Saratoga Underground Water Conservation District Management Plan – 2008

I. District Mission

The Saratoga Underground Water Conservation District Management Plan strives to protect and enhance the quantity and quality of useable water in the District.

This plan becomes effective upon approval by the Texas Water Development Board (TWDB) and will remain in effect until December 1, 2013, or a period of five years whichever is later. The plan may be revised at any time, or after five years when the plan will be reviewed to insure that it is consistent with the applicable Regional Water Plans and the State Water Plan.

Statement of Guiding Principles

The Saratoga Underground Water Conservation District is created and organized under the terms and provisions of Article XVI, Section 59, of the Constitution of Texas and Chapter 36 (formerly Chapters 50 & 52) of the Texas Water Code, Vernon's Texas Civil Statutes, and the District's actions are authorized by, and consistent with this constitutional and statutory provision, including all amendments and additions. The Act under which the Saratoga Underground Water Conservation District is created prevails over any provision of general law that is in conflict or inconsistent with this Act. The District was created for the purpose to protect and enhance the quantity of useable quality water by conserving, preserving, preventing waste, recharging, controlling subsidence, protecting and preventing waste and as far as practicable to minimize the draw-down of the water table and the reduction of artesian pressure of the Trinity and Other Aquifers within the District boundaries. In order to carry out its constitutional and statutory purposes, the District has all the powers authorized by Article XVI, Section 59, of the Texas Constitution, and Chapter 36 of the Texas Water Code, Vernon's Texas Civil Statutes, together with all amendments and additions.

The District's purposes and powers are implemented through promulgation and enforcement of the District's regulations. These regulations are adopted and revised under the authority of Subchapter E, Chapter 36, Texas Water Code, and are incorporated herein as a part of the District's management plan.

The District is governed by a board of five directors composed of a member from each of the county's precincts and an at-large member from Lampasas County, Texas. The chairman of the board of directors is elected by the board after each general election. The District is also served with at least six ex-officio directors; one from each commissioner precinct in the County; at least one at-large member; and at least one advisory member.

History

The need for a local underground water conservation district to properly manage water from the Trinity and Other Aquifers in Central Texas was first identified in the late 1980's. At the request of many concerned area citizens, our local State Representative and State Senator were contacted by our County Judge, with the approval of the Lampasas County Commissioners' Court, with an approach to create and enact an Act to form a water district. During Regular Session of the 71st Legislature, H.B. No. 3122 passed unanimously both in the House and the Senate in May, 1989. Be it enacted by the Legislature of the State of Texas on June 14, 1989 with a confirmation election to be held and approved by the registered voters of Lampasas County, Texas. Such election was held in November 1989 and approved by a majority of the voters thereby officially establishing the Saratoga Underground Water Conservation District effective January 1, 1990.

The leadership of the District transferred from the Commissioners Court and the County Judge to an appointed Board of Directors in September 2005 with the passage of HB 3539 enacted on September 1, 2005. The new board members continue to represent the four precincts of Lampasas County with an at-large member making up the fifth board membership. The

General election of 2006 confirmed three of the new directors with four-year terms of office. The remaining two members will be elected during the 2008 general election thereby composing the Board of all elected officials.

Location and Extent

The Saratoga Underground Water Conservation District is located in Central Texas. The District comprises an area of 714 square miles or 456,960 acres, all located within the boundary of Lampasas County, Texas. Principal municipalities and communities in our District include Lampasas, Lometa, Kempner, Adamsville, Izoro, Moline, and a part of Copperas Cove, with the city of Lampasas being the County Seat. County population in 2000 was 17,762.

Topography

The District is within the Brazos River Basin and the Colorado River Basin. The County/District line between San Saba and Lampasas Counties is the Colorado River. The Lampasas River, as well as numerous creeks dissects the District. Sulphur Creek is the major creek in the District and its main source of water is from springs. Drainage is typically from west to east.

II. Water Resources

The Saratoga Underground Water Conservation District lies in several aquifers, but the Trinity aquifer being the primary source of ground water of interest in our area. Water from this aquifer is used for irrigation, public water supply, industrial, stock, and domestic needs of the people and entities served.

Other aquifers include, but are not limited to, Marble Falls, Alluvium and Travis Peak Formation, Quaternary Alluvium, Alluvium and Terrace Deposits, Cretaceous System, Glen Rose Limestone, Glen Rose (lower), Sligo, Hensell, and Hosston within the District boundaries that meet the limited needs of individuals.

These aquifers occur in parts of many counties all the way up to a northern region of the state, but mostly in Central Texas. The primary source of ground water in the Travis Peak Formation is rainfall on the outcrop area. The District's altitude ranges from 800 to 1700 feet. Surface water seepage from lakes, creeks, and rivers, such as the Lampasas River located on the outcrop, is
also a source of ground water to the formation. Another source of ground water is seepage from unlined earthen tanks and ponds, and the effluent water used in the irrigation of crops on the outcrop. Ground water in the Hensell and Hosston Members of the Travis Peak Formation occurs under both water table and artesian conditions.

The lower sands and shale of the Travis Peak are geologically and hydraulically continuous with the basal sands of the Antlers and both formations have a common piezometric surface and same quality of water.

In the outcrop area, the sands and gravels of the Travis Peak Formation are not completely water saturated, and water table conditions prevail. Ground water found in one area of the outcrop may not be found in another due to localized sand and shale facies as well as channel-like sand bodies' characteristic of this formation. In addition, perched water tables and artesian conditions occur locally in the outcrop area due to sand lenses interbedded with shale within the Travis Peak Formation.

Artesian conditions exist down dip as a result of the Hensell and Hosston aquifers being overlain by the Glen Rose Formation and the Pearsall Member of the Travis Peak Formation.

Recharge

Most of the recharge to the Antlers and Travis Peak Formations occurs in the outcrop area, which covers 1,732 square miles. The exact amount is unknown, but can be approximated by planimetering the areal extent of the outcrop areas, which provide recharge, compiling rainfall records of the area, and estimating infiltration rates. This will represent the outcrop area potentially contributing recharge to the aquifers within the District. The average annual rainfall for the District is 29.80 inches.

The outcrop soils generally consist of permeable sand and sandy clay loams. The terrain is characterized by gentle sloping plains with moderate relief. These conditions are excellent for recharge from rainfall, seepage from lakes, creeks, and rivers, and infiltration resulting from the irrigation of crops. The actual amount is undetermined, but indications are that recharge does occur in the outcrop. An estimate of three (3) percent of the average annual precipitation, as applied to the outcrop area, is assumed available as recharge. This is approximately 0.1 foot per year and amounts to 110,840-acre feet per year that is available as recharge to the entire Travis Peak Formation. However, due to small streams dissecting the formations and preventing down dip movement of the ground water, this amount is reduced to about 88,400-acre feet per year. After subtracting the municipal, industrial, and irrigation pumpage that occurs shortly down dip from the dissecting streams, a net amount of approximately 82,400-acre feet is available to move down dip in the Travis Peak Formation. Much of this available recharge is discharged naturally from the formations in the outcrop area by springs, seeps, and evapotranspiration.

In the Saratoga U.W.C.D. and Lampasas County, the subsurface units of the Travis Peak Formation are well cemented and the outcrop soils are tight, reddish-brown clay loams and sandy clays. The terrain consists of tabular divides, small limestone capped mesas, and valleys of moderate relief. These conditions suggest that there is comparatively little recharge in this area which also includes Burnet, Mills, and Brown Counties. Ground water moves slowly down dip. Water level measurements indicate the present gradient of the piezometric surface is 10 to 25 feet per mile east-southeast in most of the region.

Additional recharge through feasible methods could be obtained if a brush control management program was implemented in Lampasas County. Other benefits realized are reduction in precipitation interception and infiltration. The following table illustrates the water balance differences exhibited in the Texas Agricultural Station in Sonora, Texas.

	100% Grass	**70% Grass 12% Oak 18%Juniper**	**40% Grass 24% Oak 36% Juniper**
Rainfall	**22.6**	**22.6**	**22.6**
Interception Loss	**3.0**	**6.3**	**9.6**
Water Reaching the Soil	**19.6**	**16.3**	**13.0**
Runoff	**0.2**	**0.2**	**0.2**
Water Going in the Soil	**19.4**	**16.1**	**12.8**
Evapotranspiration	**15.7**	**15.8**	**12.8**
Deep Drainage	**3.7**	**0.3**	**0.0**

3.7 inches of deep drainage/year = 100,500 gallons/acre/year
(All measurements are in inches)

Using the results from the brush management experiment in Sonora (Thurow and Hester, 1997)[1], and assuming Lampasas County contains a composition of 40% grass, 24% oak, and 36% juniper, the following additional recharge may be possible if the District implements a brush management plan to change the composition to 70% grass, 12% oak, and 18% juniper.

Rainfall:
Lampasas County = 29.8 inches per year
Sonora = 22.6 inches per year

Percent increase in rainfall from Sonora to Lampasas County:

29.8 (inches/year) - 22.6 (inches/year) = 7.2 (inches/year)
(inches/year)/22.6 (inches/year) = (0.318) (00%) = 32% increase in rainfall per year

1 “How an Increase or Reduction in Juniper Cover Alters Rangeland Ecology”, by Thomas L. Thurow and Justin W. Hester, 1997 Juniper Symposium, Technical Report 97-1, Texas A&M Research and Extension Service.

Deep Drainage:

Sonora = 0.3 inches/year
0.3 inches of deep drainage/year = 8,148.7 gallons/acre/year
32% increase in Lampasas County from 0.32 = 0.096
0.096 (increase in Lampasas County per year in inches/acre/year) + 0.30 (deep drainage in inches/acre/year) = 0.40 in/acre/year deep drainage
If: 0.3 inches/acre/year = 8,148.7 gallons
Then: 0.4 inches/acre/year = (8,148.7) (0.4)/0.3
= 10,864.9 gallons

If: 1 acre-foot = 325,851 gallons
And if: 10,864.9 gallons/acre/year n Lampasas County
Then: 10,864.9 (gallons/acre/year)/325,851 (gallons/acre/foot) = 0.033 (acre-feet)/ (acre/year)

Groundwater Availability Model run 08-40

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h), states that, in developing its groundwater management plan, groundwater conservation districts 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 groundwater management plans include:

(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 the Saratoga Underground Water Conservation District for its groundwater management plan. The groundwater management plan for the Saratoga Underground Water Conservation District is due for approval by the executive administrator of the Texas Water Development Board before December 29, 2008.
This report discusses the method, assumptions, and results from model runs using the groundwater availability models for the northern part of the Trinity Aquifer. Table 1 summarizes the groundwater availability model data required by statute for the Saratoga Underground Water Conservation Districts groundwater management plan.
The Llano Uplift aquifers, which include the Marble Falls, Hickory, and Ellenburger-San Saba aquifers, also underlie the Saratoga Underground Water Conservation District. Groundwater availability models have not yet been completed for these minor aquifers. If the district would like information for the Llano Uplift aquifers, they may request it from the Groundwater Technical Assistance Section of the Texas Water Development Board.

METHODS:

We ran the groundwater availability model for the northern part of the Trinity Aquifer and (1) extracted water budgets for each year of the 1980 through 1999 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 Trinity Aquifer located within the district.

PARAMETERS AND ASSUMPTIONS:

We used version 1.01 of the groundwater availability model for the northern part of the Trinity Aquifer for this run. See Bené and others (2004) for assumptions and limitations of the model. The model includes seven layers, representing the Woodbine Aquifer (Layer 1), the Washita and Fredericksburg Series (Layer 2), the Paluxy Aquifer (Layer 3), the Glen Rose Formation (Layer 4), the Hensell Aquifer (Layer 5), the Pearsall/Cow Creek/Hammett/Sligo Formation (Layer 6), and the Hosston Aquifer (Layer 7). The mean absolute error (a measure of the difference between simulated and actual water levels during model calibration) for the four main aquifers in the model (Woodbine, Paluxy, Hensell, and Hosston) for the calibration and verification time periods (1980 to 2000) ranged from approximately 37 to 75 feet. The root mean squared error was less than ten percent of the maximum change in water levels across the model (Bené and others, 2004). We used Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) as the interface to process model output results.

RESULTS:

A groundwater budget summarizes the water entering and leaving the aquifer according to the groundwater availability model. Selected components were extracted from the groundwater budget for the aquifers located within the district and averaged over the duration of the calibrated portion of the model run (1980 to 1999). The components of the modified 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 aquifers or confining units. This flow is controlled by the relative water levels 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.

Table 1: Summarized information needed for the Saratoga Underground Water 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. Negative values indicate water is leaving the aquifer system using the parameters or boundaries listed in the table.

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Woodbine Aquifer	0
	Washita and Fredericksburg Series	6,030
	Paluxy Aquifer	11,303
	Glen Rose Formation	23,485
	Hensell Aquifer	1,446
	Pearsall/Cow Creek/Hammett/Sligo Formation	0
	Hosston Aquifer	5,040
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Woodbine Aquifer	0
	Washita and Fredericksburg Series	0
	Paluxy Aquifer	0
	Glen Rose Formation	-2,059
	Hensell Aquifer	0
	Pearsall/Cow Creek/Hammett/Sligo Formation	0
	Hosston Aquifer	0
Estimated annual volume of flow into the district within each aquifer in the district	Woodbine Aquifer	0
	Washita and Fredericksburg Series	238
	Paluxy Aquifer	24
	Glen Rose Formation	265
	Hensell Aquifer	1,015
	Pearsall/Cow Creek/Hammett/Sligo Formation	2
	Hosston Aquifer	870
Estimated annual volume of flow out of the district within each aquifer in the district	Woodbine Aquifer	0
	Washita and Fredericksburg Series	0
	Paluxy Aquifer	-116

	Glen Rose Formation	-483
	Hensell Aquifer	-1,935
	Pearsall/Cow Creek/Hammett/Sligo Formation	-3
	Hosston Aquifer	-1,846
Estimated net annual volume of flow between each aquifer in the district	Woodbine Aquifer to Washita and Fredericksburg Series	0
	Washita and Fredericksburg Series to Paluxy Aquifer	-24
	Paluxy Aquifer to Glen Rose Formation	-144
	Glen Rose Formation to Hensell Aquifer	-877
	Hensell Aquifer to Pearsall/Cow Creek/Hammett/Sligo Formation	-973
	Pearsall/Cow Creek/Hammett/Sligo Formation to Hosston	-971

Water Levels & Storage

The sands within the calcareous facies of the Travis Peak Formation in west-central Texas exhibit extremely low permeability due to cementation. Pumping tests conducted in the calcareous facies area indicate that coefficients of permeability range from 1 to 20 gpd/ft^2. The low coefficients of permeability and the relatively thin sand thickness' combine to produce very low coefficients of transmissibility that range from 0 to 1,000 gpd/ft.

In the remainder of the region, excluding the northwest outcrop and calcareous facies areas, ground water within the Hensell and Hosston Members of the Travis Peak Formation is under artesian conditions. Test data indicate that coefficients of permeability of the Hosston range from approximately 17 to 171 gpd/ft^2. In general, permeability in the vicinity of Balcones Fault Zone appears to be low. This could be due to the faults causing decreases in permeability. Thus, the average coefficient of permeability for the Hosston is about 77 gpd/ft^2. The artesian storage coefficients for the Hosston range from 0.000028 to 0.000077.

Test data for the Hensell Member in the down dip region, show coefficients of permeability ranging from 26 to 126 gpd/ft^2. The Hensell thins and becomes shaly down dip; therefore a range in coefficients of transmissibility from approximately 0 to 15,000 gpd/ft could be expected in the region. Lack of test data prohibits assigning a coefficient of storage range for the Hensell Member; however, storage values should be somewhat less than those of the Hosston Member.

The coefficients of transmissibility and storage may be used to predict future drawdown of water levels caused by pumping from the Hensell and Hosston Members of the Travis Peak Formation. Wells show water level fluctuations which are seasonal in nature. The water level

declines correlate with the large irrigation pumpage in the summer months, and in the fall and winter water levels are recovering due to small withdrawals and recharge of the permeable sands by rainfall.

Managed Available Groundwater

The managed available groundwater (MAG) estimates for Lampasas County were derived through the joint planning process outlined in HB 1763, 79th Legislature, 2005. The Managed Available Groundwater estimates for Lampasas County, hence the Saratoga Underground Water Conservation District, listed below are the only estimates that were available at the time of the 2009 management plan date of adoption.

Aquifer	County	GMA	RWPG	Managed Available Groundwater (acre-feet)	Source
Northern Trinity - Paluxy	Lampasas	8	G	13	GAM Run 08-84mag
Northern Trinity - Glen Rose	Lampasas	8	G	774	GAM Run 08-84mag
Northern Trinity - Hensell	Lampasas	8	G	885	GAM Run 08-84mag
Northern Trinity – Hosston	Lampasas	8	G	1,446	GAM Run 08-84mag

The adopted Desired Future Conditions for Lampasas County upon which the model run for the MAG estimates was based are listed below:

Lampasas County

(1) From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.

(2) From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 1 foot after 50 years.

(3) From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 12 feet after 50 years.

(4) From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 23 feet after 50 years.

Source: GAM Run 08-84mag, TWDB

(5) Marble Falls Aquifer: “Lampasas County should maintain approximately 90 percent of the saturated thickness after 50 years.”

Source: Desired Future Conditions Submittal Adopted by GMA 8: May 19, 2008.

(6) Ellenburger-San Saba Aquifer: “Lampasas County should maintain approximately 90 percent of the saturated thickness after 50 years.”

Source: Desired Future Conditions Submittal Adopted by GMA 8: May 19, 2008.

(7) Hickory Aquifer: "Brown, Lampasas, Mills, Travis and Williamson Counties should maintain approximately 90 percent of the available draw down after 50 years."

Source: Desired Future Conditions Submittal Adopted by GMA 8: May 19, 2008.

Projected Water Supplies, Ground Water Usage, and Demands

The projected estimate of surface water supplies is:

2007 State Water Plan Projected Surface Water Supplies

Lampasas County

RWP G	Water User Group	County	River Basin	Source Name	2000	2010	2020	2030	2040	2050	2060
G	Lampasas	Lampasas	Brazos	Brazos River Authority Little River System	1,792	1,870	1,859	1,853	1,848	1,845	1,841
G	Lometa	Lampasas	Colorado	Colorado River Combined Run-of-River - LCRA Supply Reallocation	0	78	84	88	91	93	95
G	Manufacturing	Lampasas	Brazos	Brazos River Combined Run-of-River Manfacturing	0	18	18	18	18	18	18
G	Irrigation	Lampasas	Brazos	Brazos River Combined Run-of-River Irrigation	0	1,255	1,255	1,255	1,255	1,255	1,255
G	Livestock	Lampasas	Brazos	Livestock Local Supply	0	537	537	537	537	537	537
G	Livestock	Lampasas	Colorado	Livestock Local Supply	0	151	151	151	151	151	151
G	Copperas Cove	Lampasas	Brazos	Brazos River Authority Little River System	0	47	47	47	47	47	47
G	Lometa	Lampasas	Brazos	Colorado River Combined Run-of-River - LCRA Supply Reallocation	0	52	57	59	61	62	64
G	Kempner	Lampasas	Brazos	Brazos River Authority Little River System	0	300	366	411	446	467	482
G	Kempner WSC	Lampasas	Brazos	Brazos River Authority Little River System	0	3,235	3,210	3,192	3,177	3,166	3,158
Total Projected Surface Water Supplies (acre-feet per year) =					**1,792**	**7,543**	**7,584**	**7,611**	**7,631**	**7,641**	**7,648**

An estimate of projected total water demand (from all sources) for the year 2010 is 5,679 acre-feet; and, for the year 2060 is 7,290 acre-feet as verified in the following TWDB chart:

2007 State Water Plan Projected Total Water Demands
Lampasas County

RWPG	Water User Group	County	River Basin	2000	2010	2020	2030	2040	2050	2060
G	Lampasas	Lampasas	Brazos	1,224	1,594	1,640	1,662	1,673	1,683	1,669
G	Lometa	Lampasas	Colorado	72	80	89	95	100	103	104
G	Lometa	Lampasas	Brazos	49	54	60	64	67	69	70
G	Copperas Cove	Lampasas	Brazos	15	23	32	39	43	46	48
G	Kempner	Lampasas	Brazos	238	305	376	427	465	490	506
G	Kempner WSC	Lampasas	Brazos	1,053	1,311	1,583	1,780	1,927	2,023	2,083
G	County Other	Lampasas	Brazos	951	1,099	1,255	1,368	1,452	1,507	1,542
G	County Other	Lampasas	Colorado	65	76	86	94	100	104	106
G	Maunfacturing	Lampasas	Brazos	108	129	142	153	164	174	187
G	Mining	Lampasas	Brazos	114	90	85	82	80	77	76
G	Mining	Lampasas	Colorado	79	62	59	57	55	54	52
G	Irrigation	Lampasas	Brazos	34	34	33	33	32	32	32
G	Irrigation	Lampasas	Colorado	136	134	133	131	130	128	127
G	Livestock	Lampasas	Brazos	537	537	537	537	537	537	537
G	Livestock	Lampasas	Colorado	151	151	151	151	151	151	151
Total Projected Water Demands (acre-feet per year) =				**4,826**	**5,679**	**6,261**	**6,673**	**6,976**	**7,178**	**7,290**

Source: Volume 3, 2007 State Water Planning Database

The basis for projected underground water availability and Desired Future Conditions for the Saratoga Underground Water Conservation District used data from the following chart of historically surveyed groundwater pumpage data from the TWDB Water Use Survey. Supply data and information is furnished by Texas Water Development Board, Water Supplies Section and Water Resources Planning Division. Lampasas underground water usage has ranged from an estimated low of 610 acre feet in 1988 to 1872 acre feet in 2000.

Historical Groundwater Pumpage Summary by County

Unit: Acre Feet (ACFT)

LAMPASAS COUNTY								
Year	Aquifer	Municipal	Manufacturing	Steam Electric	Irrigation	Mining	Livestock	Total
1980	OTHER	41	0	0	0	0	21	62
1980	TRINITY	661	0	0	0	27	458	1,146
	Total	**702**	**0**	**0**	**0**	**27**	**479**	**1,208**
1984	OTHER	35	0	0	0	0	15	50
1984	TRINITY	757	0	0	0	36	337	1,130
	Total	**792**	**0**	**0**	**0**	**36**	**352**	**1,180**
1985	OTHER	68	0	0	0	0	14	82
1985	TRINITY	814	0	0	0	36	304	1,154
	Total	**882**	**0**	**0**	**0**	**36**	**318**	**1,236**
1986	OTHER	57	0	0	0	0	13	70
1986	TRINITY	897	0	0	0	38	279	1,214
	Total	**954**	**0**	**0**	**0**	**38**	**292**	**1,284**
1987	OTHER	67	0	0	0	0	13	80
1987	TRINITY	266	0	0	0	32	293	591
	Total	**333**	**0**	**0**	**0**	**32**	**306**	**671**
1988	OTHER	39	0	0	0	58	14	111
1988	TRINITY	158	0	0	0	35	306	499
	Total	**197**	**0**	**0**	**0**	**93**	**320**	**610**
1989	OTHER	23	0	0	0	54	14	91
1989	TRINITY	146	0	0	82	33	302	563
	Total	**169**	**0**	**0**	**82**	**87**	**316**	**654**
1990	OTHER	94	0	0	0	54	15	163
1990	TRINITY	378	0	0	95	33	315	821
	Total	**472**	**0**	**0**	**95**	**87**	**330**	**984**
1991	OTHER	96	0	0	0	70	15	181
1991	TRINITY	385	0	0	95	124	322	926
	Total	**481**	**0**	**0**	**95**	**194**	**337**	**1,107**
1992	OTHER	45	0	0	0	70	22	137
1992	TRINITY	420	0	0	95	124	470	1,109
	Total	**465**	**0**	**0**	**95**	**194**	**492**	**1,246**
1993	OTHER	0	0	0	0	70	19	89
1993	TRINITY	504	0	0	25	123	412	1,064
	Total	**504**	**0**	**0**	**25**	**193**	**431**	**1,153**
1994	OTHER	0	0	0	0	70	17	87
1994	TRINITY	543	0	0	25	123	378	1,069
	Total	**543**	**0**	**0**	**25**	**193**	**395**	**1,156**
1995	OTHER	0	0	0	0	70	17	87
1995	TRINITY	530	0	0	29	123	385	1,067
	Total	**530**	**0**	**0**	**29**	**193**	**402**	**1,154**
1996	OTHER	0	0	0	0	70	15	85
1996	TRINITY	582	0	0	29	123	349	1,083
	Total	**582**	**0**	**0**	**29**	**193**	**364**	**1,168**

1997	OTHER	0	0	0	0	70	15	85
1997	TRINITY	549	0	0	29	123	356	1,057
	Total	**549**	**0**	**0**	**29**	**193**	**371**	**1,142**
1998	OTHER	0	0	0	0	70	14	84
1998	TRINITY	525	0	0	56	123	341	1,045
	Total	**525**	**0**	**0**	**56**	**193**	**355**	**1,129**
1999	OTHER	0	0	0	0	70	15	85
1999	TRINITY	730	0	0	28	123	363	1,244
	Total	**730**	**0**	**0**	**28**	**193**	**378**	**1,329**
2000	OTHER	0	0	0	0	45	42	87
2000	TRINITY	700	0	0	1	78	1,006	1,785
	Total	**700**	**0**	**0**	**1**	**123**	**1,048**	**1,872**
2001	OTHER	0	0	0	0	71	15	86
2001	TRINITY	157	0	0	0	122	347	626
	Total	**157**	**0**	**0**	**0**	**193**	**362**	**712**
2002	OTHER	0	0	0	0	45	16	61
2002	TRINITY	510	0	0	0	77	382	969
	Total	**510**	**0**	**0**	**0**	**122**	**398**	**1,030**
2003	OTHER	0	0	0	0	45	11	56
2003	TRINITY	275	0	0	0	77	253	605
	Total	**275**	**0**	**0**	**0**	**122**	**264**	**661**

Source: TWDB, Water Use Survey

Water use from all sources (surface and groundwater) for Lampasas County from the TWDB *Water Use Survey* for 2006 is as follows:

Region	County	Population Estimates[2)]	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock
G	LAMPASAS	20,461	3,035	106	0	0	337	646

Projected Water Management Strategies

The Projected Water Management Strategies for the District are located in Appendix A as required in statute. These strategies have been extracted from the 2007 State Water Plan.

Projected Water Needs

The Projected Water Needs for the District are located below. These estimates represent the difference in projected water supplies and the projected water demand for each respective Water User Group (WUG). The following estimates were extracted form the 2007 State Water Plan.

Positive values represent projected water surpluses; negative values represent projected water needs.

RW-PG	WUG	County	River Basin	2010	2020	2030	2040	2050	2060
G	Lampasas	Lampasas	Brazos	0	0	0	0	0	0
G	Lometa	Lampasas	Colorado	0	0	0	0	0	0

G	County Other	Lampasas	Brazos	109	-18	-107	-167	-207	-791
G	County Other	Lampasas	Colorado	-31	-39	-45	-49	-53	-54
G	Manufacturing	Lampasas	Brazos	-111	-124	-135	-146	-156	-169
G	Mining	Lampasas	Brazos	-26	-25	-24	-24	-22	-23
G	Mining	Lampasas	Colorado	0	0	0	0	0	0
G	Irrigation	Lampasas	Brazos	0	0	0	0	0	0
G	Irrigation	Lampasas	Colorado	0	0	0	0	0	0
G	Livestock	Lampasas	Brazos	0	0	0	0	0	0
G	Livestock	Lampasas	Colorado	0	0	0	0	0	0
G	Copperas Cove	Lampasas	Brazos	0	0	0	0	0	0
G	Lometa	Lampasas	Brazos	0	0	0	0	0	0
G	Kempner	Lampasas	Brazos	0	0	0	0	0	0
G	Kempner WSC	Lampasas	Brazos	0	0	0	0	0	0
Total Projected Water Needs (acre-feet per year) =				**-168**	**-206**	**-311**	**-386**	**-438**	**-1,037**

Source: 2007 State Water Planning database

Tracking Methodology

The Chairman of the Board of Directors will give an activity report to the District Board of Directors at the annual meeting in November, or as needed, to insure management objectives and goals are being followed and achieved by the District. The Board will also elect its officers at that meeting. The Board will maintain the report on file for public inspection at the District office upon adoption.

III. Management Goals, Objectives, and Performance Standards

Goal 1.0 Implement management strategies that will protect and enhance the quality of useable water by encouraging the most efficient use of ground water.

Management Objective 1.1
Each year, the district will provide educational materials identifying conservation measures for the efficient use of water. Annually, two newspaper articles will be published that contain water conservation information. Handout packets with conservation literature will be provided at one annual Community Festival day, or one other water related function.

Performance Standards 1.1a and 1.1b
Number of newspaper articles published annually containing water conservation information.
Number of annual events where conservation material was provided, and upon request, at the District office.

Management Objective 1.2
Each year the District will provide at least two informative speakers to local school districts and/or civic organizations to raise public awareness to ensure wise use of ground water.

Performance Standard 1.2

Number of informative speaking appearances to promote wise water usage provided annually. Encourage rainwater harvest measures and promote rainwater harvest projects for all new governmental construction.

Goal 2.0 Implement a program to improve and protect the quality of the aquifers and to control and prevent waste and contamination.

Management Objective 2.1
Each year, continue the well water sampling program in coordination with the County Extension Agent. This sampling is available for a minimal fee and is normally conducted in the fall.

Performance Standard 2.1
SUWCD will monitor the total number of well samples turned in annually to the County Extension Agent. A sampling of 10 to 20 wells annually indicates a successful well monitor program. The total number of well samples turned in annually will be included in the District's Annual Report.

Goal 3.0 Address conjunctive surface water management issues.

Management Objective 3.1
District will lend support to a local water monitoring team that monitors Sulphur Creek, the major creek located in the District, for water quality. Our local monitoring team takes samples of water, performs various chemical testing with the water, and then individual test results and a sample of water (tested for fecal count) from each monitoring site, are delivered for final testing. The water and monitors' testing results are analyzed by a state certified laboratory for the Brazos River Authority and Texas River Watch, where permanent records are kept on the quality of water. Monitoring is performed monthly and has to take place within the same three day period every month and all monitors have to perform the testing within a three hour time frame so that test results will be more accurate.

Performance Standard 3.1
T he District will furnish a supply of paper and copying services to the "Friends of Sulphur Creek" to facilitate record keeping of their continued effort to monitor the water quality of Sulphur Creek.

Management Objective 3.2
Annually meet with leaders of the incorporated cities in our District to discuss and review potential better use of surface water resources in the area. District will consult with other water districts and other informed water conservationists on water issues throughout the year to learn more efficient ways to manage surface water.

Performance Standards 3.2a and 3.2b
The district will meet at least once annually with incorporated cities' representatives. The consultations with other districts will be facilitated through the GMA-8, which meets at least quarterly. Meetings with other conservationists will be facilitated at the District's Annual Report meeting held at once from November to February annually.

Goal 4.0 Controlling and Preventing Subsidence
The rigid geologic framework of the District precludes significant subsidence from occurring. **This goal is not applicable to the operations of the District.**

Goal 5.0 Addressing natural resource issues which impact the use and availability of ground water, and which are impacted by the use of ground water. **This goal is not applicable to the operations of the District.**

Goal 6.0 Addressing drought conditions.

