Brazos G Regional Water Planning Area

Regional Water Plan

Volume I
Executive Summary and Regional Water Plan

January 2006

Prepared by:

Brazos G Regional Water Planning Group

With administration by:

Brazos River Authority

With technical assistance by:

HDR Engineering, Inc.

In association with:

Freese and Nichols, Inc.

R.W. Harden and Associates, Inc.

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Fletcher Communications

HDR | ONE COMPANY *Many Solutions*[SM]

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Brazos G Regional Water Plan

Executive Summary

Background

Since 1957, the Texas Water Development Board (TWDB) has been charged with preparing a comprehensive and flexible long-term plan for the development, conservation, and management of the state's water resources. The current state water plan, *Water for Texas, January 2002*, was produced by the TWDB and based on approved regional water plans pursuant to requirements of Senate Bill 1 (SB1), enacted in 1997 by the 75th Legislature. As stated in SB1, the purpose of the regional water planning effort is to:

> "Provide for the orderly development, management, and conservation of water resources and preparation for and response to drought conditions in order that sufficient water will be available at a reasonable cost to ensure public health, safety, and welfare; further economic development; and protect the agricultural and natural resources of that particular region."

SB1 also provides that future regulatory and financing decisions of the Texas Commission on Environmental Quality (TCEQ) and the TWDB be consistent with approved regional plans.

The TWDB is the state agency designated to coordinate the overall statewide planning effort. The Brazos G Area, which is comprised of all or portions of 37 counties (Figure ES-1), is one of the State's 16 planning regions established by the TWDB. The TWDB appointed members to the regional planning groups, who serve without pay. The Brazos G Regional Water Planning Group (BGRWPG) was originally appointed by the TWDB to represent a wide range of stakeholder interests and act as the steering and decision-making body of the regional planning effort. As member terms expire, new members are appointed by the BGRWPG itself through solicitation of nominations. The BGRWPG adopted bylaws to govern its operations and, in accordance with its bylaws, designated the Brazos River Authority (BRA) as the administrative agency and principal contractor to receive a grant from the TWDB to develop the water plan. Ms. Teresa Clark serves as the Regional Planning Project Manager for the BRA, assisted by Julie Andress. The BGRWPG selected HDR Engineering, Inc. as prime consultant for the planning and engineering tasks necessary for plan development.

The BGRWPG consists of 19 voting members who represent the following 12 interests: the public, counties, municipalities, industries, agriculture, the environment, small businesses, electric-generating utilities, river authorities, water districts, water utilities and groundwater conservation districts. The BGRWPG also includes several non-voting members who participate in the deliberations of the BGRWPG, and contribute excellent knowledge and insight to the group. Table ES-1 lists the voting and non-voting members and interest groups represented on the BGRWPG who contributed to the development of the 2006 Brazos G Regional Water Plan (both current and recently retired).

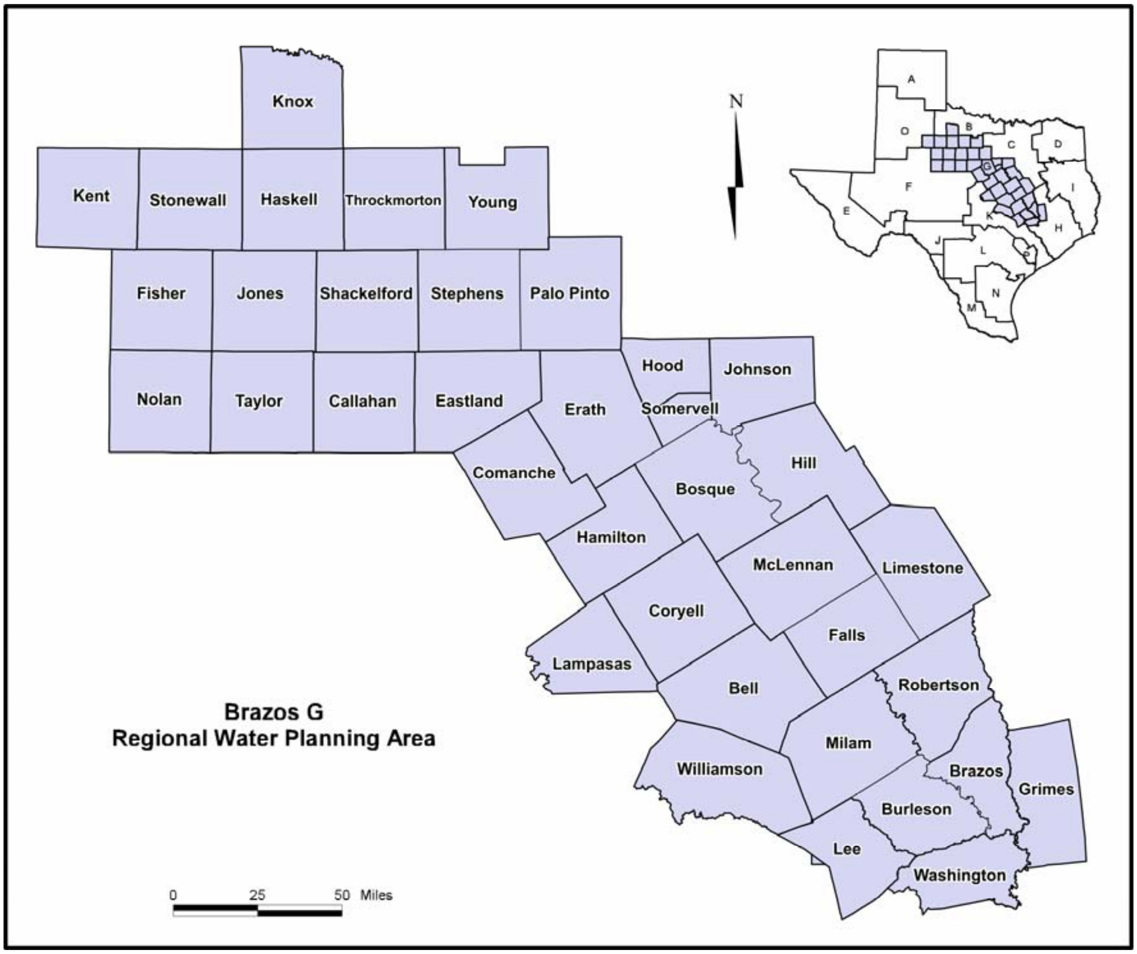

Figure ES-1. Brazos G Regional Water Planning Area

The planning horizon to be used is the 60-year period from 2000 to 2060. This planning period allows for long-term forecast of the prospective water situation, sufficiently in advance of needs, to allow for appropriate management measures to be implemented. As required in Senate Bill 1, the TWDB specified planning rules and guidelines (31 TAC 357.7 and 357.12) to focus the efforts and to provide for general consistency among the regions so that the regional plans can then be aggregated into an overall State Water Plan.

Table ES-1.
Current and Recent Brazos G RWPG Voting Members
(as of June 2005)

Interest Group	***Name***	***Entity***
Voting Members		
Agricultural	Dale Spurgin (6/04 to present) Wayne Wilson (12/04 to present) Steve Sanford (resigned 11/03) Chaunce Thompson (retired 12/04)	Judge, Jones County Rancher Farmer/Rancher Cattlemen
Counties	Judge Tim Fambrough Judge Jon Burrows Judge Mike Sutherland (12/04 to present) Tony Jones (retired 12/04) Judge David Purdue (resigned 3/02)	Nolan County Bell County Burleson County Brazos County Commissioners Court Knox County
Electric Generating Utilities	Scott Diermann Ken Smith (resigned 11/02)	TXU Electric TXU Electric
Environmental	Stephen L. Stark	Texas A&M University
Industry	Randy Waclawczyk (12/04 to present) Mark Bryson (retired 12/04)	Alcoa Alcoa
Municipalities	Mike Morrison (Chairman) Wiley Stem III Tom Clark Alva D. Cox (12/04 to present) Truman O. Blum (retired 12/04) James Nuse (retired 11/03)	City of Abilene City of Waco City of Round Rock City of Granbury Former mayor, City of Clifton City of Round Rock
Public	Scott Mack, DDS	Dentist
River Authorities	Phil Ford	Brazos River Authority
Small Business	Horace R. Grace	AMG Enterprises, Inc.
Water Districts	Terry Kelley Kathleen Webster (12/04 to present) A.V. Jones, Jr. (retired 12/04)	Johnson County SUD West Central Texas MWD West Central Texas MWD
Groundwater Districts	Mike McGuire (12/04 to present)	Rolling Plains GCD
Water Utilities	Kent Watson	Wickson Creek Special Utility District
Non-Voting Members		
Region H RWPG Liaison	John Baker	Brazos River Authority
LCRA Representative	James Clarno	Lower Colorado River Authority
Region F RWPG Liaison & CRMWD Representative	John Grant	Chair, Region F & GM of Colorado River Municipal Water District
Llano Estacado (O) RWPG Liaison	Terry Lopas	Brazos River Authority
Lower Colorado (K) RWPG Liaison	Mark Jordan	Lower Colorado River Authority
TWDB Project Manager	David Meesey	Texas Water Development Board
TPWD	Mellisa Mullins	Texas Parks and Wildlife Department
TDA	E.W. Wesley	Texas Department of Agriculture
Region C RWPG Liaison	Paul Zweiacker	Texas Utilities

Pursuant to Regional and State Water Planning Guidelines (Texas Administrative Code, Title 31, Part 10, Chapters 357 and 358), the BGRWPG developed the 2001 Brazos G Regional Water Plan, which was then integrated into the State Water Plan "Water for Texas – 2002" by the TWDB. The 2006 Brazos G Regional Water Plan, of which this Executive Summary is a part, represents the first update of the regional water plan as presently required to occur on a 5-year cycle. The TWDB will integrate this Regional Water Plan into a State Water Plan to be issued in 2007.

The structure of the 2006 Regional Water Plan is organized in accordance with TWDB guidelines and summarized by section title as follows.

1) Description of the Brazos G Region (Volume I)
2) Projected Population and Water Demands (Volume I)
3) Evaluation of Water Supplies in the Region (Volume I)
4) Identification, Evaluation and Selection of Water Management Strategies Based on Needs
   - 4A) Comparison of Demand to Supply (Volume I)
   - 4B.1) Identification, Evaluation and Selection of Water Management Strategies (Volumes I and II)
   - 4B.2) Technical Evaluations of Water Management Strategies (Volume II)
   - 4C) Water Supply Plans (Volume I)
5) Impacts of Recommended Water Management Strategies on Key Parameters of Water Quality and Moving Water from Rural and Agricultural Areas (Volume I)
6) Water Conservation and Drought Management Recommendations (Volume I)
7) Consistency with Long-Term Protection of the State's Water, Agricultural, and Natural Resources (Volume I)
8) Recommendations for Unique Stream Segments, Unique Reservoir Sites and Other Legislative Recommendations (Volume I)
9) Report to the Legislature on Water Infrastructure Funding Recommendations (Volume I)
10) Adoption of Plan (Volume I)

Description of the Region

The Brazos G Region can be described by a single word—**diverse**. From the piney woods of Brazos and Grimes Counties to the rolling plains of Nolan County; from sparsely populated Stonewall County to Williamson County, often listed as the fastest growing county in the nation; from the prodigious Carrizo-Wilcox Aquifer in the southeast to the meager dribbles from windmills in Shackelford County; from 44 inches of annual rainfall in the east to 24 inches annually in the west (in a good year); from the Chisholm Trail through Stephens County to the NAFTA trail known as Interstate Highway (IH) 35; these diverse characteristics make for a wide variation in water supplies, demands, and availability of affordable options to meet needs.

Population and Water Demand Projections

In December 2002, the TWDB published population and water demand projections for each county in the state. In the Brazos G Area, population projections were developed for 184 municipal water user groups, which are defined as cities with a population greater than 500 in 2000, and water supply corporations and utilities using water volumes of 280 acft or more in 2000. To account for people living outside the cities, projections were also developed for a 'county-other' category of municipal water use for each of the 37 counties in the region. Requests for revisions to the population and municipal water demand projections were forwarded to the TWDB and in many cases were adopted.

Water Demand Projections

Figure ES-2 illustrates population growth in the entire Brazos G Regional Water Planning Area (BGRWPA) for 1900 to 2000 and projected growth for 2010 to 2060.

Population trends may be further understood by dividing the planning region into three subregions: the northwestern Rolling Plains, the central IH-35 Corridor, and the southeastern Lower Basin. Figure ES-3 illustrates historical population growth in the three sub-regions from 1900 to 2000 and projected growth from 2010 to 2060. Projected growth is greatest in the IH-35 Corridor.

Water Demand Projections

Water demand projections have been compiled for six categories of water use: (1) Municipal, (2) Manufacturing, (3) Steam-Electric Cooling, (4) Mining, (5) Irrigation, and (6) Livestock. Each of the non-municipal uses is aggregated on a county basis, and is defined as a separate water user group (WUG) within each county. The TWDB has developed water demand projections for each of the five non-municipal WUGs in each of the 37 counties in Region G.

