

GROUNDWATER MANAGEMENT PLAN
FOR
BANDERA COUNTY RIVER AUTHORITY AND
GROUNDWATER DISTRICT

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AS AMENDED AND ADOPTED

APRIL 8, 2010

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TEXAS WATER CODE BACKGROUND

In 1917, an amendment to the Texas Constitution was added, Article XVI, Section 59 allowing for the creation of CONSERVATION AND DEVELOPMENT OF NATURAL RESOURCES; CONSERVATION AND RECLAMATION DISTRICTS. Through this amendment, all of the various types of water districts were created. Underground water conservation districts, or groundwater conservation districts as they are currently called, have been authorized and created in Texas since 1949 by authority of Article III, Section 52, or Article XVI, Section 59, of the Texas Constitution. Each water district is created with specific authorities, listed in their enabling legislation, which address the needs and functions necessary for the district's region. The different authorities are stated in the different chapters of the Texas Water Code.

BANDERA COUNTY RIVER AUTHORITY

In 1971, the 62nd Texas Legislature created the Bandera County River Authority under House Bill 988. It was created as a conservation and reclamation district under and pursuant to Article XVI, Section 59, of the Texas Constitution. As defined by Article 8280-526, Vernon's Texas Civil Statutes, the River Authority encompassed all of the territory contained in Bandera County except the territory included in the Bandera County Fresh Water Supply District No. 1 (Pebble Beach) and the Bandera County Water Control and Improvement District No. 1 (City of Bandera).

According to the provisions of the legislation, the Bandera County River Authority shall have and exercise and is hereby vested with, all of the rights, powers, privileges, authority and duties conferred and imposed by the general laws of this state now in force or hereafter enacted, applicable to water control and improvement districts created under authority of Article XVI, Section 59 of the Texas Constitution; but to the extent that the Provisions of any such general laws may be in conflict or inconsistent with the provisions of this Act, the provisions of this Act shall prevail. All such general laws are hereby adopted and incorporated by reference with the same effect as if incorporated in full in this Act.

SPRINGHILLS WATER MANAGEMENT DISTRICT

The Bandera County River Authority was a springboard for the creation of the joint surface and groundwater district. Beginning with the reorganization of the River Authority Board of Directors in 1985, the Directors began working with State and local officials, and concerned citizens to determine the most advantageous method to manage groundwater in Bandera County. After numerous public meetings the decision was made to pursue legislation creating a joint surface and groundwater district in Bandera County. The result was the creation and confirmation of the Springhills Water Management District.

Springhills Water Management District was created under Senate Bill 1636. The District's enabling legislation, appearing as Act of June 17, 1989, Ch. 654, 1989, Tex.

Gen. Laws 2155 (Vernon), granted the District the rights, powers, privileges, authority, functions, and duties provided by Chapters 50 and 52; and the rights, powers, purposes, authority, and functions of the Bandera County River Authority. The legislation defines the District's boundaries as all of the territory contained within Bandera County. The legislation further stipulates that the Board of Directors will be composed of nine (9) directors. The directors will be elected from commissioner precincts with one director at large.

The Springhills Water Management District continued all of the programs and activities initiated by the River Authority, and implemented the programs required of a groundwater conservation district.

BANDERA COUNTY RIVER AUTHORITY AND GROUNDWATER DISTRICT

On April 10, 2003, the TCEQ authorized changing the District's name to Bandera County River Authority and Groundwater District. The BCRAGD continues all the programs and activities of Springhills Water Management. The District has all of the rights, powers, privileges, authority, functions, and duties now provided by Chapter 36 of the Texas Water Code.

TEXAS WATER CODE CHAPTERS

At the time of the Bandera County River Authority's conception, water control and improvement districts originally fell under Chapters 50, and 51.

Ch. 50 - *Provisions Generally Applicable to Districts*, an administrative chapter.

Ch. 51 - *Water Control and Improvement Districts*, specific authority granted to water control and improvement districts.

Major portions of these Chapters were repealed and replaced by Chapters 36 and 49, which were enacted in 1995 by the 74th Legislature. Chapter 36 is the chapter applicable to Bandera County River Authority and Groundwater District, when the District utilizes its water control and improvement authority.

Ch. 49 - *Provisions Applicable to All Districts*, an administrative chapter applicable to any conservation and reclamation district unless superseded by another chapter of the Texas Water Code. (This chapter is applicable to Bandera County River Authority and Groundwater District only when the water control and improvement district powers are used.)

