GAM Run 10-062 MAG Version 2

by Mr. Wade Oliver

Updated to version 2 by Shirley Wade to reflect refined modeled available groundwater estimates

Texas Water Development Board
Groundwater Availability Modeling Section
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Cynthia K. Ridgeway, the Manager of the Groundwater Availability Modeling Section, 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 June 29, 2012.

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EXECUTIVE SUMMARY:

The modeled available groundwater for the Lipan Aquifer as a result of the desired future condition adopted by the districts of Groundwater Management Area 7 is, on average, approximately 41,000 acre-feet per year. We have divided the modeled available groundwater by county, regional water planning area, and river basin (Table 1) for use in the regional water planning process. We have also summarized the modeled available groundwater by county (Table 2) and groundwater conservation district (Table 3). The results presented in this report are based on Groundwater Availability Model (GAM) Run 10-002, which the districts of Groundwater Management Area 7 considered when developing the desired future condition for the Lipan Aquifer. The original version of the GAM Run 10-062 MAG report included estimates of modeled available groundwater which were considered non-relevant by the groundwater conservation districts within Groundwater Management Area 7. This report only includes estimates of modeled available groundwater within the Lipan-Kickapoo Water Conservation District.

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. Allan Lange provided the Texas Water Development Board (TWDB) with the desired future condition of the Lipan Aquifer adopted by the members of Groundwater Management Area 7. The desired future condition for the Lipan Aquifer, as presented in Resolution # 07-29-10-4 and adopted July 29, 2010 by the groundwater conservation districts within Groundwater Management Area 7, is shown below:

1) w*ithin the boundaries of the Lipan-Kickapoo* [Water Conservation District] *in Concho, Runnels, and Tom Green Counties: continue to use 100% of all available groundwater annually with annual fluctuations of water levels and zero (0) net draw down in water levels over the next 50 years; and*
2) *the Lipan aquifer is not relevant for joint planning purposes outside the boundaries of Lipan-Kickapoo* [Water Conservation District].

In response to receiving the adopted desired future condition, the TWDB has estimated the modeled available groundwater for the Lipan Aquifer in Groundwater Management Area 7.

METHODS:

Groundwater Management Area 7 contains the Lipan Aquifer, a minor aquifer as defined in the 2007 State Water Plan (TWDB, 2007). The location of the Lipan Aquifer and the groundwater availability model cells that represent the aquifer, are shown in Figure 1.

The TWDB previously completed a model simulation that meets the above desired future condition. This is documented in Groundwater Availability Model (GAM) Run 10-002

(Hutchison, 2010). As described in Hutchison (2010), historical annual pumping from the Lipan Aquifer has been based largely on the water levels in the aquifer at the beginning of the irrigation season. Each year, pumping depletes the aquifer to the point that it is no longer economical to continue. Thus, when water levels are high, higher pumping can occur than when water levels are lower. After the irrigation season, water-levels recover as the aquifer is recharged from precipitation, inflow from the neighboring Edwards-Trinity (Plateau) Aquifer, and interaction with surface water. The amount of water available for pumping, therefore, varies depending on the amount of winter recharge.

Because of this, the simulations in GAM Run 10-002 used to evaluate the pumping required to meet the desired future condition were set up to determine the average and range of pumping that would occur under a variety of recharge conditions. The results below show the minimum and maximum pumping for any single year, as well as the average pumping among all years of the simulations.

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the model run using the groundwater availability model for the Lipan Aquifer are described below:

- The results presented here are based on GAM Run 10-002 (Hutchison, 2010). See Hutchison (2010) for a full description of the methods, assumptions, and results of the groundwater availability model run.

- Version 1.01 of the groundwater availability model for the Lipan Aquifer was used for all simulations. See Beach and others (2004) for assumptions and limitations of the groundwater availability model.

- The model includes one layer representing the Quaternary Leona Formation, the underlying Permian Formations, and the Edwards-Trinity (Plateau) Aquifer to the west, south, and north. It should be noted that extent of the Lipan Aquifer in the model pre-dates the updated footprint noted in the 2007 State Water Plan and does not include all of the aquifer as it is currently delineated.

- The mean error (a measure of the difference between simulated and measured water levels during model calibration) in the groundwater availability model is 4.7 feet for the calibration period (1980-1989) and 1.8 feet for the verification period (1990-1999, Beach and others, 2004).

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. 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 TWDB is 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 Lipan Aquifer in Groundwater Management Area 7 as a result of the desired future condition is, on average, approximately 41,000 acre-feet per year. We have divided this pumping 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). Notice that the Lipan Aquifer is located entirely within Region F Regional Water Planning Area and the Colorado River Basin.

We have also summarized the minimum, average, and maximum modeled available groundwater by county and groundwater conservation district (Tables 2 and 3, respectively) based on the seasonal considerations explained earlier.

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:

Beach, J.A., Burton, S. and Kolarik, B., 2004, Groundwater availability model for the Lipan Aquifer in Texas: contract report to the Texas Water Development Board.