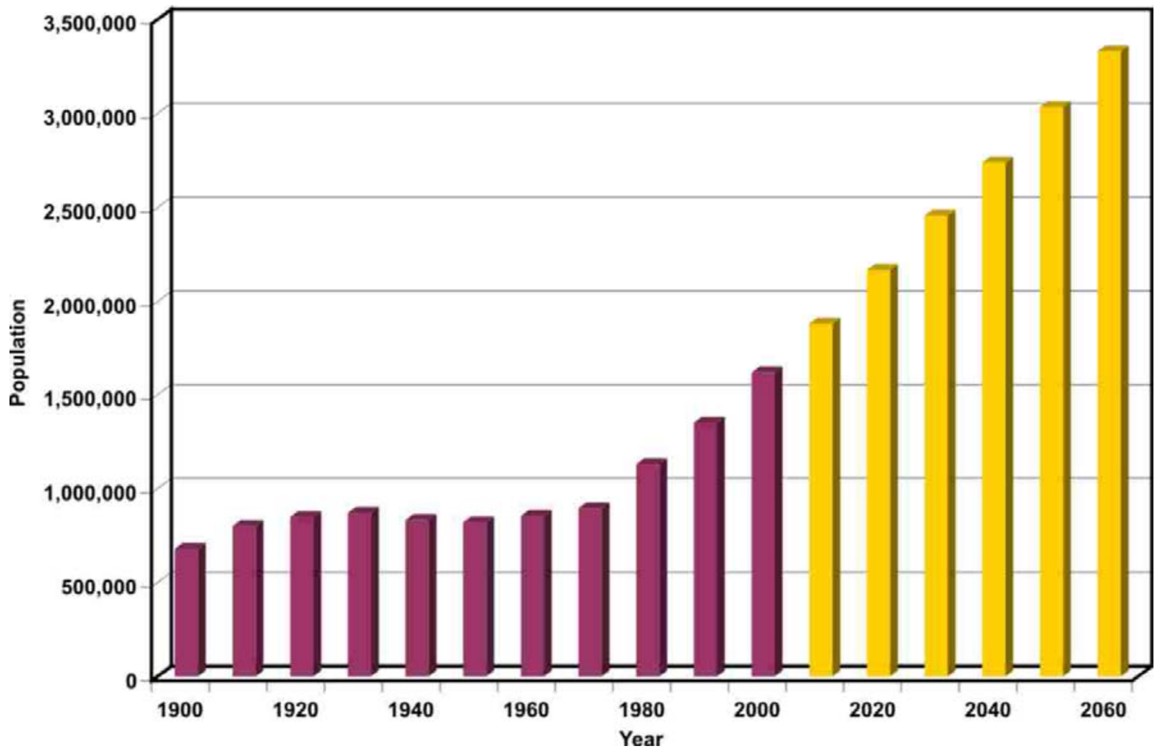

Figure ES-2. Historical and Projected BGRWPA Population

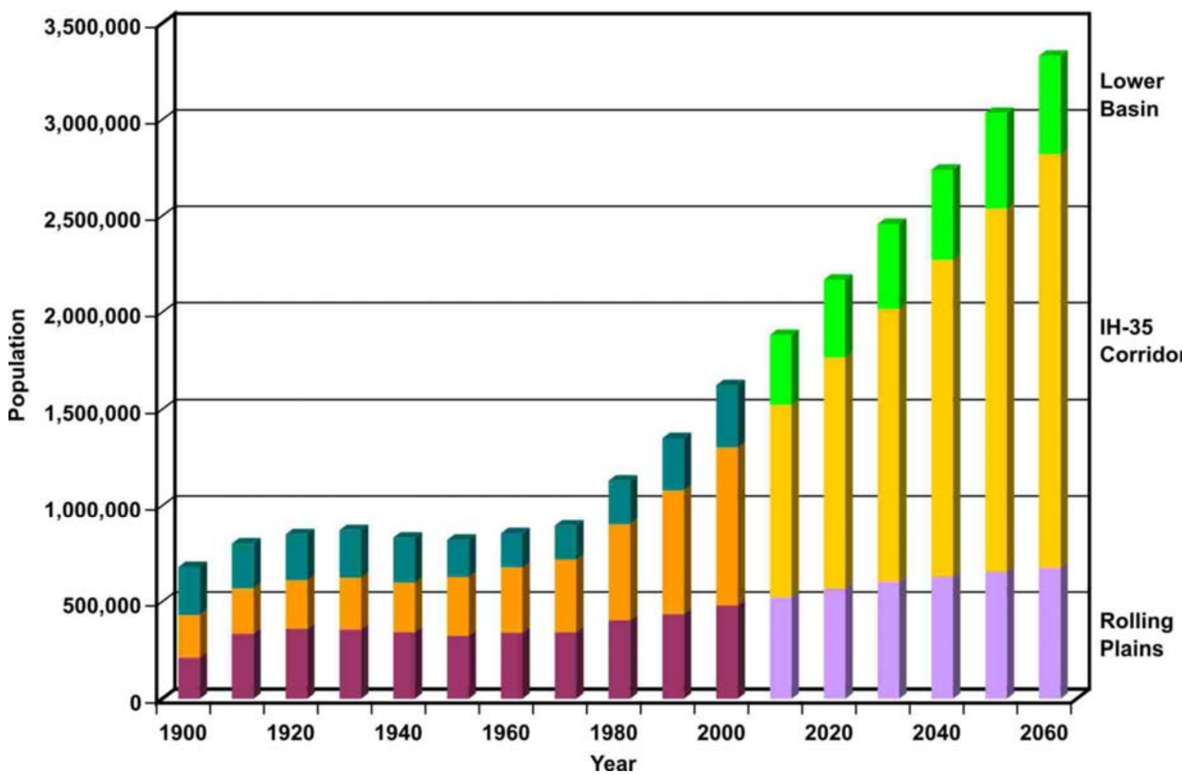

Figure ES-3. Historical and Projected Population by Sub-Region

Total water use for the region is projected to increase from 795,183 acft in 2000 to 1,150,973 acft in 2060, a 45 percent increase, as shown in Figure ES-4. The six types of water use as percentages of total water use are shown for 2000 and 2060 in Figure ES-5. Municipal, manufacturing, and steam-electric water use as percentages of the total water use are projected to increase from 2000 to 2060, while mining, irrigation, and livestock water use are projected to decrease as percentages of the total.

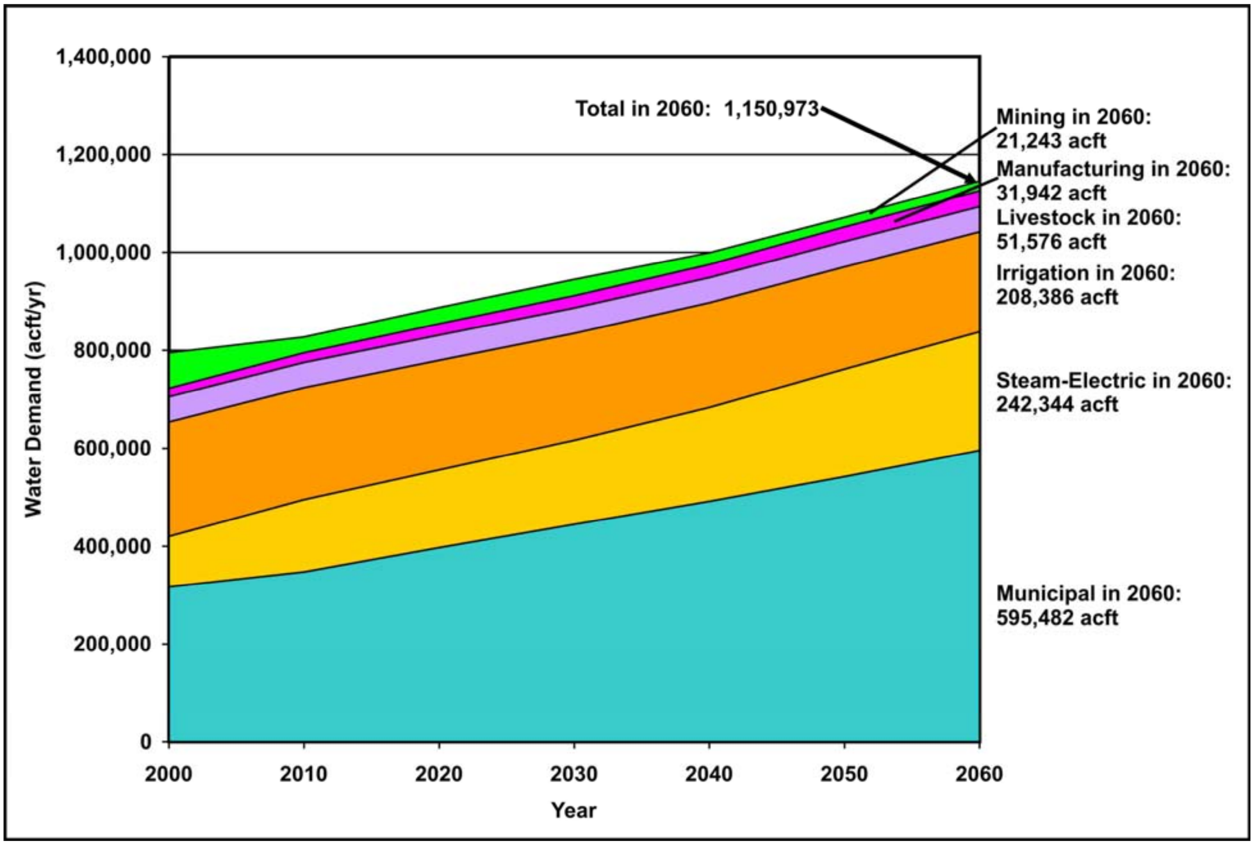

Figure ES-4. Projected Total Water Demand

Water Supply

Surface Water Supplies

Streamflow in the Brazos River and its tributaries, along with reservoirs in the Brazos River Basin, comprise a vast supply of surface water in the Brazos G Area. Diversions and use of this surface water occurs throughout the entire region with over 1,000 water rights currently issued. However, the supply of surface water varies greatly through the region due to the large variation in rainfall and a correspondingly large variation in evaporation rates. The

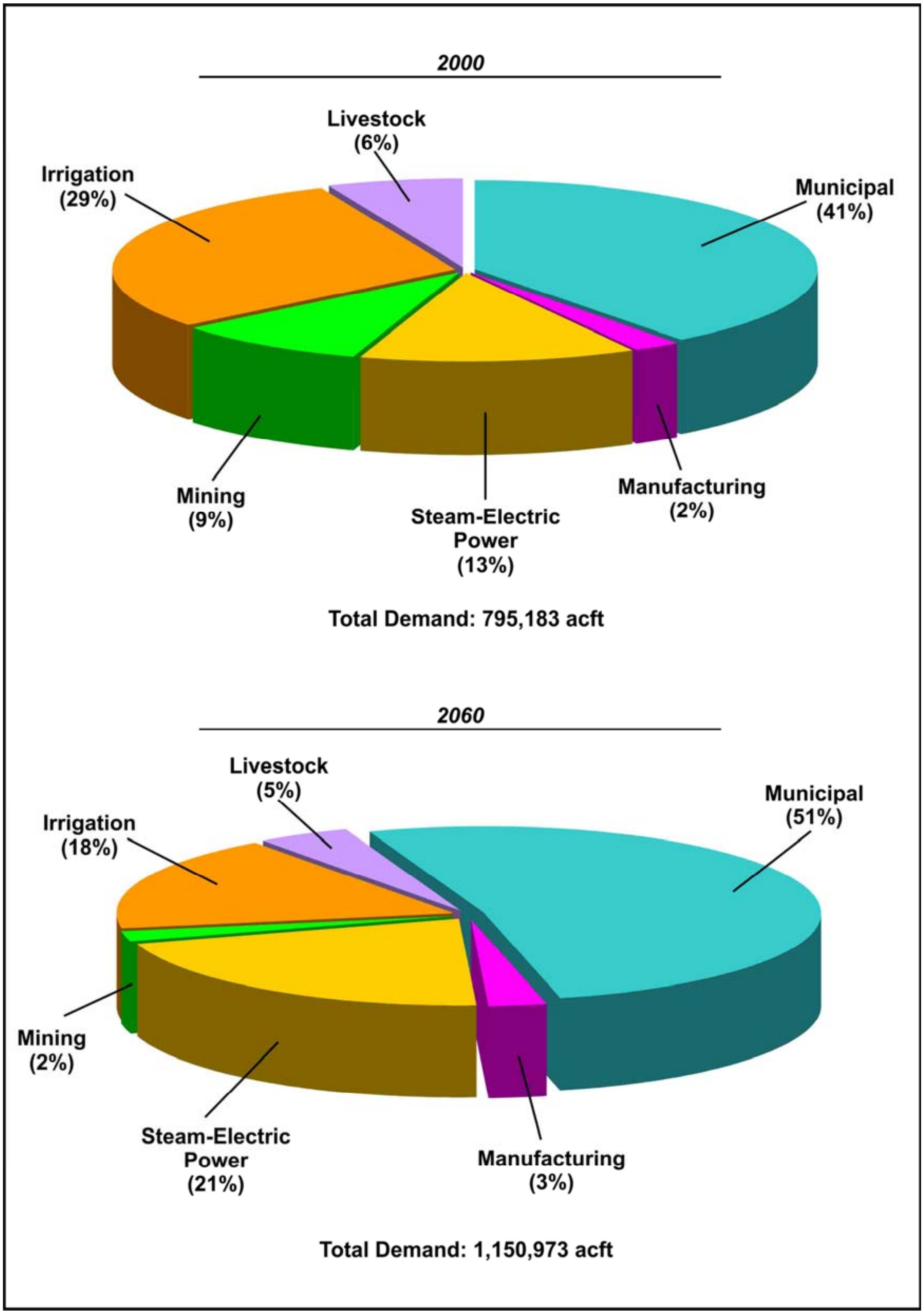

Figure ES-5. Total Water Demand

principal tributaries to the Brazos River in the planning area are the Clear Fork, the Double Mountain Fork, the Salt Fork, Bosque River, Little River, Navasota River, Little Brazos River and Yegua Creek. Major water supply reservoirs are owned by the BRA (three in the planning region), U.S. Army Corps of Engineers (nine in the region), West Central Texas MWD, the City of Abilene, and Texas Utilities. The western part of the region is heavily dependent on surface water sources, partly due to the absence of large quantities of potable-quality groundwater.

The State of Texas owns the surface water resources of the State, and issues water rights to utilize surface water. A total of 1,123 water rights currently exist in the Brazos River Basin, with a total authorized diversion of 2,664,000 acft/yr, of which 1,412,102 are located in the BGRWPA. Those rights located in the BGRWPA contribute a total firm supply of 695,479 acft/yr through a repeat of the drought of record. This supply number is less than total surface water availability in the region of 866,372 acft/yr, because supply to irrigation was calculated on a 75 percent available, 75 percent of the time basis, which increases the estimated supply available for irrigation by assuming that irrigation does not require a firm supply year in and year out. It is important to note that a small percentage of the water rights make up a large percentage of the authorized diversion volume. In the Brazos River Basin, 39 water rights (3.4 percent) make up 2,372,000 acft/yr (89 percent) of the authorized diversion volume. The remaining 1,084 water rights primarily consist of small irrigation rights distributed throughout the river basin. Figure ES-6 shows a comparison of significant water rights in the Brazos River Basin by number of rights and diversion volume.

Groundwater Supplies

Fifteen aquifers underlie parts of the Brazos G Area and, if developed fully, can provide a combined reliable supply of about 533,520 acft/yr. As currently developed, a total groundwater supply of 318,630 acft/yr exists in the region. The Seymour Aquifer supplies significant quantities of water in the western part of the region. Other aquifers that are depended on in the western part of the region are the Dockum and the Edwards-Trinity. The Trinity and Edwards-BFZ (Northern Segment) are heavily relied upon in the IH-35 corridor and to the west. Both of these aquifers are being pumped in excess of their estimated sustainable yield in some counties. In the eastern part of the region, the Carrizo-Wilcox is a prolific water supply with lesser amounts pumped from the Queen City, Sparta, and Brazos River Alluvium.