PURPOSE OF A DISTRICT

Texas Water Code, Chapter 51, Water Control and Improvement District 51.121. Purposes of District (River Authority)

A water control and improvement district organized under the provisions of Article XVI, Section 59, of the Texas Constitution, may provide for:

- (1) The control, storage, preservation, and distribution of its water and floodwater and the water of its rivers and streams for irrigation, power, and all other useful purposes;
- (2) The reclamation and irrigation of its arid, semiarid, and other land which needs irrigation;
- (3) The reclamation, drainage, conservation, and development of its forests, water, and hydroelectric power;
- (4) The navigation of its coastal and inland water;
- (5) The control, abatement, and change of any shortage or harmful excess of water;
- (6) The protection, preservation, and restoration of the purity and sanitary condition of water within the state; and
- (7) The preservation and conservation of all natural resources of the state.

The purposes stated in Subsection (b) of this section may be accomplished by any practical means.

Texas Water Code, Chapter 36, Groundwater Conservation Districts 36.0015. Purpose (Groundwater)

In order to provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater, and of groundwater reservoirs or their subdivisions, and to control subsidence caused by withdrawal of water from those groundwater reservoirs or their subdivisions, consistent with the objective of Section 59, Article XVI, Texas Constitution, groundwater conservation districts may be created as provided by this chapter. Groundwater conservation districts created as provided by this chapter are the state's preferred method of groundwater management.

ACTIVITIES OF THE DISTRICT

Since the groundwater district was formed, programs have been implemented to collect data from the aquifers and streams to better understand the subsurface and surface water in the county. Rules have been developed and adopted to regulate and record drilling of water wells. The following list includes programs conducted by the District:

1. The District registers and permits water wells. Each well is assigned a permit or registration number and is furnished with a brass well marker

displaying the number, which must be placed in the slab. The District conducts random inspections during drilling of the wells. Upon submission of the completion paperwork by the driller, the district inspects 100% of the completed wells. This inspection includes inspection of the slab, verification of the registration/permit number, a GPS reading, measurement of the water level and collection of a water sample, if possible.

2. The District samples surface water streams throughout the county to determine water quality and check for bacteriological contamination. During the summer months, a water quality report is made to the local newspapers in order to advise the public of poor water conditions for recreational contact. The District operates a non-certified lab for a majority of the sample analysis. The lab is also available for public use.
3. The District has purchased a grout machine to plug abandoned and deteriorated wells in the county. A budget is set each year to cover the cost of the plugging program.
4. In addition to the administrative requirements of the District, programs are developed to distribute literature on water conservation and to inform the public on activities of the District. An aquifer model is used for a demonstration in schools and at school related events.
5. The District's monitor well program includes a program of measuring water levels and collecting water samples from designated wells twice a year. The District has also been able to find some wells that could be dedicated to continuous monitoring. Instruments have been installed in these wells and are checked and/or downloaded each calendar quarter. The District's database is currently being upgraded to handle the data collected from these wells.
6. Rainfall data is collected on a daily basis by at least sixteen volunteers scattered across the county. These volunteers send in the rainfall reports on a quarterly basis. This data is used to study rainfall and its possible impact on the recharge of the aquifer.
7. The District investigates complaints relating to contaminants and spills from all sources of potential pollution such as petroleum, herbicides, illegal dumping, etc., as a means to protect water quality within the District.

TIME PERIOD FOR THIS PLAN

This plan becomes effective upon approval by the Texas Water Development Board (TWDB) and adoption by Bandera County River Authority and Groundwater District's Board of Directors, and remains in effect until a revised plan is approved and adopted. The plan may be revised at anytime, or after five years, when the plan will be reviewed to insure that it is consistent with applicable Regional Water Plans and the State Water Plan.

LOCATION AND EXTENT

Bandera County lies in the south central part of Texas, in the hill country region of the Edwards Plateau. The County has an areal extent of 768 square miles, or 491,520 acres. The County seat, the city of Bandera, is centrally located at the intersection of State Highways 16 and 173. Kerr, Kendall, Bexar, Medina, Uvalde, and Real Counties bound the County, in a clockwise pattern. Bandera County River Authority and Groundwater District encompasses all of Bandera County.

MANAGEMENT OF GROUNDWATER SUPPLIES

The District will continue to manage the supply of groundwater within the District in order to conserve the resource while seeking to maintain the economic viability of all resource user groups, public and private. In consideration of the economic and cultural activities occurring within the District, the District will identify and engage in such activities and practices that, if implemented, would result in a reduction of groundwater use. An observation network has been established and maintained in order to study and observe changing storage conditions of groundwater supplies within the District. The District will make a regular assessment of water supply and groundwater storage conditions and will report those conditions annually to the Board and make a report available to the public. The District will cooperate with investigations of the groundwater resource within the District and will make the results of investigations available to the public upon adoption by the Board.

