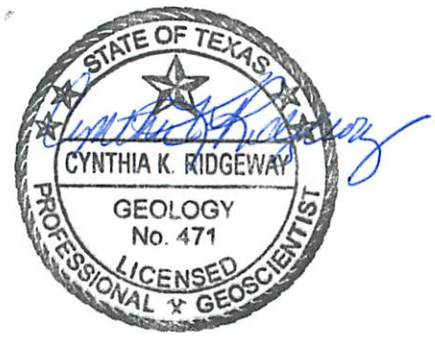
GAM Run 10-065 MAG

by Mohammad Masud Hassan, P.E.

Edited and finalized by Wade Oliver to reflect statutory changes effective September 1, 2011

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-3132
December 14, 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 December 14, 2011.

This page is intentionally left blank.

EXECUTIVE SUMMARY:

The modeled available groundwater for the Edwards (Balcones Fault Zone) Aquifer as a result of the desired future conditions adopted by the members of Groundwater Management Area 8 is approximately 15,200 acre-feet per year between 2010 and 2060. This is summarized by county, regional water planning area, and river basin as shown in Table 1 for use in the regional water planning process. The modeled available groundwater is also summarized by county, regional water planning area, river basin, and groundwater conservation district in tables 2 through 5.

REQUESTOR:

Mr. Eddy Daniel of the North Texas Groundwater Conservation District on behalf of the groundwater conservation districts within Groundwater Management Area 8

DESCRIPTION OF REQUEST:

In a letter dated August 31, 2011, Mr. Eddy Daniel provided the Texas Water Development Board (TWDB) with the desired future conditions for the northern segment of the Edwards (Balcones Fault Zone) Aquifer that were adopted in a resolution, dated April 27, 2011, by the members of Groundwater Management Area 8. This resolution referenced the desired future conditions previously adopted for the aquifer on December 17, 2007 by the groundwater conservation districts within Groundwater Management Area 8. These are described below:

- *Maintain at least 100 acre-feet per month of stream/spring flow in Salado Creek during a repeat of the Drought of Record in Bell County.*
- *Maintain at least 42 acre-feet per month of aggregated stream/spring flow during a repeat of the Drought of Record in Travis County.*
- *Maintain at least 60 acre-feet per month of aggregated stream/spring flow during a repeat of the Drought of Record in Williamson County.*

Because the desired future conditions were identical to the previous submission, the modeled available groundwater estimates in this report are identical to the previously released "managed available groundwater" estimates that were in Groundwater Availability Model (GAM) Run 08-10mag (Anaya, 2008).

METHODS:

The location of Groundwater Management Area 8, the northern segment of the Edwards (Balcones Fault Zone) Aquifer, and the groundwater availability model cells that represent the aquifer are shown in Figure 1. The modeled available groundwater for Groundwater Management Area 8 presented in this report was divided by county, regional water planning area, river basin, and groundwater conservation district. These areas are shown in Figure 2.

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 December 21, 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.

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the model run using the groundwater availability model for the northern segment of the Edwards (Balcones Fault Zone) Aquifer are described below:

- The results for modeled available groundwater presented here are taken from the results reported as "managed available groundwater" in GAM Run 08-10mag (Anaya, 2008). See GAM Run 08-10mag for a full description of the methods and assumptions associated with the model simulation.

- Version 1.01 of the groundwater availability model for the northern segment of the Edwards (Balcones Fault Zone) Aquifer (Jones, 2003) was used for this analysis. See Jones (2003) for a more detailed discussion of assumptions and limitations of the groundwater availability model.

- The model consists of one layer representing the northern segment of the Edwards (Balcones Fault Zone) Aquifer and assumes no hydraulic communication with the underlying Trinity Aquifer.

- The root mean squared error (a measure of the difference between simulated and measured water levels during model calibration) in the groundwater availability model is 32 feet for the 1980 steady-state calibration period (Jones, 2003).

RESULTS:

The modeled available groundwater for the northern segment of the Edwards (Balcones Fault Zone) Aquifer in Groundwater Management Area 8 as a result of the desired future conditions is approximately 15,200 acre-feet per year between 2010 and 2060. This 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 is also summarized by county, regional water planning area, river basin, and groundwater conservation district as shown in tables 2, 3, 4, and 5, respectively. Note that the only district within Groundwater Management Area 8 that contains the aquifer is Clearwater Underground Water Conservation District.

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:

Anaya, Robert, 2008, GAM Run 08-010mag: Texas Water Development Board GAM Run 0810mag Report, 7 p.

Jones, I.C., 2003, Groundwater availability modeling: Northern Segment of the Edwards Aquifer: Texas Water Development Board, Report 358, 75 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.

Table 1. Modeled available groundwater for the northern segment of the Edwards (Balcones Fault Zone) Aquifer in Groundwater Management Area 8. Results are in acre-feet per year and are divided by county, regional water planning area, and river basin.