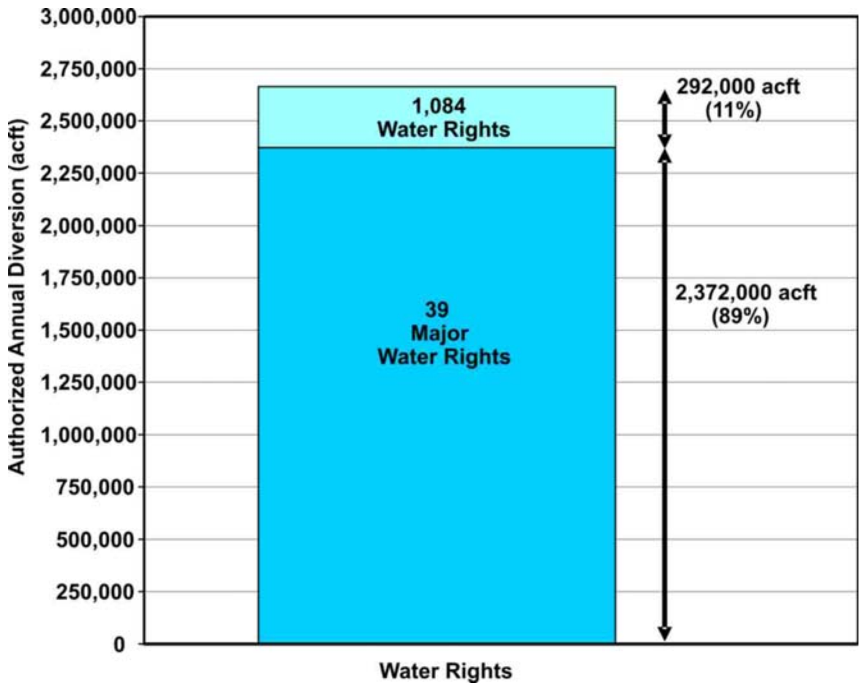

Figure ES-6. Comparison of Water Rights in the Brazos River Basin

Water Quality

Natural salt pollution has been recognized as a serious and widespread water quality problem in the Brazos River Basin. No other pollution source, man-made or natural, has had the impact of the natural salt sources located in the upper basin. Due to these water quality issues, some sources of water—particularly from Lake Whitney, Lake Granbury, and Possum Kingdom Reservoir—may limit their suitability for some uses and require higher cost, advanced treatment (desalination). As the Brazos River flows to the Gulf, inflows from tributaries decrease the concentration of dissolved minerals, which in turn improves the quality of water.

Supply and Demand Comparison

A comparison of total supplies available in the region (developed groundwater supplies and firm surface water) with demand for all use categories in the region shows a surplus past the year 2050. These mask shortages that are projected to occur to individual water supply entities and water user groups. Figure ES-7 illustrates this issue by summarizing demands and supplies for the Brazos G Area, and for Williamson County. Shortages are projected for Williamson County starting at about the year 2030, while overall regional supplies are projected to exceed regional demands until past the year 2050. Even within most counties that have projected overall surpluses, there are individual entities that do not have sufficient supply to meet projected needs. Only five of the 37 counties in the Brazos G Area have no projected shortages for all water user groups: Comanche, Hamilton, Jones, Stonewall, and Young.

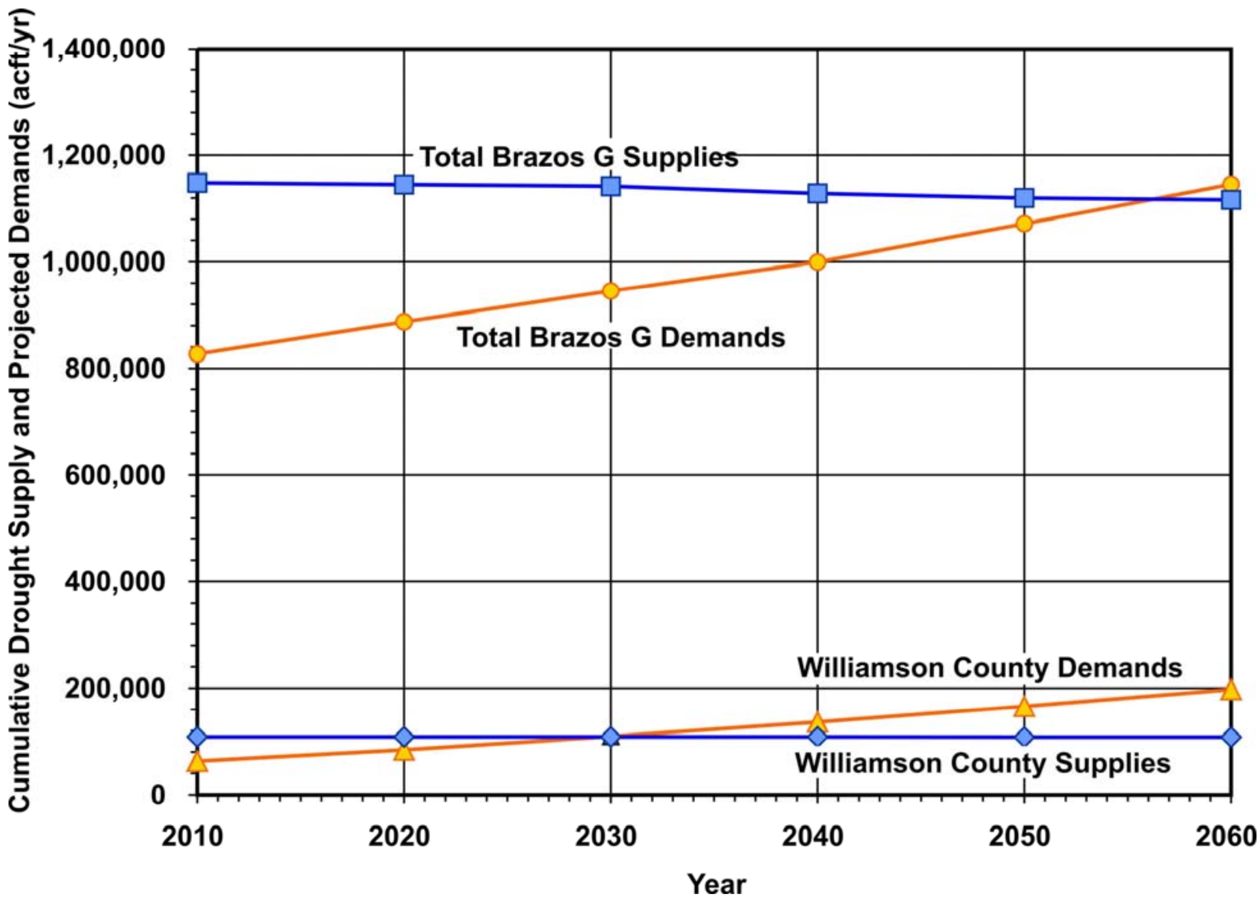

Figure ES-7. Comparison of Supplies and Demands for Brazos G Region and Williamson County

Water Supply Strategies to Meet Needs

The water management strategies in Table ES-2 were identified by the BGRWPG as potentially feasible to meet shortages. These strategies were evaluated by the consultant team and compared to criteria adopted by the BGRWPG. Section 4B in Volume 2 contains subsections discussing each of these possible strategies.

Table ES-2.
Water Management Strategies Identified as Potentially Feasible to Meet Shortages

Water Management Strategies	
Report Section (Volume II)	**Water Management Strategy and Description**
4B.2	**Advanced Water Conservation** (implement accelerated use of various water conservation techniques to achieve water savings above what is already included in the TWDB water demand projections)
4B.3	**Wastewater Reuse** (use highly treated wastewater treatment plant effluent to meet non-potable water needs, including landscape irrigation and industrial use)
4B.4	**System Operation of Brazos River Authority Reservoirs** (coordinated operation of the BRA reservoir system will increase supplies, maximize use of existing facilities and delay the need for new reservoir construction)
4B.5	**Groundwater/Surface Water Conjunctive Use (Lake Granger Augmentation)** (utilize groundwater to firm up interruptible (non-firm) supplies greater than the firm yield of the reservoir)
4B.6	**Desalination** (treatment of brackish water to remove minerals with resulting potable water) • Lake Granbury supplies to Johnson County • Brackish groundwater to N.E. Johnson County
4B.7	**Millers Creek Reservoir Augmentation** (supplement yield of a reservoir by diverting flows from an adjacent stream into the reservoir)
4B.8	**Aquifer Storage and Recovery** (Inject or percolate excess surface water into groundwater aquifers, storing for future use) • Seymour Aquifer • Trinity Aquifer (Johnson County)
4B.9	**Brush Control and Range Management** (increase deep percolation and discharge to streams by removing unwanted brush)
4B.10	**Weather Modification** (cloud seeding to increase precipitation frequency and intensity)
4B.11	**Interregional Water Management Strategies** (provide water supplies into the Brazos G Region from adjacent regions) • TRA Reuse through Joe Pool Reservoir (Region C) • Regional Surface Water Supply to Williamson County from Lake Travis (Region K)
4B.12	**New Reservoirs** (new or updated evaluations of the following proposed new reservoirs) • Breckenridge Reservoir (Cedar Ridge Site) • South Bend Reservoir • Throckmorton Reservoir • Double Mountain Fork Reservoir (Sites No. 1 & 2) • Turkey Peak Reservoir • Millican Reservoir
4B.13	**Off-Channel Reservoirs** (construction of smaller reservoirs on tributary streams with lower environmental impact, lower cost dam, and usually with pump-over of supplies from a larger stream). Possible projects include: • Wheeler Branch Off-Channel Reservoir • City of Groesbeck Off-Channel Reservoir • Peach Creek Lake • Little River Off-Channel Reservoir • Lake Palo Pinto Off-Channel Reservoir
4B.14	**Interconnection of Regional and Community Systems** (use larger cities' systems or other facilities more fully and assist smaller communities to meet their needs). Possible projects include: • Bosque County Regional Project • Midway Pipeline Project (West Central Brazos Distribution System) • Interconnection from Abilene to Sweetwater • Interconnection of City of Waco System with Neighboring Communities • Interconnection of Central Texas WSC with Salado WSC
4B.15	**Carrizo-Wilcox Aquifer Development** (further develop and utilize the Carrizo-Wilcox Aquifer) • Additional Development of Carrizo-Wilcox Aquifer for Brazos County Needs • Carrizo-Wilcox Water Supply for Williamson County • Lake Granger Augmentation (Section 4B.5)
4B.16	**Voluntary Redistribution** (the purchase or lease of water supply from an entity that has water supply in excess of long-term or interim needs)

Water Plan Findings

Table ES-3 summarizes the recommended water management strategies in the plan that develop or import new sources of supply into the Brazos G Area. Strategies that utilize existing water resources without increasing or augmenting those supplies are not listed.

Total new supplies of water into the Brazos G Area total 590,231 acft/yr, comprised of newly developed groundwater, supply transferred from other regions, newly developed surface water supplies, or supplies made available through conservation or augmentation of existing facilities. These totals do not reflect water trades between users of existing supplies in Region G, but represent entirely new supplies to the Brazos G Area. Total project costs for these new supplies exceed $1 billion.

The 2006 Brazos G Regional Water Plan includes recommendations for 21,393 acft/yr of municipal conservation savings and another 43,377 acft/yr for wastewater reuse. The conservation savings are on top of those already included in the TWDB demand projections, and the recommended reuse strategies are in excess of existing reuse supplies in the basin.

System operation of the Brazos River Authority's reservoirs can increase supplies in the Brazos G Area by more than 265,000 acft/yr (assuming interruptible supplies can be firmed up through conjunctive operation with other sources), with additional supplies available to the Region H Area in the lower basin. This strategy would more efficiently utilize the existing resources of the Brazos River Authority by expanding the supply that can be developed from the BRA's existing reservoirs, thus delaying the need for new reservoirs to meet growing needs in the basin. As shown by analysis of the Lake Granger Augmentation strategy, the interruptible supply proposed by the BRA can be firmed up with groundwater resources, further extending existing resources in the basin.

The West Central Brazos System Optimization Plan proposed by the City of Abilene and the West Central Texas Municipal Water District (WCTMWD) is an example of regional cooperation between the City of Abilene, the WCTMWD and the Brazos River Authority to ensure adequate supplies in the arid western portion of the Brazos G Area. Through a mix of existing supplies, new supplies and priority calls agreements with the BRA, the plan would develop an additional firm supply of almost 60,000 acft/yr. This system plan will provide the Abilene area with supplies that will insure against future droughts worse than the current drought of record.

Implementation of the 2006 Brazos G Regional Water Plan will result in the development of new water supplies that will be reliable in the event of a repeat of the most severe drought on record. It is evident that implementation of all recommended water management strategies is not likely to be necessary in order to meet projected needs within the planning period. The BGRWPG explicitly recognizes the difference between additional supplies and projected needs as System Management Supplies and has recommended the associated water management strategies in the Regional Water Plan for the following reasons:

- So that water management strategies are identified to replace any planned strategies that may fail to develop, through legal, economic or other reasons;
- To serve as additional supplies in the event that rules, regulations, or other restrictions limit use of any planned strategies;
- To facilitate development of specific projects being pursued by local entities for reasons that may not be captured in the supply and demand projections used to identify future supply shortages; and/or
- To ensure adequate supplies in the event of a drought more severe than that which occurred historically.

Other Aspects of the 2006 Brazos G Regional Water Plan

In addition to providing a roadmap for development of supplies to meet future water needs in the basin, the 2006 Brazos G Regional Water Plan includes other elements of value and interest to water supply managers and others in the Brazos G Area.

- The plan provides a concise summary of physiographic, hydrologic and natural resources in the Brazos G Area,
- The plan provides a comprehensive understanding of how water supplies have been developed and are managed in the region,
- The plan provides examples of drought management and water conservation plans that may assist water managers with developing plans for their systems, and
- The plan includes recommendations to the TWDB and the Texas Legislature regarding key water policy issues and the direction of water supply management in Texas.