The relevant factors to be considered in making a determination to deny a well permit or limit groundwater withdrawals will include:

- 1) The purpose of the rules of the District;
- 2) The equitable distribution of the resource;
- 3) The economic hardship resulting from grant or denial of a permit or the terms prescribed by the permit;
- 4) The landowner's rights to the water beneath his/her property, and any changes or restrictions to the right of capture laws of the State.

In pursuit of the District's mission of protecting the resource, the District may require reduction of groundwater withdrawals to amounts that will not cause harm to the aquifer. To achieve this purpose, the District may, at the Board's discretion, reduce or revoke any permits after notice and hearing. The determination to seek the amendment of a permit by the District will be based on aquifer conditions observed by the District. The District will enforce the terms and conditions of permits and the rules of the District by enjoining the permit holder in a court of competent jurisdiction as provided for in Texas Water Code, 36.102.

The District will employ all technical resources at its disposal to evaluate the resources available within the District and to determine the effectiveness of regulatory or conservation measures. A public or private user may appeal to the Board for discretion in enforcement of the provisions of the water supply deficit

contingency plan 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.

TOPOGRAPHY AND DRAINAGE

Ashworth (1983) describes the topography as:

“The land surface in Bandera County is characterized by rough and rolling terrain. The nearly flat-lying, erosion-resistant limestone rocks forming the surface of the Edwards Plateau have been deeply incised into the less resistant, marly limestone rocks of the Glen Rose Formation.”

The altitude of the land surface ranges from approximately 2,330 to 1,080 feet above mean sea level.

Wermund (1974) describes three different terrains in Bandera County as:

Along the “....., Sabinal Rivers, the terrain comprises both highly dissected divides and incised stream valleys. About the Medina and Guadalupe Rivers, most terrain lies in broad valleys and less occupies narrow divides.”

Bandera County contains parts of three major drainage basins. The Nueces River basin occupies approximately 25 percent of the County to the west and southwest, with drainage to the south. The San Antonio River basin occupies approximately 73 percent of the County; located from the north central, to the southeastern portion of the County, where the river has been dammed to form Medina Lake. Drainage from the San Antonio River basin is to the southeast. The Guadalupe River basin occupies approximately 2 percent of the County as a small portion of the central northern section. The two major rivers in the County are the Sabinal River, located in the Nueces River basin, and the Medina River, located in the San Antonio River Basin. The larger rivers are dominantly effluent and form wide valleys. Two dominant types characterize the smaller creeks and streams: the perennial spring-fed streams and the intermittent creeks that only transport precipitation runoff.

GROUNDWATER RESOURCES OF BANDERA COUNTY

The Trinity Group aquifer underlies all of Bandera County, underlying the Edwards Plateau aquifer in the northwest portion of the County and extending south into Medina and Uvalde counties and east into Kendall and Bexar counties. The Trinity Group aquifer is the primary source of groundwater in Bandera County. This aquifer is divided into three groups: the Upper Trinity, Middle Trinity, and Lower Trinity. The Upper Trinity aquifer contains the Upper Glen Rose Limestone. The Middle Trinity aquifer contains the Lower Glen Rose Limestone, the Hensell Sand, and the Cow Creek Limestone. The Lower Trinity aquifer is composed of the Sligo Limestone and

Hosston Sands. The Trinity Group aquifer yields groundwater from the Upper and Lower units of the Glen Rose Formation; and the Hensell, Cow Creek, Sligo, and Hosston members of the Travis Peak Formation of the Trinity Group of Cretaceous age. Down dip from the outcrop area, in the artesian pressure portion of the aquifer, groundwater production supplies water to all wells. Primary sources of recharge to the Trinity Group aquifer include the infiltration of precipitation on the outcrops to the north and northwest of Bandera County and infiltration of surface water from lakes and streams through vertical leakage from overlying formations. The Trinity Group aquifer primarily exists under water-table conditions along the outcrop and under artesian conditions down dip, where confining beds of limestone and shale bound the water-bearing units. Movement of shallow groundwater is primarily down gradient, from high to low elevations, and at right angles to the potentiometric surface contours, which denote the configuration of the water table. The overall groundwater movement is to the southeast with local movement away from groundwater highs, and along the surface drainage system, with groundwater lows that have developed as a result of production in large well fields.

Alluvial deposits are found in the flood plain of the major tributaries of streams, which make up the surface drainage system in the county. The alluvial deposits are highly permeable with a maximum thickness of approximately 50 feet and small areal extent. They yield only small amounts of good quality water. Due to the naturally occurring anhydrite and gypsum beds, the overall quality of groundwater obtained from the Upper Trinity aquifer, which contains the Upper Glen Rose formation is of poor quality, with small yield. The Middle Trinity aquifer, which contains the Lower Glen Rose Limestone, Hensell Sand, and Cow Creek Limestone formations, yields small to moderate amounts of water with a good to excellent water quality. The lower Trinity aquifer that contains the Sligo Limestone and Hosston Sand yields moderate to large quantities of water of good to excellent quality.

