GAM Run 10-033 MAG

by Mr. Wade Oliver

Texas Water Development Board
Groundwater Availability Modeling Section
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November 18, 2011

Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section and Interim Director of the Groundwater Resources Division, 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. 471 on November 18, 2011.

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EXECUTIVE SUMMARY:

The modeled available groundwater for the Ogallala Aquifer as a result of the desired future condition adopted by the members of Groundwater Management Area 7 declines from approximately 69,600 acre-feet per year to 52,900 acre-feet per year between 2010 and 2060. This is shown divided by county, regional water planning area, and river basin as shown in Table 1 for use in the regional water planning process. Modeled available groundwater is summarized by groundwater conservation district in Table 2. The estimates were extracted from Groundwater Availability Model Run 09-027, which meets the desired future condition adopted by the members of Groundwater Management Area 7.

REQUESTOR:

Mr. Allan Lange of Lipan-Kickapoo Water Conservation District on behalf of Groundwater Management Area 7

DESCRIPTION OF REQUEST:

In a letter dated August 13, 2010, Mr. Lange provided the Texas Water Development Board (TWDB) with the desired future condition of the Ogallala Aquifer adopted by the members of Groundwater Management Area 7. The desired future condition for the Ogallala Aquifer through 2060, as described in Resolution No. 07-29-10-5 and adopted July 29, 2010, is described below:

1) *total decline in volume of water within Ector, Glasscock, and Midland counties in the southern portion of the Ogallala aquifer within* [Groundwater Management Area] *7 at the end of the fifty-year period shall not exceed 50 percent of the volume in the aquifer in the year 2010.*
2) *the Ogallala Aquifer is not relevant for joint planning purposes in all other areas of* [Groundwater Management Area] *7.*

In response to receiving the adopted desired future condition, the Texas Water Development Board has estimated the modeled available groundwater for the Ogallala Aquifer within Groundwater Management Area 7.

METHODS:

Groundwater Management Area 7 contains part of the southern portion of the Ogallala Aquifer. The location of Groundwater Management Area 7, the Ogallala Aquifer, and the groundwater availability model cells that represent the aquifer are shown in Figure 1.

The Texas Water Development Board previously completed a predictive groundwater availability model simulation of the Ogallala Aquifer to assist the members of Groundwater Management Area 7 in developing a desired future condition. As stated in Resolution No. 07-29-10-5, the members of Groundwater Management Area 7 considered Groundwater Availability Model (GAM) Run 09-027 when developing the desired future condition statement above (Oliver, 2010). The results presented in this report were taken directly from the “base” scenario

in Oliver (2010), which meets the desired future condition adopted by the members of Groundwater Management Area 7.

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the model run using the groundwater availability model for the southern portion of the Ogallala Aquifer are described below:

- The results presented in this report are based on GAM Run 09-027 (Oliver, 2010). See GAM Run 09-027 for a full description of the methods, assumptions, and results of the groundwater availability model run.

- We used version 2.01 of the groundwater availability model for the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer. This model is an expansion on and update to the previously developed groundwater availability model for the southern portion of the Ogallala Aquifer described in Blandford and others (2003). See Blandford and others (2008) and Blandford and others (2003) for assumptions and limitations of the groundwater availability model.

- The model includes four layers representing the southern portion of the Ogallala and Edwards-Trinity (High Plains) aquifers. The units comprising the Edwards-Trinity (High Plains) Aquifer (primarily Edwards, Comanche Peak, and Antlers Sand formations) are separated from the overlying Ogallala Aquifer by a layer of Cretaceous shale, where present. Note that the Edwards-Trinity (High Plains) Aquifer is not present within Groundwater Management Area 7.

- The mean absolute error (a measure of the difference between simulated and measured water levels during model calibration) for the Ogallala Aquifer in 2000 is 33 feet (Blandford and others, 2008).

- Cells were assigned to individual counties, river basins, regional water planning areas, and groundwater conservation districts as shown in the August 3, 2010 version of the file that associates the model grid to political and natural boundaries for the southern portion of the Ogallala Aquifer and the Edwards-Trinity (High Plains) Aquifer.

