Blanco – Pedernales Groundwater Conservation District

GROUNDWATER MANAGEMENT PLAN

Originally Adopted
November 19, 2002

Board of Directors

Ron Zunker, President
At-Large
Bobby Wilson, Vice-President
Precinct 3
Shirley Beck, Secretary-Treasurer
Precinct 4
Tom Murrah
Precinct 1
James Sultemeier
Precinct 2

2nd Revision, Adopted
April 15, 2003

Board of Directors

Ron Zunker, President
At-Large
Bobby Wilson, Vice-President
Precinct 3
Shirley Beck, Secretary-Treasurer
Precinct 4
Tom Murrah
Precinct 1
David Dockery
Precinct 2

General Manager

Ronald G. Fieseler
manager@blancocountygroundwater.org

Blanco – Pedernales Groundwater Conservation District
Post Office Box 1516
304 E. Main
Johnson City, Texas 78636

(830) 868-9196
(830) 868-0376 FAX

www.blancocountygroundwater.org

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GROUNDWATER MANAGEMENT PLAN

REVISION RECORD

Date Adopted	Effective Date	Affected Sections or General Comments
11/19/02	11/19/02	Original Adoption
02/18/03	02/18/03	Revisions resulting from TWDB Certification Review
04/15/03	04/15/03	Revise Table 1, Table 3, & associated text to address TWDB comments

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TIME PERIOD FOR THIS PLAN

This plan becomes effective upon adoption by the Blanco-Pedernales Groundwater Conservation District Board of Directors (Board) and subsequent certification by the Texas Water Development Board (TWDB). This plan incorporates a planning period of ten years in accordance with 31TAC §356.5(a). After five years, the plan will be reviewed for consistency with the applicable Regional Water Plans and the State Water Plan and shall be readopted with or without amendments. The plan may be revised at anytime in order to maintain such consistency or as necessary to address any new or revised data, Groundwater Availability Models, or District management strategies.

DISTRICT MISSION

The Blanco-Pedernales Groundwater Conservation District (BPGCD or District) was created under Chapter 36 of the Texas Water Code for the purpose of conserving, preserving, recharging, protecting and preventing waste of groundwater from the aquifers within Blanco County. The District will conduct administrative and technical activities and programs to achieve these purposes. The District will collect and archive water well and aquifer data, regulate water well drilling and production, promote the capping or plugging of abandoned wells, provide information and educational material to local property owners, interact with other governmental or organizational entities, and incorporate other groundwater-related activities that may help meet the purposes of the District. The Texas Hill Country Area, which includes Blanco County, was declared a Critical Groundwater Area by the then Texas Water Commission in 1990. This declaration, now known as the Hill Country Priority Groundwater Management Area (PGMA), gave notice to the residents of the area that water availability and quality will be at risk within the next 50 years.

STATEMENT OF GUIDING PRINCIPLES

The BPGCD was created in order that appropriate groundwater management techniques and strategies could be implemented at the local level to address groundwater issues or problems within the District. The District has used both the TWDB' Groundwater Availability Model and the best and most current site-specific data available to the District in the development of this plan. This plan serves as a guideline the District can follow to ensure greater understanding of local aquifer conditions, development of groundwater management concepts and strategies, and subsequent implementation of appropriate groundwater management policies.

COMMITMENT TO IMPLEMENT GROUNDWATER MANAGEMENT PLAN

To address potential groundwater quantity and quality issues, the District is committed to, and will actively pursue, the groundwater management strategies identified in this groundwater management plan. The management plan will be coordinated with District Rules, policies, and activities in order to effectively manage and regulate the drilling of wells, production of groundwater within the District, and the possible transfer of water out of the District, encourage conservation practices and efficient water use, develop a drought contingency plan, and provide for the identification of any critical groundwater depletion areas within the District. To the greatest extent practical, the District will cooperate with and coordinate its management plan and regulatory policies with adjacent groundwater districts, Regional Water Planning Groups, and adjacent counties with similar aquifers and/or groundwater usage.

Insert County Map on this page.

Insert Geology/Stratigraphic Column Illustration on this page.

GENERAL DESCRIPTION OF THE DISTRICT

The Blanco-Pedernales Groundwater Conservation District includes all of Blanco County and covers roughly 715 square miles (457,825 acres). The BPGCD was created in accordance with the Chapter 36 petition process. On January 23, 2001, Blanco County voters approved the creation of the District, its maximum tax rate, and elected five Directors to govern the District. The District's authority and duties are derived primarily from Chapter 36 of the Texas Water Code, Vernon's Texas Civil Statues.

The Board of Directors (as of Fiscal Year 2002) is comprised of Ron Zunker - Director At-Large and Board President, Bobby Wilson - Director of Precinct 3 and Board Vice President, Shirley Beck - Director of Precinct 4 and Board Secretary, Tom Murrah - Director of Precinct 1, and James Sultemeier - Director of Precinct 2.. The District General Manager is Ron Fieseler.