ANNUAL VOLUME OF GROUNDWATER USED IN BANDERA COUNTY

The 2006 Plateau Region Water Plan reports volumes of 2,855 acre-feet of water used in Bandera County in the year 2000. TWDB's Water Use Survey (a historical water summary of groundwater and surface water in Bandera County) contains data up to 2004. The amount of groundwater being used within the District on an annual basis is shown in Table 1.

Table 1 - Annual Volume of Groundwater Usage (acre-feet)

Year	1990	1995	2000	2001	2002	2003	2004
GW Usage	1848	2321	2653	2224	2402	2766	2083

AVAILABILITY AND GROUNDWATER FLOWS

Groundwater Availability

The availability of groundwater in Bandera County is reported in the January 2006 Plateau (Region J) Regional Water Plan as prepared by LBG-Guyton Associates, and the Texas Water Development Board's Hill Country Trinity Groundwater Availability Modeling (GAM) as reported in Report 353, *Groundwater Availability of the Trinity Aquifer, Hill Country Area, TEXAS: Numerical Simulation through 2050*. In the January 2006 Plateau (Region J) Regional Water Plan, the method used to estimate available groundwater is significantly different than the one used in 2001 Plateau Region Water Plan. The Plateau Water Planning Group in 2006 defines groundwater availability as a maximum level of aquifer withdrawal that results in an acceptable level of long-term aquifer impact, such that the base flow in rivers and streams is not significantly affected beyond a level that would be anticipated due to naturally occurring conditions (Plateau Region Water Plan).

The Plateau Water Planning Group also concludes that in general, the two completed GAMs incorporate the most currently available information for the Edwards-Trinity (Plateau) and Hill Country Trinity aquifers, and that the GAMs are an appropriate tool for analyzing groundwater availability in the Plateau Region.

Table 2 represents the groundwater availability estimates in the District under drought-of-record conditions as summarized in the 2006 Plateau Region Water Plan. The estimate of available groundwater from the Lower Trinity Aquifer is based on a groundwater availability model for the Lower Trinity which was developed under a contract with LBG-Guyton Associates (2009).

Table 2 - Groundwater Availability under Drought-of-Record Conditions

Aquifer	Available Groundwater (Ac-ft/yr)
Edwards Trinity Plateau Aquifer	17,310
Trinity Aquifer	18,558
Lower Trinity Aquifer	651
TOTAL	36,519

Table 3 summarizes the groundwater budget for Bandera County as determined by GAM Run 08-68 by the Texas Water Development Board. The information is derived from groundwater availability models for the Edwards Trinity Aquifer. The model derived the information required for this Management Plan as indicated in the table.

Table 3 – Groundwater Budget Information from GAM 08-68

(Summarized information needed for Bandera County River Authority and Groundwater District’s groundwater management plan. All values are reported in acre-feet per year. All numbers are rounded to the nearest 1 acre-foot.)

Management Plan Requirement	Aquifer or Confining Unit	Results
Estimated annual amount of recharge from precipitation to the District	Edwards and associated limestones	1,766
	Undifferentiated Trinity Units	52,731
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body, including lakes, streams and rivers	Edwards and Associated Limestones	3,355
	Undifferentiated Trinity Units	33,395
Estimated annual volume of flow into the district within each aquifer in the District	Edwards and Associated Limestones	917
	Undifferentiated Trinity Units	17,254
Estimated annual volume of flow out of the district within each aquifer in the District	Edwards and Associated Limestones	2,627
	Undifferentiated Trinity Units	32,463
Estimated net annual volume of flow between each aquifer in the District	Edwards and associated Limestones flowing into undifferentiated Trinity Units	96

A Desired Future Condition (DFC) has been established for the Edwards Formation in Bandera County. The Managed Available Groundwater (MAG) has been established in GAM run 08-90 MAG Report. Table 4 shows the estimates for the requested no net increase in the average drawdown from current conditions in the Edwards Formation of the Edwards Plateau Aquifer.

Table 4 – Managed Available Groundwater

AQUIFER	RIVER BASIN	MAG (acre-feet/year)
Edwards Group	Guadalupe	21
Edwards Group	San Antonio	561
Edwards Group	Nueces	14
Edwards Group Outside of Model Boundary	Nueces	87
Total		683

Data from TWDB, GAM Run 08-90 MAG, March 6, 2009

Groundwater Flows

An analysis performed by the Texas Water Development Board for the GAM modeling, and indicated in TWDB Report 353, indicates a range of annual rainfall from 6% on the western end of the county, to 4% in the eastern end of the county, with a probable average to be about 4.5% for recharge to the Trinity Aquifer.