Table ES-3.
Summary of Recommended Water Management Strategies Involving New Sources of Supply in the 2006 Brazos G Regional Water Plan

Strategy	WUG or WWP	New Supply by 2060 (acft/yr)	Total Project Cost (2nd Quarter 2002 Prices)
Conservation Strategies			
Municipal	38 WUGs	21,393	N/D[1]
Manufacturing	18 Counties	1,430	N/D
Steam-Electric	9 Counties	13,281	N/D
Mining	10 Counties	1,074	N/D
Irrigation	6 Counties	8,027	N/D
Total Conservation		**45,205**	**N/D**
Reuse Strategies			
Reuse	Steam-Electric – Nolan County	560	$2,115,000
	City of Round Rock	7,443	$6,369,000
	City of Bryan	605	$6,485,000
	City of College Station	137	$2,358,000
	City of Cleburne	2,853	$1,048,000
	Steam-Electric – McLennan County (City of Waco)	16,000	$2,995,000
	City of Waco	15,779	N/D
Total Reuse		**43,377**	**$27,855,000**
Water Supply from other Regions			
LCRA/BRA Alliance	Chisolm Trail SUD	3,472	$18,518,000
	City of Round Rock	20,928	$101,336,000
LCRA Highland Lakes	Cedar Park	25,000	$81,748,000
TRA Reuse through Joe Pool Reservoir	Johnson County SUD	20,000	$79,257,000
Total from Other Regions		**69,400**	**$280,859,000**
Augmentation of Existing Surface Water Supplies			
Lake Palo Pinto Off-Channel Reservoir	Palo Pinto County MWD No. 1	3,110	$19,314,000
Millers Creek Reservoir Augmentation	North Central Texas Municipal Water District	4,870	$18,222,000
Raise Level of Gibbons Creek Reservoir	Steam-Electric – Grimes County	3,870	$8,003,000
BRA System Operation (Lake Granger Augmentation)	Chisholm Trail SUD	26,127[2]	$303,288,000
	City of Georgetown		
	Jarrell-Schwertner WSC		
	City of Round Rock		
	Williamson County – Other		
	Manufacturing – Williamson County		
Total Augmentation of Existing Surface Water Supplies		**37,977**	**$348,827,000**

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Table ES-3.
Summary of Recommended Water Management Strategies Involving New Sources of Supply in the 2006 Brazos G Regional Water Plan (continued)

Strategy	WUG or WWP	New Supply by 2060 (acft/yr)	Total Project Cost (2nd Quarter 2002 Prices)
New Reservoirs			
Wheeler Branch Off-Channel Reservoir	Somervell County - Other	1,800	$27,195,000
Brushy Creek Reservoir	City of Marlin	2,000	$6,301,610
Total New Reservoirs		**3,800**	**$33,496,610**

Systems Approaches			
West Central Brazos System Optimization Plan	City of Abilene	59,150	$198,055,000
	West Central Texas Municipal Water District		
	Irrigation – Throckmorton County		
BRA System Operation (Excluding Lake Granger Augmentation)	Bell County WCID #1	3,500	$0
	Bosque County – Other	475	
	Manufacturing – Bosque County	1,300	$25,492,000
	Steam-Electric – Bosque County	8,225	
	Brandon-Irene WSC	100	
	City of Hillsboro	100	
	White Bluff Community WS	700	$36,151,000
	Woodrow-Osceola WSC	200	
	Manufacturing – Hill County	100	
	Steam-Electric – Limestone County	16,000	ND
	Other Needs to be Met from BRA System Operation[3]	234,373	ND
Total from Systems Approaches		**324,223**	**> $259,698,000**

Groundwater Development			
Brackish Groundwater	Mining - Nolan County	200	$268,188
Champion Well Field Phases 1 & 2	City of Sweetwater	736	$17,060,471
Carrizo-Wilcox Aquifer – Lee and Milam Counties [BRA System Operation (Lake Granger Augmentation)]	Williamson County entities, see BRA System Operation (Lake Granger Augmentation) (above)	28,263[2]	–
Carrizo-Wilcox Aquifer – Brazos County	City of Bryan	15,300	$33,380,000
	City of College Station		
	Wickson Creek SUD		
	Brazos County – Manufacturing		
Carrizo-Wilcox Aquifer – Burleson County	Manufacturing – Burleson County	150	$124,624 (Annual)
	Irrigation – Burleson County	5,000	$8,718,000

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Table ES-3.
Summary of Recommended Water Management Strategies Involving New Sources of Supply in the 2006 Brazos G Regional Water Plan (concluded)

Strategy	WUG or WWP	New Supply by 2060 (acft/yr)	Total Project Cost (2nd Quarter 2002 Prices)
Carrizo-Wilcox Aquifer – Falls County	Falls County – Other	300	$1,376,000
Carrizo-Wilcox Aquifer – Lee County	Aqua WSC	300	$1,047,000
	City of Giddings	400	$2,099,000
	Lee County WSC	750	$1,762,000
	City of Hutto	1,680	$1,927,000 (Annual)
Carrizo-Wilcox Aquifer – Limestone County	City of Groesbeck	100	$566,000
	Manufacturing – Limestone County	100	$566,000
Carrizo-Wilcox Aquifer – Milam County	Southwest Milam WSC	600	$2,079,000
	Steam-Electric – Milam County	8,200	$3,923,000
	City of Hutto	1,680	$1,927,000 (Annual)
Carrizo-Wilcox Aquifer – Robertson County	Robertson County (Manufacturing)	85	$707,000
Trinity Aquifer – Coryell County	Coryell County – Other	1,200	$4,821,000
Trinity Aquifer – Erath County	Manufacturing – Erath County	50	$198,000
Trinity Aquifer – Lampasas County	Lampasas County – Other	850	$2,576,000
Trinity Aquifer – Williamson County	City of Florence	250	$803,500
Gulf Coast Aquifer – Grimes County	Manufacturing – Grimes County	250	$312,000
Total Groundwater Development		**66,444**	**> $86,116,159**
Total New Supplies		**590,426**	**> $1,030,366,769**

1. Not Determined.
2. The Lake Granger Augmentation includes development of an average annual supply of groundwater from the Carrizo-Wilcox Aquifer of 28,263 acft/yr to develop the total new supply of 54,390 acft/yr (Volume II, Section 4B.5).
3. Includes additional BRA contractual commitments not specifically identified in Section 4B.4. Does not include Region H supplies, but does include minor increases to Region C.

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Section 1
Description of the Region
[31 TAC §357.7(a)(1)]

1.1 Background

Senate Bill 1 (SB1), which was passed into law in June 1997 and enacted by the 75th Texas Legislature, stemmed from increased awareness of Texas' vulnerability to drought and of the limitations of existing water supplies to meet the needs of the state's growing population. Senate Bill 2 (SB2), enacted in September 2001, expanded on the regional water planning process as created by SB1, and provided for further analysis and planning for water resources in the state. With rapidly growing populations, the need to adequately plan for existing and future water needs is vital to the economic health of the region and State. Some areas of the State are already facing near-term water shortages, and the projected population is expected to double by 2060. The purpose of SB1 and SB2 is to ensure that the water needs of all Texans are met in the 21st century.

The SB1/SB2 legislation calls for a "bottom up" water planning process wherein Regional Water Planning Groups (RWPGs) are formed with members representing a minimum of 11 different interests, including the environment, industry, municipalities, water authorities, and the public. The Texas Water Development Board (TWDB) has established 16 regional water planning areas; each with its own RWPG. Each RWPG is tasked with preparing a regional water plan for its area that assesses the available water supplies, the projected demands on these supplies and identifies a means to meet future water needs while maintaining long-term protection of the State's resources.

In accordance with SB2 (as amended), all of the regional water plans must be completed and adopted by January 5, 2006. The TWDB must approve them and compile the 16 plans into one statewide plan by January 5, 2007. The regional water plans will continue to be updated every 5 years.

1.2 Brazos G Regional Water Planning Area

The Brazos G Regional Water Planning Area (BGRWPA), shown in Figure 1-1, comprises all or portions of 37 central Texas counties. The Brazos G Area is about 31,600 square miles in area, or 12 percent of the State's total area. About 90 percent of the region

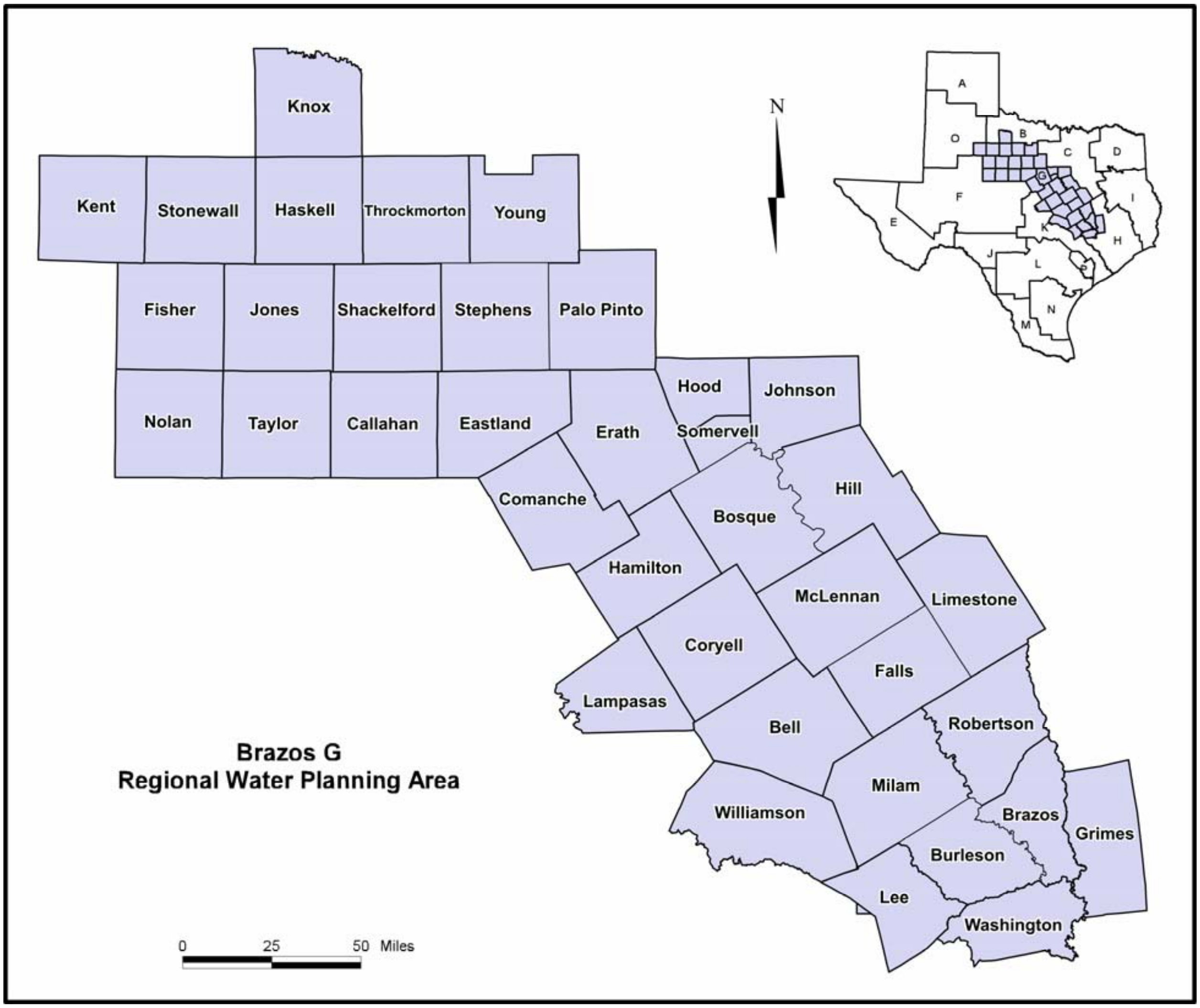

Figure 1-1. Location Map

lies in the Brazos River Basin. Figure 1-2 shows the major features of the BGRWPA, such as major cities, reservoirs, and highways. This figure also shows that parts of several counties extend into the Red, Trinity, Colorado, and San Jacinto River Basins. Cities in the region with current populations greater than 50,000 are Abilene, Bryan, College Station, Killeen, Round Rock, Temple, and Waco.

The region's geography varies from the rugged, uneven terrain and sandy soils of Kent and Knox Counties in the northwest to the hilly, forested areas and rich soils in Grimes and Washington Counties in the southeast. In the central part of the region are the Blackland Prairies in Hill and McLennan Counties.[1]

[1] The Dallas Morning News, *1997-1998 Texas Almanac*, 1998.