Current District rules were adopted by the Board in February 2002 and became effective on February 11, 2002.

Blanco County's economy is primarily agricultural based. The agricultural economy is derived from cattle, goats and sheep with significant contributions from the cultivation of flower nurseries, vegetables, hay crops, peaches, pecans, grapes and grains. Wildlife hunting also contributes to the area economy.

Tourists visiting local State and National Parks and other attractions contribute significant revenues to the local economy. In addition, over the past few decades, Blanco County and other Hill Country counties in close proximity to the cities of Austin or San Antonio have seen growth in population due to subdivision of large tracts of land into smaller acreages.

The two largest cities in the District are Johnson City and Blanco, which have a 2000 Census population of 1,191 and 1,505 people respectively. The small cities and communities (less than 300 people) of Round Mountain and Cypress Mill to the north of Johnson City, Hye to the west of Johnson City, and the Twin Sisters community south of Blanco are also in the District.

Although Blanco County lies within both the Colorado and Guadalupe River basins, for statewide water planning purposes it is part of the Lower Colorado Regional Water Planning Group (Region K).

Topography and Drainage

Blanco County has two primary watersheds: the Pedernales River, which is a tributary to the Colorado River, and the Blanco River, which is a tributary to the Guadalupe River. Surface drainage within the District is generally from west to east.

The District contains two major geologic features. The Llano Uplift extends into the northwestern portion of the District. This feature is made up of very old rocks ranging in age from 1.0 to 1.2 billion years and is comprised of granite and older metamorphic rocks. The other major feature is the Edwards Plateau. This is an elevated structure made up of Cretaceous age limestone, dolomite and marl. The Edwards Plateau extends west and covers many West Texas counties. Blanco County lies near the southeastern edge of the Plateau.

Elevation within the District ranges from a low of approximately 730 feet above sea level where the Pedernales River leaves Blanco County to approximately 1,901 feet above sea level north of the city of Blanco, on the divide between the Pedernales and Blanco River basins.

WATER RESOURCES WITHIN THE BLANCO-PEDERNALES GROUNDWATER CONSERVATION DISTRICT

Groundwater Resources and Usage in Blanco County

Within the BPGCD there are five aquifers which provide groundwater to county residents. Well depths vary from shallow, hand-dug wells 20-30 feet deep to drilled wells that vary between 30-1200 feet deep. Depths are highly variable even within the same aquifer and depend entirely on site-specific topography and geology. Water quality and water quantity also vary greatly throughout the District. Water quality within a specific aquifer can often be defined or characterized in a general sense, but can still be affected by local geology and hydrology. The five Blanco County aquifers are listed in Table 1 along with the current estimated groundwater availability for each aquifer based on information derived from the following two sources:

- Volume I Chapter 3 Tables 3.12 - 3.18 and Volume II Appendix 3B, Table 4 of the Region K Water Supply Plan for the Lower Colorado Regional Water Planning Group (December 2000 Region K Plan), and
- September 2000 TWDB report on "Groundwater Availability of the Trinity Aquifer, Hill Country Area, Texas: Numerical simulations through 2050" by Robert E. Mace, et. al.

The District will review future and/or updated calculations being investigated and prepared by TWDB's Dr. Robert Mace using the Trinity aquifer model. The District will consider this and other new data as it becomes available and will amend this plan as appropriate.

Table 1

Current Groundwater Availability by Aquifer

NAME OF SOURCE	BASIN	YR2000	YR2010	YR2020	YR2030	YR2040	YR2050
Edwards-Trinity (Plateau)	Colo.	107	107	107	107	107	108
Edwards-Trinity (Plateau)	Guad.	50	50	50	50	50	51
Ellenberger-San Saba	Colo.	2,849	2,849	2,849	2,849	2,849	2,849
Ellenberger-San Saba	Guad.	1,025	1,025	1,025	1,025	1,025	1,025
Hickory	Colo.	747	747	747	747	747	747
Hickory	Guad.	165	165	165	165	165	165
Marble Falls	Colo.	300	300	300	300	300	300
Other Aquifer (*see note on page 11)	Colo.	10,000	10,000	10,000	10,000	10,000	10,000
Trinity	Colo.	1,149	1,149	1,149	1,149	1,149	942
Trinity	Guad.	451	451	451	451	451	373
(*Other Aquifer to be omitted…see note on page 11)		-10,000	-10,000	-10,000	-10,000	-10,000	-10,000
Projected Water Supply (less Other Aquifer)		**6,843**	**6,843**	**6,843**	**6,843**	**6,843**	**6,560**

For District management and planning purposes, the groundwater availability listed for the five aquifers identified in the Region K Plan will be utilized until more accurate data can be obtained. It should be noted that, as of November 2002, the District has not identified any wells producing significant groundwater from the Edwards-Trinity (Plateau); therefore we do not expect the previously estimated 157 ac/ft to remain a valid quantity.