Table 5 is a summary of the GAM 08-68 run that was performed in September 2008 for the District using the groundwater availability model the Edwards-Trinity (Plateau) Aquifer. It includes (1) the annual amount of recharge from precipitation to the groundwater within the District; (2) an estimate of the annual volume of water that discharged from each aquifer in the district to springs and surface water bodies; (3) an estimate of the annual volume of flow into the District within each aquifer; (4) an estimate of the annual volume of flow out of the District within each aquifer; and (5) an estimate of the annual volume of flow between aquifers in the District.

Table 5 - Flow Budget (acre-feet per year) from the Edwards-Trinity (Plateau) Aquifer Groundwater Availability Model

Aquifer	Recharge	Surface Water Outflow	Flow into the District	Flow out of the District	Vertical flow
Edwards Plateau	1,766	3,355	917	2,627	-96
Upper and Middle Trinity	52,731	33,395	17,254	32,463	96

Notes:

1. **Recharge** – areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifer within the district.
2. **Surface water outflow** – the total water exiting the aquifer to surface water features such as streams, reservoirs, and springs.
3. **Flow into and out of district** – lateral flow within the aquifer between the district and adjacent counties.
4. **Vertical flow** – flow between aquifers or confining units.
5. A negative sign refers to flow out of the layer in the county.
6. A positive sign refers to flow into the layer in the county.
7. Values are rounded to the nearest 1 acre-feet.

Artificial Recharge

Rapid rainfall runoff contributes to a low recharge rate. Due to the topography found in Bandera County, the recharge rate is low. A System of small dams along the intermittent tributaries of the major streams and rivers in the county would increase recharge of the Glen Rose, and possibly the Hensel and Cow Creek formations.

The Lower Trinity (Hosston and Sligo formations) are deep under land surface and are generally confined by the Hammett Shale. They are thus not readily recharged from surface features. More studies are needed to confirm that the Lower Trinity is a confined aquifer and to identify areas that can be recharged from dams. However, there is a potential to recharge the Lower Trinity through well injection. If the recharge percentage can be increased to 5.5% for the county, the amount of water replaced in the aquifer would increase from 53,452 acre-feet to 65,340 acre-feet per year, an increase of 11,888 acre-feet. The increase would more than offset this projected demand for groundwater for the next 50 years (see projected water demand).

Surface Water Availability

According to 2006 Plateau Region Water Plan, projected surface water supply under drought-of-record conditions is summarized in Table 6. The projected supply does not change over decades.

Table 6 - Total Surface Water Supply Available under Drought-of-Record Conditions (acre-feet)

RIVER	RIVER BASIN	SOURCE AVAILABILITY (All Decades)
Livestock Local Supply	San Antonio	72
Upper Guadalupe River	Guadalupe	3
Medina River	San Antonio	0
Medina Lake/Reservoir	San Antonio	0
Sabinal River	Nueces	7
Hondo Creek	Nueces	20
Total		102

Notes:

1. Numbers represent annual quantities
2. Surface-water sources were determined from gauged flows during drought conditions or from Water Availability Models.
3. Waters from Medina and Canyon Reservoirs are not currently in use in the Plateau Region.

Table 7 represents the projected surface water supplies available for Bandera County as indicated in Volume 3, 2007 State Water Planning Database.

Table 7 - 2007 State Water Plan Projected Surface Water Supplies for Bandera County

Water User Group	County	River Basin	Source Name	2010	2020	2030	2040	2050	2060
County Other	Bandera	San Antonio	Medina River Combined Run-of-River	0	0	0	0	0	0
County Other	Bandera	Nueces	Sabinal River Combined Run-of-River	2	2	2	2	2	2
Irrigation	Bandera	San Antonio	Medina River Combined Run-of-River	0	0	0	0	0	0
Irrigation	Bandera	Nueces	Sabinal River Combined Run-of-River	5	5	5	5	5	5
Irrigation	Bandera	Nueces	Hondo Creek Combined Run-of-River	20	20	20	20	20	20
Livestock	Bandera	San Antonio	Medina River Combined Run-of-River	0	0	0	0	0	0
Livestock	Bandera	San Antonio	Other Local Supply	72	72	72	72	72	72
Livestock	Bandera	Nueces	Sabinal River Combined Run-of-River	0	0	0	0	0	0
Total Projected Surface Water Supplies (acre-feet/ year) =				99	99	99	99	99	99

PROJECTED WATER SUPPLY AND DEMAND

The Texas Water Development Board, in Report 353, *Ground Water Availability of the Trinity Aquifer*, makes a projection of the groundwater withdrawal for Bandera County. The projected demand is for the Edwards Upper and Middle Trinity Aquifer and does not include the Lower Trinity Aquifer. The projected rate of groundwater withdrawal in acre-feet per year for Bandera County is shown in Table 8.