Management Objective 6.1

Utilizing a system of either rainfall or local aquifer conditions, or other appropriate criteria determine, identify, and designate one or more mechanisms to trigger implementation of drought management plans.

Performance Standard 6.1a
Identify and designate trigger conditions within the district used to indicate drought conditions. The District will analyze the effectiveness of the designated drought condition triggers annually to continue, improve or change these measures as informative and planning implements to coordinate drought procedures within the District's sphere of influence.

Performance Standard 6.1b
Drought Condition Triggers that will be reported in the District's Annual Report:

- Palmer Drought Severity Index
- And/or lack of rain for 60 days
- And/or temperatures over 100 degrees Fahrenheit for 20 days consecutively

Management Objective 6.2
Review applicable data to determine status of drought conditions and if necessary report to the Board the need to implement drought management plan.

Performance Standard 6.2
At the monthly Board meeting during drought, report on drought and the need to implement drought management plan.

Management Objective 6.3
Each year the district will provide to the public a newspaper article on drought conditions and the need to implement drought management plans.

Performance Standard 6.3
Number of newspaper articles on drought conditions.

Management Objective 6.4
Notify water suppliers of potential groundwater resources that may be available during droughts. This is more a cooperative effort as historically, the water producers have contacted the District during times of drought.

Performance Standard 6.4
Coordinate and have at least one local water supplier at our annual meeting.

Goal 7.0 Addressing Conservation, Recharge Enhancement, Brush Control, Rainwater Harvesting, and Precipitation Enhancement.

Management Objective 7.1
The District will sponsor articles in the local newspaper on water conservation and methods for voluntary conservation.

Performance Standard 7.1
The District will produce at least one informative article on water conservation for publication in the local newspaper each year.

Management Objective 7.2
Provide the public, upon request or at a public event or forum, conservation literature.

Performance Standard 7.2
Each year provide water conservation literature at the annual Lampasas Herbfest and/or one other public function each year.

Management Objective 7.3
Encourage recharge enhancement programs such as range management and growth of native grasses to permit more recharge flow into the aquifers.

Performance Standard 7.3

Coordinate with state agencies and the County Extension program to provide recharge enhancement data to local ranchers and farmers on at least one occasion annually.

Management Objective 7.4

Encourage and determine available resources to facilitate a brush control program.

Performance Standard 7.4

Coordinate with the County Extension Agent once annually, in the spring, to determine if State funds are available for brush control and grassland management initiatives to ensure the District farmers and ranchers are apprised of these resources.

Management Objective 7.5

Encourage local government and businesses to consider rainwater harvesting for each new or renovation of public and large private construction program within the District.

Performance Standard 7.5

Coordinate with local government and business ventures when it becomes public knowledge of new construction within the District. Additionally, a District Director will attend a Lampasas City Council meeting and a Lampasas Independent School Board meeting at least annually to make the local government aware of sources for rainwater harvest projects.

The District has determined that Precipitation Enhancement is not cost effective or appropriate. Therefore, this objective is not applicable to the operations of the District.

Goal 8.0 Address in a quantitative manner the Desired Future Conditions of the District.

Management Objective 8.1

Compare annual water level measurements with previous years to determine trends, specific declines or increases in the monitor wells of the Trinity, Hickory, Ellenburger-San Saba, and Marble Falls Aquifers. The District will measure water levels in at least five monitor wells annually.

Performance Standard 8.1

The number of monitor wells sampled annually.

Management Objective 8.2

The District will determine if a serious decline in Trinity, Hickory, Ellenburger-San Saba, and Marble Falls Aquifer water levels warrant further study or action by the District Board. A report will be submitted to the District Board annually.

Performance Standard 8.1

The number of water level comparison analysis reports submitted to the District Board annually.

Management Objective 8.3

The District will conduct public hearings to make citizens of the SUWCD aware of severe changes in Trinity, Hickory, Ellenburger-San Saba, and Marble Falls Aquifer water levels.

Performance Standard 8.3

The number of public hearings conducted when severe water changes occurred will be reported in the Annual Report to the District Board.

Management Objective 8.4

The District will review new well permits and status to determine if additional conservation and public education actions are necessary. A report including the number of new well permits and any changes in status will be submitted to the District Board annually.

Performance Standard 8.4

The number of well permit and status changes analysis reports submitted to the District Board annually**.**

Management

The District will manage the supply of ground water within the District in order to conserve the resource while maintaining the viability of all resource user groups, public and private. The District will identify and engage in activities and practices that, if implemented, would result in reduction of ground water use. The District may require reduction of ground water withdrawals to amounts that will not cause harm to the aquifers. The District may, at the Board's discretion, amend or revoke any permits after notice and hearing to achieve this purpose. The District will consider the public benefit against individual hardship in determining permit denial or limiting ground water withdrawals after considering all appropriate testimony. The District shall treat all citizens with equality. A public or private user may appeal to the Board for discretion in enforcement of the provisions of the District's rules and regulations on grounds of adverse economic hardship or unique local conditions. The exercise of said discretion by the Board shall not be construed as limiting the power of the Board.

Actions, Procedures, Performance, and Avoidance for Plan Implementation

The District will implement and use the provisions of this plan as a guidepost for determining the direction or priority for all District activities. All operations of the District, all agreements entered into by the District, and any additional planning efforts that the District may participate in will be consistent with the provisions of this plan. The District will seek cooperation in the implementation of this plan and the management of ground water supplies within the District. All activities of the Saratoga Underground Water Conservation District will be undertaken in cooperation and coordination with the appropriate state, regional or local water entity.

The District will adopt rules relating to the permitting of wells and production of ground water. All rules will be adhered to and enforced. The promulgation and enforcement of the rules will be based on the best technical advice available. District Rules are contained in Appendix C.

IV. Bibliography

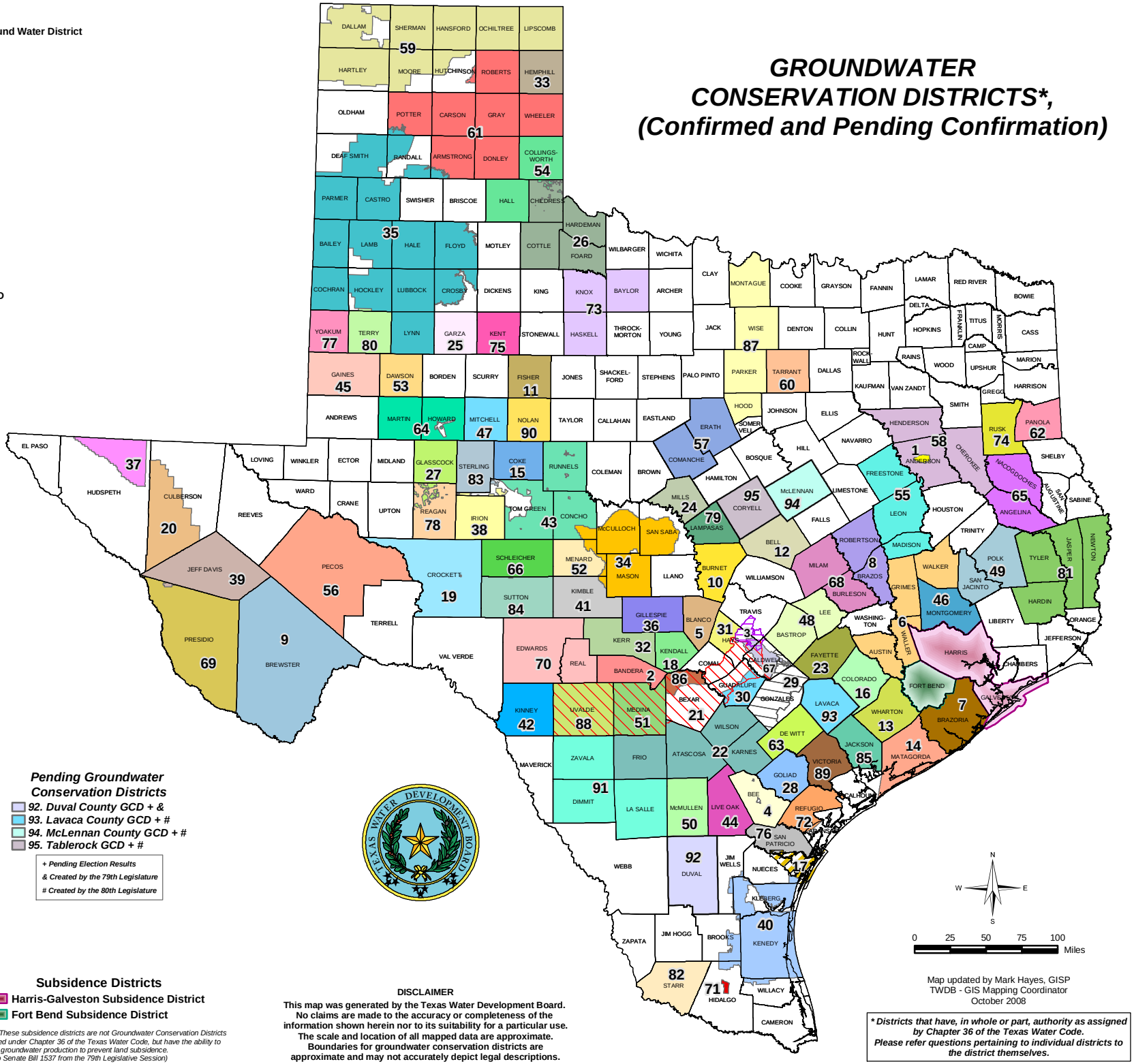
Bené, J., Harden, B., O'Rourke, D., Donnelly, A., and Yelderman, J., 2004, Northern Trinity/Woodbine Groundwater Availability Model: contract report to the Texas Water Development Board by R.W. Harden and Associates, 391 p.

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

V. Maps and Appendices

Map of Texas Water Districts
Map of Texas Regional Water Planning Groups
Map of Groundwater Management Areas
Map of GMA-8
Appendix A – Water Management Strategies
Appendix B – SUWCD Desired Future Conditions/Current GMA-8 DFC and MAGs
Appendix C – Saratoga Underground Water Conservation District Rules
Appendix D – Trinity DFC - GAM Run 08-84 mag

GROUNDWATER CONSERVATION DISTRICTS*, (Confirmed and Pending Confirmation)



Confirmed Groundwater Conservation Districts

1. Anderson County UWCD
2. Bandera County River Authority & Ground Water District
3. Barton Springs/Edwards Aquifer CD
4. Bee GCD
5. Blanco-Pedernales GCD
6. Bluebonnet GCD
7. Brazoria County GCD
8. Brazos Valley GCD
9. Brewster County GCD
10. Central Texas GCD
11. Clear Fork GCD
12. Clearwater UWCD
13. Coastal Bend GCD
14. Coastal Plains GCD
15. Coke County UWCD
16. Colorado County GCD
17. Corpus Christi ASRCD
18. Cow Creek GCD
19. Crockett County GCD
20. Culberson County GCD
21. Edwards Aquifer Authority
22. Evergreen UWCD
23. Fayette County GCD
24. Fox Crossing Water District
25. Garza County Underground and FWCD
26. Gateway GCD
27. Glasscock GCD
28. Goliad County GCD
29. Gonzales County UWCD
30. Guadalupe County GCD
31. Hays Trinity GCD
32. Headwaters GCD
33. Hemphill County UWCD
34. Hickory UWCD No.1
35. High Plains UWCD No.1
36. Hill Country UWCD
37. Hudspeth County UWCD No.1
38. Irion County WCD
39. Jeff Davis County UWCD
40. Kenedy County GCD
41. Kimble County GCD
42. Kinney County GCD
43. Lipan-Kickapoo WCD
44. Live Oak UWCD
45. Llano Estacado UWCD
46. Lone Star GCD
47. Lone Wolf GCD
48. Lost Pines GCD
49. Lower Trinity GCD
50. McMullen GCD
51. Medina County GCD
52. Menard County UWD
53. Mesa UWCD
54. Mesquite GCD
55. Mid-East Texas GCD
56. Middle Pecos GCD
57. Middle Trinity GCD
58. Neches & Trinity Valleys GCD
59. North Plains GCD
60. Northern Trinity GCD
61. Panhandle GCD
62. Panola County GCD
63. Pecan Valley GCD
64. Permian Basin UWCD
65. Pineywoods GCD
66. Plateau UWC and Supply District
67. Plum Creek CD
68. Post Oak Savannah GCD
69. Presidio County UWCD
70. Real-Edwards C and R District
71. Red Sands GCD
72. Refugio GCD
73. Rolling Plains GCD
74. Rusk County GCD
75. Salt Fork UWCD
76. San Patricio County GCD
77. Sandy Land UWCD
78. Santa Rita UWCD
79. Saratoga UWCD
80. South Plains UWCD
81. Southeast Texas GCD
82. Starr County GCD
83. Sterling UWCD
84. Sutton County UWCD
85. Texana GCD
86. Trinity Glen Rose GCD
87. Upper Trinity GCD
88. Uvalde County UWCD
89. Victoria County GCD
90. Wes-Tex GCD
91. Wintergarden GCD

Pending Groundwater Conservation Districts

92. Duval County GCD + &
93. Lavaca County GCD + #
94. McLennan County GCD + #
95. Tablerock GCD + #

+ Pending Election Results
& Created by the 79th Legislature
 # Created by the 80th Legislature

Subsidence Districts

Harris-Galveston Subsidence District
Fort Bend Subsidence District

NOTE: These subsidence districts are not Groundwater Conservation Districts as defined under Chapter 36 of the Texas Water Code, but have the ability to regulate groundwater production to prevent land subsidence. (Refer to Senate Bill 1537 from the 79th Legislative Session)

DISCLAIMER

This map was generated by the Texas Water Development Board. No claims are made to the accuracy or completeness of the information shown herein nor to its suitability for a particular use. The scale and location of all mapped data are approximate. Boundaries for groundwater conservation districts are approximate and may not accurately depict legal descriptions.

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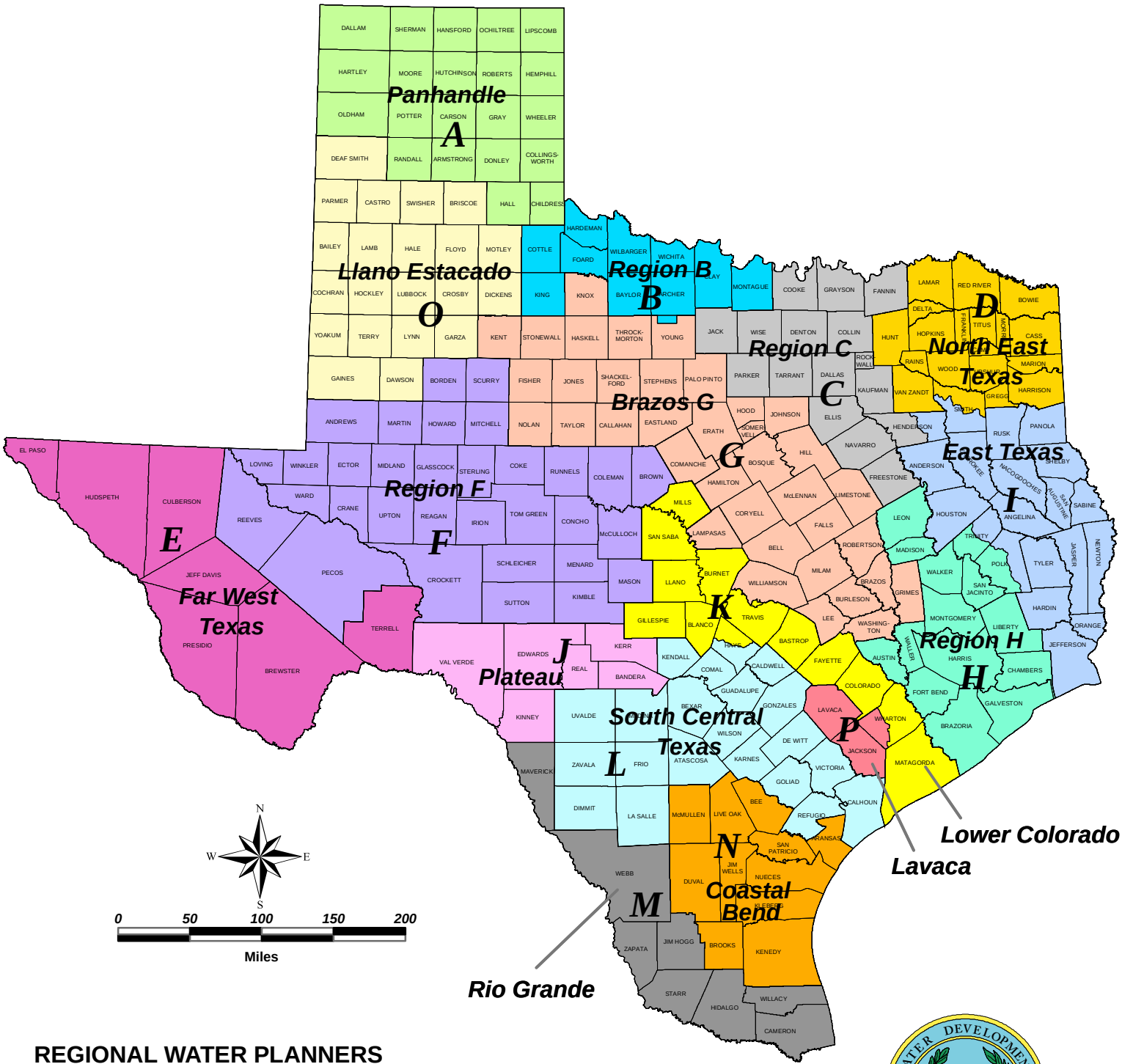
0 25 50 75 100 Miles

Map updated by Mark Hayes, GISP
TWDB - GIS Mapping Coordinator
October 2008

Districts that have, in whole or part, authority as assigned by Chapter 36 of the Texas Water Code. Please refer questions pertaining to individual districts to the district themselves.

Regional Water Planning Areas

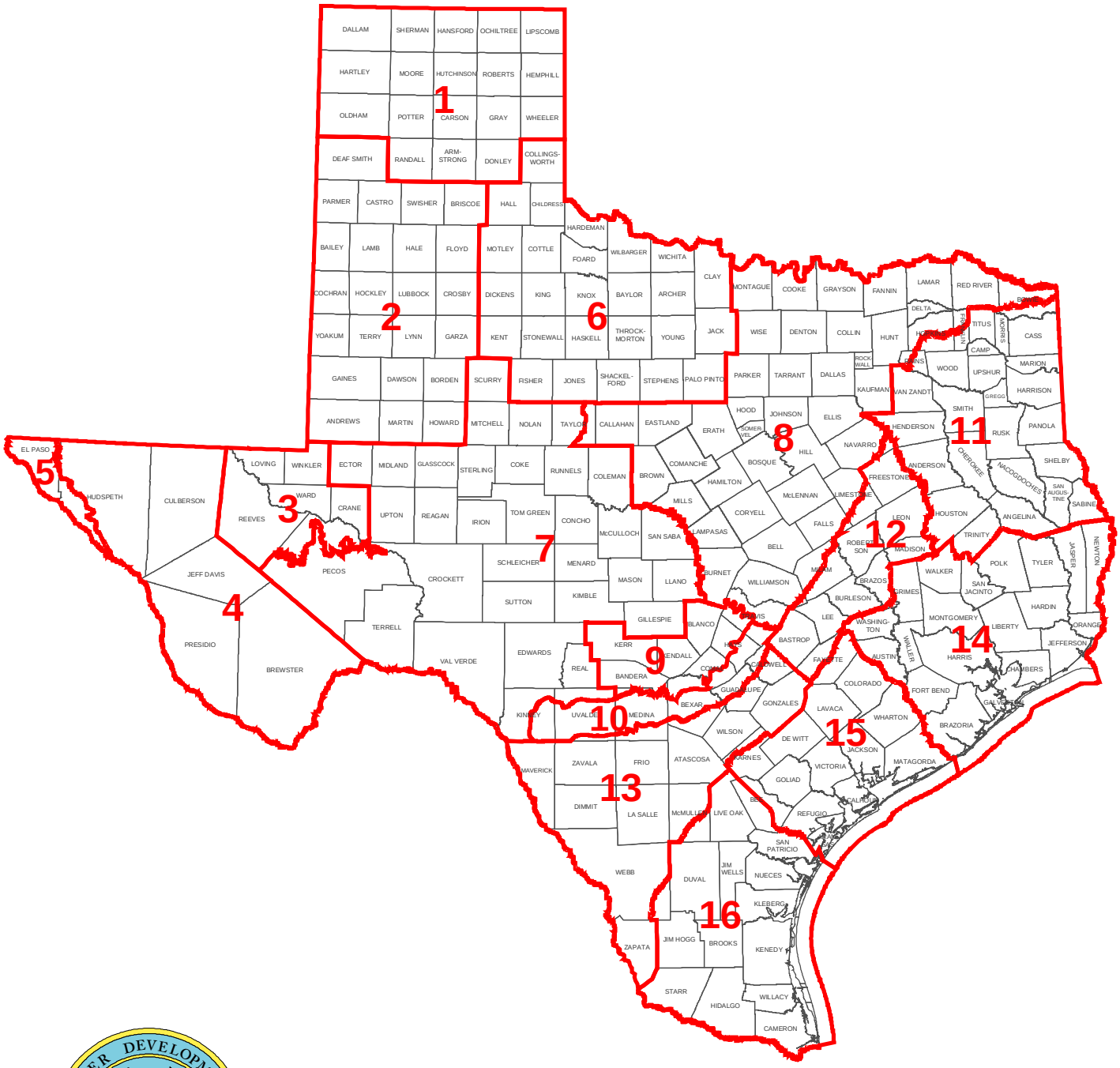


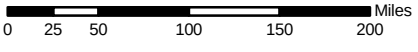
REGIONAL WATER PLANNERS

Connie Townsend (512) 463 - 8290 - Regions E, J & M
Temple McKinnon (512) 475 - 2057 - Regions D, H & I
Angela Masloff (512) 936 - 0872 - Regions A, B & C
Matt Nelson (512) 936 - 3550 - Regions G, L & N
Angela Kennedy (512) 463 - 1437 - Regions F, O & P
David Meesey (512) 936 - 0852 - Region K

Updated by Mark Hayes
Mapping Coordinator
RIO Division/GIS Section
6/10/2008

Groundwater Management Areas in Texas

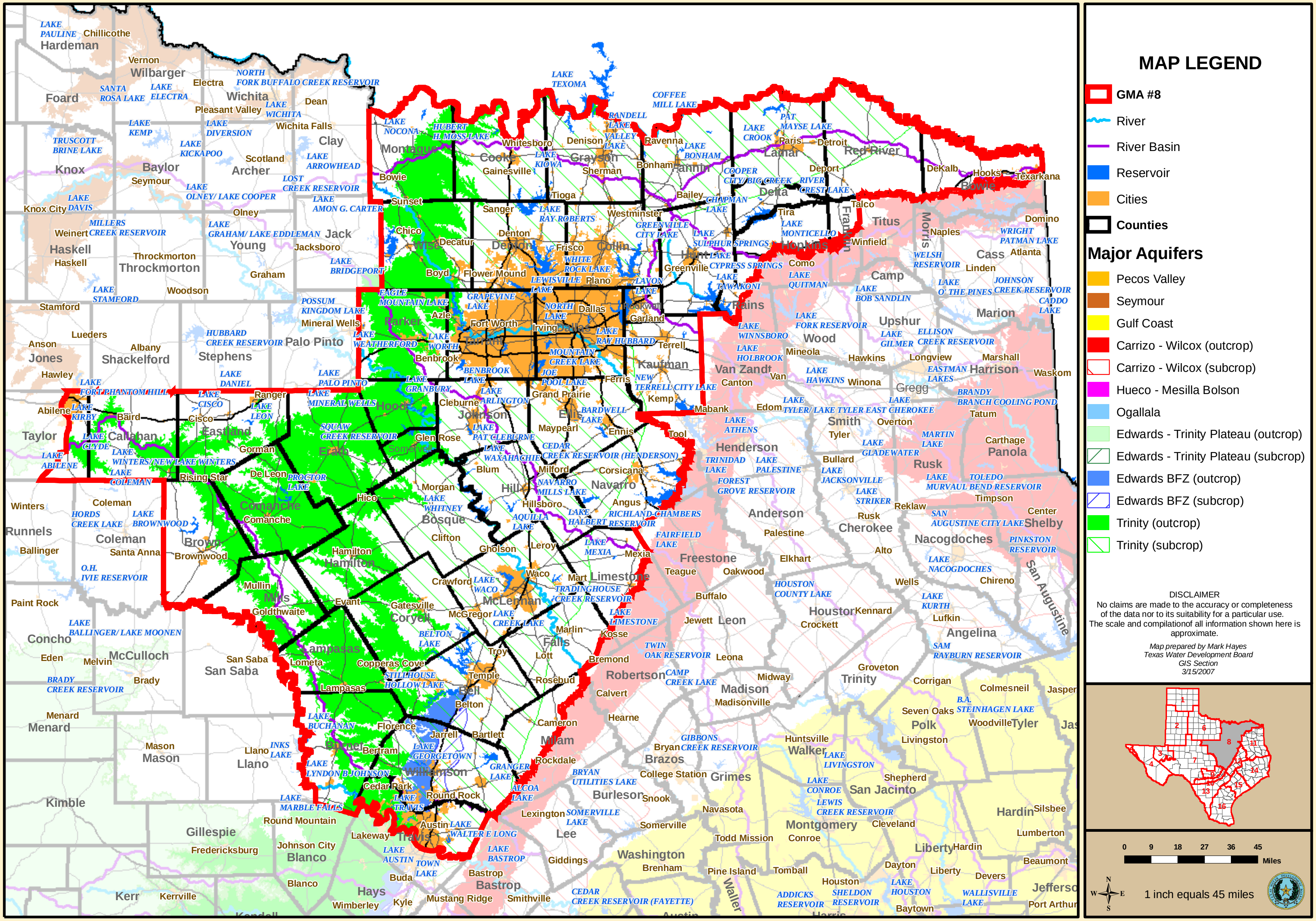




DISCLAIMER
This map was generated by the Texas Water Development Board using GIS (Geographical Information System) software. No claims are made to the accuracy or completeness of the information shown herein nor to its suitability for a particular use. The scale and location of all mapped data are approximate.

Map updated by Mark Hayes, GISP
(Mark.Hayes@twdb.state.tx.us) 512-936-0828
August 2007

Groundwater Management Area #8



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Appendix A

Projected Water Management Strategies

Lampasas County

Disclaimer: No claims are made to the accuracy or completeness of the information shown herein nor to its suitability for a particular use. District personnel must review these data and correct any discrepancies in order to ensure the approval of their management plans. These data are available on the internet from either the online 2007 State Water Plan, Volume 3, Regional Water Planning Group Database (http://www.twdb.state.tx.us/DATA/db07/defaultReadOnly.asp) or the online Historical Water Use Information-Groundwater Pumpage Estimates web page (http://www.twdb.state.tx.us/wushistorical/DesktopDefault.aspx?PageID=2). Please do not hesitate to call either Rima Petrossian (512-936-2420) or Lance Christian (512-463-9804) with questions concerning these datasets.

RWPG	WUG	WUG County	River Basin	Water Management Strategy	Source Name	Source County	2010	2020	2030	2040	2050	2060
G	County Other	Lampasas	Colorado	Additional Trinity Aquifer Development (Includes Overdrafting)	Trinity Aquifer	Lampasas	31	39	45	49	53	54
G	County Other	Lampasas	Brazos	Additional Trinity Aquifer Development (Includes Overdrafting)	Trinity Aquifer	Lampasas	819	811	805	801	797	796
G	County Other	Lampasas	Brazos	Municipal Water Conservation	Conservation	Lampasas	55	134	126	114	107	110
G	Manufacturing	Lampasas	Brazos	Voluntary Redistribution	Brazos River Authority Little River System	Reservoir	150	150	150	150	160	170
G	Manufacturing	Lampasas	Brazos	Manufacturing Water Conservation	Conservation	Lampasas	4	7	11	11	12	13
G	Mining	Lampasas	Brazos	Voluntary Redistribution	Brazos River Authority Little River System	Reservoir	30	30	30	30	30	30
G	Mining	Lampasas	Brazos	Mining Water Conservation	Conservation	Lampasas	5	7	10	9	9	9
Total Projected Water Management Strategies (acre-feet per year) =							**1,094**	**1,178**	**1,177**	**1,164**	**1,168**	**1,182**

Desired Future Conditions
Saratoga Underground Water Conservation District
October 1, 2007

I. Introduction

The Saratoga Underground Water Conservation District (SUWCD) in cooperation and partnership with Groundwater Management Area 8 (GMA 8) has analyzed data from the Texas Water Development Board (TWDB), Turner, Collie, & Braden, Inc. (TCB/AECOM), and Brazos G Regional Water Planning Group (Region G) to develop a viable plan toward the progression of Desired Future Conditions (DFC) for the SUWCD. This plan for the DFC of the SUWCD has been studied by the Saratoga board of directors and approved for incorporation in the SUWCD Management Plan and the area plan for GMA 8.

II. Present Data, Conditions and Projections

a. *Water for Texas Report TWDB February 1, 2001*.
   i. The TWDB state water plan for Texas, completed in 2001, identifies and projects water usage through the year 2060. This plan takes into account population growth, water consumption, projected climatology, and water availability.
   ii. A summation of this plan for Lampasas County (SUWCD) is as follows:
      1. Lampasas County has an estimated population growth of 50 to 100 percent. The population is estimated to grow from 17,762 to 26,606. Growth will be highest in the eastern end of Lampasas County.
      2. Water consumption, while generally low per capita, is estimated to expand from 3,667 acre-feet per year to 5,675 acre-feet per year. This usage is from all water sources.
      3. The climate of the SUWCD has produced an average of 29.80 inches of rain per year. The recharge rate for the primary aquifer, Trinity, is 1.2 inches per year or an estimated 6,570 acre-feet per year for the district.
      4. The major aquifer for the SUWCD is the Trinity Aquifer with approximately 205,799 acre-feet per year available across the entire area of the aquifer. The Marble Falls Aquifer is located primarily in the western portion of the SUWCD and has approximately 22,637 acre-feet per year available across the five counties in which it is located. The other useable aquifer is the Ellenburger-San Saba, also

located in the western part of the area. This aquifer has 45,672 acre-feet per year available.