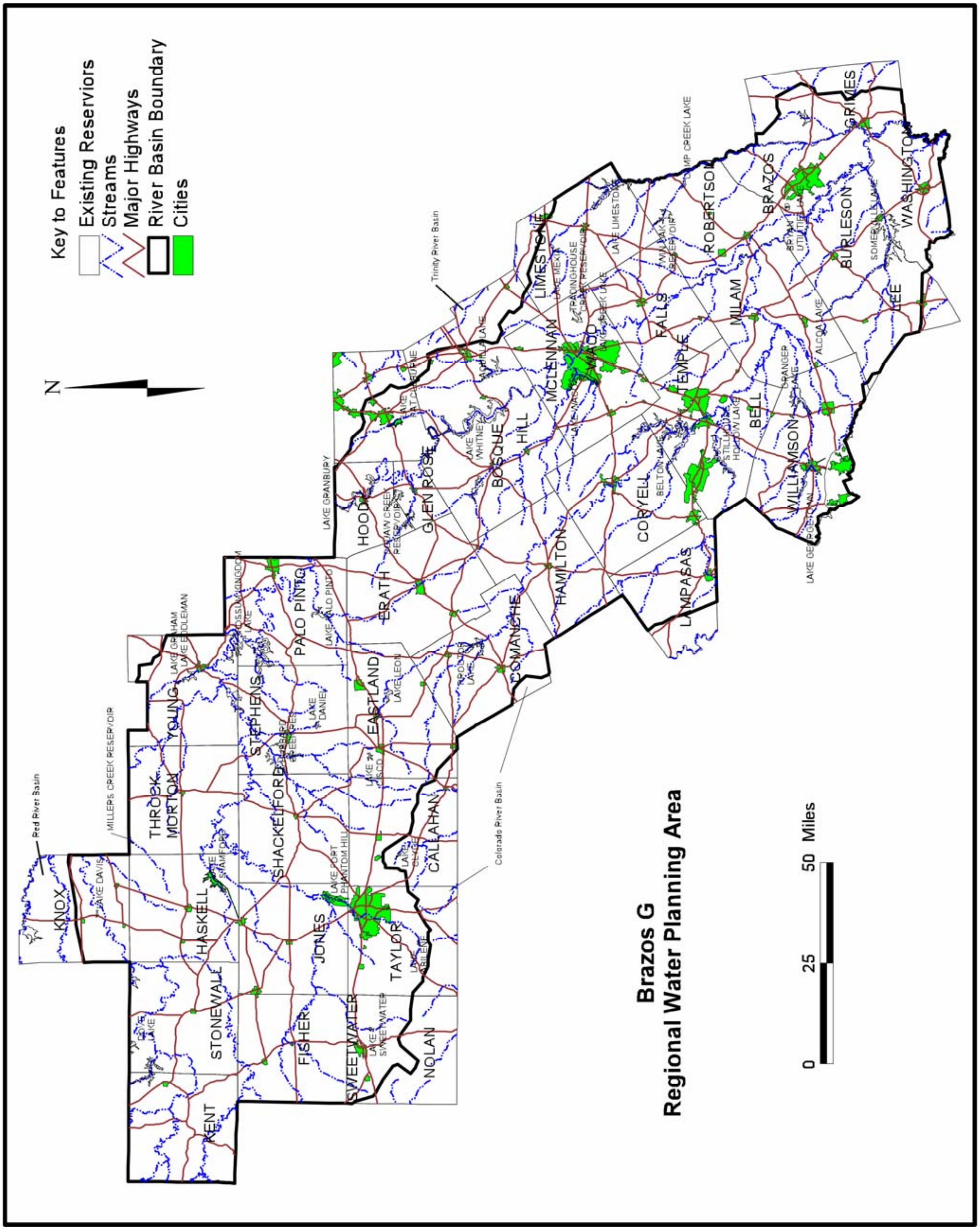

Figure 1-2. Major Features of the Brazos G Area

Members of the Brazos G RWPG who contributed to the development of the 2006 Brazos G Regional Water Plan are listed in Table 1-1. These members represent 12 interests: the public, counties, municipalities, industries, agriculture, the environment, small businesses, electric-generating utilities, river authorities, water districts, groundwater districts and water utilities. The Brazos G RWPG has retained the services of engineering firms and other specialists to assist the RWPG with the preparation of the regional plan, and it has designated the Brazos River Authority (BRA) as its administrative contracting agency.

Table 1-1.
Current and Recent Brazos G RWPG Voting Members

Interest Group	***Name***	***Entity***
Voting Members		
Agricultural	Dale Spurgin (6/04 to present)	Judge, Jones County
	Wayne Wilson (12/04 to present)	Rancher
	Steve Sanford (resigned 11/03)	Farmer/Rancher
	Chaunce Thompson (retired 12/04)	Cattlemen
Counties	Judge Tim Fambrough	Nolan County
	Judge Jon Burrows	Bell County
	Judge Mike Sutherland (12/04 to present)	Burleson County
	Tony Jones (retired 12/04)	Brazos County Commissioners Court
	Judge David Purdue (resigned 3/02)	Knox County
Electric Generating Utilities	Scott Diermann	TXU Electric
	Ken Smith (resigned 11/02)	TXU Electric
Environmental	Stephen L. Stark	Texas A&M University
Industry	Randy Waclawczyk (12/04 to present)	Alcoa
	Mark Bryson (retired 12/04)	Alcoa
Municipalities	Mike Morrison (Chairman)	City of Abilene
	Wiley Stem III	City of Waco
	Tom Clark	City of Round Rock
	Alva D. Cox (12/04 to present)	City of Granbury
	Truman O. Blum (retired 12/04)	Former mayor, City of Clifton
	James Nuse (retired 11/03)	City of Round Rock
Public	Scott Mack, DDS	Dentist
River Authorities	Phil Ford	Brazos River Authority
Small Business	Horace R. Grace	AMG Enterprises, Inc.
Water Districts	Terry Kelley	Johnson County SUD
	Kathleen Webster (12/04 to present)	West Central Texas MWD
	A.V. Jones, Jr. (retired 12/04)	West Central Texas MWD
Groundwater Districts	Mike McGuire (12/04 to present)	Rolling Plains GCD
Water Utilities	Kent Watson	Wickson Creek Special Utility District

Table 1-1.
Current and Recent Brazos G RWPG Voting Members (concluded)

Interest Group	*Name*	*Entity*
Non-Voting Members		
Region H RWPG Liaison	John Baker	Brazos River Authority
LCRA Representative	James Clarno	Lower Colorado River Authority
Region F RWPG Liaison & CRMWD Representative	John Grant	Chair, Region F & GM of Colorado River Municipal Water District
Llano Estacado (O) RWPG Liaison	Terry Lopas	Brazos River Authority
Lower Colorado (K) RWPG Liaison	Mark Jordan	Lower Colorado River Authority
TWDB Project Manager	David Meesey	Texas Water Development Board
TPWD	Mellisa Mullins	Texas Parks and Wildlife Department
TDA	E.W. Wesley	Texas Department of Agriculture
Region C RWPG Liaison	Paul Zweiacker	Texas Utilities

1.2.1 Population

1.2.1.1 Regional Trends

Figure 1-3 illustrates population growth in the entire BGRWPA for 1900 to 2000 and projected growth for 2010 to 2060. Table A-1 in Appendix A gives historical population data for each county in the BGRWPA, as well as regional and State population totals, for 1990 to 2000.

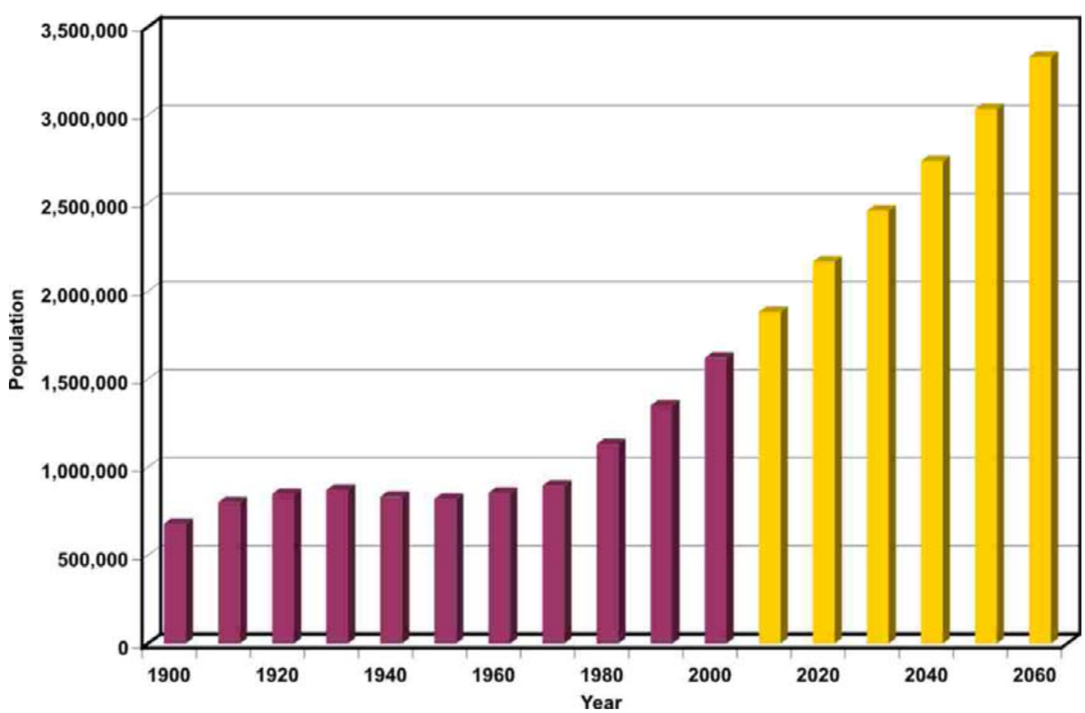

Figure 1-3. Historical and Projected BGWRPA Population

From 1900 to 1970, population in the Brazos G Area grew slowly at an average rate of 0.4 percent per year from 680,093 people to 895,682. During the same period, the total population of Texas grew at an average rate of 1.9 percent annually, from 3,048,710 to 11,196,730. Beginning in the 1970s, however, both the State's and the region's population began to increase at faster rates. Growth in the region was about 2 percent annually, which approximates the State's total growth rate of 2.1 percent. Population in the BGRWPA is expected to increase by an average of 1.2 percent annually, reaching 3.3 million by 2060. This is roughly double the population estimated in 2000.

Population trends may be further understood by dividing the BGRWPA into three subregions: the northwestern Rolling Plains, the central IH-35 Corridor, and the southeastern Lower Basin. Table A-2 in Appendix A provides historical population data for all counties in each subregion from 1990 to 2000.

Figure 1-4 illustrates historical population growth in the three subregions from 1900 to 2000 and projected growth from 2010 to 2060. Figures 1-5 and 1-6 illustrate population distribution by county for years 2000 and 2060, respectively. The greatest growth is projected to occur along the IH-35 corridor, which connects some of the larger cities in the region and the state. Table 1-2 presents 2000 populations and projected populations for 2010 and 2060 for the major cities in each subregion. Major cities are defined as those having at least 10,000 people in 2000. This table also presents the percent change in populations from 2010 to 2060 in each city. The overall division of the population between large cities and rural areas is expected to remain relatively constant, only changing about 2 percent between 2000 and 2060.

1.2.1.2 Rolling Plains

The counties in the Rolling Plains subregion are Knox, Kent, Stonewall, Haskell, Throckmorton, Young, Fisher, Jones, Shackelford, Stephens, Palo Pinto, Nolan, Taylor, Callahan, Eastland, Erath, Hood, Somervell, Comanche, Hamilton, Bosque, Coryell, and Lampasas. These counties, with about 30 percent of the BGRWPA's population in 2000, have grown moderately since 1970 at an average rate of 1.4 percent per year. Major cities in this subregion include Abilene, Copperas Cove, Gatesville, Mineral Wells, Stephenville, and Sweetwater.

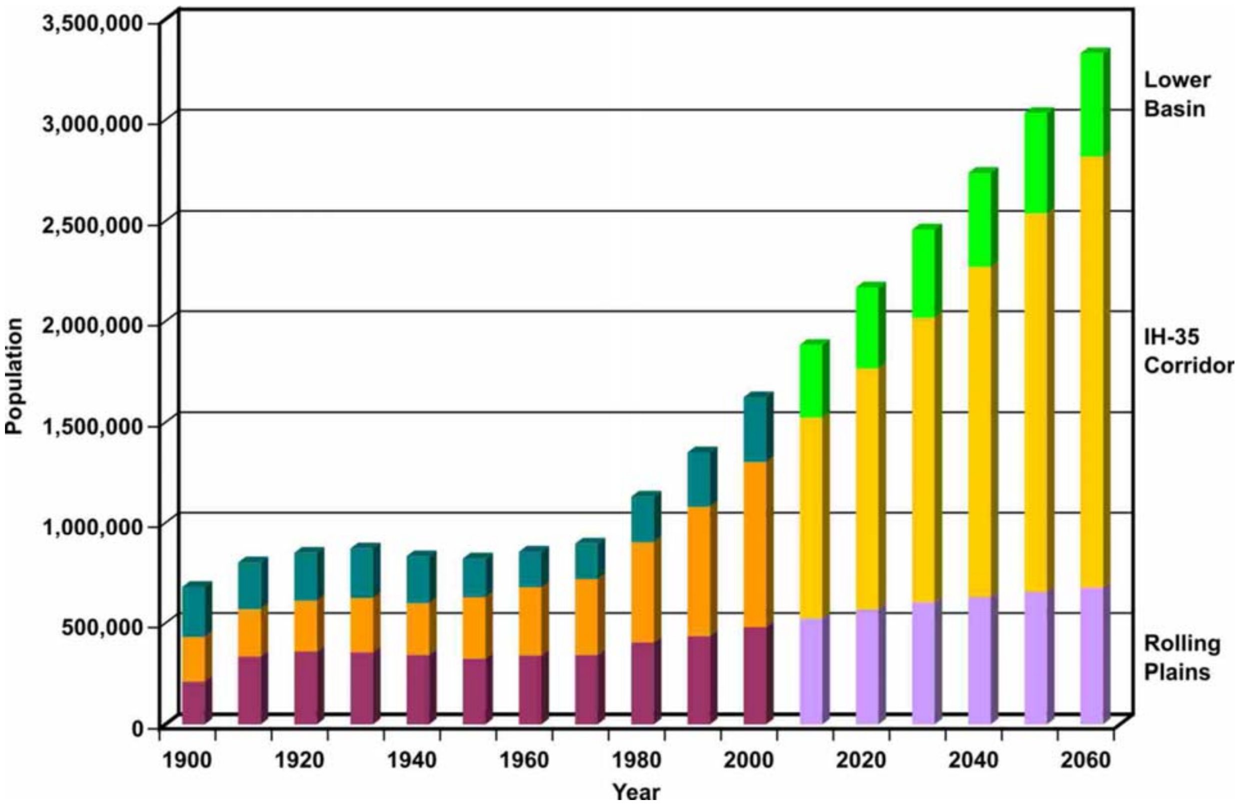

Figure 1-4. Historical and Projected Population by Subregion

1.2.1.3 IH-35 Corridor

The counties in the IH-35 Corridor are Johnson, Hill, McLennan, Bell, and Williamson. Population growth in these counties has been rapid since 1970, averaging 3.9 percent annually. In this subregion, cities with a current population greater than 10,000 include Belton, Burleson, Cedar Park, Cleburne, Fort Hood, Georgetown, Harker Heights, Hewitt, Killeen, Round Rock, Taylor, Temple, and Waco. Total population in the IH-35 Corridor was about 51 percent of the region’s total in year 2000, and it is expected to keep growing at a fast rate.

1.2.1.4 Lower Basin

Counties in the Lower Basin are Limestone, Falls, Milam, Robertson, Lee, Burleson, Brazos, Washington, and Grimes. This subregion also has seen a relatively high growth rate averaging 2.7 percent annually since 1970. Major cities include Brenham, Bryan, and College Station. The Lower Basin had 20 percent of the population of the BGRWPA in 2000.