Special Note and Point of Clarification: The Region K Water Supply Plan includes 10,000 ac/ft of water available from an "Other Aquifer" (see Table 1 and 3). Neither the District, nor the TWDB, nor the Region K consulting engineers have been able to locate and verify the origin or basis for the inclusion of the "Other Aquifer". Therefore, despite its presence in the Region K Plan, the District has omitted "Other Aquifer" from Table 1 and 3 and will not incorporate the "Other Aquifer" until its existence is verified by an appropriate state agency or other authority. District management strategies will not include "Other Aquifer" groundwater resources until a specific aquifer or groundwater resource is identified and accepted by the District as a true aquifer or groundwater resource.

Table 2

Estimated Annual Groundwater Pumpage for Blanco County in Acre/Feet

(source: TWDB Annual Water Use Survey Data)

Aquifer	Year	Municipal	Mfg	Power	Mining	Irrigation	Livestock	Yearly Totals
Ellenburger - San Saba	1980	183	0	0	0	102	227	**1980**
Trinity	1980	167	0	0	0	47	160	886
Ellenburger - San Saba	1984	266	0	0	0	319	192	**1984**
Trinity	1984	187	0	0	0	38	135	1137
Ellenburger - San Saba	1985	337	0	0	0	226	200	**1985**
Trinity	1985	163	0	0	0	28	141	1095
Ellenburger - San Saba	1986	426	0	0	0	227	225	**1986**
Trinity	1986	168	0	0	0	28	159	1233
Ellenburger - San Saba	1987	450	0	0	0	227	224	**1987**
Trinity	1987	189	0	0	0	28	157	1275
Ellenburger - San Saba	1988	497	0	0	0	227	234	**1988**
Trinity	1988	196	0	0	0	28	166	1348
Ellenburger - San Saba	1989	511	0	0	0	412	238	**1989**
Trinity	1989	183	0	0	0	41	167	1552
Ellenburger - San Saba	1990	407	0	0	0	378	260	**1990**
Trinity	1990	236	0	0	0	47	183	1511
Ellenburger - San Saba	1991	405	0	0	0	378	265	**1991**
Trinity	1991	238	0	0	6	47	186	1525
Ellenburger - San Saba	1992	411	0	0	0	378	315	**1992**
Trinity	1992	238	0	0	6	47	221	1616
Ellenburger - San Saba	1993	419	0	0	0	374	307	**1993**
Trinity	1993	249	0	0	6	51	215	1621
Ellenburger - San Saba	1994	415	0	0	0	308	248	
Other Un-differentiated	1994	0	0	0	0	64	0	**1994**
Trinity	1994	290	0	0	6	51	173	1555
Ellenburger - San Saba	1995	497	0	0	0	329	275	
Hickory	1995	0	0	0	0	68	0	**1995**
Trinity	1995	305	0	0	6	54	192	1726
Ellenburger - San Saba	1996	527	0	0	0	327	225	
Hickory	1996	0	0	0	0	68	0	**1996**
Trinity	1996	286	0	0	6	54	157	1650
Ellenburger - San Saba	1997	512	0	0	0	327	233	
Hickory	1997	0	0	0	0	68	0	**1997**
Trinity	1997	298	0	0	6	54	162	1660
Ellenburger - San Saba	1999	580	0	0	0	327	219	
Hickory	1999	0	0	0	0	68	0	**1999**
Trinity	1999	322	0	0	6	54	152	1728
Ellenburger - San Saba	2000	570	0	0	0	53	209	
Hickory	2000	0	0	0	0	11	0	**2000**
Trinity	2000	326	0	0	6	9	145	1329

The Trinity aquifer in Blanco County is comprised primarily of the Upper and Lower Glen Rose Limestone, Hensell Sand, and the Cow Creek Limestone. It extends across the majority of Blanco County, except in the northwestern corner of the county where Precambrian rock predominates. The Trinity aquifer is recharged from local precipitation on its outcrop and through the overlying units where it is in the subsurface. Yields vary greatly and are highly dependent on local subsurface physical characteristics. Yields are generally low, less than 20 gpm, but can occasionally be significantly higher, with yields of 50-90 gpm being reported. Production from Trinity wells is primarily used for municipal, rural domestic and livestock demands. A small amount of irrigation occurs for flower nurseries, vegetables, hay crops, peaches, pecans, grapes and grains.

The Edwards-Trinity (Plateau) aquifer within Blanco County is scattered across the county and is located at higher elevations along ridges. It is comprised of relatively thin layers of limestone and dolomite that is an extension of the Edwards Plateau into Blanco County from the west. Yields from the aquifer are probably low (>20 gpm) and the water, if used at all, is probably used occasionally for rural domestic and livestock demands. The Edwards-Trinity aquifer in Blanco County exists in an unconfined condition. Recharge is solely from local precipitation occurring over the outcrop. Water not pumped from wells will generally discharge from small seeps and springs at the base of the Edwards outcrop and provides base flow to small streams within the county. No wells producing from the Edwards-Trinity (Plateau) have been identified by the District as of November 2002.