5. *Water for Texas Report TWDB February 1, 2001* projects a relatively stable water table for the SUWCD for the next 50 years. Underground water level declines range from less than 50 feet in the western and central portion of Lampasas County to 50 to a 100 feet decrease in the eastern portion of the county, dependent upon projected pumping models of Coryell and Bell counties.

b. TCB/AECOM Groundwater Availability Model (GAM) - June 29, 2007
   i. The GAM run of June 29, 2007 for GMA 8 confirms the TWDB *Water for Texas Report* with minor variations. The June 2007 GAM run projects a healthy recharge and availability of over 16,000 acre-feet per year in the Paluxy, Glen Rose, Hensell, and Hosston minor aquifers of the Trinity Aquifer.
   ii. The GAM run also indicates an approximate 10 percent increase in groundwater pumpage since 1980 and is based on historical data of 990 to 1,756 acre-feet per year usage.
   iii. The GAM is based on the Regional Water Plan estimate of 2,145 acre-feet per year available and a pumping model of 3,164 acre-feet per year usage.
   iv. The GAM run predictions based on these assumptions indicate minor variations (less than -25 feet) in water levels for the Hensell and Hosston Aquifers to no measurable changes in the Paluxy and Glen Rose portion of the aquifer.

c. Brazos G Regional Water Plan – January 2006
   i. The Brazos G Regional Water Plan (RWP) confirms the assumptions of the TCB/AECOM GAM, again with minor variations.
   ii. The RWP indicates an availability of 18,150 acre-feet per year across the useable aquifers with 6,879 available in Lampasas County.
   iii. Groundwater supply from the RWP is a conservative 939 acre-feet per year for 2010 to 916 acre-feet per year for 2060.

d. Underground water data for Lampasas County
   i. Historical date for Lampasas County indicates the primary usage for underground water in the county is for municipal or home use and watering livestock. The usage trend suggests an increase in the agricultural use of groundwater with a decrease in the use by municipalities (see attachment 1).
   ii. Underground water usage has varied from a reported low of 610 acre-feet in 1988 to a high of 1,872 in 2000.

iii. Well data for the three wells in the SUWCD monitored by TWDB indicate a fairly stable water level since 1962. Water level variation has fluctuated not more than+/- 30 feet over the past 45 years.

III. Desired Future Conditions

a. Goals for the Saratoga Underground Water Conservation District
   i. The District is committed to preserving the aquifers and underground water availability for the citizens of the district and Lampasas County.
   ii. The District board of directors is also committed to oversee all of its resources and funds to minimize the burden of the taxpayers of the county to further this goal.
   iii. The SUWCD is dedicated to developing water conservation awareness and measures to educate the public about current challenges to and protection of landowner water rights.
   iv. Based on the aforementioned goals, the SUWCD accepts the results of the GAM run of June 29, 2007 as the model for desired future conditions. Acceptance of this model as the worst case scenario will ensure an adequate supply of underground water in Lampasas County for all citizens well beyond 2060.

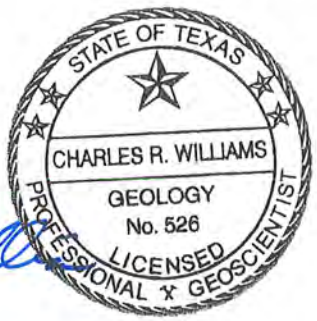
b. Measurable events, conditions, and actions for compliance with Saratoga Underground Water Conservation District DFC
   i. The District will continue to monitor the wells selected by the TWDB. The result of these measurements is generally available in late January or February each year. As a consequence of these measurements the SUWCD board will:
      1. Compare annual well measurements with previous years to determine trends, specific declines or increases in the monitor wells.
      2. Determine if a serious decline in water level warrants further study or action by the board.
      3. Conduct public hearings to make the citizens of the SUWCD aware of sever changes in water levels.
      4. Review new well permits and status to determine if additional conservation and public education actions are necessary.
   ii. The District will engage in a continuous program of public awareness and education, especially during times of drought conditions as noted in the Palmer Drought Severity Index.
   iii. The triggering event for immediate action by the SUWCD board to preserve desired future conditions are:
      1. A decline in water level in the monitor wells by more than 20 percent of the previous year. A decline in over 20 percent in any one monitored well will require the SUWCD

to review all requests for drilling of new water wells, both exempt and non-exempt. A non-exempt well permit may be denied in an area that indicates a sever decline in the water table as defined above.

2. An increase in predicted annual underground water pumpage above the forecast 2,145 acre-feet per year (as reported in the TWDB Water Usage Survey) will require the SUWCD board to analyze current conditions and issue the necessary warnings and conservation alerts to the general public.
3. If the underground water usage (as reported in the TWDB Water Usage Survey) is over the GAM estimate of 3,164 acre-feet per year in any one year, the board of directors of the SUWCD will institute emergency measures to bring water usage down to management levels. These emergency procedures may include:
    a. Focus programs to assist agriculture producers on intensive brush control, as per the *Water for Texas Report TWDB February 1, 2001* recommendations.
    b. Cooperative management of aquifers based on adjoining boundaries and neighboring water districts.
    c. Developing guidelines to encourage voluntary redistribution of water, as per the *Water for Texas Report TWDB February 1, 2001* recommendations.
    d. Encourage wastewater use as a water management option, as per the *Water for Texas Report TWDB February 1, 2001* recommendations.
    e. Intensive monitoring of District wells not previously included in the TWDB monitor program by the SUWCD board.
    f. Evaluation of transportation and production fees for non-exempt wells within the District.
    g. Denial of new well drilling within the District.

TCB
400 West 15th Street, Suite 500, Austin, Texas 78701
T 512.472.4519 F 512.472.7519 www.tcb.aecom.com

Memorandum



To: Cheryl Maxwell, Administrative Manager
Clearwater Underground Water Conservation District
Administrative Agent for Groundwater Management Area 8

From: Charles R. Williams, P.G. No. 526

Date: June 9, 2008

Re: Adopted Desired Future Conditions of the Ellenburger-San Saba, Hickory and Marble Falls Aquifers

Introduction

Groundwater Management Area 8 (GMA-8) is a groundwater management area of the State of Texas as defined by Statute with responsibility for developing a desired future condition (DFC) for aquifers within an approximately 46-County area. Membership of the GMA is composed of the groundwater conservation districts (GCDs) that occur all or in part within the GMA boundary. (Fig. 1) At the request of GMA-8, TCB Inc. (TCB) developed statements describing DFCs for the portions of the Ellenburger-San Saba, Hickory and Marble Falls Aquifers recognized by the Texas Water Development Board (TWDB) to occur in whole or in part within GMA-8. (Fig. 2)

Methodology

To predict the effects of pumping on the Ellenburger-San Saba and Marble Falls aquifers in Burnet and Lampasas Counties and the Hickory aquifer in Burnet County, TCB developed 2-D spreadsheet models. The models use estimates of the recharge area, annual rainfall, recharge rate, the saturated thickness of the aquifer and the effective porosity (specific yield) to predict the percentage of saturated thickness maintained after a specified time period for a range of simulated pumping amounts. Predictions may be made on a by-County basis or for the aquifer as a whole aquifer. The estimates of the recharge area for each aquifer are taken from the TWDB geographic information system (GIS) coverages. Estimates of the annual rainfall for each county were taken from National Oceanic and Atmospheric Agency (NOAA) data. Estimates of the recharge rates saturated thicknesses are from TWDB publications on the occurrence and availability of groundwater. (Muller and Price, 1979 and Bluntzer, 1992) Estimates of

effective porosities are based on representative value for aquifers of similar materials. (Driscoll, 1986) The time period for the predictions is 50 years.

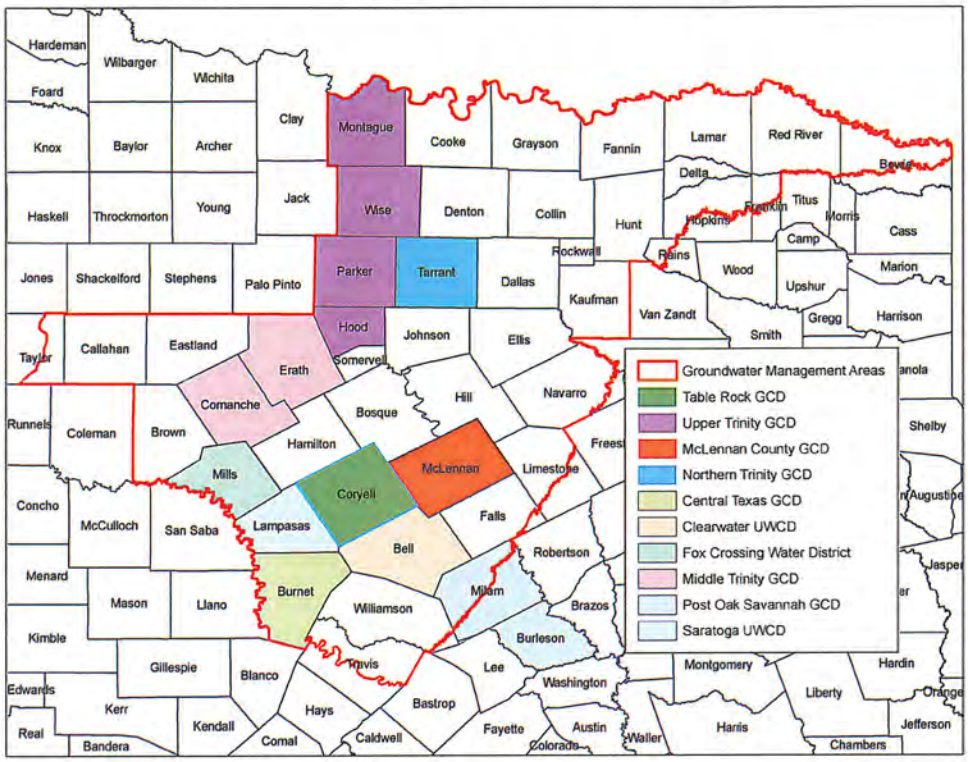


Figure 1, the Boundaries and Member GCDs of GMA-8

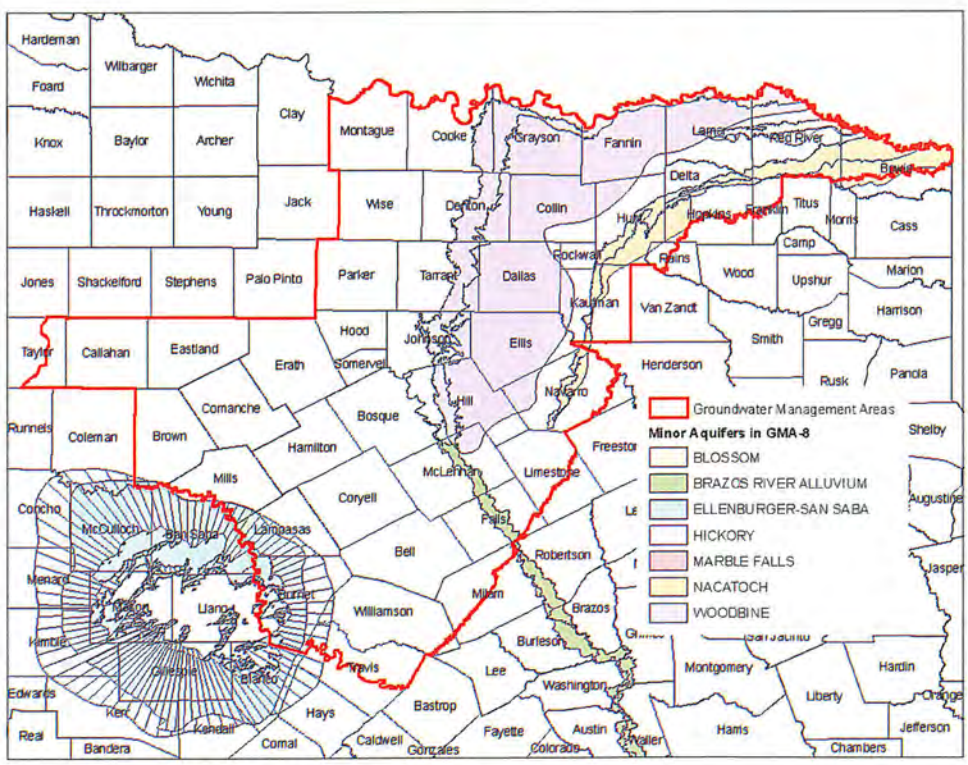


Figure 2, the Minor Aquifers of GMA-8

Where possible, for the portions of the Ellenburger-San Saba, Hickory and Marble Falls aquifers occurring within a GCD; the GCD selected the preferred percentage of aquifer saturated thickness to be maintained in the portion of the aquifer within its management. A DFC statement was developed describing the selected condition. For the portions of the Hickory aquifer outside of a GCD; no DFC was developed. The occurrence of the Hickory in those Counties is extremely deep and at the down-dip margin of the recognition of the aquifer; the Regional Water Plan (RWP) does not include an availability value for those areas.

Discussion

The purpose of the 2-D models is to conveniently predict the potential results of a range of predictive pumping amounts over time for aquifers where a TWDB GAM is not available. An assumption of the 2-D models is the aquifer is in unconfined condition. However, the 2-D models may be reasonably applicable to aquifers that have both an unconfined and a confined component if: either the confined (artesian pressured) portion of the aquifer is relatively limited in area or if pumping in the aquifer is reasonably confined to near the aquifer recharge zone for the area of interest. The Marble Falls aquifer is either in unconfined condition or pumping is believed to be limited to areas relatively near the recharge zone or outcrop area where it occurs in GMA-8. The Ellenburger-San Saba aquifer has recharge zone areas occurring in Burnet and Lampasas Counties of GMA-8; pumping is considered to be limited largely to the recharge zone and nearby vicinity due to the depth of the aquifer in down-dip areas. The 2-D model was applied to the Ellenburger-San Saba aquifer in Burnet and Lampasas Counties but was not applied to Mills County. The aquifer recharge zone does not occur in Mills County; only the extremely deep down-dip extent of the aquifer occurs in Mills County. The 2-D model was applied to the Hickory in Burnet County but was not applied to Mills and Lampasas Counties. The aquifer recharge zone does not occur in either Mills or Lampasas County; only the extremely deep down-dip extent of the aquifer occurs in these Counties.

The 2-D models project the effects of pumping using the following relationships:

The term Groundwater Availability is used to express the annual amount of pumping in the area of interest and is composed of two components;
Groundwater Availability = Groundwater Availability $_{Storage}$ + Groundwater Availability$_{Recharge}$

GWA = GWAS + GWAR

Where:
GWA = Groundwater availability (ac-ft/yr)
GWAS = Groundwater availability from storage (ac-ft/yr)
GWAR = Groundwater availability from recharge (ac-ft/yr)

GWAS = (1-DD)*B*A*N/Y/43560
Where:
DD = average percentage of drawdown maintained (%)
B = average saturated thickness of aquifer (ft)
A = area of aquifer (ft^2)

N = effective porosity
Y = time duration (yrs)

GWAR = P*A*R/43560

Where:
P = average yearly precipitation (ft/yr)
R = % precipitation that infiltrates into groundwater system

Equation: GWA = GWAS + GWAR = (1-DD)*B*A*N/Y/43560 + P*A*R/43560

DFC Development Approach

In GMA-8, the Marble Falls Aquifer occurs in 2 Counties. A GCD exists in both of the Counties. A County-specific model was applied for each GCD. After reviewing the model results the GCD selected the preferred percentage of aquifer saturated thickness to be maintained in the portion of the aquifer under its management. (Figs 3-6) A DFC statement was developed describing the selected condition for each County. Due to uncertainty regarding the inventory of springs producing water from the Marble Falls aquifer in Burnet County, the Central Texas GCD (CTGCD) preferred to maintain the saturated thickness of the aquifer by using only approximately 80 percent of the estimated annual recharge. (Table 1)

% of saturated thickness maintained	GW availability from storage (ac-ft/yr)	GW availability from recharge (ac-ft/yr)	Total GW availability (ac-ft/yr)
100%	0	1974	1974
99%	76	1974	2050
98%	152	1974	2125
97%	227	1974	2201
96%	303	1974	2277
95%	379	1974	2353
94%	455	1974	2429
93%	531	1974	2504
92%	606	1974	2580
91%	682	1974	2656
90%	758	1974	2732

Sat. Thickness	160	(ft)
Recharge Area	15790	(acres) =
Effective porosity	0.15	(fraction)
Time	50	(yr)
Rainfall Rate	2.5	(ft/yr)
Recharge Rate	0.05	(fraction)

Figure 3, Model Input Values and Tabular Results for the Marble Falls Aquifer in Burnet County (Central Texas GCD)

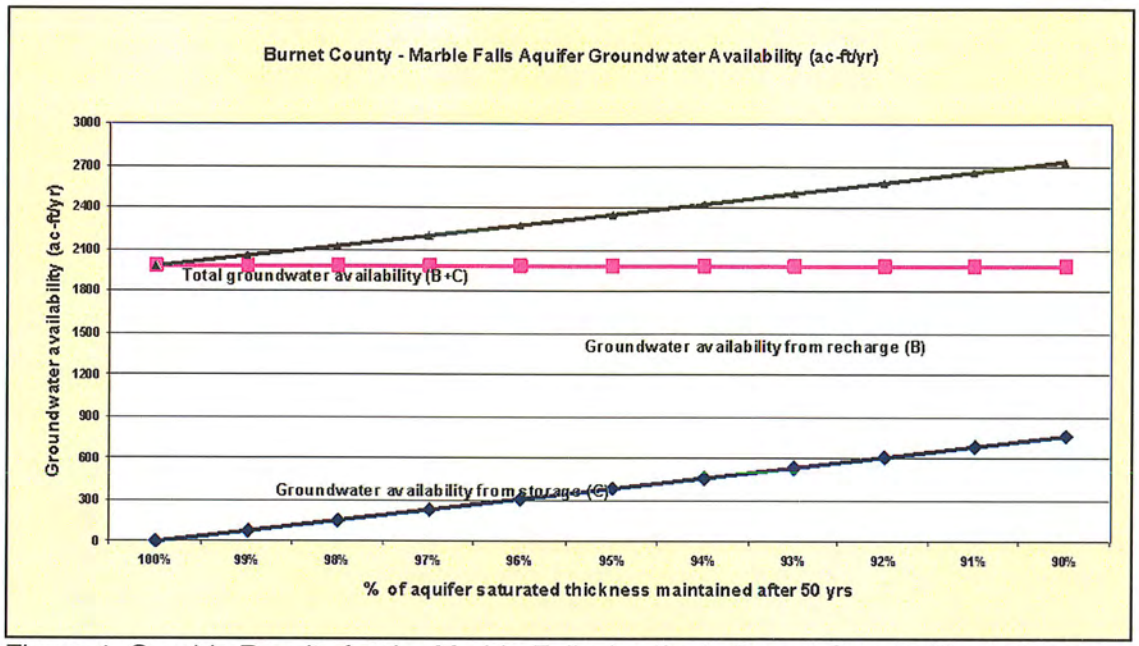


Figure 4, Graphic Results for the Marble Falls Aquifer in Burnet County (Central Texas GCD)

% of saturated thickness maintained	GW availability from storage (ac-ft/yr)	GW availability from recharge (ac-ft/yr)	Total GW availability (ac-ft/yr)
100%	0	2095	2095
99%	78	2095	2173
98%	155	2095	2251
97%	233	2095	2328
96%	311	2095	2406
95%	388	2095	2484
94%	466	2095	2561
93%	544	2095	2639
92%	621	2095	2717
91%	699	2095	2794
90%	777	2095	2872

Sat. Thickness	160	(ft)
Recharge Area	16180	(acres) =
Effective porosity	0.15	(fraction)
Time	50	(yr)
Rainfall Rate	2.59	(ft/yr)
Recharge Rate	0.05	(fraction)

Figure 5, Model Input Values and Tabular Results for the Marble Falls Aquifer in Lampasas County (Saratoga UWCD)

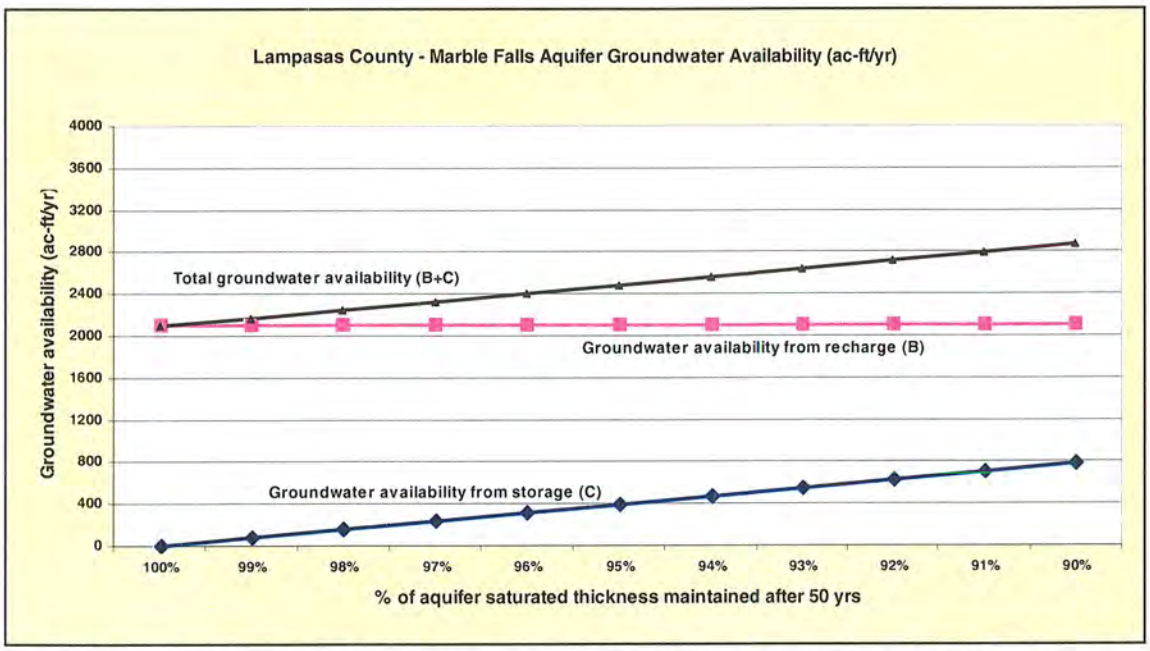


Figure 6, Graphic Results for the Marble Falls Aquifer in Lampasas County (Saratoga UWCD)

County	GMA-8 Marble Falls Aquifer Estimated Recharge (acre-feet per year)
Burnet	1,974
80%	**1,579**

Table 1, Estimated Recharge for the Marble Falls Aquifer in Burnet County

In GMA-8, the Ellenburger-San Saba Aquifer occurs in 4 Counties. A GCD exists in 3 of the 4 Counties. A County-specific model was applied for the CTGCD (Burnet County) and the Saratoga GCD (SUWCD) (Lampasas County). No model was developed for the aquifer in Mills County (Fox Crossing Water District) and Brown County because they are at the extreme down-dip edge of the aquifer. After reviewing the model results the CTGCD and SUWCD selected the preferred percentage of aquifer saturated thickness to be maintained in the portion of the aquifer under its management. (Figs 7-10) A DFC statement was developed describing the selected condition for each County. Due to uncertainty regarding the inventory of springs producing water from the Ellenburger-San Saba aquifer in Burnet County, CTGCD chose to maintain the saturated thickness of the aquifer by using approximately 80 percent of the estimated annual recharge. (Table 2)

% of saturated thickness maintained	GW availability from storage (ac-ft/yr)	GW availability from recharge (ac-ft/yr)	Total GW availability (ac-ft/yr)
100%	0	5521	5521
99%	1656	5521	7177
98%	3312	5521	8833
97%	4969	5521	10489
96%	6625	5521	12145
95%	8281	5521	13802
94%	9937	5521	15458
93%	11593	5521	17114
92%	13250	5521	18770
91%	14906	5521	20426
90%	16562	5521	22083

Sat. Thickness	500	(ft)
Recharge Area	110,413	(acres) =
Effective porosity	0.15	(fraction)
Time	50	(yr)
Rainfall Rate	2.5	(ft/yr)
Recharge Rate	0.02	(fraction)

Figure 7, Model Input Values and Tabular Results for the Ellenburger-San Saba Aquifer in Burnet County (Central Texas GCD)

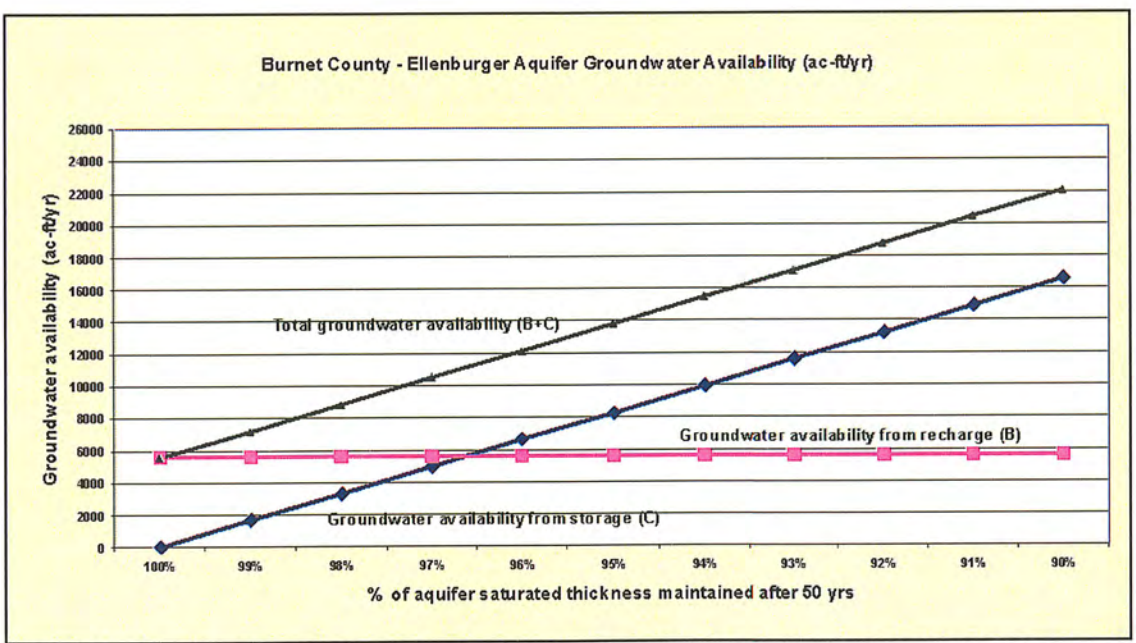


Figure 8, Graphic Results for the Ellenburger-San Saba Aquifer in Burnet County (Central Texas GCD)

County	GMA-8 Ellenburger-San Saba Aquifer Estimated Recharge (acre-feet per year)
Burnet	5,521
80%	**4,417**

Table 2, Estimated Recharge for the Ellenburger-San Saba Aquifer in Burnet County

% of saturated thickness maintained	GW availability from storage (ac-ft/yr)	GW availability from recharge (ac-ft/yr)	Total GW availability (ac-ft/yr)
100%	0	601	601
99%	174	601	775
98%	348	601	949
97%	522	601	1123
96%	696	601	1297
95%	870	601	1471
94%	1044	601	1645
93%	1218	601	1819
92%	1392	601	1993
91%	1566	601	2167
90%	1740	601	2341

Sat. Thickness	500	(ft)
Recharge Area	11599	(acres) =
Effective porosity	0.15	(fraction)
Time	50	(yr)
Rainfall Rate	2.59	(ft/yr)
Recharge Rate	0.02	(fraction)

Figure 9, Model Input Values and Tabular Results for the Ellenburger-San Saba Aquifer in Lampasas County (Saratoga UWCD)

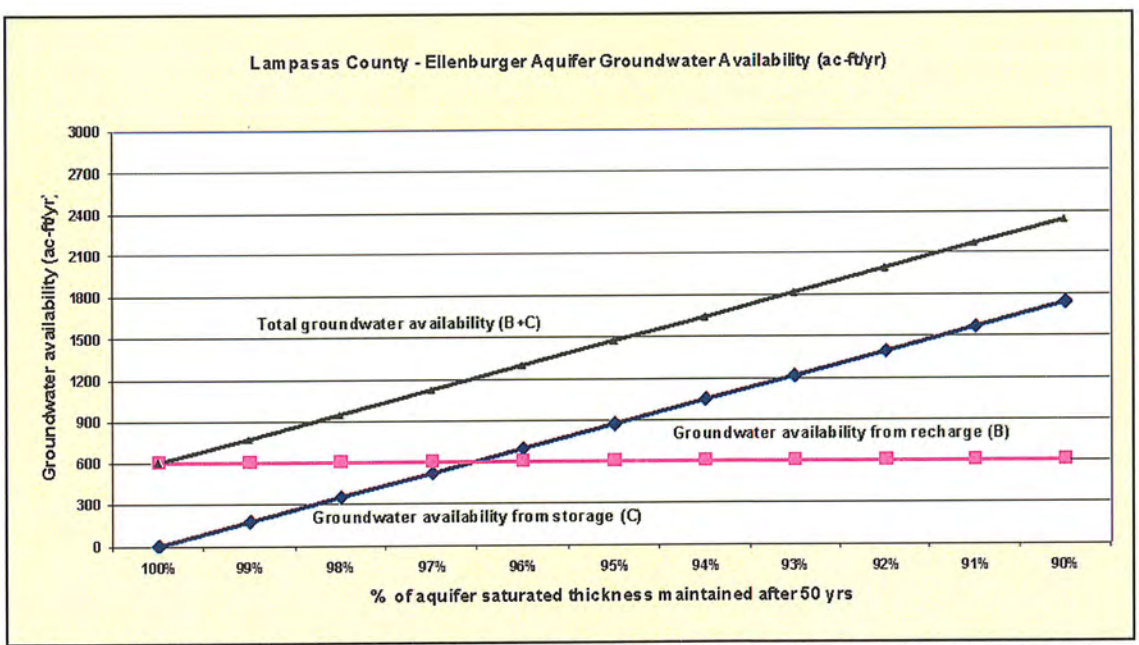


Figure 10, Graphic Results for the Ellenburger-San Saba Aquifer in Lampasas County (Saratoga UWCD)

In GMA-8, the Hickory Aquifer occurs in 6 Counties. A GCD exists in 3 of the 6 Counties. A County-specific model was applied for the CTGCD (Burnet County). No model was developed for the aquifer in Mills County (Fox Crossing Water District), Lampasas County (SUWCD), Brown, Travis and Williamson Counties because these areas are at the extreme down-dip edge of the aquifer. After reviewing the model results CTGCD

selected the preferred percentage of aquifer saturated thickness to be maintained in the portion of the aquifer under its management. (Figs. 11, 12) A DFC statement was developed describing the selected condition for each County. Due to uncertainty regarding the inventory of springs producing water from the Hickory aquifer in Burnet County, the CTGCD preferred to maintain the saturated thickness of the aquifer by using approximately 80 percent of the estimated annual recharge. (Table 3)

% of saturated thickness maintained	GW availability from storage (ac-ft/yr)	GW availability from recharge (ac-ft/yr)	Total GW availability (ac-ft/yr)
100%	0	4503	4503
99%	86	4503	4589
98%	173	4503	4676
97%	259	4503	4762
96%	346	4503	4849
95%	432	4503	4935
94%	519	4503	5021
93%	605	4503	5108
92%	692	4503	5194
91%	778	4503	5281
90%	865	4503	5367

Sat. Thickness	160	(ft)
Recharge Area	18011	(acres) =
Effective porosity	0.15	(fraction)
Time	50	(yr)
Rainfall Rate	2.5	(ft/yr)
Recharge Rate	0.1	(fraction)

Figure 11, Model Input Values and Tabular Results for the Hickory Aquifer in Burnet County (Central Texas GCD)

County	GMA-8 Hickory Aquifer Estimated Recharge (acre-feet per year)
Burnet	4,503
80%	**3,602**

Table 3, Estimated Recharge for the Ellenburger-Hickory Aquifer in Burnet County

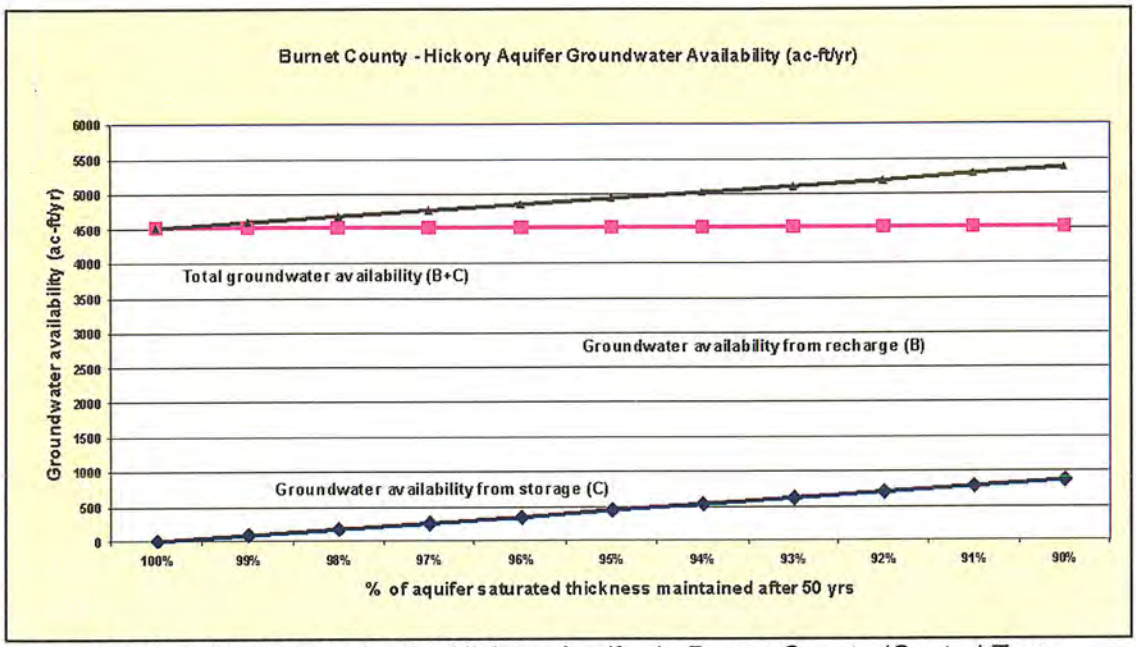


Figure 12, Graphic Results for the Hickory Aquifer in Burnet County (Central Texas GCD)

GMA-8 recognized of the limitations of the 2-D models in being applied to the extreme down-dip portion of the aquifer in confined condition under artesian pressure. As a result, GMA-8 considered several options for adoption of a DFC for the Hickory aquifer in Brown, Lampasas (Saratoga UWCD), Mills (Fox Crossing Water District), Travis and Williamson Counties. The same options for DFC adoption were considered for the Ellenburger-San Saba aquifer in Brown, Lampasas (Saratoga UWCD) and Mills (Fox Crossing Water District) Counties. The options for DFC adoption considered by GMA-8 were as follows:

1. The GMA could designate the areas that could not be addressed by the 2-D models as "down-dip slivers" of the aquifer and decline to specify a DFC for those areas of the Ellenburger-San Saba and Hickory aquifers.

