarized information needed for the District's management plan. All values 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	All aquifers and confining units	53,111
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Edwards Plateau, Upper, and Middle Trinity Aquifers	38,634
Estimated annual volume of flow into the district within each aquifer in the district	Edwards Plateau Aquifer	106
	Upper Trinity Aquifer	2,115
	Middle Trinity Aquifer	7,109
Estimated annual volume of flow out of the district within each aquifer in the district	Edwards Plateau Aquifer	205
	Upper Trinity Aquifer	7,236
	Middle Trinity Aquifer	10,417
Estimated annual volume of flow between each aquifer in the district	Edwards Plateau Aquifer and Upper Trinity Aquifer	30
	Upper Trinity Aquifer and Middle Trinity Aquifer	15,567