The Ellenburger aquifer is a fractured limestone and dolomite and is present in the north central portions of the county. It lies generally west of Cypress Mill and north of US 290. From the outcrop areas, the aquifer dips predominately southeastward into the subsurface at angles up to 10 degrees in some areas. It is absent in a broad area extending from the central portion of the county continuing to the southern and eastern parts of Blanco County. Once again, well yields vary greatly depending on local conditions. Many Ellenburger wells have been pumped at rates between 3-45 gpm. In some areas though, significant localized development of subsurface solutional features has occurred within the Ellenburger resulting in it being able to produce very large quantities of groundwater (sometimes >200 gpm). The Ellenburger aquifer is utilized extensively by Johnson City and many domestic and livestock users in that region of Blanco County. Recharge to the Ellenburger is mainly through outcrops or overlying members of the Trinity aquifer.

The Hickory aquifer is comprised of sandstone and is found in northwestern Blanco County. Exposures are highly irregular in shape, due to both faulting and overlapping by Cretaceous rocks. This aquifer dips predominantly southeastward from the outcrop areas at angles of about 10 degrees in some areas. The Hickory yields low to moderate quantities of water. Well drillers have reported new wells producing up to 30 gpm. Recharge to the Hickory occurs from local precipitation on its outcrop and through the overlying units, where it is in the subsurface.

The Marble Falls aquifer is a limestone aquifer located in the general vicinity of Pedernales Falls State Park and Cypress Mill. It is reported to be highly fractured with extensive development of subsurface solutional features. In areas where the confining rock layers are thin or nonexistent, the Marble Falls aquifer may by hydrologically connected to the Ellenburger. This rather isolated and minor aquifer yields low to moderate quantities of water. Some wells in Blanco County have produced water with high nitrate concentrations. Due to its small surface extent, groundwater usage is generally limited to local domestic and livestock needs.

Surface Water Resources and Usage in Blanco County

Within the District, all surface water impoundments consist of relatively small ponds and a few small dams on the Pedernales River, Blanco River, and their tributaries. The City of Blanco currently holds 600 acre/feet of surface water rights from the Blanco River (Region K Plan, Appendix 3B, Table 5) and uses the Blanco River as the primary source of city municipal water. Johnson City maintains 220 acre/feet of surface water rights on the Pedernales River. However, Johnson City is currently relying on groundwater from a series of wells and is not withdrawing from the Pedernales River at this time. Local usage of surface water (usually for livestock watering or limited irrigation from small ponds or small scale diversions from surface streams) is termed "local supply" in the Region K Plan and totals approximately 248 ac/ft annually. Therefore, annual surface water availability in Blanco County totals approximately 1,068 ac/ft.

Projected Total Water Supply in Blanco County

As shown in Table 3, the projected total water supply in Blanco County currently stands at 4,939 ac/ft (4,639 ac/ft of groundwater and 300 ac/ft of surface water). Of this total water supply, an estimated current demand of 2,530 ac/ft is supplied to water users through existing infrastructure (see Table 7). As future demands increase, changes in the infrastructure will be necessary. It is projected that the greatest demand on water resources will be from rural domestic users who will rely primarily on groundwater. The majority of infrastructure improvements necessary to service these new groundwater users will be provided by either local property owners or by small public water supply companies. Therefore, it is anticipated that the amount of water supplied at any given time will be primarily related to rural growth patterns.

Table 3

Projected Total Water Supply in Blanco County

(source: Region K Regional Water Plan)

Community	Basin	Source	YR2000	YR2010	YR2020	YR2030	YR2040	YR2050
Blanco	Guad.	Blanco Lake/Reservoir	300	300	300	300	300	300
Blanco	Guad.	Trinity Aquifer	25	25	25	25	25	25
Johnson City	Colo.	Ellenburger-San Saba Aquifer	887	887	887	887	887	887
County-Other	Colo.	Other Local Supply	37	43	49	55	57	56
County-Other	Colo.	Ellenburger-San Saba Aquifer	150	150	150	150	150	150
County-Other	Colo.	Hickory Aquifer	60	60	60	60	60	60
County-Other	Colo.	Other Aquifer	30	30	30	30	30	30
County-Other	Colo.	Trinity Aquifer	1,149	1,149	1,149	1,149	1,149	942
County-Other	Guad.	Edwards-Trinity Plateau Aquifer	50	50	50	50	50	50
County-Other	Guad.	Trinity Aquifer	211	211	211	211	211	173
Mining	Colo.	Other Aquifer	8,970	8,970	8,970	8,970	8,970	8,970
Mining	Colo.	Ellenburger-San Saba Aquifer	285	285	285	285	285	285
Irrigation	Colo.	Other Aquifer	1,000	1,000	1,000	1,000	1,000	1,000
Irrigation	Colo.	Ellenburger-San Saba Aquifer	667	667	667	667	667	667
Irrigation	Guad.	Irrigation Local Supply	9	9	9	9	9	9
Irrigation	Guad.	Trinity Aquifer	89	89	89	89	89	76
Livestock	Colo.	Livestock Local Supply	101	101	101	101	101	101
Livestock	Colo.	Ellenburger-San Saba Aquifer	749	749	749	749	749	749
Livestock	Guad.	Livestock Local Supply	101	101	101	101	101	101
Livestock	Guad.	Trinity Aquifer	69	69	69	69	69	56
Total Other	Aquifer	(to be omitted…see note on page 11)	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000
Projected Water	**Supply**	**(less Other Aquifer)**	**4,939**	**4,945**	**4,951**	**4,957**	**4,959**	**4,687**