County	Regional Water Planning Area	River Basin	Year					
			2010	2020	2030	2040	2050	2060
Bell	G	Brazos	6,469	6,469	6,469	6,469	6,469	6,469
Williamson	G	Brazos	3,351	3,351	3,351	3,351	3,351	3,351
		Colorado	101	101	101	101	101	101
	K	Brazos	6	6	6	6	6	6
		Colorado	4	4	4	4	4	4
Travis	K	Brazos	275	275	275	275	275	275
		Colorado	4,962	4,962	4,962	4,962	4,962	4,962
Total			**15,168**	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**

Table 2. Modeled available groundwater pumping for the northern segment of the Edwards (Balcones Fault Zone) Aquifer summarized by county in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

County	Year					
	2010	2020	2030	2040	2050	2060
Bell	6,469	6,469	6,469	6,469	6,469	6,469
Williamson	3,462	3,462	3,462	3,462	3,462	3,462
Travis	5,237	5,237	5,237	5,237	5,237	5,237
Total	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**

Table 3. Modeled available groundwater for the northern segment of the Edwards (Balcones Fault Zone) Aquifer summarized by regional water planning area in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

Regional Water Planning Area	Year					
	2010	2020	2030	2040	2050	2060
G	9,921	9,921	9,921	9,921	9,921	9,921
K	5,247	5,247	5,247	5,247	5,247	5,247
Total	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**

Table 4. Modeled available groundwater for the northern segment of the Edwards (Balcones Fault Zone) Aquifer summarized by river basin in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year.

River Basin	Year					
	2010	2020	2030	2040	2050	2060
Brazos	10,101	10,101	10,101	10,101	10,101	10,101
Colorado	5,067	5,067	5,067	5,067	5,067	5,067
Total	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**

Table 5. Modeled available groundwater for the northern segment of the Edwards (Balcones Fault Zone) Aquifer summarized by groundwater conservation district (GCD) in Groundwater Management Area 8 for each decade between 2010 and 2060. Results are in acre-feet per year. UWCD refers to Underground Water Conservation District.

Groundwater Conservation District	**Year**					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Clearwater UWCD	6,469	6,469	6,469	6,469	6,469	6,469
No District	8,699	8,699	8,699	8,699	8,699	8,699
Total	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**	**15,168**