Table 8 – Projected Rate of Groundwater Withdrawal

Year	2010	2020	2030	2040	2050
Withdrawal (Ac-Ft/Yr)	4,703	4,598	5,019	5,519	6,070

The 2006 Plateau Region Water Plan projected water supply and demand for Bandera County is shown in Tables 9 and 10.

Table 9 - Water Supply by Water User Group (acre-feet per year)

WUG Name	Source Basin	2010	2020	2030	2040	2050	2060
Bandera	San Antonio	1,210	1,210	1,210	1,210	1,210	1,210
County – Other	Guadalupe	31	31	31	31	31	31
	Nueces	806	806	806	806	806	806
	San Antonio	10,673	10,673	10,673	10,673	10,673	10,673
Irrigation	Nueces	143	143	143	143	143	143
	San Antonio	207	207	207	207	207	207
Livestock	Guadalupe	6	6	6	6	6	6
	Nueces	95	95	95	95	95	95
	San Antonio	262	262	262	262	262	262
Mining	San Antonio	24	24	24	24	24	24
TOTAL		13,457	13,457	13,457	13,457	13,457	13,457

Table 10 - Bandera County Projected Water Demands

RWPG	WUG	County	River Basin	2010	2020	2030	2040	2050	2060
J	Bandera	Bandera	San Antonio	259	284	312	332	351	371
J	County Other	Bandera	Guadalupe	1	2	2	3	3	3
J	County Other	Bandera	San Antonio	2,425	3,381	4,330	4,817	4,932	5,232
J	County Other	Bandera	Nueces	183	255	327	386	439	491
J	Mining	Bandera	San Antonio	24	24	24	24	24	24
J	Irrigation	Bandera	San Antonio	283	283	283	283	283	283
J	Irrigation	Bandera	Nueces	181	181	181	181	181	181
J	Livestock	Bandera	Guadalupe	6	6	6	6	6	6
J	Livestock	Bandera	San Antonio	218	218	218	218	218	218
J	Livestock	Bandera	Nueces	91	91	91	91	91	91
Total Projected Water Demands (acre-feet per year)=				3,671	4,725	5,774	6,341	6,528	6,900

Data from Vol. 3, 2007 State Water Planning Database

The demand estimate is based on the projections of usage from the City of Bandera and other water systems in the county, along with agriculture, mining and industrial usage. The Plateau Report's projection includes the demand for the lower Trinity Aquifer. The Lower Trinity Aquifer has an estimated 64 wells, which includes the City of Bandera and other water supply systems as well as domestic and livestock wells. Of the 64 wells completed in the Lower Trinity, 35 of these wells are also completed to produce some water from the Middle Trinity Aquifer. The dual completion adds to the complexity of determining the percentage of use from the lower aquifer since recharge is being made to the lower aquifer from the upper aquifer. The water head is lower in the lower aquifer. More detailed information is needed to determine the affect of these wells on each aquifer and the water available for long-term projection of water demand.

Tables 9 & 10 indicate that a projected irrigation shortage will occur in Bandera County; therefore, there will be water supply needs.

Table 11 - Projected Water Management Strategies for Bandera County (acres-feet per year)

WUG	River Basin	Water Management Strategy	Source Name	Source County	2010	2020	2030	2040	2050	2060	WMS Project ID
Irrigation	San Antonio	Irrigation Scheduling	Conservation	Bandera	58	58	58	58	58	58	J-11
Irrigation	San Antonio	Volumetric Measurement of Water Use	Conservation	Bandera	0	0	0	0	0	0	J-12
Irrigation	San Antonio	Crop Residue Management and Conservation Tillage	Conservation	Bandera	88	88	88	88	88	88	J-13
Irrigation	Nueces	Crop Residue Management and Conservation Tillage	Conservation	Bandera	37	37	37	37	37	37	J-13
Irrigation	San Antonio	On-Farm Irrigation Audit	Conservation	Bandera	0	0	0	0	0	0	J-14
Irrigation	San Antonio	Low Pressure Center Pivot Sprinkler Systems	Conservation	Bandera	3	3	3	3	3	3	J-15
Irrigation	Nueces	Low Pressure Center Pivot Sprinkler Systems	Conservation	Bandera	1	1	1	1	1	1	J-21

Data from Volume 3, 2007 State Water Planning Database

MANAGEMENT OF GROUNDWATER SUPPLIES

The District will study, monitor and manage the groundwater supplies within Bandera County. The District will continue the programs and activities presently being performed in the District.