Recharge of Groundwater in Blanco County

The annual natural recharge occurring in Blanco County is thought to be primarily through percolation of rainfall countywide. More localized recharge, along with potentially higher rates of recharge, is probably occurring in the beds of rivers and tributaries. The District is currently unaware of any significant recharge feature in Blanco County that may be providing a major avenue for recharge.

The District is unaware of any scientific study on recharge rates or aquifer capabilities specific to Blanco County as a whole. However, a calculated annual recharge coefficient of approximately 4% of annual rainfall was developed in the September 2000 TWDB report on "Groundwater Availability of the Trinity Aquifer, Hill Country Area, Texas: Numerical simulations through 2050" by Robert E. Mace, et. al. Although the actual coefficients presented in Figure 25 of that report vary from 3% to 5%, and only cover the lower half of Blanco County, it seems reasonable for the District to assume a 4% average for Blanco County Trinity aquifer recharge, (Mace, et. al. have done this for the Trinity Aquifer as a whole). John Ashworth also developed a similar annual effective recharge coefficient (also 4% of average annual rainfall…about 30 inches) for the Trinity aquifer in the Texas Department of Water Resources Report 273, Ground-Water Availability of the Lower Cretaceous Formations in the Hill Country of South-Central Texas, January 1983. However, the amount of recharge estimated using this method appears to be unrealistically high and fails to take into account other factors effecting recharge flow into and out of the Trinity aquifer in Blanco County. In Table 4, Mace, et. al. have provided a flow budget for Blanco County based on the Hill Country Trinity aquifer model:

Table 4

County flow budget from the Hill Country Trinity Aquifer Model (Mace and others, 2000) for the steady state model in 1975 for the Middle Trinity aquifer.

County	Recharge	Rivers	GHB	Lakes	Wells	X-flow in	X-flow out	Z-flow
Blanco	9,900	-13,400	0	0	-200	4,800	-9,200	8,200

Notes:

1. Units are in acre-ft/yr.
2. **GHB** refers to flow out of the Hill Country area to the south and east.
3. **X-flow in** refers to lateral flow into the county.
4. **X-flow out** refers to lateral flow out of the county.
5. **Z-flow** refers to flow into the Middle Trinity aquifer (downward cross-formational flow).
6. **Wells** is for 1975 pumping.
7. A negative sign refers to flow out of the county.
8. A positive sign refers to flow into the county.
9. Values greater than 100 acre-ft are rounded to the nearest 100 acre-ft and values less than 100 acre-ft are rounded to the nearest 10 acre-ft.
10. Because the table only represents the Middle Trinity aquifer, recharge may be zero or very small if the Middle Trinity sediments are not exposed at land surface.

Mace, R. E., Chowdury, A. H., Anaya, R., and Way, S.-C., 2000, Groundwater availability of the Middle Trinity aquifer, Hill Country area, Texas- Numerical simulations through 2050: Texas Water Development Board Final Report, 169 p.

The Region K Plan provides estimated annual recharge for the Edwards-Trinity (Plateau), Ellenburger, Hickory, and Marble Falls aquifers. If we accept these recharge capabilities and include the recharge estimated for the Trinity aquifer by Mace, et. al., the resulting estimated annual recharge for the five primary Blanco County aquifers is shown in Table 5. The District will review future and/or updated calculations being investigated and prepared by TWDB's Dr. Robert Mace using the Trinity aquifer model. The District will consider this and other new data as it becomes available and will amend this plan as appropriate.

Table 5

Blanco County Aquifers	**Estimated Annual Recharge**
Trinity	9,900 ac/ft
Edwards-Trinity (Plateau)	157 ac/ft
Ellenburger	2,136 ac/ft
Hickory	6,528 ac/ft
Marble Falls	300 ac/ft
TOTAL	**19,021 ac/ft**

These numbers clearly need further study and refinement to more accurately correlate estimated recharge with estimated groundwater availability. The estimated annual recharge for the Ellenberger is less than, and the estimated annual recharge for the Hickory far exceeds, the available water shown in Tables 1 and 3. The calculated recharge potential for the Trinity aquifer and the Hickory may be deceptively high when viewed in terms of groundwater actually available for well production.