- The recharge used for the model run represents average recharge as described in Blandford and others (2003).

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code, “modeled available groundwater” is the estimated average amount of water that may be produced annually to achieve a desired future condition. This is distinct from “managed available groundwater,” shown in the draft version of this report dated November 22, 2010, which was a permitting value and accounted for the estimated use of the aquifer exempt from permitting. This change was made to reflect changes in statute by the 82nd Texas Legislature, effective September 1, 2011.

Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits. The estimated amount of pumping exempt from permitting, which the Texas Water Development Board is now required to develop after soliciting input from applicable groundwater conservation districts, will be provided in a separate report.

RESULTS:

The modeled available groundwater for the Ogallala Aquifer in Groundwater Management Area 7 as a result of the desired future condition declines from approximately 69,600 acre-feet per year in 2010 to 52,900 acre-feet per year in 2060. This pumping has been divided by county, regional water planning area, and river basin for each decade between 2010 and 2060 for use in the regional water planning process (Table 1).

The modeled available groundwater for the Ogallala Aquifer is also summarized by groundwater conservation district as shown in Table 2. Note that Glasscock Groundwater Conservation District is the only district within Groundwater Management Area 7 that contains the Ogallala Aquifer.

LIMITATIONS:

The groundwater model used in developing estimates of modeled available groundwater is the best available scientific tool that can be used to estimate the pumping that will achieve the desired future conditions. Although the groundwater model used in this analysis is the best available scientific tool for this purpose, it, like all models, has limitations. In reviewing the use of models in environmental regulatory decision-making, the National Research Council (2007) noted:

> "Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."

A key aspect of using the groundwater model to develop estimates of modeled available groundwater is the need to make assumptions about the location in the aquifer where future pumping will occur. As actual pumping changes in the future, it will be necessary to evaluate the amount of that pumping as well as its location in the context of the assumptions associated with this analysis. Evaluating the amount and location of future pumping is as important as evaluating the changes in groundwater levels, spring flows, and other metrics that describe the condition of the groundwater resources in the area that relate to the adopted desired future condition(s).

Given these limitations, users of this information are cautioned that the modeled available groundwater numbers should not be considered a definitive, permanent description of the amount of groundwater that can be pumped to meet the adopted desired future condition. Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor future groundwater pumping as well as whether or not they are achieving their desired future conditions. Because of the limitations of the model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine the modeled available groundwater numbers given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future.

REFERENCES:

Blandford, T.N., Blazer, D.J., Calhoun, K.C., Dutton, A.R., Naing, T., Reedy, R.C., and Scanlon, B.R., 2003, Groundwater availability of the southern Ogallala aquifer in Texas and New Mexico—Numerical simulations through 2050: Final report prepared for the Texas Water Development Board by Daniel B. Stephens & Associates, Inc., 158 p.

Blandford, T.N., Kuchanur, M., Standen, A., Ruggiero, R., Calhoun, K.C., Kirby, P., and Shah, G., 2008, Groundwater availability model of the Edwards-Trinity (High Plains) Aquifer in Texas and New Mexico: Final report prepared for the Texas Water Development Board by Daniel B. Stephens & Associates, Inc., 176 p.

National Research Council, 2007, Models in Environmental Regulatory Decision Making. Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p.

Oliver, W., 2010, GAM Run 09-027: Texas Water Development Board, GAM Run 09-027 Report, 23 p.

Table 1. Modeled available groundwater for the Ogallala Aquifer in Groundwater Management Area 7. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Regional Water Planning Area	Basin	Year					
			2010	2020	2030	2040	2050	2060
Ector	F	Colorado	8,665	8,026	7,730	7,171	7,135	6,727
Glasscock	F	Colorado	21,773	21,322	20,875	19,691	17,289	14,868
Midland	F	Colorado	39,149	38,388	36,824	34,623	32,693	31,325
Total			**69,587**	**67,736**	**65,429**	**61,485**	**57,117**	**52,920**

Table 2. Modeled available groundwater for the Ogallala Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 7 for each decade between 2010 and 2060. Results are in acre-feet per year.