The District will continue to manage and monitor the groundwater of Bandera County in order to provide the best use of the resources while protecting the rights of the public. The District will continue to monitor and collect data to better understand and manage the aquifers. The existing monitoring system will be improved and expanded as needed for the development of data and a report will be prepared annually and made available to the public.

The District has implemented a drought management plan to aid in groundwater conservation. This plan is based on the Palmer Index and is designed to reduce pumpage of the aquifer during the different drought stages.

The District will strive to conserve the groundwater resources by encouraging municipal use of surface water supplies when available, and promote aquifer storage and recovery where practical. The District will encourage the use of rainwater harvesting to supplement water well usage in the county to conserve groundwater. The District will support brush control programs by providing public information and interacting with other governmental or organization groups that use brush management for water conservation.

ACTION, PROCEDURES, PERFORMANCE AND AVOIDANCE FOR PLAN IMPLEMENTATION

The District has adopted rules with the most recent amendment dated August 8, 2002 relating to the permitting of wells and the production of groundwater. The rules adopted by the District are pursuant to Texas Water Code Chapter 36 and the provisions of this plan. All rules will be adhered to and enforced. The promulgation and enforcement of the rules will be based on the best technical evidence available. A public hearing has been held regarding an updated set of rules. The latest updated rules are expected to be approved by the Board in the July 2009 Board meeting.

The District shall treat all citizens with equality. Citizens may apply to the District for discretion in enforcement of the rules on grounds of adverse economic effect or unique local conditions. In granting of discretion to any rule the Board shall consider the potential for adverse effect on adjacent landowners. The exercise of said discretion by the Board shall not be construed as limiting the power of the Board.

The District will strive to implement the provisions of this plan and will utilize the provisions of this plan for determining the direction or priority for the District. Agreements entered into by the District and any additional planning efforts in which the

District may participate will be consistent with the purposes of this plan. All activities of the District will be undertaken in cooperation and coordinated with the appropriate state, regional or local water management entities and in compliance with State and Regional Water Plans.

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's 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 first regular Board meeting following the end of the fiscal year.

GROUNDWATER MANAGEMENT GOALS

Management Goal 1

1.0.0 Manage groundwater in order to provide the most efficient use of groundwater resources.

1.1.1 Management Objective

Implement a program to develop data on the aquifers for better modeling of the aquifers.

1.1.2 Performance Standard

- a. Collect pump test data from subdivision test wells after water availability studies are conducted.
- b. Install, complete or equip, at a minimum, one dedicated monitor well each year for continuous monitoring of the aquifers.
- c. Collect water level data from a minimum of 20 wells on a semi-annual basis.

1.2.1 Management Objective

Maintain a program of issuance of well permits for non-exempt wells and registrations for exempt wells.

1.2.2 Performance Standard

Maintain an ongoing program of issuance of well permits each year. Provide the number of permits issued each year and the number of registrations issued each year in an annual report to the Board of Directors.

Management Goal 2

2.0.0 Control and prevent the waste of groundwater.

2.1.1 Management Objective

Provide literature to the public on the efficient use of water and water saving devices in the home.

2.1.2 Performance Standard

- a. Provide literature handouts with well permits to educate the public on water saving devices.
- b. Coordinate a minimum of one public presentation per year. Provide the number of shows, demonstrations or events at which literature is provided to the public, in an annual report to the Board of Directors.

2.2.1 Management Objective

Promote public awareness about preventing the waste of water resources.

2.2.2 Performance Standard

Record the number of speaking appearances and/or shows, demonstrations or events at which literature is provided to the public on preventing the waste of water resources. The District will report the number of aforementioned events in the annual report to the Board of Directors.

Management Goal 3

3.0.0 Control and prevent subsidence.

The control and prevention of subsidence is not a concern of this District as the formations are carbonates and do not contain the water saturated clays which can cause subsidence if dewatered; therefore, this management goal is not applicable to the District.

Management Goal 4

4.0.0 Address conjunctive surface water management issues.

4.1.1 Management Objective

Make at least one annual evaluation of the groundwater resources and surface water quality in Bandera County and include the results of the evaluation in the annual report to the Board of Directors.

4.1.2 Performance Standard

- a. Record the number of reports and evaluations provided to the Board of Directors on the groundwater resources and the surface water quality.
- b. Maintain at the District Office an annual report of District activities available to the public.

4.2.1 Management Objective

Annually contact at least one municipal water supplier in the District that is using groundwater regarding the potential use of surface water.