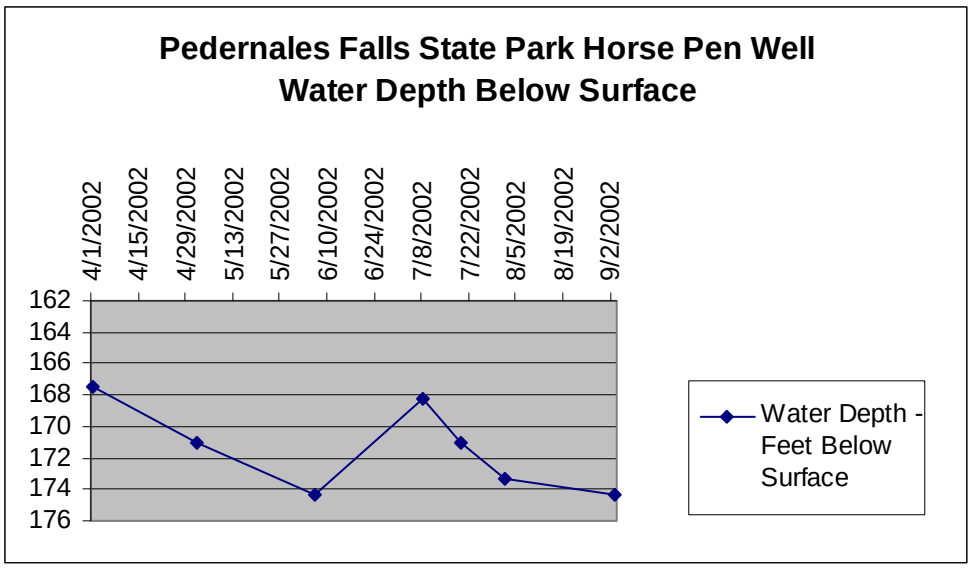
These recharge potentials are not to be confused with "recoverable" groundwater. Not all groundwater is recoverable. Some is lost to spring flow and seeps, some is used by plant life while the water is still near the surface, while some is almost permanently retained within the rock itself. For instance, much of the Trinity is a rather "tight" formation, particularly in the vertical direction. The Trinity is known for its low porosity and permeability, limited fracturing and faulting, and a complicated stratigraphy that includes layers of rock that reduce transmissivity and retard downward-moving recharge water. As a result, individual well yields are often quite low and, though large quantities of water may be present in the subsurface, much of the groundwater may be unrecoverable due to these hydrogeologic conditions.

As previously mentioned, considerable amounts of water recharging the Trinity aquifer will be lost, some through biologic uptake and a significant amount through discharge at springs and seeps that provide relatively reliable base flow to local rivers and tributaries. Thus, much of the annual recharge may enter the ground, only to quickly leave it again as base flow to surface streams. This is water that the aquifer rejects on an average annual basis and is potentially available and can theoretically be retrieved (at least on a short-term basis) without diminishing the average volume of groundwater being recharged to storage or, in other words, without creating a mining situation within the aquifer. However, if extensive pumping of this available water occurs, then base flow to area springs and streams will be greatly reduced and the effects of this reduction may be undesirable. Extensive pumping will also reduce the pressure head and may result in a significantly smaller quantity of recharge water actually percolating downward through the complex geology before providing deeper aquifer recharge that would be available for more reliable, long-term well production. Once pumping exceeds average annual recharge, then an aquifer mining condition will exist and groundwater availability will decline. Until further studies can provide more accurate estimates of average annual recharge, management strategies for the Trinity aquifer should rely on the 1,600 ac/ft of Trinity groundwater estimated

as available for production by the Region K plan.

Table 6 illustrates how heavy rainfall during July 2002 resulted in significant recharge and a rapid rise in water levels in local wells, only to return to previous levels over a two month period as groundwater was discharged, most likely through springs and seeps.

Table 6



Recharge Enhancement Potential

The District is just beginning operations and has yet to assess potential recharge projects in Blanco County. The District General Manager will solicit ideas and information and will investigate any potential recharge enhancement opportunity, natural or artificial, that is brought to the District's attention. Such projects may include, but are not limited to: cleanup or site protection projects at any identified significant recharge feature, encouragement of prudent brush control practices, non-point source pollution mitigation projects, aquifer storage and recovery projects, development of recharge ponds or small reservoirs, and the encouragement of appropriate and practical erosion and sedimentation control at construction projects located near surface streams.

Projected Population and Water Demands in Blanco County

Population and water demand projections are given for Blanco County in Volume II Appendix 2A, Table 2A-9 of the Region K Plan. However, the 2000 Census has provided new population data. This data has been incorporated by the TWDB for an upcoming revision of the Region K Plan. The following tables incorporates those revisions and provides updated Blanco County populations and water demand projections for every ten years beginning in 2000 and ending with 2060. Updated annual municipal/rural water demands in Table 7 are based on the new population data multiplied by a Per Capita Rate (calculated from the estimated populations and municipal/rural demands in the original Region K Plan). Estimated demands on groundwater by irrigation, mining, and livestock users have been left unchanged except for estimating the 2060 demands.