Groundwater Conservation District	Year					
	2010	2020	2030	2040	2050	2060
Glasscock GCD	21,773	21,322	20,875	19,691	17,289	14,868
No District	47,814	46,414	44,554	41,794	39,828	38,052
Total	**69,587**	**67,736**	**65,429**	**61,485**	**57,117**	**52,920**

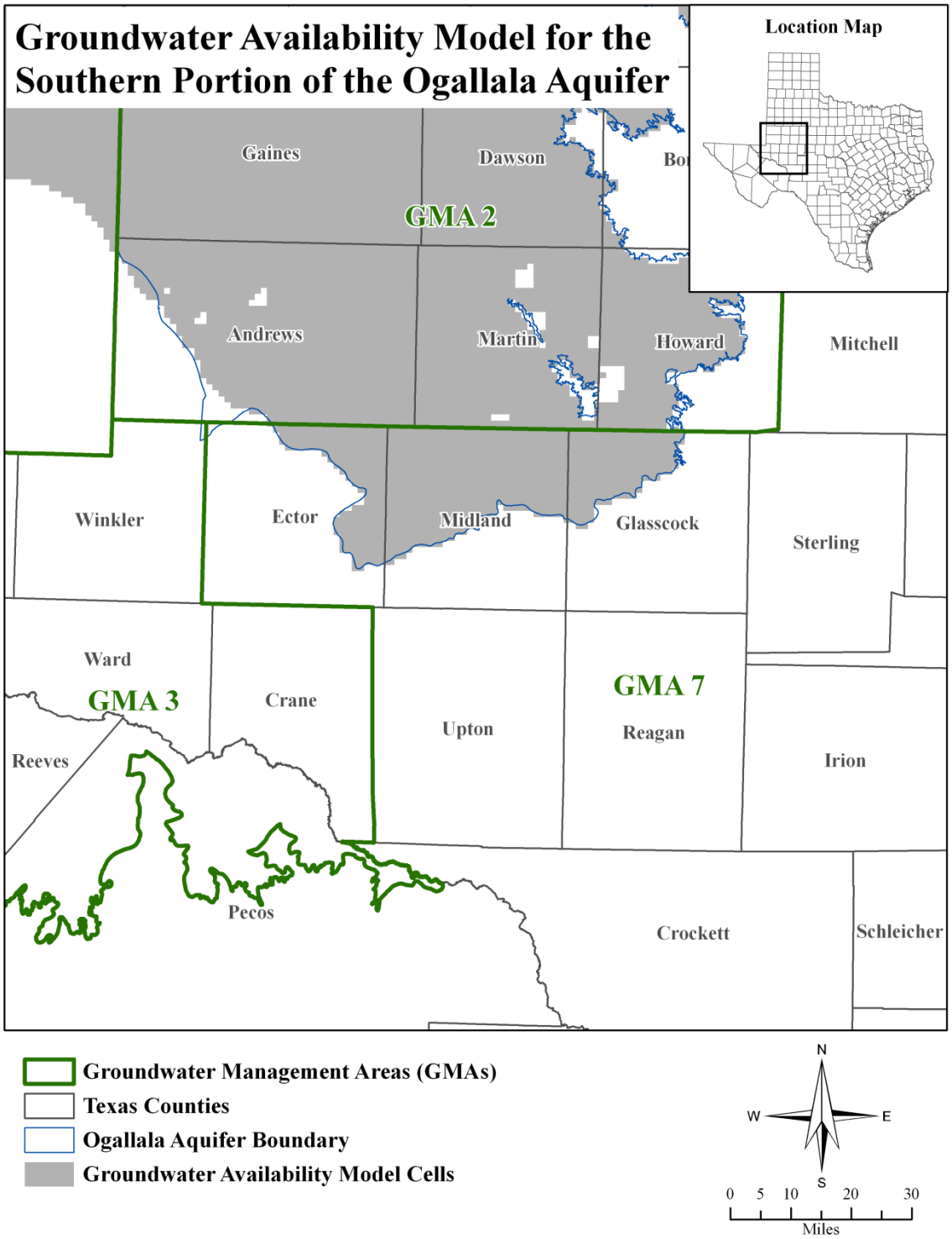

Figure 1. Map showing the areas covered by the groundwater availability model for the southern portion of the Ogallala Aquifer.