4.2.2 Performance Standard

Provide the number of contacts annually to public water systems to discuss alternate water supplies.

Management Goal 5

5.0.0 Address natural resource issues that impact and are impacted by the use and availability of groundwater.

The District is not aware of any natural resources issues in Bandera County; therefore, this goal is not applicable at this time.

Management Goal 6

6.0.0 Address drought conditions.

6.1.1 Management Objective

Record the Palmer Drought Severity Index once at the first of each month and when drought conditions exist, implement the Drought Management Plan as adopted in April 2009.

6.1.2 Performance Standard

Determine and record the Palmer index at the first of each month and implement the appropriate stage of the Drought Management Plan when necessary.

6.2.1 Management Objective

Evaluate groundwater availability each year by monitoring water levels of the aquifer from at least 6 monitor wells with continuous recorders within Bandera County.

6.2.2 Performance Standard

Record number of wells recording daily water levels and number of wells analyzed each year in the annual report to the Board of Directors.

Management Goal 7

7.0.0 Address conservation

7.1.1 Management Objective

Promote public awareness of the need for water conservation.

7.1.2 Performance Standard

Provide the number of shows, demonstrations or events at which literature or presentations on conservation are made available to the public. A minimum of one public water conservation show, demonstration or event will be held each year.

Management Goal 8

8.0.0 Address rainwater harvesting

8.1.1 Management Objective

Provide literature on designing and operating a rainwater harvesting system to the public.

8.1.2 Performance Standard

Provide Rainwater Harvesting material to the public in handouts. Publish a minimum of one newspaper article annually on the benefits of Rainwater Harvesting. Report annually to the Board of Directors the number of publications provided and other demonstrations by the District.

Management Goal 9

9.0.0 Address recharge enhancement

The District does not currently have the financial resources to buy property and construct recharge structures, therefore, this goal is not applicable to the District at this time.

Management Goal 10

10.0.0 Address precipitation enhancement

Precipitation enhancement over Bandera County is financed by the Edward Aquifer Authority and operates from Pleasanton, Texas; therefore, this goal is not applicable to the District at this time.

Management Goal 11

11.0.0 Address brush control.

11.1.1 Management Objective

Provide to the public available information or published reports on the benefits of brush control to 100 percent of written public requests.

11.1.2 Performance Standard

Report the number of requests received for brush control information, and the number of times brush control information was provided, in an annual report to the Board of Directors.

Management Goal 12

12.0.0 Addressing water quality.

12.1.1 Management Objective

Continue the existing program to monitor groundwater quality in the District.

12.1.2 Performance Standard

Continue to monitor water quality from a minimum of 20 wells in the monitoring system on a semi-annual basis, and from newly drilled wells when samples can be obtained. Report the number of samples obtained to the Board of Directors in an annual report.

12.2.1 Management Objective

Continue the existing program to monitor surface water quality in the District.

12.2.2 Performance Standard

Continue to monitor water quality from a minimum of 18 locations in the county from the Sabinal and Medina River basins on a semi-annual basis. Report the number of samples obtained to the Board of Directors in an annual report.

Management Goal 13

13.0.0 Addressing in a Quantitative Manner the Desired Future Conditions.

13.1.1 Management Objective

Groundwater Management Area 9 has adopted a Desired Future Condition (DFC) for the Edwards Plateau portion of the Hill Country Trinity

aquifer in Bandera County which states that there will be no long-term water level decline in the aquifer. The Managed Available Groundwater (MAG) for the Edwards Plateau Aquifer has been adopted; the District rules are being amended to prohibit permitted wells in this aquifer. The District will establish one monitor well in the Edwards Aquifer and monitor the water level on a semi-annual basis. A comparison of the annual water level measurements and the cumulative water level trend to the adopted Desired Future Condition will be made annually.

13.1.2 Performance Standard

The water levels will be included in the District database and a discussion of the water level trend-Desired Future Condition comparison will be reported to the Board of Directors on an annual basis.

Groundwater Management Area 9 has not yet adopted Desired Future Conditions for the Upper Glen Rose formation of the Upper Trinity Aquifer; the Lower Glen Rose, Hensell and Cow Creek formations of the Middle Trinity Aquifer; and the Sligo and Hosston formations of the Lower Trinity Aquifer in Bandera County.

I, the undersigned, do hereby certify that this Management Plan was formally adopted by the District Board and will be effective on the date of signature.

Signed this ____ day of _____, 2010.

James Chastain, President

Attest: _____
Jerry Sides, Secretary

Sworn to and subscribed to before me this ____ day of _____, 2010.

(Signature of Notary)

(Printed Name of Notary)