2. The GMA could opt to follow (or extend) the DFC that may be adopted for the Ellenburger-San Saba and Hickory aquifers by GMA-7 at such time as a DFC for those aquifers may be adopted by GMA-7.

3. The GMA could opt to follow (or extend) the DFC that may be adopted for the Ellenburger-San Saba and Hickory aquifers by GMA-7 with exception of Burnet and Lampasas Counties in the Ellenburger-San Saba aquifer and Burnet County in the Hickory aquifer. In Burnet and Lampasas Counties; the 2-D model based DFCs previously developed by GMA-8 would be used.

4. The GMA could determine that the 2-D model-based DFCs previously developed by GMA-8 for the Ellenburger-San Saba aquifer in Burnet and Lampasas Counties and Burnet County in the Hickory aquifer would be used. The GMA could then specify a DFC (or DFCs) for the remaining areas in the Ellenburger-San Saba and Hickory aquifers to be submitted to TWDB. TWDB would then determine the Managed Available Groundwater (MAG) based on the DFC or DFCs specified for each aquifer using a methodology other than the 2-D models.

After holding a public hearing and consideration of the 4 identified options in a public meeting; GMA-8 selected option 4 for submittal of DFCs for the Paleozoic-age minor aquifers. After selecting the method of DFC submittal GMA-8 then deliberated on the aquifer measure to be used in describing a DFC for the Paleozoic-age minor aquifers. GMA-8 considered and selected maintenance of a specified percentage of the available draw down of the Hickory and Ellenburger-San Saba aquifers after 50-years in the applicable counties or GCDs. Having selected maintenance of a specified the aquifer available draw down after 50-years; GMA-8 then considered the percentage of the aquifer available draw down to be maintained. After deliberation, GMA-8 determined that 90 percent of the available draw down in the Hickory and Ellenburger-San Saba aquifers in the applicable counties or GCDs should be maintained after 50-years.

GMA-8 Desired Future Conditions for the Marble Falls Aquifer

- Burnet County should maintain approximately100 percent of the saturated thickness after 50 years by using approximately 80 percent of the estimated recharge.
- Lampasas County should maintain approximately 90 percent of the saturated thickness after 50 years.

GMA-8 Desired Future Conditions for the Ellenburger-San Saba Aquifer

- Burnet County should maintain approximately100 percent of the saturated thickness after 50 years by using approximately 80 percent of the estimated recharge.
- Lampasas County should maintain approximately 90 percent of the saturated thickness after 50 years.
- Brown and Mills Counties should maintain approximately 90 percent of the available draw down after 50 years.

GMA-8 Desired Future Conditions for the Hickory Aquifer

- Burnet County pumping should maintain approximately100 percent of the saturated thickness after 50 years by using approximately 80 percent of the estimated recharge.
- Brown, Lampasas, Mills, Travis and Williamson Counties should maintain approximately 90 percent of the available draw down after 50 years.

Note: The observations and assessments made in this report were based on data supplied by CUWCD, TWDB or available from referenced published sources available at the time the report preparation. The conclusions drawn in the report are based on the available data and reasonable methods of assessment. The Desired Future Conditions presented in this report reflect policy decisions made by GMA-8. If new or different data is made available the conclusions of this report may change.

Bibliography

Bluntzer, Robert, 1992; evaluation of the Ground-Water Resources of the Paleozoic and Cretaceous Aquifers in the Hill County of Central Texas, Texas Water Development Board Report 339

Driscoll, Fletcher, 1986; Groundwater and Wells, Second Edition; Johnson Division; ISBN 0-9616456-0-1

Muller, Daniel and Price, Robert, 1979; Ground-Water Availability in Texas; Texas Water Development Board Report 238

April 30, 2009

Ms. Cheryl Maxwell, General Manager
Clearwater Underground Water Conservation District
P.O. Box 729
Belton, TX 76513

Re: Managed available groundwater estimates for the Marble Falls Aquifer in Groundwater Management Area 8

Dear Ms. Maxwell:

The Texas Water Code, Section 36.108, Subsection (o), states that Texas Water Development Board's executive administrator shall provide each district and regional water planning group located wholly or partly within a groundwater management area with the managed available groundwater in the management area based upon the desired future condition of the groundwater resource. This letter and the attached report (GTA Aquifer Assessment 08-02mag) are in response to this directive.

As noted in your letter dated June 10, 2008, the desired future condition submitted for the Marble Falls Aquifer in Groundwater Management Area 8 was as follows:

- Burnet County should maintain approximately 100 percent of the saturated thickness after 50 years by using approximately 80 percent of the estimated recharge.
- Lampasas County should maintain approximately 90 percent of the saturated thickness after 50 years.

Managed available groundwater is defined in the Texas Water Code as the amount of water that may be permitted by a district for beneficial use in accordance with the desired future condition of the aquifer as determined under Texas Water Code, Section 36.108. For various planning purposes the managed available groundwater estimates have been reported at the combined aquifer, county, river basin, regional water planning area, groundwater management area, groundwater conservation district (if applicable), and geographic area (if designated) level.

We understand that groundwater conservation districts have options on how to distribute managed available groundwater in a groundwater management area; therefore we encourage open communication and coordination between groundwater conservation districts, regional water planning groups and the TWDB to ensure that managed available groundwater reported in

regional water plans and groundwater management plans are not in conflict. In addition, please note that estimates of managed available groundwater are based on the best available scientific tools that can be currently used to evaluate managed available groundwater and that these estimates may be based on assumptions made on the magnitude and distribution of pumping in the aquifer. Therefore, it is important for groundwater conservation districts to monitor whether or not their management of pumping is achieving their desired future conditions. Districts are encouraged to continue work with the TWDB to better define available groundwater as additional new data could help better assess responses of the aquifer to actual pumpage values and their distribution now and in the future.

Sincerely,

J. Kevin Ward
Executive Administrator

Attachment: GTA Aquifer Assessment 08-02mag

c w/att.: Cary Betz, Texas Commission of Environmental Quality, Water Supply Division

Kelly Mills, Texas Commission of Environmental Quality, Groundwater Planning and Assessment Division

Robert E. Mace, Ph.D., P.G., Deputy Executive Administrator, TWDB, Water Science and Conservation

Rima Petrossian, P.G., Manager, TWDB, Groundwater Technical Assistance Section

Cindy Ridgeway, P.G., Manager, TWDB, Groundwater Availability Modeling Section

Robert G. Bradley, P.G., Groundwater Management Area Liaison, TWDB Groundwater Technical Assistance Section

Carolyn Brittin, Deputy Executive Administrator, TWDB, Water Resources Planning and Information

David Meesey, Planner - Region K, TWDB, Regional Water Planning Section

Matt Nelson, Planner - Region G, TWDB, Regional Water Planning Section

David Dunn, HDR Engineering, Inc.

Mark Lowry, AECOM

GTA Aquifer Assessment 08-02mag

by Robert G. Bradley, P.G.
Texas Water Development Board
Groundwater Technical Assistance Section
(512) 936-0870
May 1, 2009

REQUESTOR:

Cheryl Maxwell, of the Clearwater Underground Water Conservation District acting on behalf of Groundwater Management Area 8.

DESCRIPTION OF REQUEST:

In a letter dated June 10, 2008, Ms. Cheryl Maxwell provided the Texas Water Development Board (TWDB) with the desired future conditions for the Ellenburger-San Saba, Hickory, and Marble Falls aquifers in Groundwater Management Area 8 and requested that TWDB estimate managed available groundwater values. This aquifer assessment presents the managed available groundwater for the Marble Falls Aquifer in Groundwater Management Area 8.

DESIRED FUTURE CONDITIONS:

- Burnet County should maintain approximately 100 percent of the saturated thickness after 50 years by using approximately 80 percent of the estimated recharge.
- Lampasas County should maintain approximately 90 percent of the saturated thickness after 50 years.

METHODS:

The desired future conditions requested for the Marble Falls Aquifer were based on maintaining a percentage of the estimated saturated thickness left in 50 years. The desired future for Burnet County adds a stipulation of using 80 percent of the estimated recharge. Because this is a volume and not a condition of the aquifer, this part of the statement was disregarded in the calculation of the managed available groundwater.

The amount of data available for the Marble Falls Aquifer is limited; no site-specific information on specific yield from the aquifer is available. A limited number of wells indicate that the saturated thickness assumed by Williams (2008) is reasonable for the estimation of managed available groundwater (TWDB 2009).

A transient hydrologic budget for the saturated portion of an aquifer is (Freeze and Cherry, 1979, p.365):

$$Q(t) = R(t) - D(t) + \frac{dS}{dt}$$

Where: Q(t)= total rate of groundwater withdrawal
R(t)= total rate of groundwater recharge to the basin
D(t)= total rate of groundwater discharge from the basin
$\frac{dS}{dt}$ = rate of change of storage in the saturated zone of the basin

For this analysis, it is assumed that:

$$R(t) = R(r) + R(e)$$

Where: R(r) = rejected recharge for the basin
R(e) = effective recharge

In addition, it is assumed that:

$$R(r) \cong D(t)$$

Then the total rate of groundwater withdrawal equals effective recharge plus the change in storage of the aquifer, or:

$$Q(t) = R(e) + \frac{dS}{dt}$$

For the desired future condition in Burnet County, in which no water can be taken from storage, then dS/dt can be set to zero and the budget is simplified to obtain,

$$Q(t) = R(e)$$

County, river basin, and groundwater conservation district boundaries subdivided the aquifer into map areas (Figure 1). The areal extent of each aquifer map area was calculated. These areas were used to calculate estimated average effective recharge and pumped volumes.

To determine the volume from storage used, the areas were multiplied by the estimated aquifer specific yield, and then by the drained saturated thickness necessary to maintain the desired future condition. This volume was then divided by 50 years to obtain a yearly volume.

Average annual effective recharge to the aquifer was calculated by multiplying each area by the average precipitation (1971 to 2000) and an estimated effective recharge rate.

Water-level data from the TWDB groundwater database was used to calculate average saturated thickness.

The calculations were done in a Microsoft Excel worksheet.

The two conditions were assumed to be physically possible individually and collectively across groundwater management area.

PARAMETERS AND ASSUMPTIONS:

- The estimated average total thickness of the Marble Falls Aquifer is 160 feet (CTGCD, 2007, Williams 2008, TWDB 2008)
- The areas for each subdivision were calculated from the Texas Water Development Board (TWDB) shapefile for the Marble Falls Aquifer, projected into the GAM projection (Anaya, 2001).
- Areas, in acres, were calculated within ArcGIS 9.2.
- Average annual precipitation was used to calculate annual average effective recharge volumes.
- The average annual precipitation for each aquifer map area (Table 1) was determined from the Texas Climatic Atlas (Narasimhan and others, 2008) which is for the average for years 1971 to 2000.
- Average effective recharge from precipitation is estimated to be 5 percent of annual precipitation (Muller and Price, 1979, Preston and others, 1996, CTGCD, 2007, Williams, 2008,).
- The managed available groundwater volume estimates are the sum of the annual average effective recharge amount and the volume of water depleted from the aquifer based on the desired future condition.
- Annual volumes are calculated by dividing the total volume by 50 years.
- Specific yield of the aquifer is estimated as 0.15 (Williams, 2008; Heath, 2004; Morris and Johnson, 1967).

RESULTS:

The estimated average effective recharge for the Marble Falls Aquifer in GMA 8 is 4,035 acre-feet per year (Table 1).

The results (Tables 2 and 3) show 4,815 acre-feet per year of managed available groundwater for the Marble Falls Aquifer in Groundwater Management Area 8. The Saratoga Underground Water Conservation District, in Lampasas County, has 2,837 acre-feet per year of managed available groundwater in the Marble Falls Aquifer. Central Texas Groundwater Conservation District has 1,978 acre-feet per year.

Table 1. Estimated total annual average effective recharge volume for the Marble Falls Aquifer by map area subdivisions (See Figure 1).

GMA	Aquifer	County	GCD	Map area	Areal extent (acres)	Average precipitation (inches)	Average precipitation (feet)	Recharge rate (percent)	Estimated annual recharge (acre-feet)
8	Marble Falls	Lampasas	Saratoga UWCD	1	13,434	30	2.5	5	1,679
				2	2,802	32	2.7	5	378
		Burnet	Central Texas GCD	3	715	31	2.6	5	93
				4	15,078	30	2.5	5	1,885
								Total	4,035

UWCD = underground water conservation district GCD= groundwater conservation district
GMA = groundwater management area

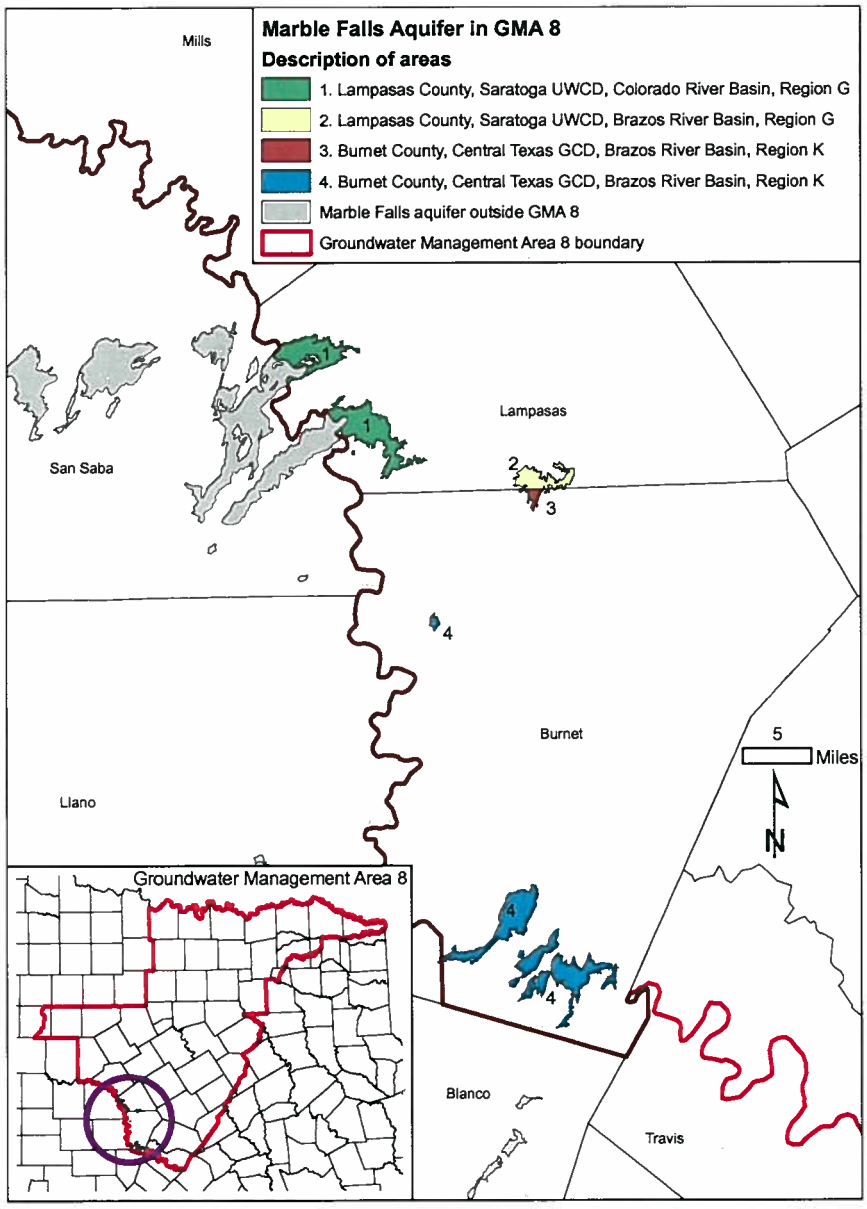


Figure 1. Geographic subdivisions for analyzing managed available groundwater the Marble Falls Aquifer in groundwater management area 8. GMA = groundwater management area, UWCD = underground water conservation district, GCD = groundwater conservation district.

Table 2. Estimates of managed available groundwater for the Marble Falls Aquifer by map area subdivisions (see Figure 1).

GMA	Aquifer	County	GCD	Map area	Specific yield	Areal extent (acres)	Estimated saturated thickness (feet)	Desired future percent of saturated thickness	Desired future saturated thickness (feet)	Saturated thickness drained (feet)	Estimated total volume from storage (acre-feet)	Estimated annual volume from storage (acre-feet)	Estimated annual recharge (acre-feet)	Estimated annual total Volume (acre-feet)
8	Marble Falls	Lampasas	Saratoga UWCD	1	0.15	13,434	160	90	144	16	32,242	645	1,679	2,324
				2	0.15	2,802	160	90	144	16	6,725	134	378	513
		Burnet	Central Texas GCD	3	0.15	715	160	100	160	0	0	0	93	93
				4	0.15	15,078	160	100	160	0	0	0	1,885	1,885
											Total	779	4,035	4,815

GMA = groundwater management area UWCD = underground water conservation district GCD= groundwater conservation district

Table 3. Estimates of managed available groundwater for the Marble Falls Aquifer (See Figure 1).

Aquifer	Map Key	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (acre-feet per year)
Marble Falls	1	Lampasas	G	Colorado	SUWCD	8	n/a	n/a	2,324
Marble Falls	2	Lampasas	G	Brazos	SUWCD	8	n/a	n/a	513
Marble Falls	3	Burnet	K	Brazos	CTGCD	8	n/a	n/a	93
Marble Falls	4	Burnet	K	Colorado	CTGCD	8	n/a	n/a	1,885

RWPG = regional water planning area GCD= groundwater conservation district GMA = groundwater management area
GeoArea = geographic areas defined by unique desired future conditions as specified by a groundwater management area.
CTGCD = Central Texas Groundwater Conservation District SUWCD = Saratoga Underground Water Conservation District
MAG = managed available groundwater in units of acre-feet per year.

STIPULATIONS:

Additional data are needed to create improved estimates; these estimates are a simplistic interpretation of the requested conditions. These solutions assume homogeneous and isotropic aquifers; however, conditions for the Marble Falls Aquifer may not behave in a uniform manner.

Note that estimates of managed available groundwater are based on the best available scientific tools that can be used to evaluate managed available groundwater and that these estimates can be a function of assumptions made on the magnitude and distribution of pumping in the aquifer. Therefore, it is important for groundwater conservation districts to monitor whether or not they are achieving their desired future conditions and to work with the TWDB to refine managed available groundwater given the reality of how the aquifer responds to the actual magnitude and distribution of pumping now and in the future.

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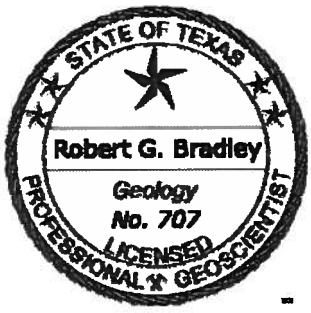

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GTA Aquifer Assessment 08-03mag

by Robert G. Bradley, P.G.
Texas Water Development Board
Groundwater Technical Assistance Section
(512) 936-0870
May 6, 2009

REQUESTOR:

Cheryl Maxwell, of the Clearwater Underground Water Conservation District acting on behalf of Groundwater Management Area 8.

DESCRIPTION OF REQUEST:

In a letter dated June 10, 2008, Ms. Cheryl Maxwell provided the Texas Water Development Board (TWDB) with the desired future conditions for the Ellenburger-San Saba, Hickory, and Marble Falls aquifers in Groundwater Management Area 8 and requested that TWDB estimate managed available groundwater values. This aquifer analysis presents the managed available groundwater for the Ellenburger-San Saba Aquifer in Groundwater Management Area 8.

DESIRED FUTURE CONDITIONS:

- Burnet County should maintain approximately 100 percent of the saturated thickness after 50 years by using approximately 80 percent of the estimated recharge.
- Lampasas County should maintain approximately 90 percent of the saturated thickness after 50 years.
- Brown and Mills Counties should maintain approximately 90 percent of the available draw down after 50 years.

METHODS:

The desired future conditions requested for the Ellenburger-San Saba Aquifer were based on maintaining a percentage of the estimated saturated thickness left in 50 years.

The desired future for Burnet County adds a stipulation of using 80 percent of the estimated recharge. Because this is a volume and not a condition of the aquifer, this part of the statement was disregarded in the calculation of the managed available groundwater.

A transient hydrologic budget for the saturated portion of an aquifer is (Freeze and Cherry, 1979, p.365):

$$Q(t) = R(t) - D(t) + \frac{dS}{dt}$$

Where: Q(t)= total rate of groundwater withdrawal
R(t)= total rate of groundwater recharge to the basin
D(t)= total rate of groundwater discharge from the basin
$\frac{dS}{dt}$ = rate of change of storage in the saturated zone of the basin

For this analysis, it is assumed that:

$$R(t) = R(r) + R(e)$$

Where: R(r) = rejected recharge for the basin
R(e) = effective recharge

In addition, it is assumed that:

$$R(r) \cong D(t)$$

Then the total rate of groundwater withdrawal equals effective recharge plus the change in storage of the aquifer, or:

$$Q(t) = R(e) + \frac{dS}{dt}$$

For the desired future condition in Burnet County, in which no water can be taken from storage, then dS/dt can be set to zero and the budget is simplified to obtain,

$$Q(t) = R(e)$$

County, river basin, and groundwater conservation district boundaries subdivided the aquifer into map areas (Figure 1). The areal extent of each aquifer map area was calculated. These areas were used to calculate estimated average effective recharge and pumped volumes.

To determine the volume from storage used, the areas were multiplied by the estimated aquifer specific yield, and then by the drained saturated thickness necessary to maintain the desired future condition. This volume was then divided by 50 years to obtain a yearly volume.

Average annual effective recharge to the aquifer was calculated by multiplying each area by the average precipitation (1971 to 2000) and an estimated effective recharge rate.

Estimated saturated thicknesses were calculated by taking average water-level elevations from the TWDB groundwater database and subtracting the average base of the San Saba Limestone from by Standen and Ruggiero (2007) for each map area.

Water-levels within a one mile buffer were used to calculate the average water-level elevation for map areas 1. No wells were within this buffer for map areas 7 and 10, so two-mile buffer was used to obtain water-levels for those two areas. Map areas 2 and 3 have no water-levels nearby and an estimated water-level elevation was determined from the upgradient wells in San Saba County. The average elevation of the structural surface was calculated for each map area by using zonal statistics in ArcGIS.

The final calculations were done in a Microsoft Excel worksheet.

PARAMETERS AND ASSUMPTIONS:

- An average saturated thickness for each map area is used to make volume calculations (Table 2).
- The areas for each area were calculated from the Texas Water Development Board (TWDB) shapefile for the Ellenburger-San Saba Aquifer, projected into the groundwater availably modeling (GAM) projection (Anaya, 2001).
- Areas, in acres, were calculated within ArcGIS 9.2.
- Average annual precipitation was used to calculate annual effective recharge volumes.
- The average annual precipitation (1971-2000) for the each aquifer map area (Table 1) was determined from the Texas Climatic Atlas (Narasimhan and others, 2008).
- Average effective recharge from precipitation is estimated to be 2 percent of annual precipitation (Preston and others, 1996).
- The managed available groundwater volume estimates are the sum of the annual average effective recharge amount and the volume of water depleted from the aquifer based on the desired future condition.
- Annual volumes are calculated by dividing the total volume by 50 years.
- Specific yield of the aquifer is estimated as 0.03 (LBG-Guyton Associates, 2003) and the storage coefficient is estimated as 0.002 (TWDB, 2009; Bluntzer, 1992; LBG-Guyton Associates, 2003).
- Outcrop areas are calculated as unconfined areas of the aquifer and subcrop areas are calculated as confined areas of the aquifer.

- Saturated thickness is used for both unconfined and confined map areas, where the decline in confined areas is in reality the total head plus the saturated thickness of the aquifer.

RESULTS:

The annual effective recharge estimate for the Ellenburger-San Saba Aquifer in Groundwater Management Area 8 is 6,109 acre-feet per year.

The results (Tables 2 and 3) show 8,749 acre-feet per year of managed available groundwater for the Ellenburger-San Saba Aquifer in Groundwater Management Area 8. The Saratoga Underground Water Conservation District, in Lampasas County, has 2,593 acre-feet per year of managed available groundwater in the Ellenburger-San Saba Aquifer. The Central Texas Groundwater Conservation District has 5,526 acre-feet per year and Fox Crossing Water District has 499 acre-feet per year of managed available groundwater.

Table 1. Estimated total annual effective recharge volume for the Ellenburger-San Saba Aquifer by map areas (See Figure 1).

GMA	Aquifer	County	GCD	Map area	Areal extent (acres	Average annual precipitation (inches)	Average annual precipitation (feet)	Effective recharge rate (percent)	Estimated annual effective recharge (acre-feet)
8	Ellenburger-San Saba	Lampasas	Saratoga UWCD	5	11,347	30	2.5	2	567
				7	293	31	2.6	2	15
		Burnet	Central Texas GCD	8	108,063	30	2.5	2	5,403
				10	2,372	31	2.6	2	123
								Total	6,109

UWCD = underground water conservation district GCD= groundwater conservation district
GMA = groundwater management area

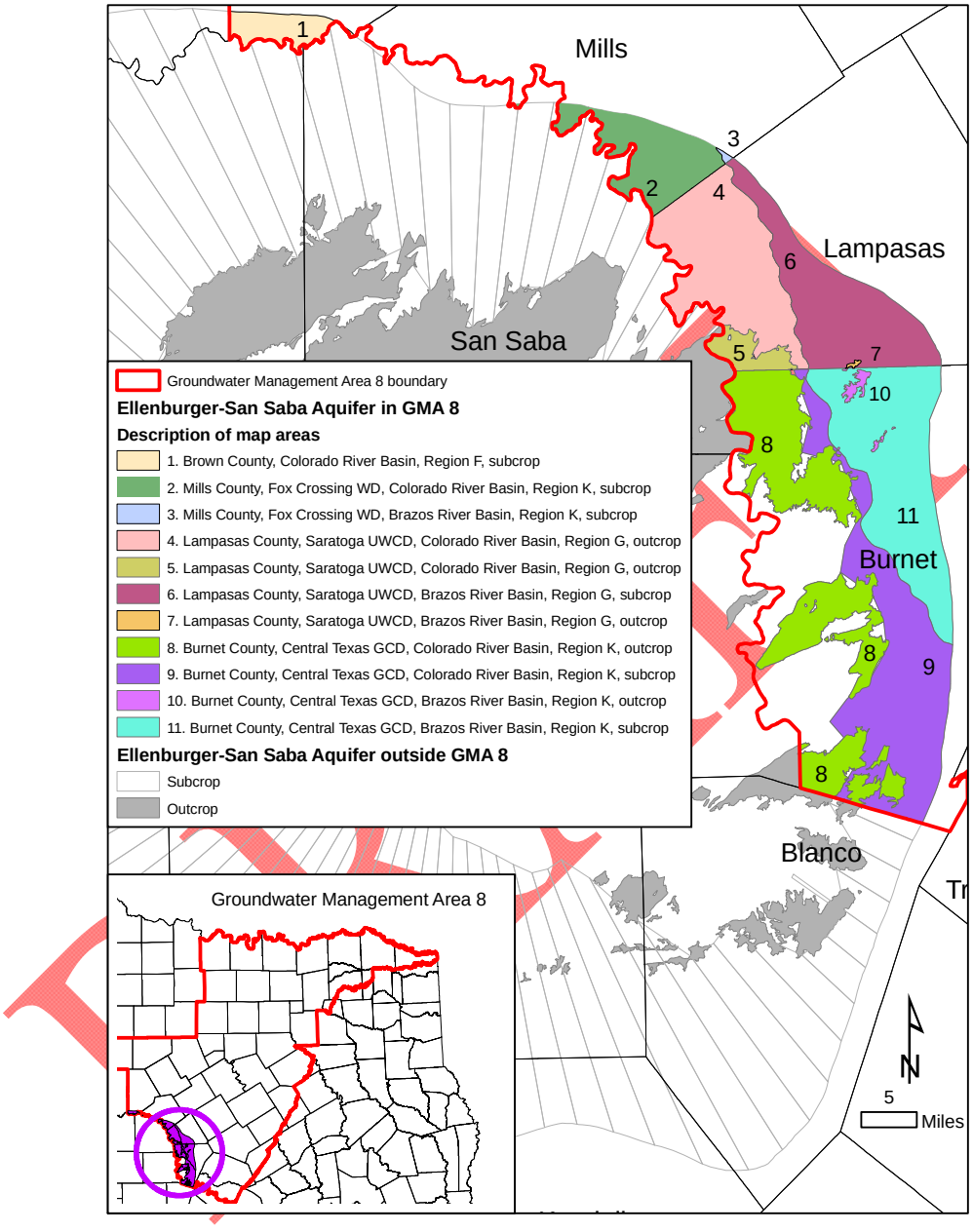

Figure 1. Map areas for analyzing managed available groundwater the Ellenburger-San Saba Aquifer in groundwater management area 8. GMA = groundwater management area, UWCD = underground water conservation district, GCD = groundwater conservation district.