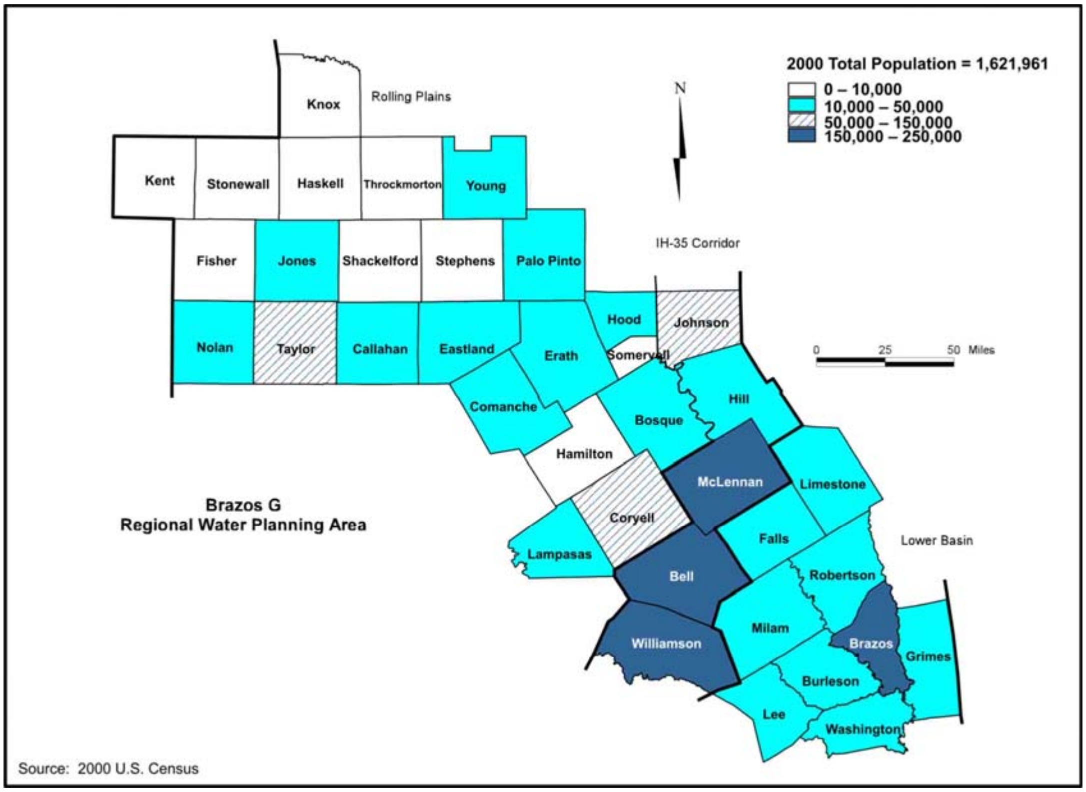

Figure 1-5. 2000 Population Distribution by County

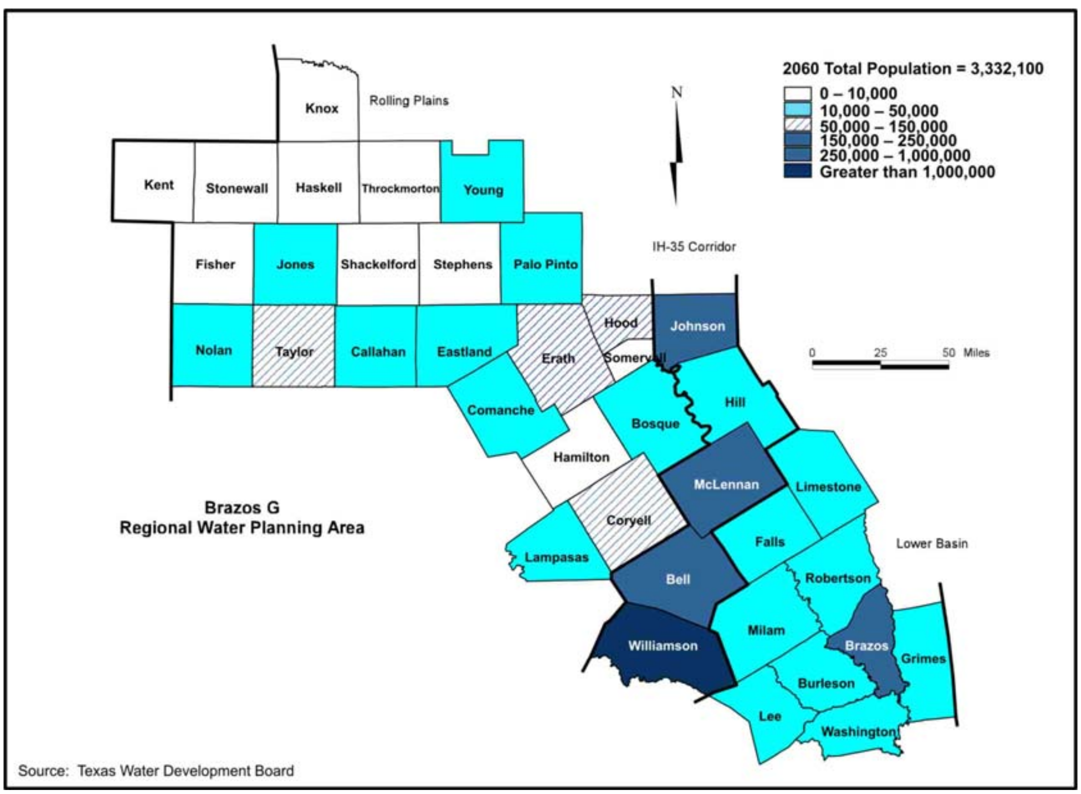

Figure 1-6. 2060 Population Distribution by County

Table 1-2.
Population of Major Cities in the BGRWPA
(Greater than 10,000 People in 2000)

City	County	Population Data[1]			% Change
		2000	2010	2060	(2010 to 2060)
Rolling Plains					
Abilene	Jones, Taylor	115,926	124,607	126,835	1.8
Copperas Cove	Coryell	29,455	34,762	57,765	66.2
Gatesville	Coryell	15,591	19,637	37,177	89.3
Mineral Wells	Palo Pinto	14,770	15,074	19,901	32.0
Stephenville	Erath	14,921	15,959	23,462	47.0
Sweetwater	Nolan	11,415	11,955	11,525	-3.6
IH-35 Corridor					
Belton	Bell	14,623	17,633	26,116	48.1
Burleson	Johnson	17,514	20,303	41,224	103.0
Cedar Park	Williamson	25,508	52,700	187,931	256.6
Cleburne	Johnson	26,005	29,158	52,812	81.1
Fort Hood	Bell, Coryell	33,711	33,711	33,711	0.0
Georgetown	Williamson	28,339	40,888	136,082	232.8
Harker Heights	Bell	17,308	22,477	41,818	86.0
Hewitt	McLennan	11,085	12,667	19,170	51.3
Killeen	Bell	86,911	104,528	169,937	62.6
Round Rock	Williamson	60,060	87,187	292,970	236.0
Taylor	Williamson	13,575	15,530	30,363	95.5
Temple	Bell	54,514	62,382	105,519	69.1
Waco	McLennan	113,726	121,355	152,715	25.8
Lower Basin					
Brenham	Washington	13,507	14,313	16,844	17.7
Bryan	Brazos	65,660	74,650	109,881	47.2
College Station	Brazos	67,890	80,920	131,981	63.1
Total, Major Cities	—	852,014	1,012,396	1,825,739	80.3
% of Region Total	—	52.5	53.8	54.8	
Total, Rural Areas	—	769,947	870,500	1,506,361	73.0
% of Region Total	—	47.5	46.2	45.2	
Region Total	—	1,621,961	1,882,896	3,332,100	77.0

[1] 2000 population data obtained from U.S. Census. 2010 and 2060 projections are from TWDB.

1.2.2 Economic Activities

The BGRWPA includes all or part of the following metropolitan statistical areas as defined by the Texas State Data Center: Abilene, Waco, Temple-Killeen, Austin-San Marcos, and Bryan-College Station. The economy of the region can be divided into the following general sectors: agriculture, agribusiness, mineral production, wholesale and retail trade, and varied manufacturing. Table 1-3 lists 1995 payrolls and employment in the BGRWPA by subregion and economic sector.[2] As of this writing, 1995 was the most recent year for which such data were available. Payroll and employment in the Brazos G Area were concentrated along the IH-35 Corridor, which in 1995 had a total payroll of about $4.3 billion and employment of over 211,000 people. Primary economic activities accounting for about 69 percent of the region's total payroll in 1995 were manufacturing, retail trade, and services.

Table 1-3.
1995 Economic Data[1]
(x$1,000)

Economic Sector	Rolling Plains	IH-35 Corridor	Lower Basin	Region Total
Agricultural, Forestry, Fishing	$11,062	$18,546	$8,258	$37,866
Mining	$93,360	$19,259	$49,813	$162,432
Construction	$116,711	$295,443	$82,851	$495,005
Manufacturing	$287,420	$1,035,039	$307,656	$1,630,115
Transportation, Public Utilities	$148,619	$245,949	$85,847	$480,415
Wholesale Trade	$118,579	$295,645	$92,806	$507,030
Retail Trade	$341,208	$634,257	$220,879	$1,196,344
Finance, Insurance, Real Estate	$114,908	$361,882	$93,548	$570,338
Services	$648,024	$1,387,420	$411,138	$2,446,582
Unclassified	$1,017	$2,987	$1,100	$5,104
Not Categorized	$88,868	$0	$5,927	$94,795
Total Payroll	$1,969,776	$4,296,427	$1,359,823	$7,626,026
Total Employed	107,150	211,097	70,517	388,764

[1] Data from U.S. Census Bureau.

[2] U.S. Census Bureau, "1995 Economic Data," Online: available URL: http://www.census.gov/datamap/May 1998.

1.2.3 Climate

Temperatures in the Brazos G Area range from an average low of 35°F in January to an average high of 95°F in July. Average annual precipitation ranges from 20 to 24 inches in Kent County in the northwest corner of the region to 40 to 44 inches in Washington and Grimes Counties in the southeast. Figure 1-7 depicts average annual precipitation for the entire region.

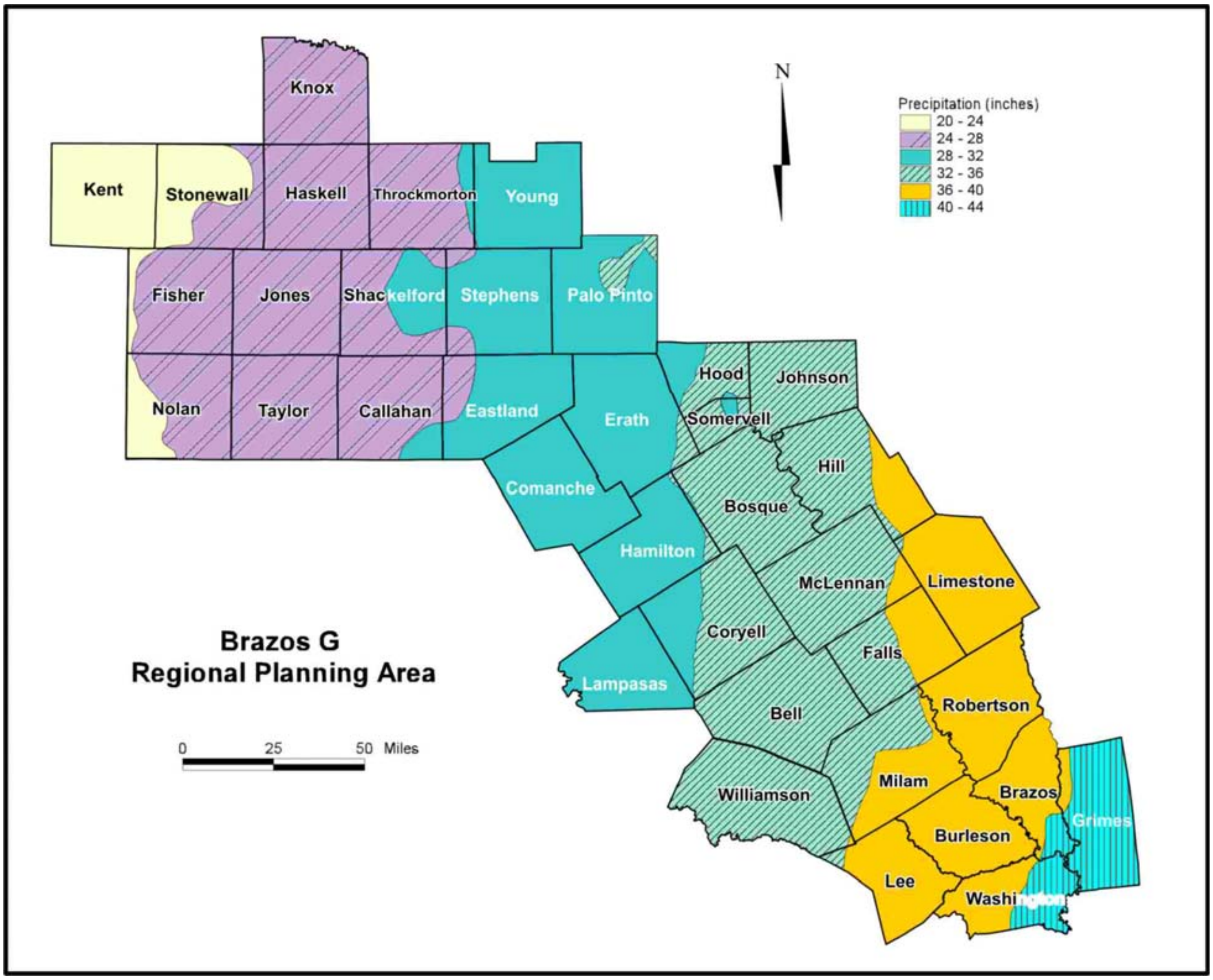

Figure 1-7. Average Annual Precipitation (1961 to 1990)

1.3 Sources of Water

Table A-3 in Appendix A provides historical data on use of groundwater and surface water within the BGRWPA from 1980 to 2000. These data suggest that the planning area has depended slightly more on surface water than on groundwater during the 1980s and 1990s. Figure 1-8 shows the proportion of surface water use to groundwater use in 1980, 1990, and

2000. While the proportions were equal in 1980, surface water use was greater by 4 percent in 1990 and 6 percent in 2000.