Hutchison, W.R., 2010, GAM Run 10-002: Texas Water Development Board, GAM Run 10-002 Report, 8 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.

Texas Water Development Board, 2007, Water for Texas – 2007—Volumes I-III; Texas Water Development Board Document No. GP-8-1, 392 p.

Table 1. Modeled available groundwater in acre-feet for the Lipan Aquifer in Groundwater Management Area 7 by county, regional water planning area, and river basin. Pumping volumes are included for only portions of the counties included in the Lipan-Kickapoo Groundwater Conservation District. Note this table reflects the results assuming average pumping and climatic conditions. For drier climatic conditions, please see Table 2 (Minimum Modeled Available Groundwater).

County	Regional Water Planning Area	Basin	Year					
			2010	2020	2030	2040	2050	2060
Concho	F	Colorado	1,834	1,834	1,834	1,834	1,834	1,834
Runnels	F	Colorado	15	15	15	15	15	15
Tom Green	F	Colorado	39,361	39,361	39,361	39,361	39,361	39,361
Total			**41,209**	**41,209**	**41,209**	**41,209**	**41,209**	**41,209**

Table 2. Estimated minimum, average, and maximum modeled available groundwater for the Lipan Aquifer summarized by county in Groundwater Management Area 7. Results are in acre-feet per year. Pumping volumes are included for only portions of the counties included in the Lipan-Kickapoo Groundwater Conservation District.

County	Modeled Available Groundwater		
	Minimum	Average	Maximum
Concho	1,403	1,834	2,311
Runnels	11	15	19
Tom Green	30,131	39,361	49,602
Total	**31,545**	**41,209**	**51,932**

Table 3. Estimated minimum, average, and maximum modeled available groundwater for the Lipan Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 7. Results are in acre-feet per year. WCD refers to Water Conservation District.

Groundwater Conservation District	Modeled Available Groundwater		
	Minimum	Average	Maximum
Lipan-Kickapoo WCD	31,545	41,209	51,932