Table 2. Estimates of managed available groundwater for the Ellenburger-San Saba Aquifer by map areas (see Figure 1).

GMA	Aquifer	County	GCD	Map area	Storage coefficient	Areal extent (acres)	Estimated saturated thickness (feet)	Desired future percent of saturated thickness	Desired future saturated thickness (feet)	Saturated thickness drained (feet)	Estimated total volume from storage (acre-feet)	Estimated annual volume from storage (acre-feet)	Estimated annual effective recharge (acre-feet)	Estimated annual total volume (acre-feet)
8	Ellenburger-San Saba	Brown	n/a	1	0.002	14,898	2,200	90	1,980	220	6,555	131	0	131
		Mills	Fox Crossing Water District	2	0.002	42,560	2,900	90	2,610	290	24,685	494	0	494
				3	0.002	480	2,600	90	2,340	260	250	5	0	5
		Lampasas	Saratoga UWCD	4	0.002	86,348	2,100	90	1,890	210	36,266	725	0	725
				5	0.03	11,347	1,000	90	900	100	34,041	681	567	1,248
				6	0.002	71,855	2,000	90	1,800	200	28,742	575	0	575
				7	0.03	293	1,700	90	1,530	170	1,494	30	15	45
		Burnet	Central Texas GCD	8	0.03	108,063	600	100	600	0	0	0	5,403	5,403
				9	0.002	119,220	1,200	100	1,200	0	0	0	0	0
				10	0.03	2,372	1,600	100	1,600	0	0	0	123	123
				11	0.002	101,846	1,500	100	1,500	0	0	0	0	0
											Total	1,355	6,108	8,749

GMA = groundwater management area UWCD = underground water conservation district GCD= groundwater conservation district

Table 3. Estimates of managed available groundwater for the Ellenburger-San Saba Aquifer (See Figure 1).

Aquifer	Map Key	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (acre-feet per year)
Ellenburger-San Saba	1	Brown	F	Colorado	n/a	8	n/a	n/a	131
Ellenburger-San Saba	2	Mills	K	Colorado	FCWD	8	n/a	n/a	494
Ellenburger-San Saba	3	Mills	K	Brazos	FCWD	8	n/a	n/a	5
Ellenburger-San Saba	4	Lampasas	G	Colorado	SUWCD	8	n/a	n/a	725
Ellenburger-San Saba	5	Lampasas	G	Colorado	SUWCD	8	n/a	n/a	1,248
Ellenburger-San Saba	6	Lampasas	G	Brazos	SUWCD	8	n/a	n/a	575
Ellenburger-San Saba	7	Lampasas	G	Brazos	SUWCD	8	n/a	n/a	45
Ellenburger-San Saba	8	Burnet	K	Colorado	CTGCD	8	n/a	n/a	5,403
Ellenburger-San Saba	9	Burnet	K	Colorado	CTGCD	8	n/a	n/a	0
Ellenburger-San Saba	10	Burnet	K	Brazos	CTGCD	8	n/a	n/a	123
Ellenburger-San Saba	11	Burnet	K	Brazos	CTGCD	8	n/a	n/a	0

RWPA = regional water planning area GCD= groundwater conservation district GMA = groundwater management area
GeoArea = Geographic areas defined by unique desired future conditions as specified by a groundwater management area.
FCWD = Fox Crossing Water District CTGCD = Central Texas Groundwater Conservation District
SUWCD = Saratoga Underground Water Conservation District MAG = Managed available groundwater in units of acre-feet per year.

STIPULATIONS:

Additional data are needed to create improved estimates; these estimates are a simplistic interpretation of the requested conditions. These solutions assume homogeneous and isotropic aquifers; however, conditions for the Ellenburger-San Saba Aquifer may not behave in a uniform manner.

Note that estimates of managed available groundwater are based on the best available scientific tools that can be used to evaluate managed available groundwater and that these estimates can be a function of assumptions made on the magnitude and distribution of pumping in the aquifer. Therefore, it is important for groundwater conservation districts to monitor whether or not they are achieving their desired future conditions and to work with the TWDB to refine managed available groundwater given the reality of how the aquifer responds to the actual magnitude and distribution of pumping now and in the future.

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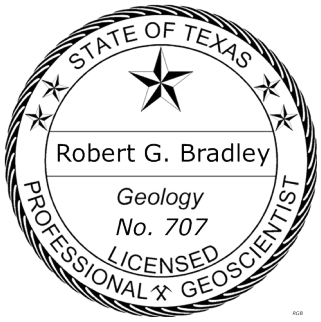

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RULES OF THE

SARATOGA UNDERGROUND WATER CONSERVATION DISTRICT

IN TEXAS ARE HEREBY PUBLISHED AS OF

August 13. 2007

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PREAMBLE

In accordance with the terms and provisions of Article XVI Section 59 of the Constitution of Texas and Chapters 36 of the Texas Water Code, the following rules are hereby ratified and adopted by the Saratoga Underground Water Conservation District. All references herein citing sections of the Texas Water Code Chapter 36 as authority shall be shown as sections or subsections of said Code, i.e. (36.113) shall reference Section 36.113 of the Texas Water Code. Nothing in these rules shall be construed as depriving or divesting the right of ownership as recognized by Section 36.002 of the Texas Water Code.

The rules, regulations and modes of procedure herein contained are and have been adopted for the purpose of simplifying procedure, avoiding delays, saving expense, and facilitating the administration of the ground water laws of the State by the District.

SECTION 1 – DEFINITIONS AND CONCEPTS

1.1 Definitions

Unless the context hereof indicates a contrary meaning, the words hereinafter defined, either capitalized or uncapitalized, shall have the following meaning in these rules:

(a) "Exempt well" shall mean a well that is exempt from permitting under Section 3.2.

(b) A "Non-exempt" well shall mean a well that is not exempt from permitting under Section 3.2

(c) "Abandoned Well" shall mean a well that has not been used for twelve consecutive months. A well is considered to be in use in the following cases:

(1) A non-deteriorated well which contains the casing, pump and pump column in good condition; or

(2) A non- deteriorated well which has been capped.

(d) An "Aggregate Well" shall mean more than one well whose combined total production is aggregated for permitting purposes. Transport wells may not include aggregated wells.

(e) "Applicant" shall be the owner of the land on which the well or proposed well is located, unless the landowner authorizes another person to own the permit or registration.

(f) "Beneficial Use" or "Beneficial Purpose" shall mean use for:

(1) agricultural, gardening, domestic, stock raising, municipal, mining, manufacturing, industrial, commercial, recreational, or pleasure purposes;

(2) exploring for, producing, handling, or treating oil, gas, sulphur, or other minerals; or

(3) any other purpose that is useful and beneficial to the user that does not commit waste as defined in this rule.

(g) "Board" shall mean the Board of Directors of the Saratoga Underground Water Conservation District.

(h) "Casing" shall mean a tubular watertight structure installed in an excavated or drilled hole to maintain the well opening.

(i) A “Completed Well” is a well that has been drilled, equipped and is ready to pump water.

(j) "Conservation" shall mean those practices, techniques, and technologies that will reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water.

(k) "Deteriorated Well" shall mean a well, the condition of which will cause, or is likely to, based on judgment of the Board, cause pollution of any water in the District.

(l) "District" shall mean the Saratoga Underground Water Conservation District. When applications, reports, and other papers are required to be filed or sent to "the District" this means the District's headquarters in Lampasas, Texas. When these Rules state that an action is taken by “the District”, such action may be taken by the Board.

(m) "Driller's Log" shall mean a record, made at the time of drilling, showing the depth, thickness, character of the different strata penetrated, and location of water-bearing strata, as well as the depth, size, and character of casing installed.

(n) "Flow monitoring device" shall mean an electrical or mechanical register that incorporates both a digit totalizer and instantaneous flow-rate indicator utilizing generally accepted units (i.e. gallons, acre feet, or acre inches).

(o) "Groundwater" shall mean water percolating below the earth's surface within the District, but shall not include water produced with oil in the production of oil and gas.

(p) "Licensed Water Well Driller" shall mean any person who holds a license issued by the State of Texas pursuant to the provisions of the Texas Water Well Drillers Act, as amended, and the substantive rules of the Water Well Drillers Board, or its successors.

(q) "Permit" shall mean a drilling and production permit as described, as applicable, in Rules 3, 4 and 5.

(r) "Person" shall mean and include any individual, partnership, firm, corporation, entity, municipal corporation, unincorporated area, government, or governmental subdivisions or agency, business trust, estate, trust, or any other legal entity or association.

(s) "Pollution" shall mean the alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any water in the District, that renders the water harmful, detrimental, or injurious to humans, animal life, vegetation, or property; or to public health, safety, or welfare; or impairs the usefulness of the water for any lawful or reasonable purpose.

(t) A “Replacement Well” is a well that is drilled to replace the production of an existing well. For non-exempt wells, in order to be considered a replacement well, the existing well must be capped or plugged in accordance with 6.2. For exempt wells, the existing well can continue in production as long as the pumping capability of the existing and replacement well is not more than 17.36 gallons per minute.

(u) "Underground Water Reservoir" shall mean water suitable for agricultural, gardening, public supply, domestic, or stock raising uses, percolating below the earth's surface in the District.

(v) The word "Waste" as used herein shall mean any one or more of the following:

(1) The withdrawal of groundwater from an Underground Water Reservoir at a rate and in an amount that causes or threatens to cause intrusion into the reservoir, water unsuitable for agricultural, gardening, domestic, or stock raising purposes;

(2) The flowing or producing of water from an Underground Water Reservoir if the water produced is not used for a beneficial purpose;

(3) The escape of groundwater from an Underground Water Reservoir to any other reservoir that does not contain groundwater, or contains undesirable water;

(4) The pollution or harmful alteration of groundwater in an Underground Water Reservoir by salt water, other deleterious matter admitted from another stratum or from the surface of the ground;

(5) Willfully or negligently causing, suffering, or permitting groundwater to escape into any river, creek, natural water course, depression, lake, reservoir, drain, sewer, street, highway, road, or road ditch, or onto any land other than that of the owner of the well or;

(6) Groundwater pumped for irrigation that escapes as irrigation tail-water onto land other than that of the owner of the well unless permission has been granted by the occupant of the land receiving the discharge.

(7) The loss of groundwater in the distribution system and/or storage facilities of a public water supply system in excess of 20% of total annual pumpage. This loss is also termed "shrinkage", "line loss" or "unaccounted for water". Excessive line loss is a non-beneficial use of groundwater.

(w) "Water" shall mean groundwater.

(x) "Well" or "Water Well" shall mean and include any artificial excavation into which groundwater from an Underground Water Reservoir may flow and be produced.

(y) "Well Location" shall mean the location of a proposed well on an application duly filed until such application is granted or denied, or the location of a well on a valid permit.

1.2 Use and effect of Rules

The District uses these rules in the exercise of the powers conferred by law and in the accomplishment of the purposes of the District Act.

1.3 Changes to Rules

All changes to the District's Rules shall only be made after notice and public hearing. Such changes include repeal or amendment of existing Rules and the adoption of new Rules.

Section 2 - WELL REGISTRATION

2.1 Registration of Existing Wells

The owner of an existing well located in Lampasas County may register the well with the District. Forms for registering an existing well are available from the District Office. The well shall be registered under its existing State well number. If the well does not have a State well number, the District shall issue a temporary well number pending assignment of a State well number.

Registration of an existing Completed Well with the District prior to October 1, 2005 shall entitle the owner of the well to be granted a Designation of Historic and Existing Use. Transport wells are not entitled to a Designation of Historic and Existing Use. Designations of Historic and Existing Use shall be given priority consideration in the designation of a Critical Groundwater Management Area and in requests for selection for inclusion in any voluntary groundwater monitoring program.

2.2 Registration of New Wells

The owner of a new well proposed to be located in Lampasas County shall file an intent to drill a new well with the District prior to commencement of drilling. Forms for an intent to drill a new well are available from the District Office. A registration fee shall be charged and paid at the time of filing the intent to drill. If the intent to drill indicates that the owner intends that the well be an exempt well, unless further clarification is requested from the District within ten days, the owner may commence drilling the well. If the intent to drill indicates that the owner intends that the well be a non-exempt well, the owner or his representative shall follow the application procedures set forth in Sections 4 and 5.

Within 60 days after drilling and casing of the well, the well driller shall submit a complete record; to include an accurate driller's log, any electric log which may have been made, and such additional data as may be required by the District.

Within 60 days after completion of the well, the well owner shall submit a complete record concerning the equipping and completion of the well. Such report shall include any such additional data concerning the description of the well, its discharge and equipment as may be required by the District. The report shall also certify that the information in the registration application is true and correct. Such report shall be filed with the District at its office in Lampasas, Texas. The District may issue a temporary well number pending assignment of a State well number.

The District shall review the above referenced reports and determine whether the new well is an exempt well under Rule 3.2. If the well is determined to be non-exempt, the rules governing non-exempt wells shall apply. If the well is determined to be exempt, no

further processing is required, except as may be required by Rule 2.3 regarding changes in well conditions.

2.3 Changes to Registered Wells

Increases in the pumping capability, changes in the use of groundwater, or reductions in lot size to 10 acres or less must be reported to the District and may result in the well being reclassified as non-exempt which would require the well owner to apply for an operating permit. A transfer of ownership of the registered well shall be reported to the District but transfers of ownership are not a reason for reclassification of the well.

An existing well may be reworked or re-equipped or replaced in a manner that will not change the existing well status. A replacement well, in order to be considered such, must be drilled within three hundred (300) feet of the existing well. A well that is used as a replacement for a well that has been granted a Designation of Historic and Existing Use shall be entitled to a Designation of Historic and Existing Use. For exempt wells where the existing well is not capped or plugged, the well owner may designate either the existing well or the replacement well as the well with the Designation of Historic and Existing Use. Replacement wells shall file the forms described in Section 2.2.

2.4 Providing Correct and Current Address to the District

Owners of registered wells under these Rules are entitled to notices in certain circumstances. It is the duty of the owner of a well to provide the District with a current address.

2.5 Confidentiality of Information

Tex Occ. Code Title 12, Chapter 1901.251 authorizes the owner of the well to keep information contained in the well driller's report which is filed with the state to be declared confidential and removed from the public record by sending a written request by certified mail to the State. The owner may send a copy of this letter to the district which shall accept this request and shall remove all information regarding the owner's well from public record in the District's files.

SECTION 3 GENERAL PERMITTING PROCEDURES

3.1 Requirement for Permit to Drill.

No person shall drill, own, pump or operate a well or produce groundwater from a well located within an Underground Water Reservoir aquifer without a permit unless that well is exempt under Rule 3.2. Owners of all wells not exempt by Rule 3.2 shall be required to obtain a permit following the procedures in Section 4. Additionally, owners of transport wells shall be required to also follow the procedures outlined in Section 5.

3.2 Permit Exclusions and Exemptions.

The following wells are not required to have a permit from the District:

(1) A well used solely for domestic use or for providing water for livestock or poultry on a tract of land larger than 10 (ten) acres that is either drilled, completed or equipped so that it is incapable of producing more than 25,000 gallons of water in a day; provided, however that this exemption shall also apply after the effective date of this rule to a well that has been drilled or which is to be drilled on a tract of land equal to or less than 10 (ten) acres in size only if:

(a) the well is to be used solely for domestic use or providing water for livestock or poultry on a tract;

(b) such tract was platted prior to the effective date of this rule as a tract equal to or less than ten acres in size; and

(c) such tract is not further subdivided into smaller tracts of land after the effective date of this rule.

(2) A well that meets the requirements of 36.117 (b) (2) or 36.117 (b) (3) [governing wells permitted by the Railroad Commission of Texas] as long as 36.117 (d) does not apply to such wells; or

(3) Jet wells used for domestic needs.

3.3 Issuance of a permit

On approval of an application as set forth in sections 4 and 5, the District may issue a permit to the applicant subject to any safeguards or restrictions the Board determines are necessary in order to conserve the groundwater, prevent waste, minimize as far as practicable the draw-down of the water table or the reduction of artesian pressure, or lessen interference between wells. The applicant's right to produce shall be limited to the rate, term, quantity and purpose(s) stated in the permit. When two or more wells are owned and operated by the same retail water utility as a multi-well system, the District may issue an operating permit for an aggregate withdrawal. An operating permit for an aggregate withdrawal shall allow groundwater to be produced from any well of the aggregate system up to the permitted volume. The aggregate wells shall be listed on the permit. The District may issue a permit for lesser quantities or a lesser term than is requested by the applicant.

3.4 Time during which drilling shall be initiated

Actual on site drilling, pursuant to a permit granted by the District, shall be initiated within four (4) months from the date the permit is issued. If such drilling is not initiated within the four (4) months, the permit is void and drilling may not be initiated; provided,

however, that the District, for good cause, may extend the life of such permit for an additional four (4) months if an application for such extension shall have been made to the District during the first four (4) month period. Provided further, that when it is made known to the District that a proposed project will take more time to complete, the District upon receiving written application, may grant such time as is reasonably necessary to complete such project.

3.5 Requirements prior to start of production

For permitted wells completed after the effective date of these Rules, production shall not commence until:

(a) The permit owner or his representative submits a complete record concerning the drilling, equipping and completion of the well. Such report shall include an accurate driller's log, any electric log which may have been made, and such additional data concerning the description of the well, its discharge, and its equipment as may be required by the District. The report shall also certify that the information in the permit application is true and correct. If there is a material variation between the permit application and the well as drilled and equipped, the District may require that the permit owner submit a revised application in accordance with section 4.2 or section 5.1.

(b) In addition, in the case of wells subject to a transport permit and non-exempt wells**,** **t**he permit owner or his representative certifies that the well has been equipped, at the well owners expense, with a flow monitoring device approved by the District and available for District inspection.

(c) Operating permits on new wells shall be assessed a one time operating permit fee which shall be filed with the drilling record. On transport wells, the drilling record shall also include the transport permit fee. Transport permit fees are in addition to the operating permit fee. A transport permit fee is not a one time fee and must be paid every time the transport permit is renewed. All records and fees shall be filed with the District at its office in Lampasas, Texas.

3.6 Permit terms and renewal

(a) Permits issued by the District are effective for three (3) years from the date of issuance. Each permit shall be considered for renewal every three (3) years from the anniversary of the original date of permit issuance. A permit issued prior to the effective date of this Rule shall be first considered for renewal on the next date that corresponds to a three year multiple of the anniversary of the original date of issuance, and then every three (3) years thereafter (b) At least ninety (90) days prior to a permit renewal date, the District shall send notice to the permit owner requesting verification of the owner’s compliance with permit conditions, rules and orders of the Board. The permit owner shall respond to the request for verification of owner’s compliance within 60 days.

(1) Upon receipt of the verification of owner's compliance, if the District makes a determination that a permit owner is in compliance with the permit conditions, rules and orders, the permit shall be automatically renewed and a renewal permit shall be issued to the permit owner, prior to the renewal date, with no material changes to the rights conditions, use of water, location of water use, or production amount; or

(2) Upon receipt of the verification of owner's compliance, if the District makes a determination that a permit owner is in general compliance with the permit conditions, rules and orders, but that additional information or updating of information is required, the District shall promptly notify the permit owner of the needed information for permit renewal. The permit shall automatically be renewed and the permit issued upon the District's determination of receipt of all required renewal information, if received prior to the permit renewal date. If the District does not receive the required information prior to the renewal date, the permit may not be renewed; or

(3) Upon receipt of the verification of owner's compliance, if the District makes a determination that a permit owner is not in compliance with the permit conditions, rules and orders, the District shall notify the permit owner by certified mail at least ten (10) days prior to the permit renewal date, and specify the District's findings. If the items of non-compliance are not corrected prior to the renewal date the permit may not be renewed.

3.65 Production Fees for Non-Exempt Wells

a). Production fees for non-exempt wells will be assessed based on the Texas Water Code Chapter 36 Section 36.205 (see SUWCD Fee Schedule). The flow monitoring device for all non-exempt wells will be read monthly by a District Director to determine the amount of water produced during that month. A bill will be submitted to the producer within 10 days. The producer is to pay the fees upon receipt of the billing. Failure to submit fees could result in the forfeiture of the ability to produce as a non-exempt well. The producer, who has delinquent fees, must appear before a quorum of the Saratoga Underground Water Conservation District Board to retain the production privileges of a non-exempt well or face termination in accordance with Section 6.3. A majority of positive votes of board directors present will determine the status of the non-exempt well.

b). For non-exempt wells other than transport wells, production fees are in addition to the one time operating permit fee. The production fees and reporting of the amount of water produced is set forth in Section 3.65 of these rules. All records and fees shall be filed with the District at its office in Lampasas, Texas The well's facilities, flow monitoring devices and daily production records shall be available during normal working hours for inspection by District personnel.

3.7 Permit Recall

After notice and an opportunity for a hearing, permits are subject to involuntary amendment or revocation for violation of District Rules, violation of the permit, including special permit conditions imposed by the Board, violation of the provisions of Chapter 36, Waste of groundwater, or other actions that the Board determines to be detrimental to the groundwater resources in Lampasas County.

3.8 Changes to permits

a) A permittee may apply for a transfer of ownership of any permit granted by the District, and such transfer may be approved as a ministerial act upon filing the required information. However, a transfer of ownership shall be approved as a ministerial act only if the transfer is to change the ownership of the permit and no other changes to the permit are requested.

b) A permittee may apply to the District for changes in the use, location of production, maximum permitted quantity or any other changes required. The application shall state in writing the reason, nature and the purpose of the proposed changes. The District may request any additional relevant information necessary to analyze the request for the amendment. A change in the location of use for uses other than municipal or industrial purposes does not require a permit revision or District approval.

c) An existing well may be reworked or re-equipped in a manner that will not change the existing well status. A permit must be applied for and granted by the District if a party wishes to replace an existing well with a replacement well. A replacement well, in order to be considered such, must be drilled within three hundred feet s of the existing well.

3.9 Continuing Right of Supervision

All District permits are issued subject to the rules of the District and to the continuing right of the District to regulate groundwater within the District's boundaries as authorized by Chapter 36, Texas Water Code, as amended. The decision of the Board on any matter contained herein may be reconsidered by it on its own motion or upon motion showing changed conditions, or upon the discovery of new or different conditions or facts after the hearing or decision on such matter. If the Board should decide to reconsider a matter, after having announced a ruling or decision, or after having finally granted or denied an application, it shall give notice to persons who were proper parties to the original action, and such persons shall be entitled to a hearing thereon, if they file a request thereof within fifteen days from the date of the mailing of such notice.

SECTION 4 – OPERATING PERMIT APPLICATION PROCEDURES

4.1 Operating Permit on Existing Wells

The owner of an existing non-exempt well shall submit to the District an operating permit application on a form obtained from the District. Upon receipt of such application, the District shall issue an operating permit for such well. **No fee shall be charged for issuing an operating permit for an existing well.** Once the owner has submitted the application, the District shall issue the operating permit. No public hearing need be held.

4.2 Operating Permit on New Wells

If the well is projected to be non-exempt, the owner or his representative shall submit an operating permit application prior to beginning drilling the well. If a well that was originally projected to be exempt is drilled and, after drilling, the owner determines that it wishes to equip the well so as to make it non-exempt, such owner or his representative shall also file an operating permit application.

An application for an operating permit for a new non-exempt well shall be submitted to the District in writing and be sworn to by the well owner. The application shall be submitted on forms obtained from the District and shall contain such information as deemed necessary by the District to comply with the requirements of Chapter 36 and address specific District needs. Such information shall include, but is not limited to, a location map or property plat drawn on a scale that adequately details the well site, the property lines, the location of other existing wells on the subject tract, the location of the existing use(s), the location of any existing or proposed on-site wastewater system, and the location of any other potential source of contamination within 100 feet of the existing well. In order to adequately address the purposes and requirements of Chapter 36 and District Rules, the District may require further clarification or additional documentation from the applicant. An application from the owner of a proposed new non-exempt well shall not be administratively complete until the applicant: (1) publishes public notice of the application once in a newspaper of local circulation acceptable to the District and (2) provides public notice by certified mail, return receipt requested, to any adjacent landowner within one-quarter mile of the proposed well location.

If an application remains administratively incomplete for more than 180 days following either the original application date, or the date the District notified the applicant of the need to submit additional clarification or documentation, the application shall expire.

If the proposed well is located within a Critical Groundwater Depletion Area (see Rule 8), before approving the application the District shall consider the conditions within the CGDA, how the proposed well may affect the CGDA, whether additional groundwater

production is available, and, if available, how much can be allocated to the proposed well.

The District shall promptly consider and act on each administratively complete application for a permit. The District shall, within 30 days after the date a permit application is administratively complete, either act on the application or set it for a public hearing on a specific date. The District may approve an application if it determines that it meets the requirements of Chapter 36 and District Rules, otherwise it shall schedule a public hearing before the Board. Additionally, whenever a protest is received during the public comment period on a non-exempt well, the Board shall schedule a public hearing for consideration of the application. The public hearing shall be conducted in accordance with Section 9. The Board shall hold the hearing within 35 days of setting the hearing and shall act on the application within 35 days after the hearing is held.

After drilling and completing the well, the owner or his representative shall file the reports and fees set forth in Rule 3.5.

SECTION 5 – TRANSPORT PERMIT APPLICATION PROCEDURES

5.1 Application Required

An owner of a well producing groundwater that is transported outside of Lampasas County shall obtain a transport permit from the District unless the well is exempt from permitting under Rule 3.2 or this Rule. The requirements of this rule are applicable without regard to the manner the water is transferred out of the district and specifically includes discharges into watercourses to convey water as well as pipelines and aqueducts. Transportation of water that is part of a manufactured product such as water bottled for sale outside the county requires a transport permit. The application process, review process, and the terms and conditions of Board-approved transport permits shall be in compliance with and pursuant to all the provisions of District Rules and Section 36.122.

5.2 Exceptions

Groundwater transported by truck and used outside Lampasas County for emergency purposes such as fire fighting needs does not require a transport permit. If the groundwater is to be used on property that straddles the District boundary line, a permit is not required as long as the water is used solely on the tract of land that straddles the property line and is an exempt well under 3.2.

5.3 Application Procedure

The well owner shall submit an application for a transport permit on a form obtained from the District. It shall include, but is not limited to, the following information: (1) the

availability of water in the District and in the proposed receiving areas during the period for which the water supply is requested and (2) the projected effect of the proposed transfer on aquifer conditions, depletion, subsidence, or effects on existing permit holders or other groundwater uses within the District; and (3) the projected effect upon holders of wells that have obtained a Historic and Existing Use Designation. A transport application from the owner of a proposed new non- exempt well shall not be administratively complete until the applicant: (1) publishes public notice of the application once in a newspaper of local circulation acceptable to the District and (2) provides public notice by certified mail, return receipt requested, to any adjacent landowner within one-quarter mile of the proposed well location.

The District shall determine whether the transport permit application is administratively complete. In order to adequately address the purposes and requirements of Chapter 36 and District Rules, the District may require further clarification or additional documentation from the applicant.

If an application remains administratively incomplete for more than 180 days following either the original application date, or the date the District notified the applicant of the need to submit additional clarification or documentation, the application shall expire.

5.4 Export Fee

The District shall impose a reasonable application fee and export fees for transport permits. Such fees shall be assessed in accordance with the current fee schedule adopted by the Board or the fees allowed by Section 36.122(e), whichever is greater.

5.5 Board Approval

In reviewing the application for the proposed transfer of water outside of Lampasas County, the District shall consider the application and all its associated documents. The District shall not deny the application based solely on the fact that the applicant seeks to transfer groundwater outside the District, however, the Board may deny or limit the transport permit if it determines that it is warranted by consideration of (1) the availability of water in the District and in the proposed receiving areas during the period for which the water supply is requested; (2) the effect of the proposed transfer on aquifer conditions, depletion, subsidence, or effects on existing permit holders or other groundwater uses within the District; (3) the projected effect upon holders of wells that have obtained a Historic and Existing Use Designation; and (4) the approved regional water plan and certified district management plan.

The Board shall, within 30 days after the date a permit application is administratively complete either act on the application or set it for a public hearing on a specific date. The Board may approve an application if it determines that it meets the requirements of Chapter 36 and District Rules, otherwise, a public hearing before the Board shall be scheduled. Additionally, whenever a protest is received during the public comment period on a potential transport well, the Board shall schedule a public hearing for

consideration of the application. The public hearing shall be conducted in accordance with the District's public hearing policy. The District shall hold the hearing within 35 days of setting the hearing and shall act on the application within 35 days after the hearing is held.

5.6 Transport Permit Terms and Conditions

Transport permits approved by the Board and issued by the District shall contain, in addition to the information set forth in an operating permit, the amount of water that may be transferred out of the District and the period for which the water may be transferred in accordance with Section 36.122. Notwithstanding Rule 3.6, the District may issue a Transport Permit for a period of less than three years. Further, after drilling and completing the well, the owner or his representative shall file the reports and fees set forth in Rule 3.5.

All permitted wells or permitted transport facilities that produce groundwater for transport outside Lampasas County shall be equipped with a functional and accurate flow-measuring device that measures the daily production rate of groundwater transported outside Lampasas County. The person holding a transport permit is required to keep records of daily production rates of groundwater transported outside Lampasas County. These daily production records shall be submitted to the District on a monthly basis, together with any applicable export fees. The wells, facilities, flow monitoring devices, and daily production records shall be available during normal working hours for inspection by District employees or personnel.

5.7 Transport Permit Amendments

Transport permit holders may apply for an amendment to their permitted export volume on a form obtained from the District. Applications requesting an increase in the permitted export volume shall require a public hearing and Board action.

SECTION 6 WELL STANDARDS AND SPACING REQUIREMENTS

6.1 Well Construction and Closure Standards

Construction and completion of wells and installation of pumps shall be in accordance with the Texas Water Code Chapter 32, “Water Well Drillers” and Chapter 33, “Water Well Pump Installers,” as amended and the Administrative Rules of the Texas Department of Licensing and Regulation, 16 Texas Administrative Code, Chapter 76, as amended.

Open or uncovered wells must be capped or plugged in accordance with the requirements of the TCEQ, the Texas Department of Licensing and Regulation's Water Well Drillers and Pump Installers Program, and the District Rules and Well Construction Standards.

6.2 Persons authorized to drill wells and install pumps

a) Only persons who are licensed water well drillers, in good standing with the Department of Licensing and Regulation Texas Water Well Drillers Board and whose licenses are verified with the District are allowed to commercially drill water wells within the District. License verification with the District shall be on forms provided by the District and be in accordance with and contain information called for in the form of verification. Owners may drill water wells on their property provided wells are completed according to State and District completion requirements.

b) Commercial Pump Installers are required to show licensed verification with the District. License verification shall be on forms provided by the District and shall be in accordance with and contain the information called for in the form of verification.