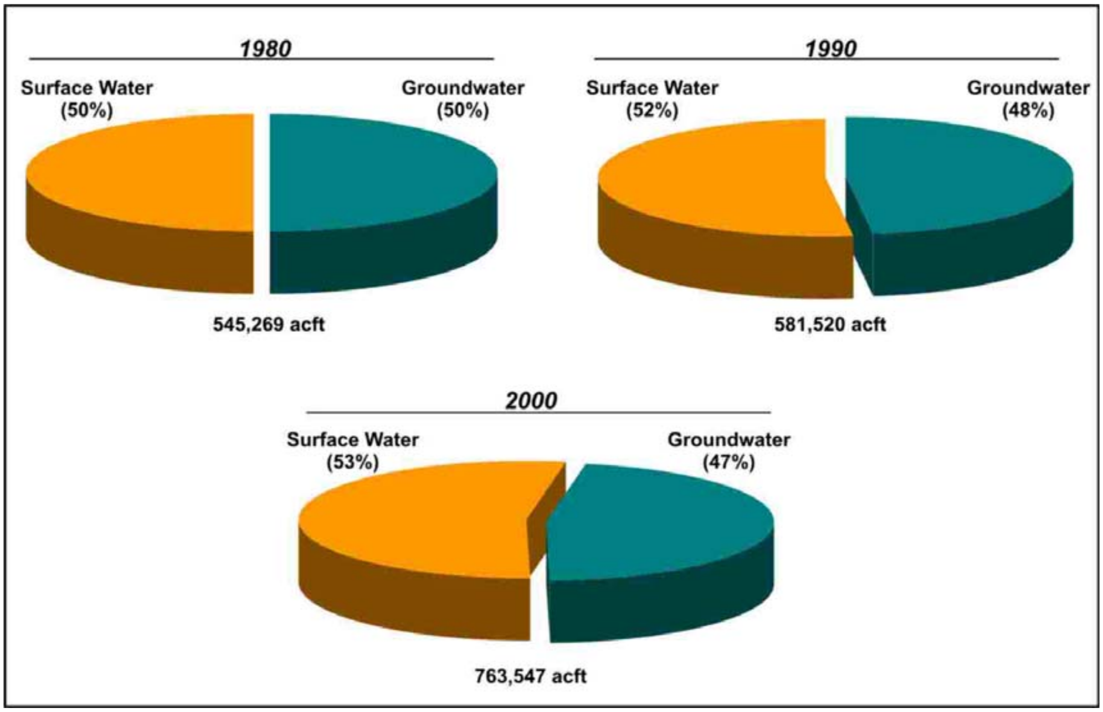

Figure 1-8. BGRWPA Historical Water Use by Source

1.3.1 Groundwater

1.3.1.1 Aquifers[3,4,5]

Portions of six major and nine minor aquifers extend into the Brazos G Area (Figures 1-9 and 1-10). Major aquifers are defined generally as those aquifers that supply large amounts of water to large areas of the State. Minor aquifers are defined as those that supply large amounts of water to small areas of the State or provide small supplies to wide areas. Figure 1-11 shows historical water pumpage for each aquifer in the BGRWPA in 1980, 1990, and 2000. In 2000, about 77 percent of the groundwater pumped came from three aquifers: Seymour, Trinity, and Carrizo-Wilcox. Table 1-4 depicts historical pumpage in 2000 and projected availability in 2060 of groundwater in each aquifer in the BGRWPA.

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[3] Texas Water Commission, *Groundwater Quality in Texas - An Overview of Natural and Man-Affected Conditions*, TWC Report No. 89-01, 1989.
[4] Texas Water Development Board (TWDB), *Water for Texas*, 1997.
[5] TWDB, *Estimated Groundwater Pumpage by County and Aquifer*, 2000.

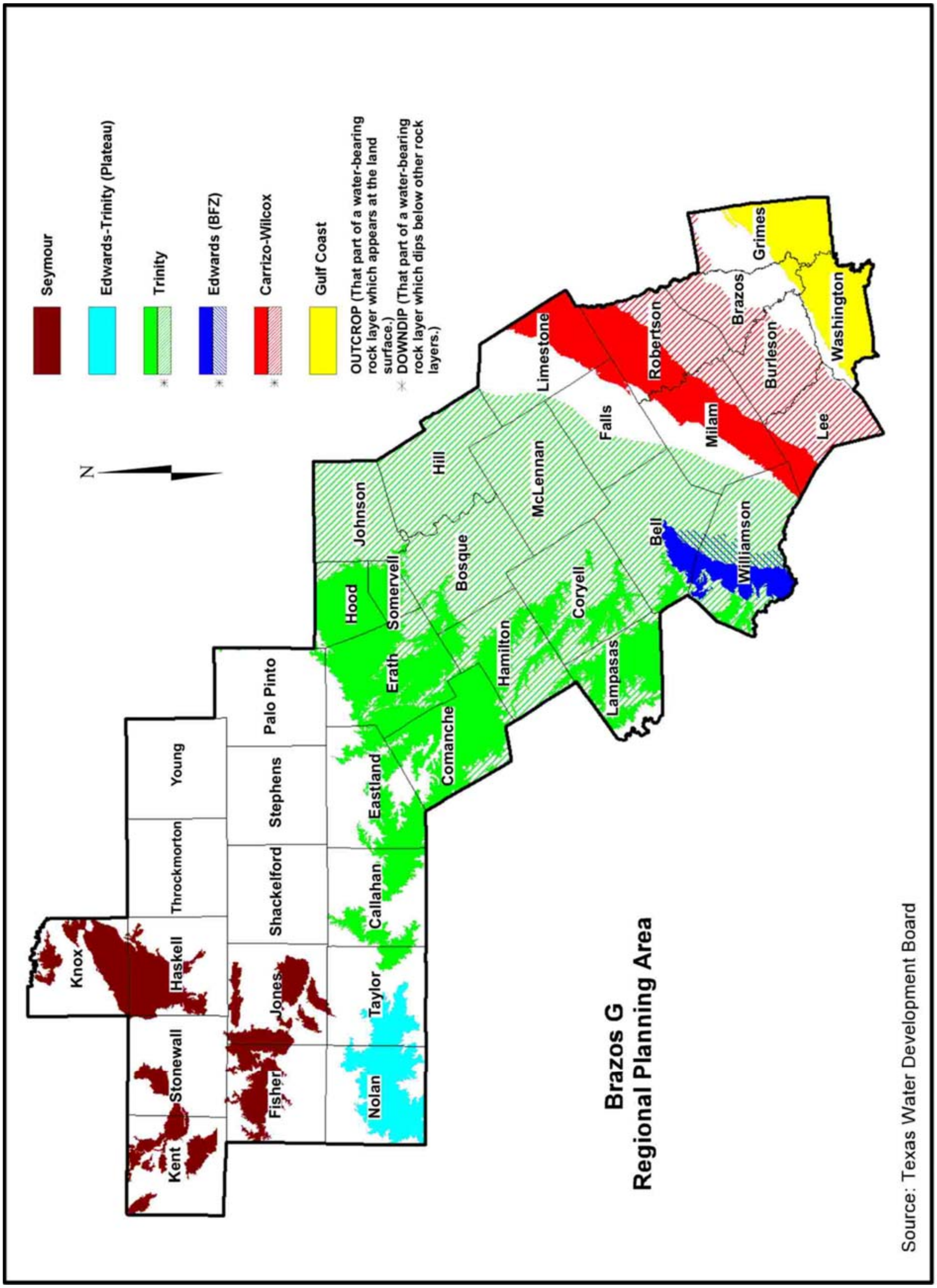

Figure 1-9. Major Aquifers

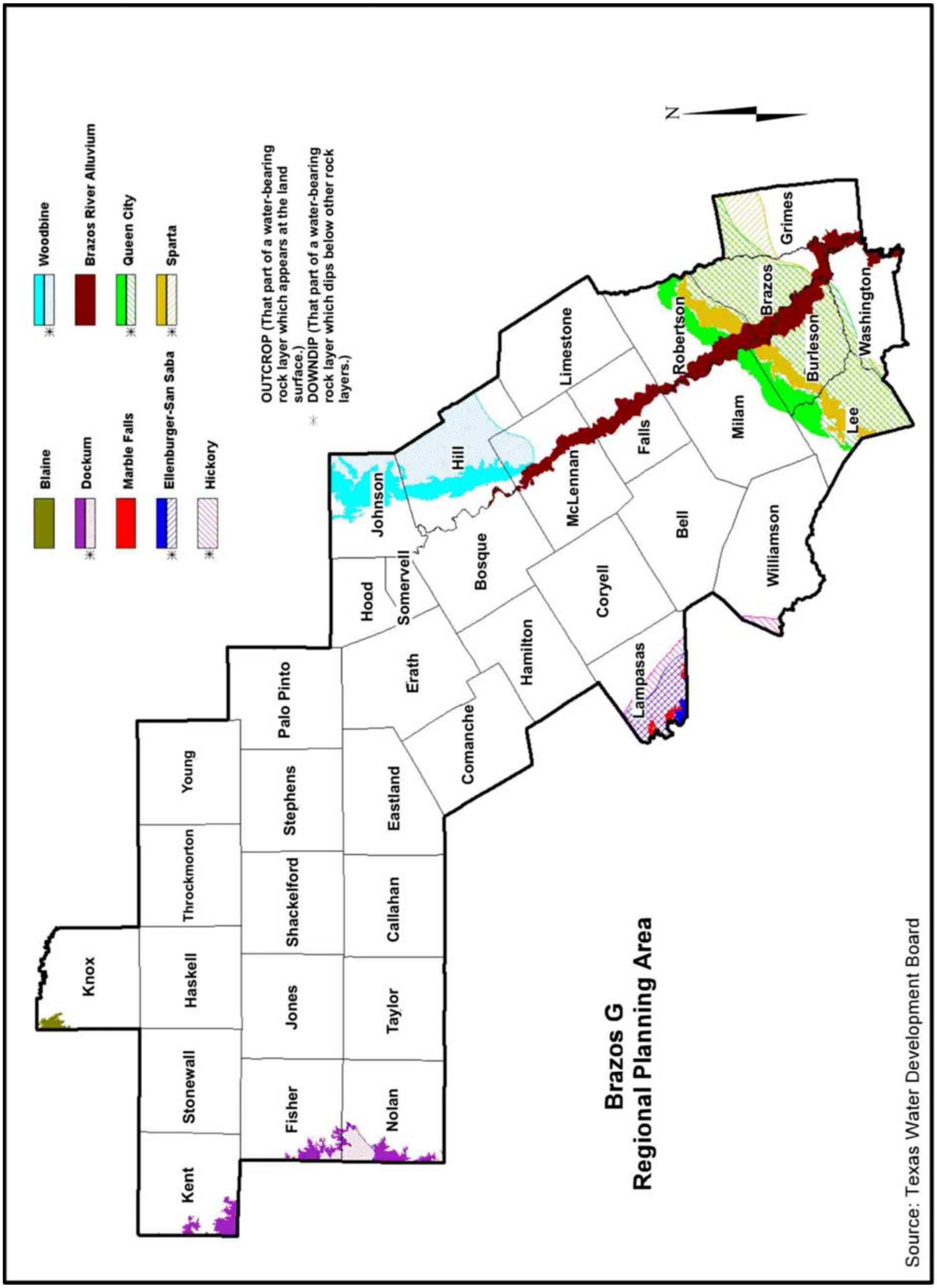

Figure 1-10. Minor Aquifers

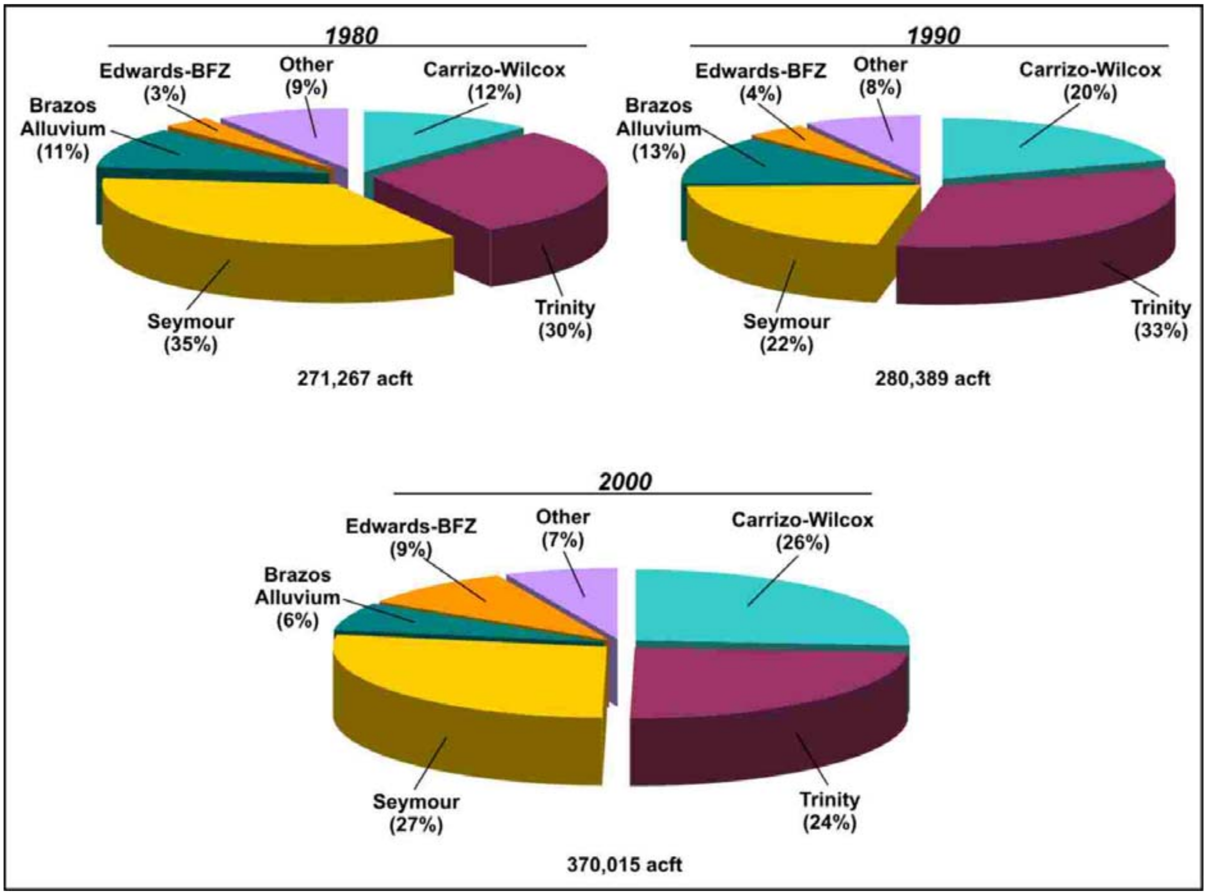

Figure 1-11. Brazos G Area Historical Water Pumpage by Aquifer

Fewer than half of the aquifers in the BGRWPA have potential for further development. Seven of them extend only slightly into the planning area. The several aquifers that do offer potential for further development are all in the southeastern part of the region.