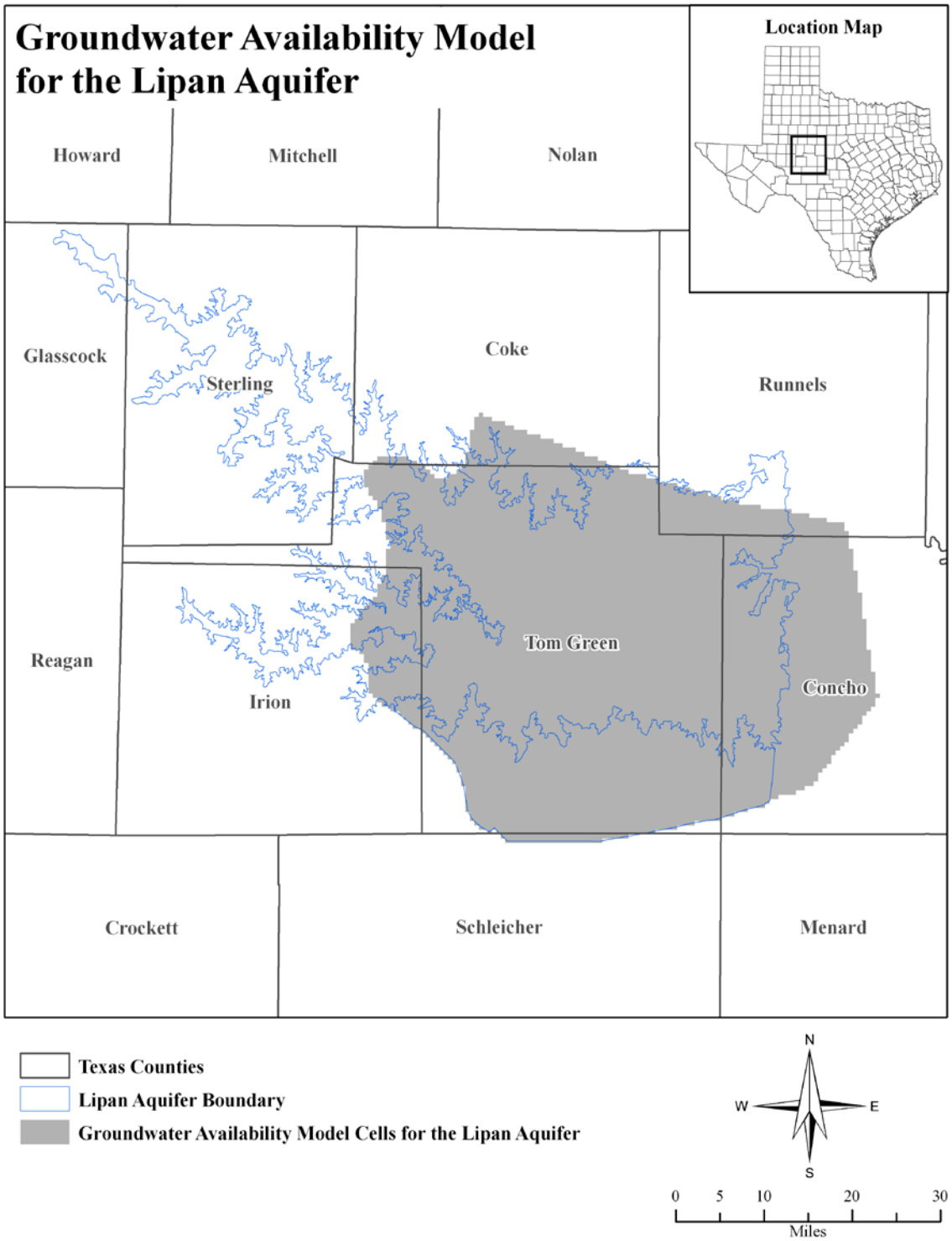

Figure 1. Map showing the areas covered by the groundwater availability model for the Lipan Aquifer.

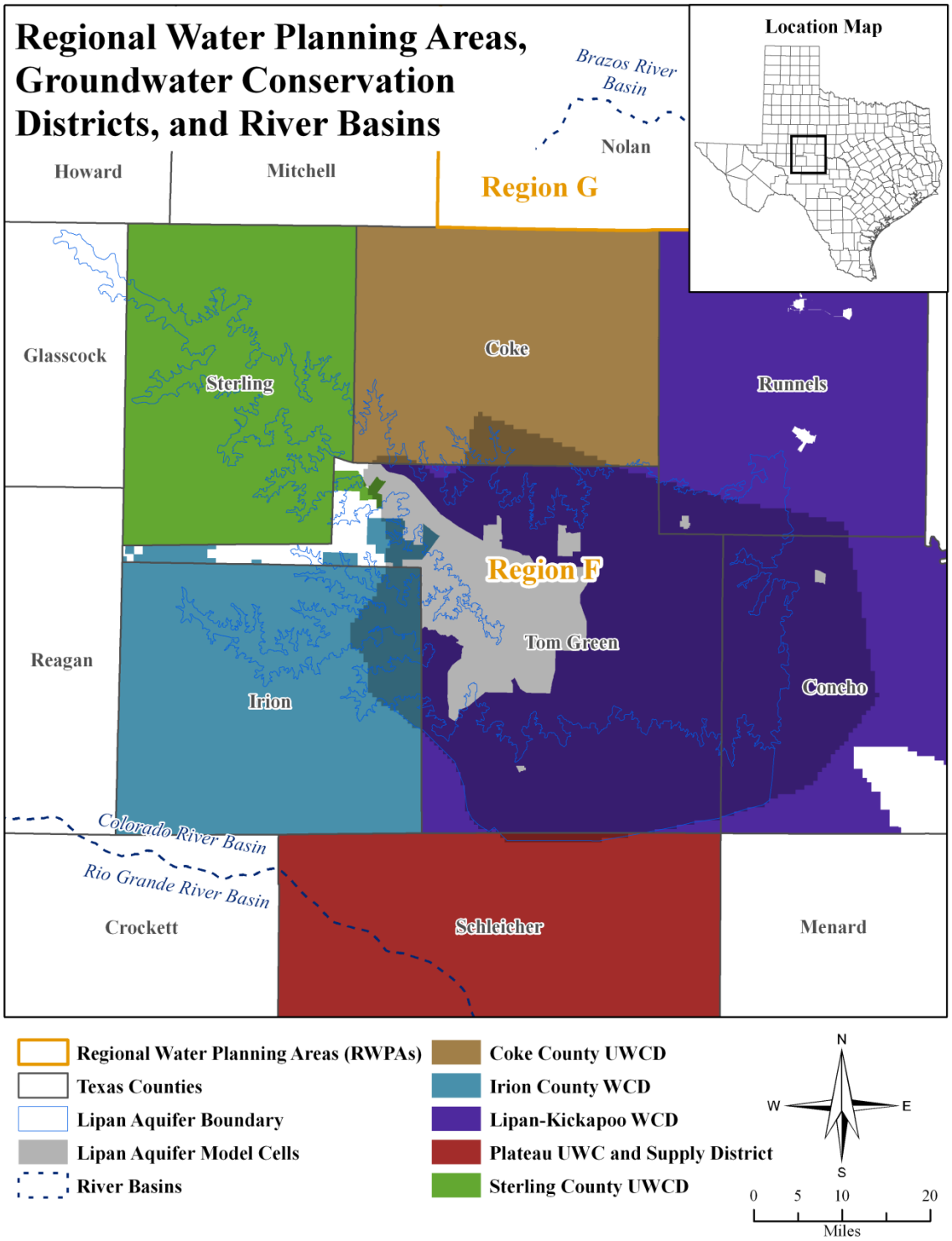

Figure 2. Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in the vicinity of the Lipan Aquifer in Groundwater Management Area 7.