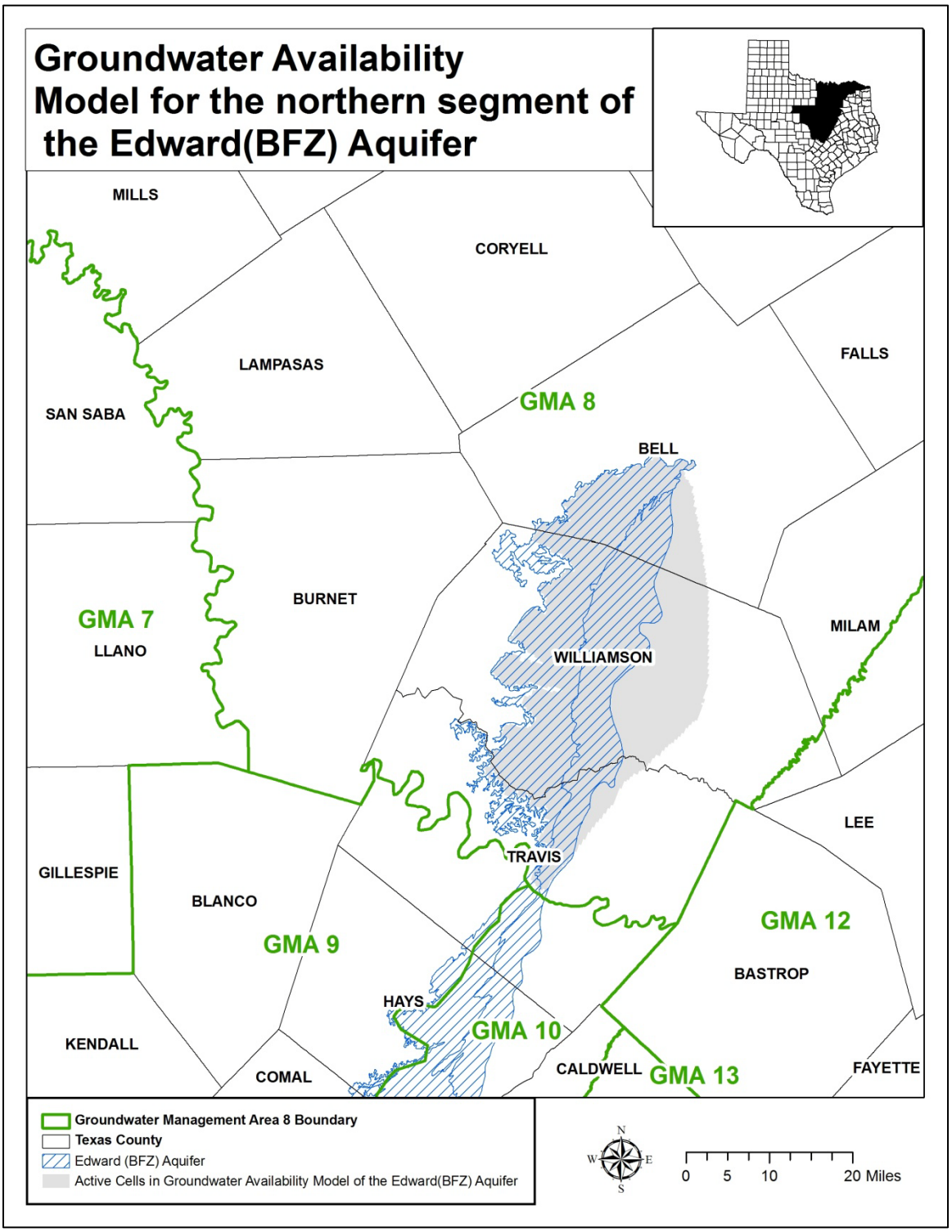


Figure 1. Map showing the areas covered by the groundwater availability model for the Edwards (Balcones Fault Zone) Aquifer.

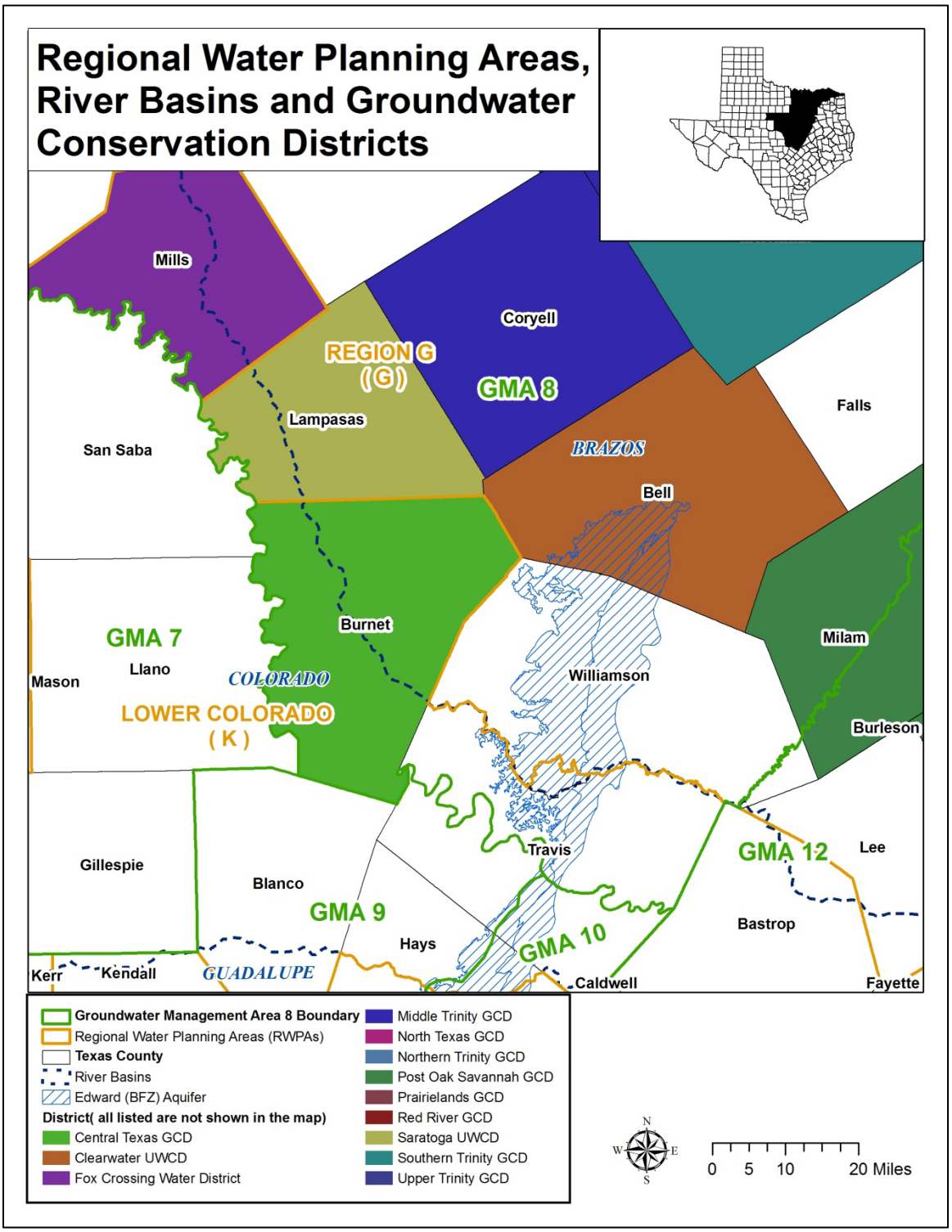


Figure 2. Map showing regional water planning areas (RWPAs), groundwater conservation districts (GCDs), counties, and river basins in Groundwater Management Area 8. UWCD refers to Underground Water Conservation District.