Table 7

Blanco County Population Projections and Water Demands

Blanco County Population Projections (based on 2000 Census)	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Blanco	1,238	1,505	1,672	1,870	2,059	2,224	2,403	2,611
Johnson City	932	1,191	1,353	1,545	1,728	1,888	2,062	2,264
County Other	3,802	5,722	6,921	8,341	9,700	10,890	12,176	13,669
Total	**5,972**	**8,418**	**9,946**	**11,756**	**13,487**	**15,002**	**16,641**	**18,544**

Blanco County Water Demands	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
(Per Capita Rate)		.165	.151	.140	.136	.132	.132	.132
Municipal/Rural (Pop. x Per Capita Rate)	n/a	1,389	1,506	1,649	1,835	1,986	2,198	2,448
Irrigation	n/a	458	435	413	392	362	353	350
Mining	n/a	13	9	5	1	0	0	0
Livestock	n/a	670	670	670	670	670	670	670
Total Water Demand	n/a	**2,530**	**2,620**	**2,737**	**2,898**	**3,018**	**3,221**	**3,468**

Up to the year 2060, total countywide water demand is estimated to increase approximately 25.2%, from 2,530 ac/ft to 3,168 ac/ft. The estimated amount of groundwater currently available within the county is approximately 6,843 ac/ft per year. As a result, it would appear that there will be a surplus of 3,675 ac/ft per year in the year 2060 and no shortfall should occur. This will probably be the case for some of the county's aquifers and areas. However, there will probably be areas of the county where demand will be such that some of the aquifers with low production capability will be in a stressed condition and may not be able to meet higher demand.

Much of the growth now occurring in Blanco County is focused on the southern end of the county. This area is served primarily by private water wells producing from the Upper and Lower Glen Rose stratigraphic units of the Trinity Aquifer. This aquifer is well known for low yield wells (5-10 gpm seems to be the average) as well as some water quality concerns involving hardness and odors. It is conceivable that with continued growth, this particular aquifer could be overextended during the next 48 years to the point where quantity and quality problems may increase.

The Ellenburger Aquifer as a whole should be able to meet future demands placed on it through the year 2060. However the District believes that the areas adjacent to Johnson City may experience seasonal shortfalls from the Ellenburger if development of small acreage lots increases. Many of these developments will be solely dependent upon the Ellenburger since the underlying Precambrian rocks are essentially void of groundwater. Consequently, the Ellenburger adjacent to Johnson City will need to be carefully monitored in order to determine how long it will be able to meet future demands of local users.

The Edwards-Trinity (Plateau), Hickory, and Marble Falls aquifers are located in areas that are not expected to undergo extensive development and are not likely to experience water quantity or quality problems during the 50 year planning horizon.

GROUNDWATER MANAGEMENT POLICIES

The District will manage the supply of groundwater within the District based on the District's best available data and its assessment of water availability and groundwater storage conditions. The Groundwater Availability Model (GAM 2000 and any subsequent updates) developed by the TWDB for the Trinity Aquifer will also aid in the decision making process by this District in the management of Blanco County groundwater.

The District shall promulgate Rules that will require the permitting of wells and groundwater production limits for non-exempt wells within the District consistent with the provisions of Chapter 36.113 and other pertinent sections of Chapter 36.

The District is in agreement with the opposition to mining of groundwater expressed in the Region K Plan (ES.6.1). Therefore, it shall be the policy of the District to limit withdrawal of groundwater from permitted wells producing from Blanco County aquifers to no more than the current groundwater availability volumes indicated for the individual aquifers in the Region K Plan (December 2000). These volumes are listed in Table 1 of this Groundwater Management Plan. Development or analysis of new or existing groundwater or aquifer data may result in changes to the groundwater availability volumes, with a corresponding change in production limits from the affected aquifers.

The District shall promulgate Rules that will regulate the spacing of wells and the production of groundwater consistent with the provisions Chapter 36.116. The District wishes to emphasize that in regulating or limiting groundwater production, it shall be the policy of the District to preserve historic use prior to February 11, 2002 (the effective date of the District's Rules) to the greatest extent practical and consistent with this plan.

The District will implement and utilize the provisions of this groundwater management plan for all District activities. The District's current and future Rules will be promulgated pursuant to the provisions of Texas Water Code Chapter 36 and shall address, implement, and be consistent with the provisions and policies of this plan.

The District shall review and re-adopt this plan, with or without revisions, at least once every five years in accordance with Chapter 36.1072(e).

Any amendment to this plan shall be in accordance with Chapter 36.1073.

The District will seek cooperation and coordination in the development and implementation of this plan with the appropriate state, regional or local water management or planning entities.

The District will monitor groundwater conditions through its water level and water quality monitoring programs that are currently in place and will continue to maintain and update the District's database, which was established in 2002.

If necessary, the District may, through the rule-making process, identify areas within the District which, based on results from District aquifer monitoring, are identified as Critical Groundwater

Depletion Areas. These areas, when identified by the District in accordance with District Rules, may require specific pumping limits or reduction measures to ensure that groundwater supply is maintained and protected.

The District will encourage cooperative and voluntary Rule compliance, but if Rule enforcement becomes necessary, the enforcement will be legal, fair, and impartial.