6.3 Sealing of Wells

Following public notice, the Board may order the sealing of a well that is in violation of District Rules or that has been prohibited from producing groundwater. The reasons for ordering the sealing of a well include: (1) failure to apply for an operating permit or a transport permit prior to drilling a nonexempt well; (2) operating a nonexempt well without an operating permit or a transport permit; (3) exceeding the production limits when the well is located within a Critical Groundwater Depletion Area (CGDA); or (4) when the Board has denied, cancelled, or revoked an operating permit or transport permit.

Once the Board has ordered a well sealed, the District is authorized to provide notice of intent to access the well for the purpose of sealing the well pursuant to Section 36.123. Upon accessing the well, District may seal the well by physical means, tag it to indicate that the well has been sealed by the District, or take any other appropriate action necessary to clearly indicate that the well has been sealed. The seal is intended to preclude operation of the well and/or identify unauthorized operation of the well.

Unless a person has permission from the District to modify or remove a well seal, tampering with, altering, damaging, removing, or violating the seal of a sealed well in any way, or pumping groundwater from a well that has been sealed constitutes a violation of District Rules and subjects the person who performs that action, as well as the well owner who authorizes, allows, encourages, or condones such action, to enforcement and penalties pursuant to all applicable District Rules

6.4 Well Spacing Requirements

To minimize as far as practicable the drawdown of the water table, the reduction of artesian pressure, to control subsidence, to prevent interference between wells, to prevent degradation of water quality, or to prevent waste, the district by rule may regulate the spacing of water wells.

a) All wells drilled prior to the effective date of these Rules, shall be drilled in accordance with state law in effect, if any, on the date such drilling commenced.

b) All new wells must comply with the spacing and location requirements set forth under the Texas Water Well Drillers and Pump Installers Administration Rules, Title 16, Part 4, Chapter 76, Texas Administrative Code, unless a written variance is granted by the Texas Department of Licensing and Regulation and a copy of the variance is forwarded to the District by the applicant or registrant.

c) After authorization to drill a well has been granted under a registration or a permit, the well, if drilled, must be drilled within three hundred (300) feet of the location specified in the permit, and not elsewhere. If the well should be commenced or drilled at a different location, the drilling or operation of such well may be enjoined by the Board pursuant to Chapter 36, Texas Water Code, and these Rules.

d) In addition to the requirements of 6.6 (b), the following spacing of wells shall be required for new wells in Lampasas County.

Pumping Capability of Proposed Well in Gallons per Minute	Spacing Required Between Existing Registered Wells and the Proposed Well	Distance of Proposed Well from Property Lines
Up to 17.36	150 feet	50 feet
17.36 – 50 GPM	300 feet	200 feet
> 50 GPM	3000 feet	1000 feet

6.5 Exceptions to Spacing Requirements

a) If the applicant presents waivers signed by the adjoining landowner(s) stating that they have no objection to the proposed location of the well site, the District may waive the spacing requirements for the new proposed well location.

b) The District, shall, if good cause is shown, enter special orders or add special permit conditions increasing or decreasing spacing requirements.

c) A landowner may drill a well or wells to supplement an existing well and such supplemental well(s) does not need to meet the spacing requirements as long as the

combined pumping capability of the existing and supplemental well(s) is not more than 17.36 gallons per minute.

6.6 Well and Property Access

The District has authority under Section 36.123 to enter any public or private property in Lampasas County at any reasonable time for purposes of inspecting and investigating conditions relating to water quality, water wells, or compliance with District Rules, regulations, permits, or other orders. Notwithstanding this authority, the District may enter onto a person's property only with (i) the permission of the property owner or his designated agent, or (ii) by Court Order.

SECTION 7 - CONSERVATION MEASURES

7.1 Designation of Conservation Measures

The Board may impose measures deemed appropriate to provide for the conservation of groundwater to prevent waste and to carry out the duties of the District, including requiring

a) All groundwater supply systems to institute conservation oriented rate structure in the sale of water to their retail customers.

b) All groundwater supply systems to have a water conservation plan which requires:

1. Voluntary conservation measures and information/education programs; and

2. Promotion of water saving devices and water efficient landscaping.

c) All permit applications to contain a statement relating to effective water conservation programs and methods that will insure a concerted water conservation program.

7.2 Groundwater Monitoring Program

a) The Farm Bureau of Lampasas County shall create a database of information on existing water wells located within Lampasas County and shall provide such database to the District in accordance with mutually agreed upon timetables. The District shall locate, collect, and add existing data to this database as opportunity permits.

b) Pursuant to Section 36.107 and Section 36.109, the District may implement any research projects or scientific studies and collect any information deemed necessary by the Board including groundwater use, water conservation, aquifer recharge, groundwater quantity and quality, aquifer conditions, geology, hydrology, hydrogeology, and other groundwater related fields. Participation in these programs by owners of registered wells

shall be voluntary. Owners of permitted and transport wells may be required by the District to participate.

SECTION 8 CRITICAL GROUNDWATER DEPLETION AREA

8.1 Identification of a Critical Groundwater Depletion Area (CGDA)

If evidence of drawdown of the water table or reduction of artesian pressure in an area of an aquifer indicates an aquifer mining situation, that is, a non-sustainable yield, and/or in consideration of such local climate indicators such as the Palmer Hydrological Drought Severity Index published by the National Oceanic and Atmospheric Administration (NOAA), the Board may declare the area a Critical Groundwater Depletion Area (CGDA). Prior to establishing a CGDA the District shall invite comment and exchange aquifer condition data from well owners within the proposed CGDA. Following the foregoing collaboration study, notice and hearing shall be held using the procedures of Section 9 prior to declaration of a CGDA. A CGDA shall be classified into one of two categories:

(1) A Category One classification shall be assigned to an area experiencing critical depletion due to climatic events where the ability of the aquifer to provide sustainable yields at normal usage rates is seriously impaired. The duration and severity of the climatic conditions shall determine the extent and period of the conservation actions taken by the District. Upon return of normal climatic conditions and adequate recharge to bring the aquifer back to sustainable normal usage, the District shall cancel the CGDA.

(2) A Category Two classification shall be assigned to an area experiencing critical depletion due to increased pumpage that has caused or will shortly cause the aquifer to fall below sustainable yield on a permanent basis, not primarily caused by but possibly exacerbated by short-term climatic conditions. Conservation actions taken by the District shall remain in effect until such time the aquifer shows long-term reversal of the non-sustaining condition. Such reversal can conceivably be brought about through permanent pumpage reduction, use of alternative water sources, or changes in well owner's use of water.

8.2 Procedures Following Establishment of a CGDA

Once a CGDA is declared and delineated, the area shall be given a unique name or number for identification purposes and all registered and permitted well owners in the area shall be notified. Notification of all Board decisions related to a CGDA shall be made to all registered and permitted well owners within the CGDA by published notice. When the Board declares and delineates a CGDA, the Board shall take action, including any combination of the following:

(1) Deny all applications for drilling within the CGDA.

(2) Set production limits on Permitted Wells located within the CGDA to an

assigned volume of water as may be determined from the historical production data obtained from District records. The allowed volume shall be an amount that will halt the decline of the aquifer sustainable yield, which may allow continued but reduced pumpage. The approved conservation/drought management plans shall be considered in determining the production limits. The Board shall review the production allocation on a quarterly basis and make appropriate adjustments as permitted or dictated by aquifer conditions.

(3) Require all Permitted Wells within the CGDA to be equipped with a District approved meter or measuring device. The expense of the device shall be borne by the well owner.

(4) Require increased spacing for all new permits within the CGDA.

(5) Establish recommended production limits on all exempted wells within the CGDA to reasonably correspond to retail water utility conservation/drought management plans used within the District.

(6) Issue such rules as are necessary to protect holders of Historic and Existing Use Designations.

8.3 Reporting Requirements

Owners of Permitted Wells within the CGDA shall provide the District with reports of the amount of water produced from each well under permit in the CGDA on forms provided by the District and on a schedule determined by the Board. If the Board has not required metering devices on wells, production volume reports shall be provided by accurate estimates such as recording duration of pumping and the well output capacity (gpm).

8.4 Requests for Temporary Change in Water Allocation

Owners of Permitted Wells within the CGDA may request a temporary change in water allocation through petition to the Board. Decision on such requests shall be made consistent with prudent aquifer management, the effect on other well owners in the CGDA, and the degree of necessity for the request.

SECTION 9 HEARINGS

9.1 General Rules of Procedure for Hearings

a) Nature of Hearing. Hearings will be conducted in such manner as the Board deems most suitable to the particular case and technical rules of legal and court procedure need not be applied. It is the purpose of Board to obtain all the relevant and reliable information and testimony pertaining to the issue before it as conveniently, inexpensively, and speedily as possible without prejudicing the rights of either applicants or Protestants.

b) Hearing Officer. The Board may authorize the President, a Director, or any individual acting on the Board's behalf to serve as a hearing officer and to conduct hearings for the Board. The hearing officer shall have the authority to administer oaths and to make all rulings necessary and appropriate to conduct the hearing. If conducted by a committee or a hearing officer, a brief written summary of the hearing and recommendation of action shall be prepared by the hearing officer and provided to the Board for its consideration. A copy of the summary report shall be provided to all parties.

c) Who May Appear. Any interested party in a proceeding may appear either in person, or by attorney, or both in such proceedings. An interested party is a person having a justifiable interest, who is or may be affected by such proceeding. At the discretion of the Board anyone not a party at interest in a proceeding may appear.

d) Admissibility. Evidence will be admitted if it is of that quality upon which reasonable persons are accustomed to rely in the conduct of serious affairs. It is intended that needful and proper evidence shall be conveniently, inexpensively, and speedily produced while preserving the substantial rights of the parties to the proceeding.

e) Testimony shall be Pertinent. The testimony shall be confined to the subject matter contained in the application or contest. In the event that any party at a hearing shall pursue a line of testimony or interrogation of a witness that is clearly irrelevant, incompetent or immaterial, the person conducting the hearing may forthwith terminate such line of interrogation.

f) A Stipulation. Evidence may be stipulated by agreement of all parties at interest.

g) Limiting Number of Witnesses and Duration. The right is reserved to the Board or its hearing officer in any proceeding to limit the number of witnesses appearing whose testimony may be merely cumulative and to limit the total amount of time allotted to each party.

9.2 Protests

a) Notice of Protest. In the event anyone should desire to protest or oppose any pending matter before the Board or a hearing officer, the person wishing to protest must file with the Board or hearing officer a written notice of protest or opposition on or before the date on which the application or matter has been set for hearing. Such protest shall be filed at least five (5) days before the hearing date.

b) Protest Requirements. Protests shall be submitted in writing with a duplicate copy to the opposite party or parties and shall comply in substance with the following requirements:

1. Each protest shall show the name and address of the protestant.

2. The protestant shall identify any injury that will result from the proposed action or matter to be considered by the Board.

3. If the protest is based upon claim of interference with some present right of protestant, it shall include a statement of the basis of protestant's claim of right.

4. Protestant should call attention to any amendment of the application or adjustment which, if made would result in withdrawal of the protest.

c) Contested Applications or Proceedings Defined. An application, appeal, motion, or proceeding pending before the Board is considered contested when either protestants or interveners, or both, files the notice of protest as above set out or appears at the hearing or proceeding and present testimony or evidence in support of their contentions, or present a question or questions of law regarding the application, motion, or proceeding. When neither protestants nor interveners so appear and offer testimony or evidence in support of their contentions, or raise a question of law with reference to any pending application, motion, or proceeding, the same shall be considered as non-contested.

d) In the event of a contested hearing, each party shall furnish other parties to the proceeding with the copy of all motions, amendments, or briefs filed by him with the Board or examiners.

9.3 Final Order of the Board

The orders of the Board in any non-contested application or proceeding shall become the final order of the Board on the day it is entered by the Board. All orders of the Board in contested applications, appeals, or other proceedings shall contain a statement that the same was contested. In such event the order will become final after fifteen (15) days from the entry thereof and be binding on the parties thereto unless a motion for rehearing is filed.

9.4 Rehearing

a) Any person whose application is denied, whose contest is overruled, or who is not granted the relief desired, may file with the Board a motion for rehearing within fifteen (15) days from the announcement by the Board of its decision or action. The Board shall act thereon within thirty (30) days. If such a motion for rehearing is filed and is overruled, the order of the Board shall be final on the date acted on by the Board. If the motion is not acted upon, the Board's action becomes final following the expiration of thirty (30) days after filing the motion.

b) If the Board finds that an emergency exists, or that substantial injustice will result from delay, upon recitation of such finding, the order of the Board will become final on the date of the announcement of the order by the Board, and no motion for rehearing will be considered thereon.

c) If an application or contest is denied by the Board, and if the applicant or contestant has not had an opportunity for hearing before the Board, as elsewhere provided by these Rules, the applicant or contestant shall be entitled to a hearing before the Board. A written request to the Board for such a hearing, stating such facts, must be filed with the Board within the above fifteen (15) day period. If such motion is in order and is duly filed, the Board shall give notice to the applicant and all proper and necessary parties of the time and place of such hearing, and shall proceed to conduct such a hearing.

SECTION 10 - ENFORCEMENT OF RULES

10.1 General Enforcement of Rules

The District shall have all enforcement powers as set forth in these rules. An accusation of infraction of these Rules shall be investigated by the Board.

10.2 Enforcement of Rules in Courts

In addition to the enforcement powers set forth herein, if the Board determines that it appears a person has violated or is violating, any provision of Chapter 36 of the Texas Water Code, or any rule, regulation, permit, or order of the District, the Board may institute and conduct a suit in the name of the District for injunctive relief, for recovery of a civil penalty or for both injunctive relief and penalty.

a) The Board may set reasonable civil penalties for breach of any rule of the District that shall not exceed the limits of Section 36.102.

b) A penalty under this section is in addition to any other provided by the law of this state and may be enforced by complaints filed in the appropriate court of jurisdiction in the county in which the District's principal office or meeting place is located.

c) If the District prevails in any suit to enforce its rules, the District may seek and the Court shall grant, in the same action, recover reasonable fees for attorneys, expert witnesses, and other costs incurred by the District before the court. The amount of the attorney's fees shall be fixed by the court.

SECTION 11 FEES AND DEPOSITS

11.1 Permit Application Fees and Other Fees

The Board, by resolution, may establish a schedule of fees for administrative acts of the district, including but not limited to the cost of reviewing and processing new registration and permit applications, renewal applications, the cost of permit hearings, and such administrative fees shall not unreasonably exceed the cost to the District for performing

such administrative acts. Applications shall not be accepted for filing or processing or hearings scheduled until receipt by the District of all applicable fees established by Board resolution. Permit fees shall only be adjusted after notice and public hearing.

11.2 Funding of the District

The cash funding of the District shall be limited to funds generated from District fees, any voluntary contributions and grants, and annual cash operating funds from the County general revenue fund in an amount not to exceed $3000.00. Additionally, the District may apply to the County to use existing County office space, equipment, personnel and supplies.

If special circumstances arise outside of the normal annual operating expenditures of the District that require additional funds, the District may apply for additional cash funds from the County to cover such special circumstances. However, it is the intent of the District to derive its annual cash operating expenses from District fees, voluntary contributions and grants, and $3000.00 from the County general revenue funds.

All requests for use of funds from the County general revenue fund are subject to the review and notice procedures required for establishing other County expenditures from the general revenue fund.

March 31, 2009

Ms. Cheryl Maxwell
Clearwater Underground Water Conservation District
P.O. Box 729
Belton, TX 76513

Re: Managed available groundwater estimates for the Trinity Aquifer in Groundwater Management Area 8

Dear Ms. Maxwell:

The Texas State Water Code, Section 36.108, Subsection (o), states that Texas Water Development Board's executive administrator shall provide each district and regional water planning group located wholly or partly within a groundwater management area with the managed available groundwater in the management area based upon the desired future condition of the groundwater resource. Attachment A lists the desired future conditions submitted by the groundwater conservation districts. This letter and Attachment B (GAM Run 08-84) are in response to this directive.

Managed available groundwater is defined in the Texas State Water Code as the amount of water that may be permitted by a district for beneficial use in accordance with the desired future condition of the aquifer as determined under Texas State Water Code, Section 36.108. For various planning purposes the managed available groundwater estimates have been reported at the combined aquifer, county, river basin, regional water planning area, groundwater management area, groundwater conservation district (if applicable), and geographic area (if designated) level.

We understand that groundwater conservation district have options on how to distribute managed available groundwater in a groundwater management area; therefore we encourage open communication and coordination between groundwater conservation districts, regional water planning groups, and the TWDB to ensure that managed available groundwater reported in regional water plans and groundwater management plans are not in conflict. In addition, please note that estimates of managed available groundwater are based on the best available scientific tools that can be used to evaluate managed available groundwater and that these estimates may be based on assumptions made on the magnitude and distribution of pumping in the aquifer.

Therefore, it is important for groundwater conservation districts to monitor whether or not their management of pumping is achieving their desired future conditions. Districts are encouraged to work with the TWDB to better define available groundwater as better data become available for how the aquifer responds to the actual magnitude and distribution of pumping now and in the future.

Sincerely,

J. Kevin Ward
Executive Administrator

Attachment A: List of Desired Future Conditions Submitted by the Groundwater Conservation Districts
Attachment B: GAM Run 08-84mag

c w/atts.: Cary Betz, Texas Commission of Environmental Quality Water Supply Division
Kelly Mills, Texas Commission of Environmental Quality Groundwater Planning and Assessment Division
Robert Mace, Ph.D., P.G., Deputy Executive Administrator, TWDB, Water Science and Conservation
Rima Petrossian, P.G., Manager, TWDB Groundwater Technical Assistance Section
Cindy Ridgeway, P.G., Manager, TWDB Groundwater Availability Modeling Section
Shirley Wade, Ph.D., P.G., Groundwater Modeler, TWDB Groundwater Availability Modeling Section
Carolyn Brittin, Deputy Executive Administrator, TWDB Water Resources Planning and Information
David Meesey, Manager, TWDB Regional Water Planning Section
Matt Nelson, Planner, Region G, TWDB Regional Water Planning Section
Angela Masloff, Planner, Region C, TWDB Regional Water Planning Section
Temple McKinnon, Planner, North East Texas Region, TWDB Regional Water Planning Section
Angela Kennedy, Planner, Region F, TWDB Regional Water Planning Section
Tom Gooch, Freese & Nichols, Inc.
Stephanie Griffin, Freese & Nichols, Inc.
Simone Kiel, Freese & Nichols, Inc.
Ray Flemons, Bucher, Willis & Ratliff
David Dunn, HDR Engineering
Kerry Maroney, Biggs & Mathews
Mark Lowry, Turner Collie & Braden

Attachment A
Desired Future Conditions Submitted by the Groundwater Conservation Districts

As noted in your letter dated October 6, 2008, and memorandum dated December 15, 2008, the submitted desired future condition for the northern segment of the Trinity Aquifer in Groundwater Management Area 8 was as follows:

Bell County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 134 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 155 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 286 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 319 feet after 50 years.

Bosque County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 26 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 33 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 201 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 220 feet after 50 years.

Brown County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 1 foot after 50 years.

Burnet County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 11 feet after 50 years.

- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 29 feet after 50 years.

Callahan County

- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 2 feet after 50 years.

Collin County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 298 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 247 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 224 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 236 feet after 50 years.

Comanche County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 2 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 11 feet after 50 years.

Cooke County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 26 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 42 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 60 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 78 feet after 50 years.

Coryell County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 15 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 15 feet after 50 years.

- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 156 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 179 feet after 50 years.

Dallas County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 240 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 224 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 263 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 290 feet after 50 years.

Delta County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 175 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 162 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 162 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 159 feet after 50 years.

Denton County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 98 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 134 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 180 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 214 feet after 50 years.

Eastland County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 0 feet after 50 years.

Ellis County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 265 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 283 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 336 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 362 feet after 50 years.

Erath County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 11 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 27 feet after 50 years.

Falls County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 279 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 354 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 459 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 480 feet after 50 years.

Fannin County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 212 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 196 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 182 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 181 feet after 50 years.

Grayson County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 175 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 161 feet after 50 years.

- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 160 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 165 feet after 50 years.

Hamilton County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 2 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 39 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 51 feet after 50 years.

Hill County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 209 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 253 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 381 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 406 feet after 50 years.

Hood County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 2 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 16 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 56 feet after 50 years.

Hunt County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 286 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 245 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 215 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 223 feet after 50 years.

Johnson County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 37 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 83 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 208 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 234 feet after 50 years.

Kaufman County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 303 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 286 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 295 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 312 feet after 50 years.

Lamar County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 132 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 130 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 136 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 134 feet after 50 years.

Lampasas County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 12 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 23 feet after 50 years.

Limestone County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 328 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 392 feet after 50 years.

- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 475 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 492 feet after 50 years.

McLennan County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 251 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 291 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 489 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 527 feet after 50 years.

Milam County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 252 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 294 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 337 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 344 feet after 50 years.

Mills County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 3 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 12 feet after 50 years.

Montague County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 3 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 12 feet after 50 years.

Navarro County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 344 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 353 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 399 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 413 feet after 50 years.

Parker County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 5 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 6 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 16 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 40 feet after 50 years.

Red River County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 82 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 77 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 78 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 78 feet after 50 years.

Rockwall County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 346 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 272 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 248 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 265 feet after 50 years.

Somervell County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 4 feet after 50 years.

- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 53 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 113 feet after 50 years.

Tarrant County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 33 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 75 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 160 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 173 feet after 50 years.

Taylor County

- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 3 feet after 50 years.

Travis County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 124 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 61 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 98 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 116 feet after 50 years.

Williamson County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 108 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 88 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 142 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 166 feet after 50 years.

Wise County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 4 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 14 feet after 50 years.

- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 23 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 53 feet after 50 years.

Attachment B

GAM Run 08-84mag

GAM Run 08-84mag

by Shirley C. Wade, P.G.
Texas Water Development Board
Groundwater Availability Modeling Section
(512) 936-0883
March 5, 2009

REQUESTOR:

Ms. Cheryl Maxwell of the Clearwater Underground Water Conservation District acting on behalf of Groundwater Management Area 8.

DESCRIPTION OF REQUEST:

In a letter dated October 6, 2008, Ms. Cheryl Maxwell provided the Texas Water Development Board (TWDB) with the desired future conditions for the Trinity Aquifer in Groundwater Management Area 8 and requested that TWDB estimate managed available groundwater values. A memorandum dated December 15, 2008 provided clarification to the desired future conditions outlined in the letter dated October 6, 2008. In order to match the results of GAM Run 08-06 (Donnelly, 2008) that memorandum made the following corrections:

- the average drawdown for Grayson County in the Glen Rose portion of the Trinity Aquifer was changed from 160 feet to 161 feet,
- the average drawdown for Grayson County in the Hensell portion of the Trinity Aquifer was changed from 161 feet to 160 feet,
- the average drawdown for Brown County in the Hosston portion of the Trinity Aquifer was changed from 2 feet to 1 foot, and
- the average drawdown for Somervell County in the Hosston portion of the Trinity Aquifer was changed from 114 to 113 feet.

This groundwater availability modeling run presents the managed available groundwater for the Trinity Aquifer in Groundwater Management Area 8.

DESIRED FUTURE CONDITIONS:

Desired future conditions for the Trinity Aquifer submitted to TWDB by the groundwater conservation districts in Groundwater Management Area 8:

Bell County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 134 feet after 50 years.

- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 155 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 286 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 319 feet after 50 years.

Bosque County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 26 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 33 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 201 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 220 feet after 50 years.

Brown County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 1 foot after 50 years.

Burnet County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 11 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 29 feet after 50 years.

Callahan County

- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 2 feet after 50 years.

Collin County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 298 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 247 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 224 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 236 feet after 50 years.

Comanche County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 2 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 11 feet after 50 years.

Cooke County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 26 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 42 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 60 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 78 feet after 50 years.

Coryell County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 15 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 15 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 156 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 179 feet after 50 years.

Dallas County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 240 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 224 feet after 50 years.

- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 263 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 290 feet after 50 years.

Delta County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 175 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 162 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 162 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 159 feet after 50 years.

Denton County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 98 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 134 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 180 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 214 feet after 50 years.

Eastland County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 0 feet after 50 years.

Ellis County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 265 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 283 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 336 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 362 feet after 50 years.

Erath County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 11 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 27 feet after 50 years.

Falls County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 279 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 354 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 459 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 480 feet after 50 years.

Fannin County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 212 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 196 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 182 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 181 feet after 50 years.

Grayson County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 175 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 161 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 160 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 165 feet after 50 years.

Hamilton County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 2 feet after 50 years.

- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 39 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 51 feet after 50 years.

Hill County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 209 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 253 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 381 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 406 feet after 50 years.

Hood County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 2 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 16 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 56 feet after 50 years.

Hunt County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 286 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 245 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 215 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 223 feet after 50 years.

Johnson County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 37 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 83 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 208 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 234 feet after 50 years.

Kaufman County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 303 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 286 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 295 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 312 feet after 50 years.

Lamar County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 132 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 130 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 136 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 134 feet after 50 years.

Lampasas County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 12 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 23 feet after 50 years.

Limestone County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 328 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 392 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 475 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 492 feet after 50 years.

McLennan County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 251 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 291 feet after 50 years.

- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 489 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 527 feet after 50 years.

Milam County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 252 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 294 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 337 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 344 feet after 50 years.

Mills County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 3 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 12 feet after 50 years.

Montague County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 0 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 3 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 12 feet after 50 years.

Navarro County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 344 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 353 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 399 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 413 feet after 50 years.

Parker County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 5 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 6 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 16 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 40 feet after 50 years.

Red River County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 82 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 77 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 78 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 78 feet after 50 years.

Rockwall County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 346 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 272 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 248 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 265 feet after 50 years.

Somervell County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 1 foot after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 4 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 53 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 113 feet after 50 years.

Tarrant County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 33 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 75 feet after 50 years.

- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 160 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 173 feet after 50 years.

Taylor County

- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 3 feet after 50 years.

Travis County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 124 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 61 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 98 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 116 feet after 50 years.

Williamson County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 108 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 88 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 142 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 166 feet after 50 years.

Wise County

- From estimated year 2000 conditions, the average drawdown of the Paluxy Aquifer should not exceed approximately 4 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Glen Rose Aquifer should not exceed approximately 14 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hensell Aquifer should not exceed approximately 23 feet after 50 years.
- From estimated year 2000 conditions, the average drawdown of the Hosston Aquifer should not exceed approximately 53 feet after 50 years.

This information is summarized in Table 1.

Table 1. Summary of requested desired future conditions for the Trinity Aquifer in Groundwater Management Area 8.

County	Average water level decrease (feet)			
	Paluxy	Glen Rose	Hensell	Hosston
Bell	134	155	286	319
Bosque	26	33	201	220
Brown	0	0	1	1
Burnet	1	1	11	29
Callahan	n/a	n/a	0	2
Collin	298	247	224	236
Comanche	0	0	2	11
Cooke	26	42	60	78
Coryell	15	15	156	179
Dallas	240	224	263	290
Delta	175	162	162	159
Denton	98	134	180	214
Eastland	0	0	0	0
Ellis	265	283	336	362
Erath	1	1	11	27
Falls	279	354	459	480
Fannin	212	196	182	181
Grayson	175	161	160	165
Hamilton	0	2	39	51
Hill	209	253	381	406
Hood	1	2	16	56
Hunt	286	245	215	223
Johnson	37	83	208	234
Kaufman	303	286	295	312
Lamar	132	130	136	134
Lampasas	0	1	12	23
Limestone	328	392	475	492
McLennan	251	291	489	527
Milam	252	294	337	344
Mills	0	0	3	12
Montague	0	1	3	12
Navarro	344	353	399	413
Parker	5	6	16	40
Red River	82	77	78	78
Rockwall	346	272	248	265
Somervell	1	4	53	113
Tarrant	33	75	160	173
Taylor	n/a	n/a	n/a	3
Travis	124	61	98	116
Williamson	108	88	142	166
Wise	4	14	23	53

EXECUTIVE SUMMARY:

TWDB staff ran the groundwater availability model for the northern part of the Trinity Aquifer and the Woodbine Aquifer to determine the managed available groundwater based on the desired future conditions for the Trinity Aquifer adopted by the groundwater conservation districts in Groundwater Management Area 8. The results (Tables 2, 3, 4, and 5) show 65,025 acre-feet per year of managed available groundwater for the Paluxy Aquifer (of which 89 acre-feet are outside the official aquifer boundary), 7,287 acre-feet per year of managed available groundwater for the Glen Rose Formation (of which 55 acre-feet are outside the official aquifer boundary) , 46,067 acre-feet per year of managed available groundwater for the Hensell Aquifer (of which 342 acre-feet are outside the official aquifer boundary), and 130,340 acre-feet per year of managed available groundwater for the Hosston Aquifer (of which 875 acre-feet are outside the official aquifer boundary)in Groundwater Management Area 8.

METHODS:

This request is based on previous GAM Run 08-06 (Donnelly, 2008). In that simulation, average streamflows and evapotranspiration rates were used for each year of the predictive simulation. Average recharge was used for the first forty-seven years of the simulation, followed by a three-year drought-of-record.

PARAMETERS AND ASSUMPTIONS:

The groundwater availability model for the northern part of the Trinity Aquifer was used for this model run. The parameters and assumptions for this model are described below:

- We used version 1.01 of the groundwater availability model for the northern part of the Trinity Aquifer for this run. See Bené and others (2004) for assumptions and limitations of the model.

- The model includes seven layers, representing the Woodbine Aquifer (Layer 1), the Washita and Fredericksburg Groups (Layer 2), the Paluxy Formation (Layer 3), the Glen Rose Formation (Layer 4), the Hensell Formation (Layer 5), the Pearsall/Cow Creek/Hammett/Sligo Members (Layer 6), and the Hosston Formation (Layer 7). The Trinity Aquifer is comprised of the Paluxy, Hensell, and Hosston formations. The Woodbine, Paluxy, Hensell, and Hosston layers are the main aquifers used in the region.

- The mean absolute error (a measure of the difference between simulated and actual water levels during model calibration) for the four main aquifers in the model (Woodbine, Paluxy, Hensell, and Hosston) for the calibration and verification time periods (1980 to 2000) ranged from approximately 38 to 75 feet. The root mean squared error was less than ten percent of the maximum change in water levels across the model (Bené and others, 2004).

- We used average annual recharge conditions based on climate data from 1980 to 1999 for the simulation. The last three years of the simulation used drought-of-record recharge conditions, which were defined as the years 1954 to 1956.

- The model uses the MODFLOW stream-routing package to simulate the interaction between the aquifer(s) and major intermittent streams flowing in the region. Flow both from the stream to the aquifer and from the aquifer to the stream is allowed, and the direction of flow is determined by the water levels in the aquifer and stream during each stress period in the simulation.

- Spatial and vertical pumpage distribution is described in GAM Run 08-06 (Donnelly, 2008).

Estimates of managed available groundwater were calculated for several geographic areas created by the geographic information systems overlay analysis of counties, groundwater conservation districts, regional water planning areas, major river basins, the boundary extents of Groundwater Management Area 8, and the northern portion of the Trinity Aquifer. These geographically divided sections of managed available groundwater values provide the greatest amount of flexibility to the groundwater management districts for summarizing managed available groundwater for both desired future conditions of the groundwater management area and for district level groundwater management planning. The geographically divided sections of managed available groundwater values also assist the regional water planning areas with their planning efforts. It should be noted that the model included portions of the units that comprise the Trinity Aquifer that spatially fall outside the official aquifer boundaries. We have provided estimates for these outliers separately from areas within the official aquifer boundary. These areas may contain water with total dissolved solids greater than 3,000 part per million.