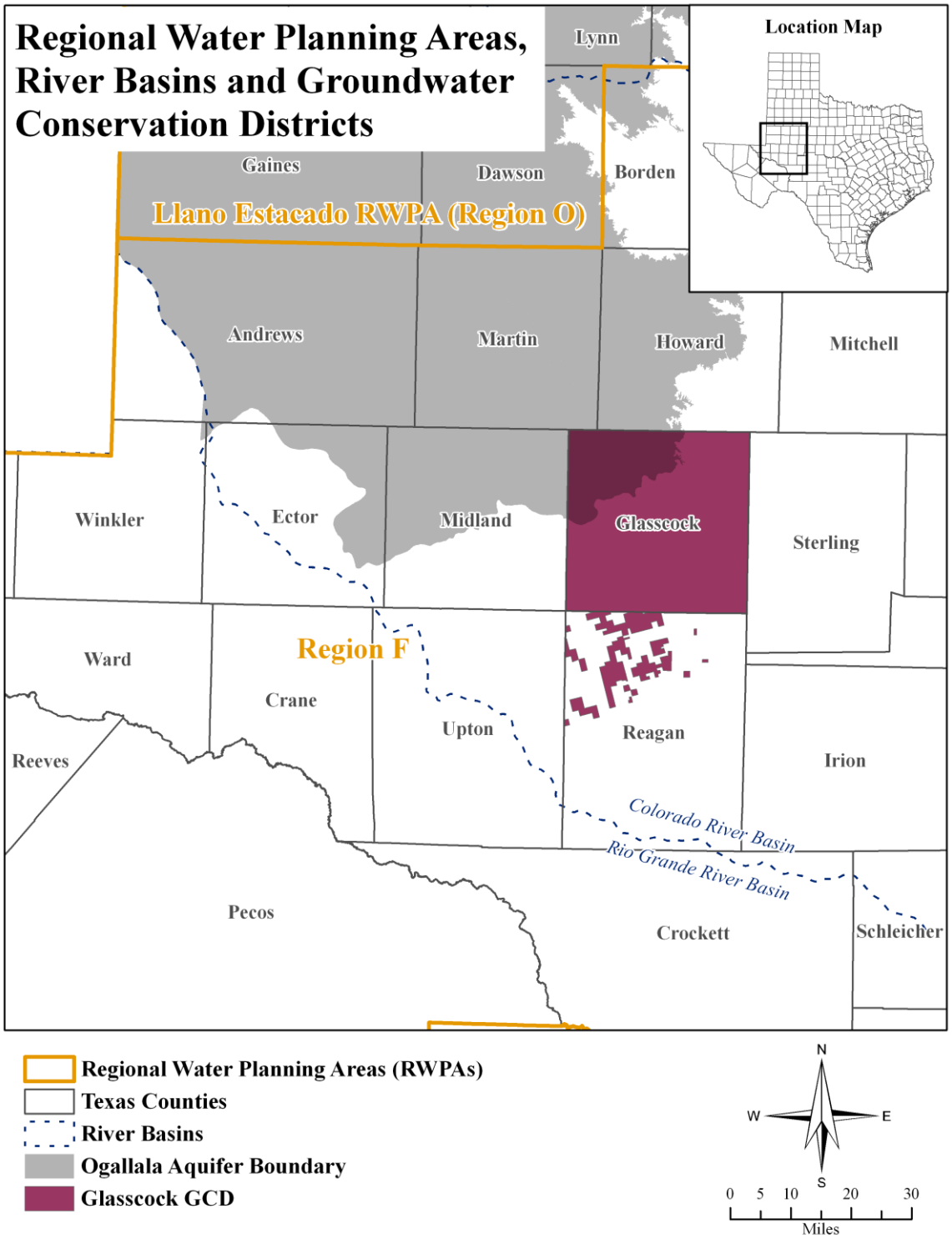

Figure 2. Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in Groundwater Management Area 7.