METHODOLOGY FOR TRACKING PROGRESS IN ACHIEVING MANAGEMENT GOALS

The District will use the following methodology to track its progress toward achieving its management goals:

The District General Manager will present an annual report to the Board of Directors on District performance and progress in achieving management goals and objectives at the last regular Board meeting of the fiscal year beginning in Fiscal Year 2003 (September meeting).

GROUNDWATER MANAGEMENT GOALS

1.0 Implement management strategies that will provide for the most efficient use of groundwater.

1.1 Management Objective

Implement and maintain a program of issuing well operating permits for non-exempt wells within Blanco County.

Performance Standards

Ongoing program of issuance or re-issuance of well operating permits each year.

1.2 Management Objective

Incorporate well spacing requirements in District Rules to help reduce or prevent interference between nearby wells. Spacing requirements will be coordinated to the greatest extent possible with Blanco County subdivision regulations and the Water Well Drillers Rules (16 Texas Administrative Code Chapter 76).

Performance Standards

Annual report submitted to the Board regarding suitability of current District well spacing rules and their compatibility with Blanco County subdivision regulations and the Water Well Drillers Rules.

2.0 Implement strategies that will control and prevent waste of groundwater.

2.1 Management Objective

Each year the District will provide to local newspapers at least one article describing a 5-7 day summer watering schedule and water efficient practices available for implementation by groundwater users during summer months.

Performance Standards

Number of summer watering articles submitted to local newspapers each year.

2.2 Management Objective

Provide to the public, upon request, water efficient literature handouts.

Performance Standards

Each year provide water efficient literature handouts on at least one occasion.

2.3 Management Objective

Provide either a speaker at a local club or organization or a display booth at public events twice each year.

Performance Standards

Number of speaking engagements or booth displays each year.

3.0 Implement strategies that will control and prevent subsidence.

The rigid geologic framework of the region precludes significant subsidence from occurring. Therefore, this goal is not applicable to the operations of this District.

4.0 Implement management strategies that will address conjunctive surface water management issues.

4.1 Management Objective

Assist Blanco County Commissioners Court in the evaluation of water availability reports submitted in accordance with County subdivision requirements.

Performance Standard

Implement and maintain an inter-governmental cooperative agreement such as a Memorandum of Understanding (MOU) with Blanco County to review groundwater availability reports on an annual basis.

4.2 Management Objective

Determine if studies may be warranted regarding possible need to develop correlations between spring flow, surface stream elevations/flows, rainfall, and groundwater levels.

Performance Standard

Annual report submitted to Board on determination of whether such studies may be warranted.

4.3 Management Objective

Investigate potential opportunities for recharge enhancement projects, either natural or artificial.

Performance Standard

Annual report submitted to Board on investigation of potential recharge enhancement opportunities, if any.

5.0 Implement strategies that will address natural resource issues which impact the use and availability of groundwater, or which are impacted by the use of groundwater.

The District is not aware of any such natural resource issues. Therefore, this goal is not applicable to the operations of the District at this time.

6.0 Implement strategies that will address drought conditions.

6.1 Management Objective

Quarterly, review applicable data to determine status of drought condition and, if necessary, report to District Board on need to implement drought contingency plan.

Performance Standards

Annual report submitted to Board on drought conditions in preceding year.

6.2 Management Objective

Provide to the public, upon request, drought-orientated literature handouts.

Performance Standards

Each year provide drought-orientated literature handouts on at least one occasion.

6.3 Management Objective

To evaluate groundwater availability each year the District will monitor water levels on selected wells representative of the two major aquifers within the District in accordance with the water level monitoring schedule in Table 8.

Table 8

Water Level Monitoring Schedule

Aquifer	# of Wells	Minimum Frequencies
Trinity	3	4 times per year
Ellenburger	2	3 times per year

Performance Standard

Number of water level records measured annually.

6.4 Management Objective

By October 2004, utilizing a system of either/or rainfall, local aquifer conditions, the Palmer Drought Severity Index, or other appropriate criteria, determine, identify, and designate one or more mechanisms to trigger implementation of drought management plans.

Performance Standard

Identification and designation of trigger conditions within District aquifers by October 2004 used to indicate drought conditions and trigger subsequent implantation of emergency drought management plans.

7.0 Implement strategies that will address groundwater conservation.

7.1 Management Objective

Each year the District will provide to local newspapers at least one article identifying the importance of water conservation and various water conservation methods available for implementation by groundwater users.

Performance Standards

Each year provide water conservation oriented article to local newspapers on at least one occasion.

7.2 Management Objective

Provide to the public, upon request, conservation literature handouts.

Performance Standards

Each year provide conservation literature handouts on at least one occasion.

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Blanco-Pedernales Groundwater Conservation District

304 East Main, P.O. Box 1516, Johnson City, Texas 78636 (830) 868-9196 FAX (830) 868-0376

www.blancocountygroundwater.org

manager@blancocountygroundwater.org