Table 2. Estimates of managed available groundwater for the Paluxy Aquifer by geographic subdivisions. See Figure 1 to locate Map Reference (MapRef).

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
43	N. Trinity-Paluxy	Bell	G	Brazos	Clearwater	8	Bell	n/a	96
45	N. Trinity-Paluxy	Bosque	G	Brazos	None	8	Bosque	n/a	1,013
50	N. Trinity-Paluxy	Brown	F	Brazos	None	8	Brown	n/a	1
52	N. Trinity-Paluxy	Brown	F	Colorado	None	8	Brown	n/a	17
54	N. Trinity-Paluxy	Burnet	K	Brazos	Central Texas	8	Burnet	n/a	141
56	N. Trinity-Paluxy	Burnet	K	Colorado	Central Texas	8	Burnet	n/a	41
59	N. Trinity-Paluxy	Collin	C	Sabine	None	8	Collin	n/a	0
60	N. Trinity-Paluxy-outside	Collin	C	Sabine	None	8	Collin	n/a	0
61	N. Trinity-Paluxy	Collin	C	Trinity	None	8	Collin	n/a	1,762
62	N. Trinity-Paluxy-outside	Collin	C	Trinity	None	8	Collin	n/a	0
64	N. Trinity-Paluxy	Comanche	G	Brazos	Middle Trinity	8	Comanche	n/a	18
66	N. Trinity-Paluxy	Comanche	G	Colorado	Middle Trinity	8	Comance	n/a	1
70	N. Trinity-Paluxy	Cooke	C	Red	None	8	Cooke	n/a	640
71	N. Trinity-Paluxy	Cooke	C	Trinity	None	8	Cooke	n/a	2,888
73	N. Trinity-Paluxy	Coryell	G	Brazos	None	8	Coryell	n/a	254
74	N. Trinity-Paluxy	Dallas	C	Trinity	None	8	Dallas	n/a	433
76	N. Trinity-Paluxy	Delta	D	Sulphur	None	8	Delta	n/a	0
77	N. Trinity-Paluxy-outside	Delta	D	Sulphur	None	8	Delta	n/a	0
78	N. Trinity-Paluxy	Denton	C	Trinity	None	8	Denton	n/a	9,822
80	N. Trinity-Paluxy	Eastland	G	Brazos	None	8	Eastland	n/a	4
82	N. Trinity-Paluxy	Ellis	C	Trinity	None	8	Ellis	n/a	400
83	N. Trinity-Paluxy-outside	Ellis	C	Trinity	None	8	Ellis	n/a	0
85	N. Trinity-Paluxy	Erath	G	Brazos	Middle Trinity	8	Erath	n/a	4,230
87	N. Trinity-Paluxy	Falls	G	Brazos	None	8	Falls	n/a	0

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
88	N. Trinity-Paluxy-outside	Falls	G	Brazos	None	8	Falls	n/a	0
90	N. Trinity-Paluxy	Fannin	C	Red	None	8	Fannin	n/a	205
91	N. Trinity-Paluxy	Fannin	C	Sulphur	None	8	Fannin	n/a	0
92	N. Trinity-Paluxy	Fannin	C	Trinity	None	8	Fannin	n/a	83
95	N. Trinity-Paluxy	Grayson	C	Red	None	8	Grayson	n/a	3,863
96	N. Trinity-Paluxy	Grayson	C	Trinity	None	8	Grayson	n/a	845
98	N. Trinity-Paluxy	Hamilton	G	Brazos	None	8	Hamilton	n/a	291
99	N. Trinity-Paluxy	Hill	G	Trinity	None	8	Hill	n/a	48
100	N. Trinity-Paluxy	Hill	G	Brazos	None	8	Hill	n/a	1,206
101	N. Trinity-Paluxy	Hood	G	Trinity	Upper Trinity	8	Hood	n/a	11
103	N. Trinity-Paluxy	Hood	G	Brazos	Upper Trinity	8	Hood	n/a	931
108	N. Trinity-Paluxy	Hunt	D	Sulphur	None	8	Hunt	n/a	0
109	N. Trinity-Paluxy-outside	Hunt	D	Sulphur	None	8	Hunt	n/a	0
111	N. Trinity-Paluxy	Hunt	D	Sabine	None	8	Hunt	n/a	0
112	N. Trinity-Paluxy-outside	Hunt	D	Sabine	None	8	Hunt	n/a	0
113	N. Trinity-Paluxy	Hunt	D	Trinity	None	8	Hunt	n/a	551
114	N. Trinity-Paluxy	Johnson	G	Trinity	None	8	Johnson	n/a	6,791
115	N. Trinity-Paluxy	Johnson	G	Brazos	None	8	Johnson	n/a	2,702
117	N. Trinity-Paluxy-outside	Kaufman	C	Sabine	None	8	Kaufman	n/a	4
119	N. Trinity-Paluxy	Kaufman	C	Trinity	None	8	Kaufman	n/a	13
120	N. Trinity-Paluxy-outside	Kaufman	C	Trinity	None	8	Kaufman	n/a	85
122	N. Trinity-Paluxy	Lamar	D	Red	None	8	Lamar	n/a	0
123	N. Trinity-Paluxy	Lamar	D	Sulphur	None	8	Lamar	n/a	0
124	N. Trinity-Paluxy-outside	Lamar	D	Sulphur	None	8	Lamar	n/a	0
126	N. Trinity-Paluxy	Lampasas	G	Brazos	Saratoga	8	Lampasas	n/a	13

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
128	N. Trinity-Paluxy	Lampasas	G	Colorado	Saratoga	8	Lampasas	n/a	0
130	N. Trinity-Paluxy	Limestone	G	Trinity	None	8	Limestone	n/a	0
131	N. Trinity-Paluxy-outside	Limestone	G	Trinity	None	8	Limestone	n/a	0
133	N. Trinity-Paluxy	Limestone	G	Brazos	None	8	Limestone	n/a	0
134	N. Trinity-Paluxy-outside	Limestone	G	Brazos	None	8	Limestone	n/a	0
135	N. Trinity-Paluxy	McLennan	G	Brazos	None	8	McLennan	n/a	231
137	N. Trinity-Paluxy	Milam	G	Brazos	Post Oak Savannah	8	Milam	n/a	0
138	N. Trinity-Paluxy-outside	Milam	G	Brazos	Post Oak Savannah	8	Milam	n/a	0
140	N. Trinity-Paluxy	Mills	K	Brazos	Fox Crossing	8	Mills	n/a	3
142	N. Trinity-Paluxy	Mills	K	Colorado	Fox Crossing	8	Mills	n/a	2
145	N. Trinity-Paluxy	Montague	B	Red	Upper Trinity	8	Montague	n/a	29
147	N. Trinity-Paluxy	Montague	B	Trinity	Upper Trinity	8	Montague	n/a	476
149	N. Trinity-Paluxy	Navarro	C	Trinity	None	8	Navarro	n/a	413
150	N. Trinity-Paluxy-outside	Navarro	C	Trinity	None	8	Navarro	n/a	0
151	N. Trinity-Paluxy	Parker	C	Trinity	Upper Trinity	8	Parker	n/a	9,370
153	N. Trinity-Paluxy	Parker	C	Brazos	Upper Trinity	8	Parker	n/a	430
156	N. Trinity-Paluxy	Red River	D	Red	None	8	Red River	n/a	206
157	N. Trinity-Paluxy-outside	Red River	D	Red	None	8	Red River	n/a	0
159	N. Trinity-Paluxy	Red River	D	Sulphur	None	8	Red River	n/a	267
160	N. Trinity-Paluxy-outside	Red River	D	Sulphur	None	8	Red River	n/a	0
161	N. Trinity-Paluxy-outside	Rockwall	C	Sabine	None	8	Rockwall	n/a	0
162	N. Trinity-Paluxy	Rockwall	C	Trinity	None	8	Rockwall	n/a	958
163	N. Trinity-Paluxy-outside	Rockwall	C	Trinity	None	8	Rockwall	n/a	0

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
165	N. Trinity-Paluxy	Somervell	G	Brazos	None	8	Somervell	n/a	120
166	N. Trinity-Paluxy	Tarrant	C	Trinity	Northern Trinity	8	Tarrant	n/a	10,544
169	N. Trinity-Paluxy	Travis	K	Brazos	None	8	Travis	n/a	0
171	N. Trinity-Paluxy	Travis	K	Colorado	None	8	Travis	n/a	3
174	N. Trinity-Paluxy	Williamson	G	Colorado	None	8	Williamson	n/a	10
175	N. Trinity-Paluxy-outside	Williamson	G	Brazos	None	8	Williamson	n/a	0
176	N. Trinity-Paluxy	Williamson	K	Brazos	None	8	Williamson	n/a	0
177	N. Trinity-Paluxy	Williamson	G	Colorado	None	8	Williamson	n/a	1
178	N. Trinity-Paluxy	Williamson	K	Colorado	None	8	Williamson	n/a	0
180	N. Trinity-Paluxy	Wise	C	Trinity	Upper Trinity	8	Wise	n/a	2,559

Aquifer marked as outside with table row shaded denotes that the volume of water is from an area of the model outside the official aquifer boundary.

GCD = Groundwater conservation district.
GeoArea = Geographic areas defined by unique desired future conditions as specified by a groundwater management area.
GMA = Groundwater management area.
MAG = Managed available groundwater in units of acre-feet per year.
Clearwater = Clearwater Underground Water Conservation District
McLennan C. = McLennan County Groundwater Conservation District
N. Trinity = Northern Trinity Groundwater Conservation District
Fox Crossing = Fox Crossing Water District
Saratoga = Saratoga Underground Water Conservation District
RWPA = Regional water planning area.

Table 3. Estimates of managed available groundwater for the Glen Rose Aquifer by geographic subdivisions. See Figure 2 to locate MapRef.

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
43	N. Trinity-Glen Rose	Bell	G	Brazos	Clearwater	8	Bell	n/a	880
44	N. Trinity-Glen Rose	Bosque	G	Brazos	None	8	Bosque	n/a	258
49	N. Trinity-Glen Rose	Brown	F	Brazos	None	8	Brown	n/a	0
51	N. Trinity-Glen Rose	Brown	F	Colorado	None	8	Brown	n/a	0
53	N. Trinity-Glen Rose	Burnet	K	Brazos	Central Texas	8	Burnet	n/a	145
55	N. Trinity-Glen Rose	Burnet	K	Colorado	Central Texas	8	Burnet	n/a	60
58	N. Trinity-Glen Rose	Collin	C	Sabine	None	8	Collin	n/a	0
59	N. Trinity-Glen Rose-outside	Collin	C	Sabine	None	8	Collin	n/a	0
60	N. Trinity-Glen Rose	Collin	C	Trinity	None	8	Collin	n/a	0
61	N. Trinity-Glen Rose-outside	Collin	C	Trinity	None	8	Collin	n/a	0
63	N. Trinity-Glen Rose	Comanche	G	Brazos	Middle Trinity	8	Comanche	n/a	0
64	N. Trinity-Glen Rose	Comanche	G	Colorado	Middle Trinity	8	Comanche	n/a	0
68	N. Trinity-Glen Rose	Cooke	C	Red	None	8	Cooke	n/a	0
69	N. Trinity-Glen Rose	Cooke	C	Trinity	None	8	Cooke	n/a	0
70	N. Trinity-Glen Rose	Coryell	G	Brazos	None	8	Coryell	n/a	784
71	N. Trinity-Glen Rose	Dallas	C	Trinity	None	8	Dallas	n/a	0
73	N. Trinity-Glen Rose	Delta	D	Sulphur	None	8	Delta	n/a	0
74	N. Trinity-Glen Rose-outside	Delta	D	Sulphur	None	8	Delta	n/a	0
75	N. Trinity-Glen Rose	Denton	C	Trinity	None	8	Denton	n/a	0
77	N. Trinity-Glen Rose	Eastland	G	Brazos	None	8	Eastland	n/a	0
79	N. Trinity-Glen Rose	Ellis	C	Trinity	None	8	Ellis	n/a	0
80	N. Trinity-Glen Rose-outside	Ellis	C	Trinity	None	8	Ellis	n/a	0

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
82	N. Trinity-Glen Rose	Erath	G	Brazos	Middle Trinity	8	Erath	n/a	1
84	N. Trinity-Glen Rose	Falls	G	Brazos	None	8	Falls	n/a	2
85	N. Trinity-Glen Rose-outside	Falls	G	Brazos	None	8	Falls	n/a	0
87	N. Trinity-Glen Rose	Fannin	C	Red	None	8	Fannin	n/a	0
88	N. Trinity-Glen Rose	Fannin	C	Sulphur	None	8	Fannin	n/a	0
89	N. Trinity-Glen Rose	Fannin	C	Trinity	None	8	Fannin	n/a	0
92	N. Trinity-Glen Rose	Grayson	C	Red	None	8	Grayson	n/a	0
93	N. Trinity-Glen Rose	Grayson	C	Trinity	None	8	Grayson	n/a	0
95	N. Trinity-Glen Rose	Hamilton	G	Brazos	None	8	Hamilton	n/a	46
96	N. Trinity-Glen Rose	Hill	G	Trinity	None	8	Hill	n/a	0
97	N. Trinity-Glen Rose	Hill	G	Brazos	None	8	Hill	n/a	10
98	N. Trinity-Glen Rose	Hood	G	Trinity	Upper Trinity	8	Hood	n/a	0
100	N. Trinity-Glen Rose	Hood	G	Brazos	Upper Trinity	8	Hood	n/a	4
105	N. Trinity-Glen Rose	Hunt	D	Sulphur	None	8	Hunt	n/a	0
106	N. Trinity-Glen Rose-outside	Hunt	D	Sulphur	None	8	Hunt	n/a	0
108	N. Trinity-Glen Rose	Hunt	D	Sabine	None	8	Hunt	n/a	0
109	N. Trinity-Glen Rose-outside	Hunt	D	Sabine	None	8	Hunt	n/a	0
110	N. Trinity-Glen Rose	Hunt	D	Trinity	None	8	Hunt	n/a	0
111	N. Trinity-Glen Rose	Johnson	G	Trinity	None	8	Johnson	n/a	4
112	N. Trinity-Glen Rose	Johnson	G	Brazos	None	8	Johnson	n/a	20
114	N. Trinity-Glen Rose-outside	Kaufman	C	Sabine	None	8	Kaufman	n/a	0
116	N. Trinity-Glen Rose	Kaufman	C	Trinity	None	8	Kaufman	n/a	0
117	N. Trinity-Glen Rose-outside	Kaufman	C	Trinity	None	8	Kaufman	n/a	0

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
119	N. Trinity-Glen Rose	Lamar	D	Red	None	8	Lamar	n/a	0
120	N. Trinity-Glen Rose	Lamar	D	Sulphur	None	8	Lamar	n/a	0
121	N. Trinity-Glen Rose-outside	Lamar	D	Sulphur	None	8	Lamar	n/a	0
123	N. Trinity-Glen Rose	Lampasas	G	Brazos	Saratoga	8	Lampasas	n/a	769
125	N. Trinity-Glen Rose	Lampasas	G	Colorado	Saratoga	8	Lampasas	n/a	4
127	N. Trinity-Glen Rose	Limestone	G	Trinity	None	8	Limestone	n/a	0
128	N. Trinity-Glen Rose-outside	Limestone	G	Trinity	None	8	Limestone	n/a	0
130	N. Trinity-Glen Rose	Limestone	G	Brazos	None	8	Limestone	n/a	4
131	N. Trinity-Glen Rose-outside	Limestone	G	Brazos	None	8	Limestone	n/a	0
132	N. Trinity-Glen Rose	McLennan	G	Brazos	None	8	McLennan	n/a	265
134	N. Trinity-Glen Rose	Milam	G	Brazos	Post Oak Savannah	8	Milam	n/a	95
135	N. Trinity-Glen Rose-outside	Milam	G	Brazos	Post Oak Savannah	8	Milam	n/a	54
136	N. Trinity-Glen Rose	Mills	K	Brazos	Fox Crossing	8	Mills	n/a	59
138	N. Trinity-Glen Rose	Mills	K	Colorado	Fox Crossing	8	Mills	n/a	7
141	N. Trinity-Glen Rose	Montague	B	Red	Upper Trinity	8	Montague	n/a	0
143	N. Trinity-Glen Rose	Montague	B	Brazos	Upper Trinity	8	Montague	n/a	0
145	N. Trinity-Glen Rose	Navarro	C	Trinity	None	8	Navarro	n/a	0
146	N. Trinity-Glen Rose-outside	Navarro	C	Trinity	None	8	Navarro	n/a	0
147	N. Trinity-Glen Rose	Parker	C	Trinity	Upper Trinity	8	Parker	n/a	189
149	N. Trinity-Glen Rose	Parker	C	Brazos	Upper Trinity	8	Parker	n/a	3
152	N. Trinity-Glen Rose	Red River	D	Red	None	8	Red River	n/a	0

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
153	N. Trinity-Glen Rose-outside	Red River	D	Red	None	8	Red River	n/a	0
155	N. Trinity-Glen Rose	Red River	D	Sulphur	None	8	Red River	n/a	0
156	N. Trinity-Glen Rose-outside	Red River	D	Sulphur	None	8	Red River	n/a	0
157	N. Trinity-Glen Rose-outside	Rockwall	C	Sabine	None	8	Rockwall	n/a	0
158	N. Trinity-Glen Rose	Rockwall	C	Trinity	None	8	Rockwall	n/a	0
159	N. Trinity-Glen Rose-outside	Rockwall	C	Trinity	None	8	Rockwall	n/a	0
160	N. Trinity-Glen Rose	Somervell	G	Brazos	None	8	Somervell	n/a	134
161	N. Trinity-Glen Rose	Tarrant	C	Trinity	Northern Trinity	8	Tarrant	n/a	112
164	N. Trinity-Glen Rose	Travis	K	Brazos	None	8	Travis	n/a	4
166	N. Trinity-Glen Rose	Travis	K	Colorado	None	8	Travis	n/a	2,608
168	N. Trinity-Glen Rose	Williamson	G	Brazos	None	8	Williamson	n/a	604
169	N. Trinity-Glen Rose-outside	Williamson	G	Brazos	None	8	Williamson	n/a	1
170	N. Trinity-Glen Rose	Williamson	K	Brazos	None	8	Williamson	n/a	81
171	N. Trinity-Glen Rose	Williamson	G	Colorado	None	8	Williamson	n/a	37
172	N. Trinity-Glen Rose	Williamson	K	Colorado	None	8	Williamson	n/a	37
174	N. Trinity-Glen Rose	Wise	C	Trinity	Upper Trinity	8	Wise	n/a	5

Aquifer marked as outside with table row shaded denotes that the volume of water is from an area of the model outside the official aquifer boundary.

GCD = Groundwater conservation district.

GeoArea = Geographic areas defined by unique desired future conditions as specified by a groundwater management area.

GMA = Groundwater management area.

MAG = Managed available groundwater in units of acre-feet per year.

Clearwater = Clearwater Underground Water Conservation District

McLennan C. = McLennan County Groundwater Conservation District

N. Trinity = Northern Trinity Groundwater Conservation District

Fox Crossing = Fox Crossing Water District

Saratoga = Saratoga Underground Water Conservation District

RWPA = Regional water planning area.

Table 4. Estimates of managed available groundwater for the Hensell Aquifer by geographic subdivisions. See Figure 3 for location of MapRef.

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
43	N. Trinity-Hensell	Bell	G	Brazos	Clearwater	8	Bell	n/a	1,099
44	N. Trinity-Hensell	Bosque	G	Brazos	None	8	Bosque	n/a	1,749
48	N. Trinity-Hensell	Brown	F	Brazos	None	8	Brown	n/a	2
50	N. Trinity-Hensell	Brown	F	Colorado	None	8	Brown	n/a	77
52	N. Trinity-Hensell	Burnet	K	Brazos	Central Texas	8	Burnet	n/a	590
54	N. Trinity-Hensell	Burnet	K	Colorado	Central Texas	8	Burnet	n/a	100
56	N. Trinity-Hensell	Callahan	G	Brazos	None	8	Callahan	n/a	9
58	N. Trinity-Hensell	Callahan	G	Colorado	None	8	Callahan	n/a	114
59	N. Trinity-Hensell	Collin	C	Sabine	None	8	Collin	n/a	0
60	N. Trinity-Hensell-outside	Collin	C	Sabine	None	8	Collin	n/a	0
61	N. Trinity-Hensell	Collin	C	Trinity	None	8	Collin	n/a	103
62	N. Trinity-Hensell-outside	Collin	C	Trinity	None	8	Collin	n/a	0
64	N. Trinity-Hensell	Comanche	G	Brazos	Middle Trinity	8	Comanche	n/a	413
65	N. Trinity-Hensell	Comanche	G	Colorado	Middle Trinity	8	Comanche	n/a	6
69	N. Trinity-Hensell	Cooke	C	Red	None	8	Cooke	n/a	298
70	N. Trinity-Hensell	Cooke	C	Trinity	None	8	Cooke	n/a	1,313
71	N. Trinity-Hensell	Coryell	G	Brazos	None	8	Coryell	n/a	1,765
72	N. Trinity-Hensell	Dallas	C	Trinity	None	8	Dallas	n/a	1,121
74	N. Trinity-Hensell	Delta	D	Sulphur	None	8	Delta	n/a	50
75	N. Trinity-Hensell-outside	Delta	D	Sulphur	None	8	Delta	n/a	131
76	N. Trinity-Hensell	Denton	C	Trinity	None	8	Denton	n/a	3,112
78	N. Trinity-Hensell	Eastland	G	Brazos	None	8	Eastland	n/a	73
80	N. Trinity-Hensell	Eastland	G	Colorado	None	8	Eastland	n/a	6

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
81	N. Trinity-Hensell	Ellis	C	Trinity	None	8	Ellis	n/a	1,142
82	N. Trinity-Hensell-outside	Ellis	C	Trinity	None	8	Ellis	n/a	0
84	N. Trinity-Hensell	Erath	G	Brazos	Middle Trinity	8	Erath	n/a	9,142
86	N. Trinity-Hensell	Falls	G	Brazos	None	8	Falls	n/a	22
87	N. Trinity-Hensell-outside	Falls	G	Brazos	None	8	Falls	n/a	0
89	N. Trinity-Hensell	Fannin	C	Red	None	8	Fannin	n/a	203
90	N. Trinity-Hensell	Fannin	C	Sulphur	None	8	Fannin	n/a	0
91	N. Trinity-Hensell	Fannin	C	Trinity	None	8	Fannin	n/a	0
94	N. Trinity-Hensell	Grayson	C	Red	None	8	Grayson	n/a	1,929
95	N. Trinity-Hensell	Grayson	C	Trinity	None	8	Grayson	n/a	416
96	N. Trinity-Hensell	Hamilton	G	Brazos	None	8	Hamilton	n/a	1,109
97	N. Trinity-Hensell	Hill	G	Trinity	None	8	Hill	n/a	9
98	N. Trinity-Hensell	Hill	G	Brazos	None	8	Hill	n/a	924
99	N. Trinity-Hensell	Hood	G	Trinity	Upper Trinity	8	Hood	n/a	16
101	N. Trinity-Hensell	Hood	G	Brazos	Upper Trinity	8	Hood	n/a	3,579
106	N. Trinity-Hensell	Hunt	D	Sulphur	None	8	Hunt	n/a	0
107	N. Trinity-Hensell-outside	Hunt	D	Sulphur	None	8	Hunt	n/a	0
109	N. Trinity-Hensell	Hunt	D	Sabine	None	8	Hunt	n/a	0
110	N. Trinity-Hensell-outside	Hunt	D	Sabine	None	8	Hunt	n/a	0
111	N. Trinity-Hensell	Hunt	D	Trinity	None	8	Hunt	n/a	0
112	N. Trinity-Hensell	Johnson	G	Trinity	None	8	Johnson	n/a	349
113	N. Trinity-Hensell	Johnson	G	Brazos	None	8	Johnson	n/a	716
115	N. Trinity-Hensell-outside	Kaufman	C	Sabine	None	8	Kaufman	n/a	9
117	N. Trinity-Hensell	Kaufman	C	Trinity	None	8	Kaufman	n/a	30
118	N. Trinity-Hensell-outside	Kaufman	C	Trinity	None	8	Kaufman	n/a	201

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
120	N. Trinity-Hensell	Lamar	D	Red	None	8	Lamar	n/a	660
121	N. Trinity-Hensell	Lamar	D	Sulphur	None	8	Lamar	n/a	0
122	N. Trinity-Hensell-outside	Lamar	D	Sulphur	None	8	Lamar	n/a	1
124	N. Trinity-Hensell	Lampasas	G	Brazos	Saratoga	8	Lampasas	n/a	878
126	N. Trinity-Hensell	Lampasas	G	Colorado	Saratoga	8	Lampasas	n/a	7
128	N. Trinity-Hensell	Limestone	G	Trinity	None	8	Limestone	n/a	0
129	N. Trinity-Hensell-outside	Limestone	G	Trinity	None	8	Limestone	n/a	0
131	N. Trinity-Hensell	Limestone	G	Brazos	None	8	Limestone	n/a	15
132	N. Trinity-Hensell-outside	Limestone	G	Brazos	None	8	Limestone	n/a	0
133	N. Trinity-Hensell	McLennan	G	Brazos	None	8	McLennan	n/a	4,190
135	N. Trinity-Hensell	Milam	G	Brazos	Post Oak Savannah	8	Milam	n/a	36
136	N. Trinity-Hensell-outside	Milam	G	Brazos	Post Oak Savannah	8	Milam	n/a	0
137	N. Trinity-Hensell	Mills	K	Brazos	Fox Crossing	8	Mills	n/a	832
139	N. Trinity-Hensell	Mills	K	Colorado	Fox Crossing	8	Mills	n/a	114
142	N. Trinity-Hensell	Montague	B	Red	Upper Trinity	8	Montague	n/a	20
144	N. Trinity-Hensell	Montague	B	Trinity	Upper Trinity	8	Montague	n/a	342
146	N. Trinity-Hensell	Navarro	C	Trinity	None	8	Navarro	n/a	256
147	N. Trinity-Hensell-outside	Navarro	C	Trinity	None	8	Navarro	n/a	0
148	N. Trinity-Hensell	Parker	C	Trinity	Upper Trinity	8	Parker	n/a	884
150	N. Trinity-Hensell	Parker	C	Brazos	Upper Trinity	8	Parker	n/a	557
153	N. Trinity-Hensell	Red River	D	Red	None	8	Red River	n/a	19
154	N. Trinity-Hensell-outside	Red River	D	Red	None	8	Red River	n/a	0
156	N. Trinity-Hensell	Red River	D	Sulphur	None	8	Red River	n/a	0
157	N. Trinity-	Red River	D	Sulphur	None	8	Red River	n/a	0

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
158	N. Trinity-Hensell-outside	Rockwall	C	Sabine	None	8	Rockwall	n/a	0
159	N. Trinity-Hensell	Rockwall	C	Trinity	None	8	Rockwall	n/a	0
160	N. Trinity-Hensell-outside	Rockwall	C	Trinity	None	8	Rockwall	n/a	0
161	N. Trinity-Hensell	Somervell	G	Brazos	None	8	Somervell	n/a	741
162	N. Trinity-Hensell	Tarrant	C	Trinity	Northern Trinity	8	Tarrant	n/a	2,535
165	N. Trinity-Hensell	Travis	K	Brazos	None	8	Travis	n/a	2
167	N. Trinity-Hensell	Travis	K	Colorado	None	8	Travis	n/a	154
169	N. Trinity-Hensell	Williamson	G	Brazos	None	8	Williamson	n/a	363
170	N. Trinity-Hensell-outside	Williamson	G	Brazos	None	8	Williamson	n/a	0
171	N. Trinity-Hensell	Williamson	K	Brazos	None	8	Williamson	n/a	39
172	N. Trinity-Hensell	Williamson	G	Colorado	None	8	Williamson	n/a	5
173	N. Trinity-Hensell	Williamson	K	Colorado	None	8	Williamson	n/a	8
175	N. Trinity-Hensell	Wise	C	Trinity	Upper Trinity	8	Wise	n/a	1,480

Aquifer marked as outside with table row shaded denotes that the volume of water is from an area of the model outside the official aquifer boundary.

GCD = Groundwater conservation district.

GeoArea = Geographic areas defined by unique desired future conditions as specified by a groundwater management area.

GMA = Groundwater management area.

MAG = Managed available groundwater in units of acre-feet per year.

Clearwater = Clearwater Underground Water Conservation District

McLennan C. = McLennan County Groundwater Conservation District

N. Trinity = Northern Trinity Groundwater Conservation District

Fox Crossing = Fox Crossing Water District

Saratoga = Saratoga Underground Water Conservation District

RWPA = Regional water planning area.

Table 5. Estimates of managed available groundwater for the Hosston Aquifer by geographic subdivisions. See Figure 4 for location of MapRef.

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
44	N. Trinity-Hosston	Bell	G	Brazos	Clearwater	8	Bell	n/a	4,993
45	N. Trinity-Hosston	Bosque	G	Brazos	None	8	Bosque	n/a	2,829
49	N. Trinity-Hosston	Brown	F	Brazos	None	8	Brown	n/a	25
51	N. Trinity-Hosston	Brown	F	Colorado	None	8	Brown	n/a	1,923
53	N. Trinity-Hosston	Burnet	K	Brazos	Central Texas	8	Burnet	n/a	1,847
55	N. Trinity-Hosston	Burnet	K	Colorado	Central Texas	8	Burnet	n/a	622
57	N. Trinity-Hosston	Callahan	G	Brazos	None	8	Callahan	n/a	1,783
59	N. Trinity-Hosston	Callahan	G	Colorado	None	8	Callahan	n/a	1,871
60	N. Trinity-Hosston	Collin	C	Sabine	None	8	Collin	n/a	0
61	N. Trinity-Hosston-outside	Collin	C	Sabine	None	8	Collin	n/a	0
62	N. Trinity-Hosston	Collin	C	Trinity	None	8	Collin	n/a	239
63	N. Trinity-Hosston-outside	Collin	C	Trinity	None	8	Collin	n/a	0
65	N. Trinity-Hosston	Comanche	G	Brazos	Middle Trinity	8	Comanche	n/a	23,215
66	N. Trinity-Hosston	Comanche	G	Colorado	Middle Trinity	8	Comanche	n/a	68
69	N. Trinity-Hosston	Cooke	C	Red	None	8	Cooke	n/a	346
70	N. Trinity-Hosston	Cooke	C	Trinity	None	8	Cooke	n/a	1,365
71	N. Trinity-Hosston	Coryell	G	Brazos	None	8	Coryell	n/a	913
72	N. Trinity-Hosston	Dallas	C	Trinity	None	8	Dallas	n/a	3,904
74	N. Trinity-Hosston	Delta	D	Sulphur	None	8	Delta	n/a	50
75	N. Trinity-Hosston-outside	Delta	D	Sulphur	None	8	Delta	n/a	131
76	N. Trinity-Hosston	Denton	C	Trinity	None	8	Denton	n/a	6,399
78	N. Trinity-Hosston	Eastland	G	Brazos	None	8	Eastland	n/a	4,412

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
80	N. Trinity-Hosston	Eastland	G	Colorado	None	8	Eastland	n/a	225
81	N. Trinity-Hosston	Ellis	C	Trinity	None	8	Ellis	n/a	2,417
82	N. Trinity-Hosston-outside	Ellis	C	Trinity	None	8	Ellis	n/a	0
84	N. Trinity-Hosston	Erath	G	Brazos	Middle Trinity	8	Erath	n/a	15,723
86	N. Trinity-Hosston	Falls	G	Brazos	None	8	Falls	n/a	137
87	N. Trinity-Hosston-outside	Falls	G	Brazos	None	8	Falls	n/a	8
89	N. Trinity-Hosston	Fannin	C	Red	None	8	Fannin	n/a	209
90	N. Trinity-Hosston	Fannin	C	Sulphur	None	8	Fannin	n/a	0
91	N. Trinity-Hosston	Fannin	C	Trinity	None	8	Fannin	n/a	0
94	N. Trinity-Hosston	Grayson	C	Red	None	8	Grayson	n/a	1,930
95	N. Trinity-Hosston	Grayson	C	Trinity	None	8	Grayson	n/a	417
96	N. Trinity-Hosston	Hamilton	G	Brazos	None	8	Hamilton	n/a	698
97	N. Trinity-Hosston	Hill	G	Trinity	None	8	Hill	n/a	4
98	N. Trinity-Hosston	Hill	G	Brazos	None	8	Hill	n/a	946
99	N. Trinity-Hosston	Hood	G	Trinity	Upper Trinity	8	Hood	n/a	37
101	N. Trinity-Hosston	Hood	G	Brazos	Upper Trinity	8	Hood	n/a	6,567
106	N. Trinity-Hosston	Hunt	D	Sulphur	None	8	Hunt	n/a	0
107	N. Trinity-Hosston-outside	Hunt	D	Sulphur	None	8	Hunt	n/a	0
109	N. Trinity-Hosston	Hunt	D	Sabine	None	8	Hunt	n/a	0
110	N. Trinity-Hosston-outside	Hunt	D	Sabine	None	8	Hunt	n/a	0
111	N. Trinity-Hosston	Hunt	D	Trinity	None	8	Hunt	n/a	0
112	N. Trinity-Hosston	Johnson	G	Trinity	None	8	Johnson	n/a	787
113	N. Trinity-Hosston	Johnson	G	Brazos	None	8	Johnson	n/a	1,502
115	N. Trinity-Hosston-outside	Kaufman	C	Sabine	None	8	Kaufman	n/a	32
117	N. Trinity-Hosston	Kaufman	C	Trinity	None	8	Kaufman	n/a	104

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
118	N. Trinity-Hosston-outside	Kaufman	C	Trinity	None	8	Kaufman	n/a	703
120	N. Trinity-Hosston	Lamar	D	Red	None	8	Lamar	n/a	660
121	N. Trinity-Hosston	Lamar	D	Sulphur	None	8	Lamar	n/a	0
122	N. Trinity-Hosston-outside	Lamar	D	Sulphur	None	8	Lamar	n/a	1
124	N. Trinity-Hosston	Lampasas	G	Brazos	Saratoga	8	Lampasas	n/a	1,265
126	N. Trinity-Hosston	Lampasas	G	Colorado	Saratoga	8	Lampasas	n/a	181
128	N. Trinity-Hosston	Limestone	G	Trinity	None	8	Limestone	n/a	0
129	N. Trinity-Hosston-outside	Limestone	G	Trinity	None	8	Limestone	n/a	0
131	N. Trinity-Hosston	Limestone	G	Brazos	None	8	Limestone	n/a	50
132	N. Trinity-Hosston-outside	Limestone	G	Brazos	None	8	Limestone	n/a	0
133	N. Trinity-Hosston	McLennan	G	Brazos	None	8	McLennan	n/a	16,004
135	N. Trinity-Hosston	Milam	G	Brazos	Post Oak Savannah	8	Milam	n/a	102
136	N. Trinity-Hosston-outside	Milam	G	Brazos	Post Oak Savannah	8	Milam	n/a	0
137	N. Trinity-Hosston	Mills	K	Brazos	Fox Crossing	8	Mills	n/a	379
139	N. Trinity-Hosston	Mills	K	Colorado	Fox Crossing	8	Mills	n/a	1,005
142	N. Trinity-Hosston	Montague	B	Red	Upper Trinity	8	Montague	n/a	80
144	N. Trinity-Hosston	Montague	B	Trinity	Upper Trinity	8	Montague	n/a	1,727
146	N. Trinity-Hosston	Navarro	C	Trinity	None	8	Navarro	n/a	1,204
147	N. Trinity-Hosston-outside	Navarro	C	Trinity	None	8	Navarro	n/a	0
148	N. Trinity-Hosston	Parker	C	Trinity	Upper Trinity	8	Parker	n/a	2,006
150	N. Trinity-Hosston	Parker	C	Brazos	Upper Trinity	8	Parker	n/a	1,809
153	N. Trinity-Hosston	Red River	D	Red	None	8	Red River	n/a	38
154	N. Trinity-Hosston-	Red River	D	Red	None	8	Red River	n/a	0

MapRef	Aquifer	County	RWPA	River Basin	GCD	GMA	GeoArea	Year	MAG (Acre-feet per year)
	outside								
156	N. Trinity-Hosston	Red River	D	Sulphur	None	8	Red River	n/a	0
157	N. Trinity-Hosston-outside	Red River	D	Sulphur	None	8	Red River	n/a	0
158	N. Trinity-Hosston-outside	Rockwall	C	Sabine	None	8	Rockwall	n/a	0
159	N. Trinity-Hosston	Rockwall	C	Trinity	None	8	Rockwall	n/a	0
160	N. Trinity-Hosston-outside	Rockwall	C	Trinity	None	8	Rockwall	n/a	0
161	N. Trinity-Hosston	Somervell	G	Brazos	None	8	Somervell	n/a	1,490
162	N. Trinity-Hosston	Tarrant	C	Trinity	Northern Trinity	8	Tarrant	n/a	5,556
164	N. Trinity-Hosston	Taylor	G	Brazos	None	8	Taylor	n/a	153
166	N. Trinity-Hosston	Taylor	G	Colorado	None	8	Taylor	n/a	278
167	N. Trinity-Hosston	Travis	K	Brazos	None	8	Travis	n/a	2
169	N. Trinity-Hosston	Travis	K	Colorado	None	8	Travis	n/a	1,117
171	N. Trinity-Hosston	Williamson	G	Brazos	None	8	Williamson	n/a	546
172	N. Trinity-Hosston-outside	Williamson	G	Brazos	None	8	Williamson	n/a	0
173	N. Trinity-Hosston	Williamson	K	Brazos	None	8	Williamson	n/a	37
174	N. Trinity-Hosston	Williamson	G	Colorado	None	8	Williamson	n/a	15
175	N. Trinity-Hosston	Williamson	K	Colorado	None	8	Williamson	n/a	16
177	N. Trinity-Hosston	Wise	C	Trinity	Upper Trinity	8	Wise	n/a	5,238

Aquifer marked as outside with table row shaded denotes that the volume of water is from an area of the model outside the official aquifer boundary.

GCD = Groundwater conservation district.

GeoArea = Geographic areas defined by unique desired future conditions as specified by a groundwater management area.

GMA = Groundwater management area.

MAG = Managed available groundwater in units of acre-feet per year.

Clearwater = Clearwater Underground Water Conservation District

McLennan C. = McLennan County Groundwater Conservation District

N. Trinity = Northern Trinity Groundwater Conservation District
Fox Crossing = Fox Crossing Water District
Saratoga = Saratoga Underground Water Conservation District
RWPA = Regional water planning area.

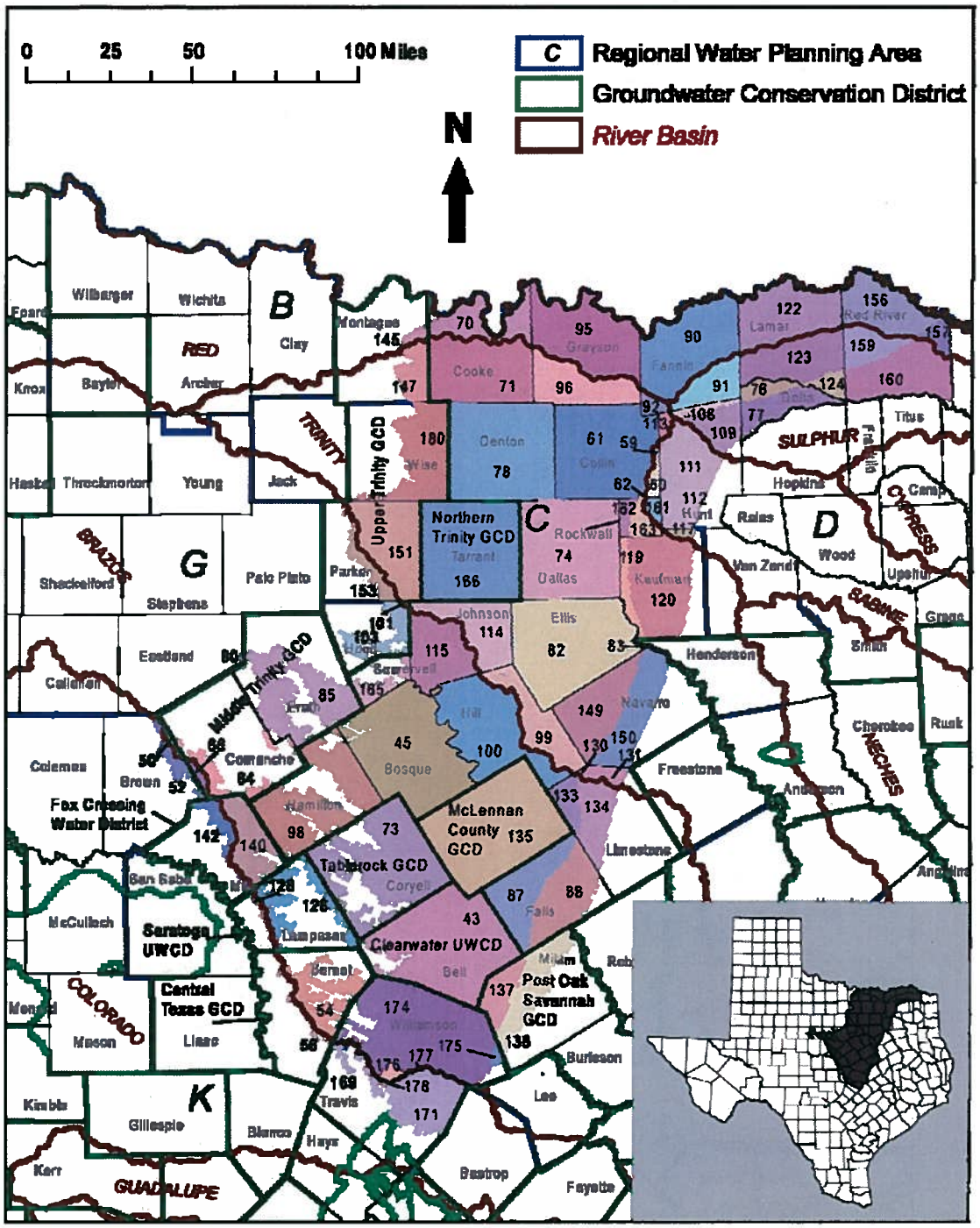

Figure 1. Geographic subdivisions of managed available groundwater for the Paluxy Aquifer. See Table 2 for descriptions of the geographic subdivisions.

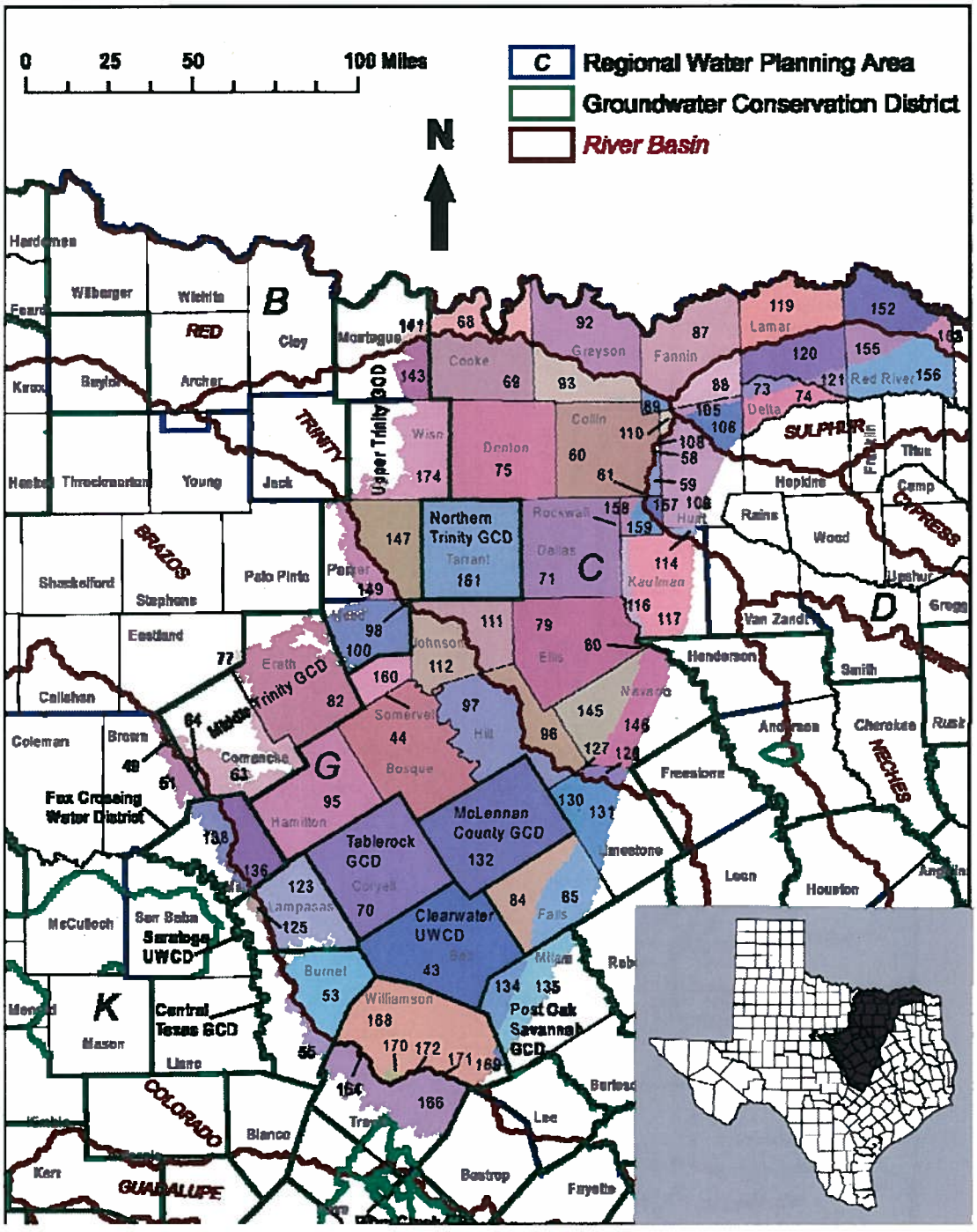

Figure 2. Geographic subdivisions of managed available groundwater for the Glen Rose Aquifer. See Table 3 for descriptions of the geographic subdivisions.

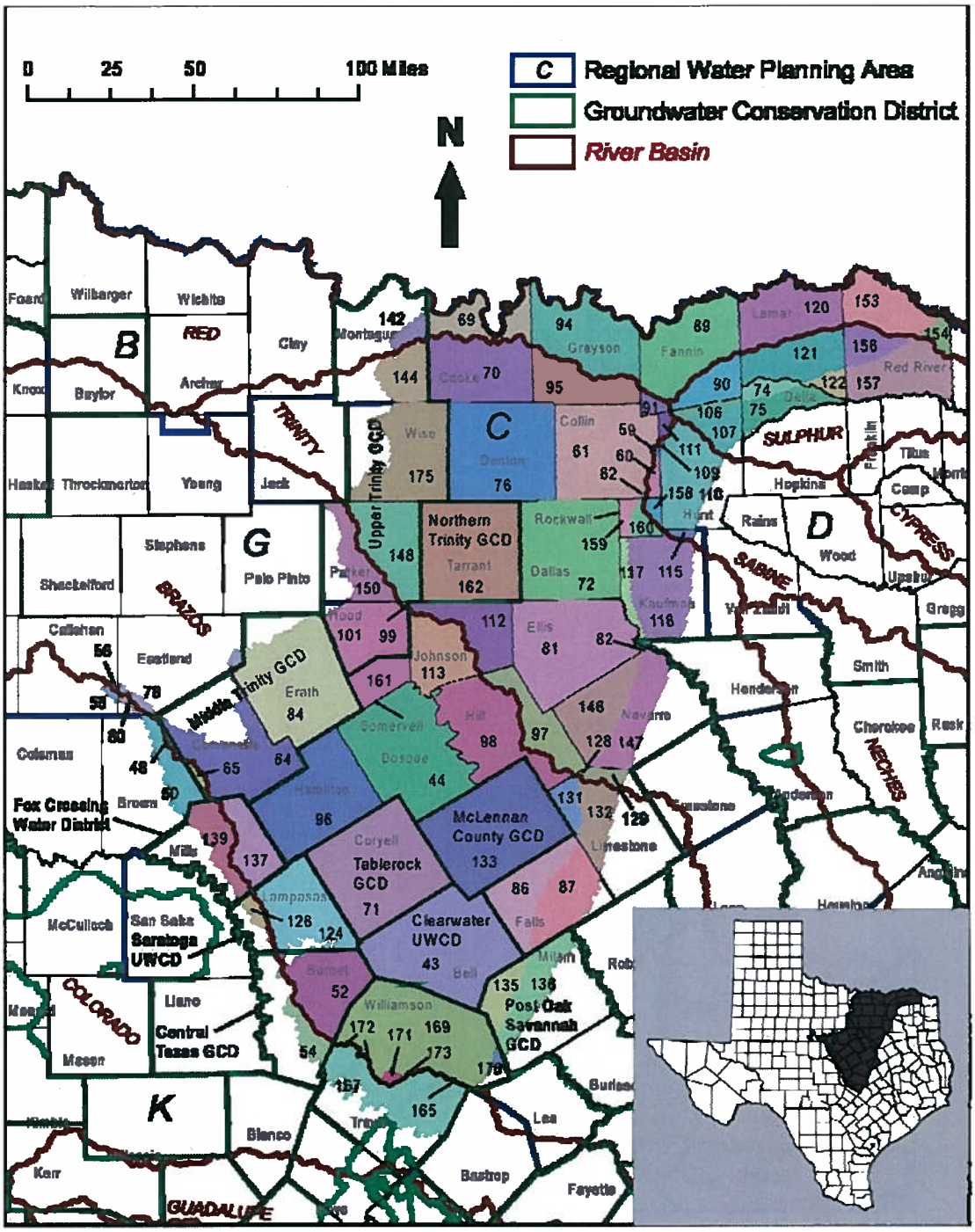

Figure 3. Geographic subdivisions of managed available groundwater for the Hensell Aquifer. See Table 4 for descriptions of the geographic subdivisions.

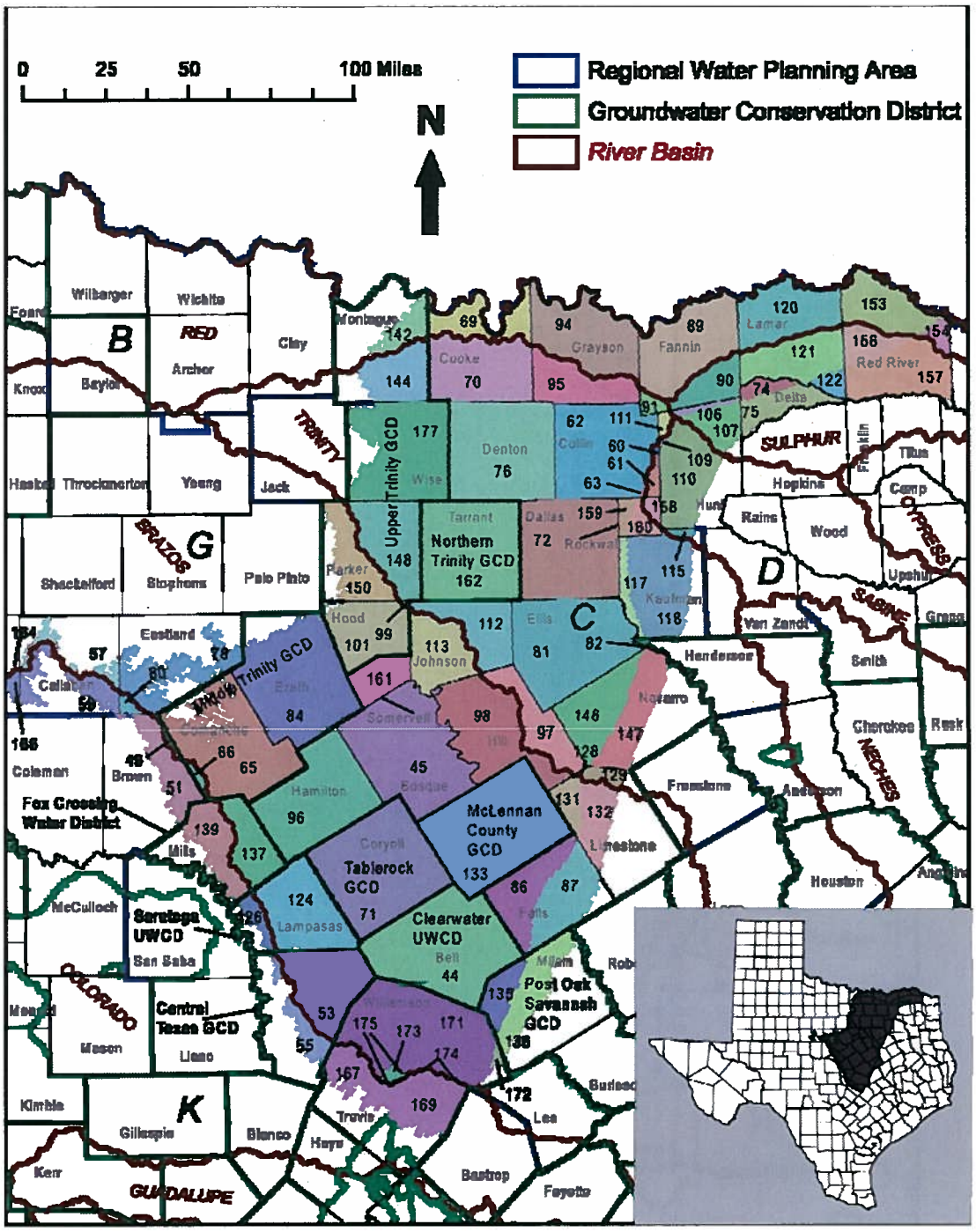

Figure 4. Geographic subdivisions of managed available groundwater for Hosston Unit of the northern part of the Trinity Aquifer. See Table 5 for descriptions of the geographic subdivisions.

RESULTS:

Water level declines in the Trinity Aquifer for the counties in Groundwater Management Area 8 were verified to meet the desired future conditions developed by groundwater conservation districts in Groundwater Management Area 8. The results (Figure 1 and Table 2) show 65,025 acre-feet per year of managed available groundwater for the Paluxy Aquifer in Groundwater Management Area 8. Of those, 89 acre-feet per year may not be fresh water. Under the jurisdiction of the Northern Trinity Groundwater Conservation District, Tarrant County has 10,544 acre-feet per year of managed available groundwater in the Paluxy Aquifer. Under the jurisdiction of the Upper Trinity Groundwater Conservation District; Montague, Wise, Parker, and Hood counties have 13,806 acre-feet per year of managed available groundwater in the Paluxy Aquifer. The remaining counties in Regional Planning Area C have 22,413 acre-feet per year of managed available groundwater in the Paluxy Aquifer. McLennan County Groundwater Conservation District has 231 acre-feet per year, Clearwater Underground Water Conservation District (Bell County) has 96 acre-feet per year, Tablerock Groundwater Conservation District (Coryell County) has 254 acre-feet per year, Saratoga Underground Water Conservation District (Lampasas County) has 13 acre-feet per year, and the Middle Trinity Groundwater Conservation District (Erath and Comanche counties) has 4,249 acre-feet per year of managed available groundwater in the Paluxy Aquifer. The remaining counties in Regional Planning Area G have 12,187 acre-feet per year of managed available groundwater. Central Texas Groundwater Conservation District (Burnet County) has 182 acre-feet per year and Fox Crossing Water District (Mills County) has 6 acre-feet per year. The remaining counties in Regional Planning Area K have 3 acre-feet per year of managed available groundwater. The counties in Regional Planning Area D have 1,024 acre-feet per year of managed available groundwater and the counties in Regional Planning Area F have 18 acre-feet per year in the Paluxy Aquifer.

The results (Figure 2 and Table 3) show 7,387 acre-feet per year of managed available groundwater for the Glen Rose Formation in Groundwater Management Area 8. Of those, 55 acre-feet per year may not be fresh water. Under the jurisdiction of the Northern Trinity Groundwater Conservation District, Tarrant County has 112 acre-feet per year of managed available groundwater in the Glen Rose Aquifer. Under the jurisdiction of the Upper Trinity Groundwater Conservation District; Montague, Wise, Parker, and Hood counties have 201 acre-feet per year of managed available groundwater in the Glen Rose Aquifer. The remaining counties in Regional Planning Area C have 0 acre-feet per year of managed available groundwater in the Glen Rose Formation. McLennan County Groundwater Conservation District has 265 acre-feet per year, Clearwater Underground Water Conservation District (Bell County) has 880 acre-feet per year, Tablerock Groundwater Conservation District (Coryell County) has 784 acre-feet per year, Saratoga Underground Water Conservation District (Lampasas County) has 774 acre-feet per year, the Middle Trinity Groundwater Conservation District (Erath and Comanche counties) has 1 acre-foot per year of managed available groundwater in the Glen Rose Formation and the Post Oak Savannah Groundwater Conservation District has 149 acre-feet per year of managed available groundwater in the Glen Rose Aquifer. The remaining counties in Regional Planning Area G have 1,122 acre-feet per year of managed available

groundwater. Central Texas Groundwater Conservation District (Burnet County) has 205 acre-feet per year and Fox Crossing Water District (Mills County) has 66 acre-feet per year. The remaining counties in Regional Planning Area K have 2,731 acre-feet per year of managed available groundwater. The counties in Regional Water Planning Area D have 0 acre-feet per year of managed available groundwater and the counties in Regional Water Planning Area F have 0 acre-feet per year in the Glen Rose Aquifer.

The results (Figure 3 and Table 4) show 46,067 acre-feet per year of managed available groundwater for the Hensell Aquifer in Groundwater Management Area 8. Of those, 342 acre-feet per year may not be fresh water. Under the jurisdiction of the Northern Trinity Groundwater Conservation District, Tarrant County has 2,535 acre-feet per year of managed available groundwater in the Hensell Aquifer. Under the jurisdiction of the Upper Trinity Groundwater Conservation District; Montague, Wise, Parker, and Hood counties have 6,879 acre-feet per year of managed available groundwater in the Hensell Aquifer. The remaining counties in Regional Planning Area C have 10,134 acre-feet per year of managed available groundwater in the Hensell Aquifer. McLennan County Groundwater Conservation District has 4,190 acre-feet per year, Clearwater Underground Water Conservation District (Bell County) has 1,099 acre-feet per year, Tablerock Groundwater Conservation District (Coryell County) has 1,765 acre-feet per year, Saratoga Underground Water Conservation District (Lampasas County) has 885 acre-feet per year, the Middle Trinity Groundwater Conservation District (Erath and Comanche counties) has 9,562 acre-foot per year of managed available groundwater in the Hensell Aquifer and the Post Oak Savannah Groundwater Conservation District has 36 acre-feet per year of managed available groundwater in the Hensell Aquifer. The remaining counties in Regional Planning Area G have 6,204 acre-feet per year of managed available groundwater. Central Texas Groundwater Conservation District (Burnet County) has 690 acre-feet per year and Fox Crossing Water District (Mills County) has 945 acre-feet per year. The remaining counties in Regional Planning Area K have 203 acre-feet per year of managed available groundwater. The counties in Regional Planning Area D have 861 acre-feet per year of managed available groundwater and the counties in Regional Planning Area F have 79 acre-feet per year in the Hensell Aquifer.

The results (Figure 4 and Table 5) show 130,340 acre-feet per year of managed available groundwater for the Hosston Aquifer in Groundwater Management Area 8. Of those, 875 acre-feet per year may not be fresh water. Under the jurisdiction of the Northern Trinity Groundwater Conservation District, Tarrant County has 5,556 acre-feet per year of managed available groundwater in the Hosston Aquifer. Under the jurisdiction of the Upper Trinity Groundwater Conservation District; Montague, Wise, Parker, and Hood counties have 17,463 acre-feet per year of managed available groundwater in the Hosston Aquifer. The remaining counties in Regional Planning Area C have 19,269 acre-feet per year of managed available groundwater in the Hosston Aquifer. McLennan County Groundwater Conservation District has 16,004 acre-feet per year, Clearwater Underground Water Conservation District (Bell County) has 4,993 acre-feet per year, Tablerock Groundwater Conservation District (Coryell County) has 913 acre-feet per year, Saratoga Underground Water Conservation District (Lampasas County) has 1,446 acre-feet per year, the Middle Trinity Groundwater Conservation District (Erath and Comanche counties) has 39,006 acre-foot per year of managed available groundwater in

the Hosston Aquifer and Post Oak Savannah Groundwater Conservation District (Milam County) has 103 acre-feet per year of managed available groundwater. The remaining counties in Regional Planning Area G have 17,734 acre-feet per year of managed available groundwater. Central Texas Groundwater Conservation District (Burnet County) has 2,469 acre-feet per year and Fox Crossing Water District (Mills County) has 1,383 acre-feet per year. The remaining counties in Regional Planning Area K have 1,172 acre-feet per year of managed available groundwater. The counties in Regional Planning Area D have 880 acre-feet per year of managed available groundwater and the counties in Regional Planning Area F have 1,948 acre-feet per year in the Hosston Aquifer.

In addition, we have reviewed the results from this model simulation and compared the results from GAM Run 08-14mag (Wade, 2008) for the Woodbine Aquifer to verify that they are physically possible, individually and collectively.

Note that estimates of managed available groundwater are based on the best available scientific tools that can be used to evaluate managed available groundwater and that these estimates can be a function of assumptions made on the magnitude and distribution of pumping in the aquifer. Therefore, it is important for groundwater conservation districts to monitor whether or not they are achieving their desired future conditions and to work with the TWDB to refine managed available groundwater given the reality of how the aquifer responds to the actual magnitude and distribution of pumping now and in the future.

REFERENCES:

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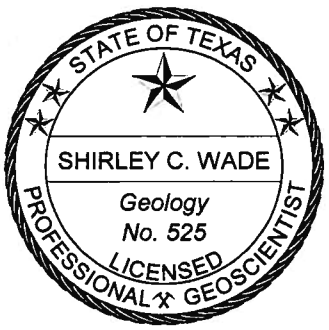
Donnelly, A., 2008, GAM08-06 Final Report, Texas Water Development Board GAM Run Report, October 26, 2007, 44 p.

Wade, S., 2008, GAM08-14mag Report, Texas Water Development Board GAM Run Report, May 6, 2008, 7 p.



The seal appearing on this document was authorized by Shirley C. Wade, P.G., on March 5, 2009.