In the western part of the region, the Seymour Aquifer is the most significant in terms of usage and yield. The Seymour Aquifer, which has an uneven distribution, is highly developed, and most of its water is used for irrigation. The aquifer is prone to depletion if subjected to a combination of prolonged drought and heavy use, but groundwater supply in the aquifer has remained fairly constant. Also in the west, the fringes of three aquifers, the Dockum, Blaine, and Edwards-Trinity (Plateau), extend into the planning area, but these offer little room for further development. In the northeastern part of the region, there is a wide area with no aquifers, including the counties of Throckmorton, Young, Shackelford, Stephens, and Palo Pinto. In these areas, locally occurring groundwater is not associated with a defined major or minor aquifer system and is sufficient only for individual homes and livestock.

Table 1-4.
Brazos G Area Aquifers

Aquifer	2000 Pumpage (acft)	2060 Availability (acft/yr)	Remarks
Western Area			
Seymour	101,710	67,000	Fully developed
Dockum	4,880	3,700	Limited extent within region
Blaine	ND[1]	1,333	Limited extent within region
Edwards-Trinity (Plateau)	300	1,500	Limited extent within region
Subtotal:	106,890	73,533	
Central Area			
Trinity	90,180	77,563	Overdeveloped in some areas
Edwards (BFZ)	34,370	12,500	Overdeveloped in drought
Woodbine	1,360	2,432	Limited extent within region
Marble Falls	ND[1]	4,183	Limited extent within region
Ellenburger-San Saba	ND[1]	551	Limited extent within region
Hickory	ND[1]	ND[1]	Limited extent within region
Subtotal:	125,910	97,229	
Southeastern Area			
Brazos River Alluvium	23,070	66,700	Added potential, water quality variable
Carrizo-Wilcox	96,160	251,000	Large added potential
Queen City	2,130	3,459	
Sparta	1,600	10,333	Added potential
Gulf Coast	7,250	28,296	Added potential
Subtotal:	130,210	359,788	
Other and Undifferentiated	7,000	2,915	Many widely-scattered sources
Total:	**370,010**	**533,465**	

[1] ND indicates no data available.

In the central part of the BGRWPA, the Trinity Aquifer is the most significant. It is widespread and furnishes small to moderate amounts of groundwater to entities in 17 counties. In the confined portions of the aquifer, however, development has resulted in significant declines in artesian water levels.

In the southeastern part of the region, groundwater supplies are dominated by the Carrizo-Wilcox System and, to a lesser extent, the Gulf Coast Aquifer. The Carrizo-Wilcox has significant potential for further development, but the Gulf Coast Aquifer in this area has low to moderate potential. Several minor aquifers also have potential for further development over wide areas in this sector. The Brazos Alluvium, which lies along the Brazos River, also extends into the central portion of the area and has some potential for additional development, but most of the BGRWPA's undeveloped groundwater lies in the southeastern sector.

The Trinity Aquifer and all other artesian aquifers to the southeast have outcrop areas under water-table conditions and downdip areas with overlying confining layers where artesian conditions occur. Most of these aquifers contain fresh water to considerable depths, and all contain slightly saline water just downdip (commonly to the southeast) of the fresh water. Maps in Appendix B show the locations of fresh water, defined as containing less than 1,000 milligrams per liter (mg/L) total dissolved solids (TDS), and slightly saline water, defined as having 1,000 to 3,000 mg/L TDS, within various aquifers. Maps are included for all aquifers within the BGRWPA that have availability estimated to exceed 5,000 acre-feet per year (acft/yr). The use of aquifers with groundwater containing more than 1,000 mg/L TDS is an option only where consumers can use the saline water or where special treatment (desalination or blending) is available. More detailed descriptions and availability of water from each aquifer in the BGRWPA are in Appendix B.

1.3.1.2 Major Springs

The BGRWPA contains few major springs, defined as springs with discharges commonly greater than 1 cubic foot per second (cfs). The majority of these issue from the Edwards-Balcones Fault Zone (BFZ) Aquifer in Bell and Williamson Counties and from the Marble Falls Aquifer in Lampasas County. Of the Edwards Aquifer springs, all but one are intermittent. The three largest Edwards springs are:

1. Salado Springs at Salado along the Lampasas River with discharges ranging from 5 to 60 cfs.
2. Berry Springs, which is located 5 miles north of Georgetown, with discharges ranging from 0 to 50 cfs.
3. San Gabriel Springs at Georgetown with discharges ranging from 0 to 25 cfs.

Springs from the Marble Falls Aquifer include Hancock Park Springs along the Sulfur River, which is a tributary to the Lampasas River, with discharges reportedly ranging from 6 to 12 cfs, and Swimming Pool Springs at Hancock Park with a reported discharge of 1.3 to 1.6 cfs.

Some springs in the region significantly affect the quality of the water in the Brazos River. These are primarily the salt springs and seeps, such as those along Salt Croton and Croton Creeks, in the upper Brazos River Basin. These natural saltwater sources cause the water in the main stem of the Brazos River above Possum Kingdom Lake to be too saline for most uses during low flow periods. For example, from 1963 to 1986, TDS and chloride concentrations in Croton Creek near Jayton averaged 7,933 mg/L and 3,169 mg/L, respectively. The mean values for TDS and chlorides in the Salt Croton Creek near Aspermont from 1969 to 1977 were 71,237 mg/L and 41,516 mg/L, respectively. Water in Possum Kingdom Lake usually contains more than 400 mg/L chloride and 1,200 mg/L TDS. The natural chloride pollution in the upper Brazos River affects water quality in the lower basin. In the Brazos River at Richmond, it has been estimated that 85 percent (or about 95 mg/L for the years 1946 to 1986)[6] of the chloride is from the upper basin.

There are many smaller springs in the Brazos G Area, but cataloging is inconsistent and incomplete. Only a few small springs have been cataloged in just nine of the 37 counties in the BGRWPA.[7] These springs flow substantially less than 1 cfs, and most flow only a few gallons per minute (1 cfs = 448.8 gpm).

1.3.2 Surface Water

The BGWRPA lies within the Brazos River Basin, the boundaries of which are the Red River Basin to the north, the Colorado River Basin to the west, the Trinity and San Jacinto River Basins to the east, and the counties of Fayette, Austin, Waller, and Montgomery to the south. The total drainage area for the Brazos River Basin is about 45,400 square miles, and of this about 28,400 square miles are in the BGRWPA.

The Brazos River is the third-largest river in Texas and the largest river between the Rio Grande River and the Red River in terms of total watershed area.[8] The Brazos River rises in three upper forks: the Double Mountain Fork, Salt Fork, and Clear Fork. Twenty-nine major reservoirs

[6] Ganze, C. Keith and Ralph A. Wurbs, "Compilation and Analysis of Monthly Salt Loads and Concentrations in the Brazos River Basin," U.S. Army Corps of Engineers, Contract No. DACW63-88-M-0793, January 1989.
[7] Brune, Gunnar, *Major and Historical Springs of Texas: TWDB Report 189*, 1970.
[8] The Dallas Morning News, *2004-2005 Texas Almanac*, 2004.

provide surface water to the BGRWPA. Major reservoirs, listed in Table 1-5, are defined as having an authorized conservation capacity greater than 10,000 acft. This table shows amounts of storage and annual use that the Texas Commission on Environmental Quality (TCEQ) authorizes for each reservoir. Figure 1-2 shows locations of some of the reservoirs in the BGRWPA, and Table A-5 in Appendix A provides more detailed information about all reservoirs in the BGRWPA with a permitted capacity greater than 2,500 acft. Diversions permitted for municipal, industrial, irrigation, and mining uses for each BGRWPA subregion are listed in Table 1-6. Total diversions permitted by use in each BGWRPA county are given in Table A-6 in Appendix A.

1.4 Wholesale Water Providers

Wholesale water providers are defined in SB2 as any entity that sold more than 1,000 acft of wholesale water in any one year during the five years preceding the adoption of the last regional water plan. The Brazos G RWPG may also identify a provider who is expected to sell more than 1,000 acft per year of wholesale water during the 60-year planning period. There are 17 identified wholesale water providers in the BGRWPA. These providers are listed in Table 1-7 and described below.

1.4.1 Authorities

1.4.1.1 Brazos River Authority

The largest provider of water in the BGRWPA is the BRA. The BRA also operates water and wastewater treatment systems, has programs to assess and protect water quality, does water supply planning, and supports water conservation efforts in the Brazos River Basin. The BRA provides water from three wholly owned and operated reservoirs: Lake Granbury, Possum Kingdom Lake, and Lake Limestone. The BRA also owns water rights for the proposed Allens Creek Reservoir in Region H. In addition to these sources, the BRA contracts for conservation storage space in the eight U.S. Army Corps of Engineers reservoirs in the region: Lakes Proctor, Belton, Stillhouse Hollow, Georgetown, Granger, Somerville, Whitney, and Aquilla. The total permitted capacity of the 12 constructed reservoirs in the BRA system is approximately 2.3 million acft. The BRA holds rights for diversion in the region totaling 661,901 acft, and contracts to supply

Table 1-5.
Major Reservoirs in BGRWPA
(Authorized Capacity Greater than 10,000 acft)

Reservoir	Stream	County	Authorized Storage (acft)	Authorized Use (acft/yr)	Owner
Abilene	Elm Creek	Taylor	11,868	1,675	City of Abilene
Alcoa Lake	Sandy Creek	Milam	15,650	14,000	Aluminum Co. of America
Aquilla	Aquilla Creek	Hill	52,400	13,896	U.S. Army Corps of Engineers[1]
Belton	Leon River	Bell	469,600	112,257	U.S. Army Corps of Engineers[2]
Cisco	Sandy Creek	Eastland	45,000	2,027	City of Cisco
Cleburne	Nolan Creek	Johnson	25,600	6,000	City of Cleburne
Daniel	Gonzales Creek	Stephens	11,400	2,100	City of Breckenridge
Dansby Power Plant	Unnamed Trib. Brazos River	Brazos	15,227	850	City of Bryan
Fort Phantom Hill	Elm Creek	Jones	73,960	30,690	City of Abilene
Georgetown	North Fork San Gabriel River	Williamson	37,100	13,610	U.S. Army Corps of Engineers[1]
Gibbons Creek	Gibbons Creek	Grimes	32,084	9,740	Texas Municipal Power Agency
Graham/Eddleman	Flint Creek	Young	52,386	20,000	City of Graham
Granbury	Brazos River	Hood	155,000	64,712	Brazos River Authority
Granger	San Gabriel River	Williamson	65,500	19,840	U.S. Army Corps of Engineers[1]
Hubbard Creek	Hubbard Creek	Stephens	317,750	56,000	West Central Texas MWD
Leon	Leon River	Eastland	28,000	6,300	Eastland Co. WSD
Limestone	Navasota River	Robertson	225,400	65,074	Brazos River Authority
Millers Creek Lake[3]	Millers Creek	Baylor	30,696	5,000	North Central Texas MWA
Palo Pinto	Palo Pinto Creek	Palo Pinto	44,124	18,500	Palo Pinto MWD
Possum Kingdom	Brazos River	Palo Pinto	724,739	230,750	Brazos River Authority
Proctor	Leon River	Comanche	59,400	19,658	U.S. Army Corps of Engineers[1]
Somerville	Yegua Creek	Washington	160,110	48,000	U.S. Army Corps of Engineers[1]
Squaw Creek	Squaw Creek	Somervell	151,500	20,780	Texas Utilities Electric Co.
Stamford	Paint Creek	Haskell	60,000	10,000	City of Stamford
Stillhouse Hollow	Lampasas River	Bell	235,700	67,768	U.S. Army Corps of Engineers[1]
Tradinghouse	Tradinghouse Creek	McLennan	37,800	27,000	Texas Utilities Electric Co.
Truscott Brine	Bluff Creek	Knox	107,000	N/A	Red River Authority of Texas
Twin Oak	Duck Creek	Robertson	30,319	13,200	Texas Utilities Electric Co.
Waco	Bosque River	McLennan	192,062	79,870	U.S. Army Corps of Engineers[4]
Whitney	Brazos River	Hill	50,000	18,336	U.S. Army Corps of Engineers[1]
Totals	—	—	**3,517,375**	**997,633**	—

[1] Water rights held by the Brazos River Authority.
[2] Water rights held by the Brazos River Authority and the Department of the Army (Fort Hood).
[3] Millers Creek Lake is listed in Baylor County in Region B, but is used exclusively in the Brazos G Area.
[4] Water rights held by the City of Waco.

Table 1-6.
Permitted Surface Water Diversions by Subregion

Subregion	Permitted Diversion (acft/yr) [1]					
	Municipal	Industrial	Irrigation	Mining	Other[2]	Total
Rolling Plains	472,530	46,658	66,553	10,109	1,343	597,193
IH-35 Corridor	395,973	76,377	16,497	921	0	489,768
Lower Basin	127,637	137,054	57,959	885	1,607	325,142
Region Total	996,140	260,089	141,009	11,915	2,950	1,412,102

[1] Available supply may be less than the permitted diversion based on hydrologic conditions and priority of individual water rights.
[2] Category includes consumptive amounts for recreation and other uses as classified by the TCEQ.

Table 1-7.
Wholesale Water Providers

Entity	2000 Contracts	2000 Sales	Water Source
Aquilla Water Supply	5,953	4,844	Lake Aquilla
Bell County WCID #1	49,510	26,211	Lake Belton
Bluebonnet WSC	2,675	2,848	Lake Belton
Brazos River Authority	600,640[1]	231,613[1]	Lakes Aquilla, Belton, Georgetown, Granbury, Granger, Limestone, Possum Kingdom, Proctor, Somerville, Stillhouse Hollow, Whitney
Central Texas WSC	7,741	6,900	Lake Stillhouse Hollow
City of Abilene	4,824	3,659	Abilene, Fort Phantom Hill, Hubbard Creek, Kirby
City of Cedar Park	1,819	2,378	Lake Travis
City of Round Rock	4,295	3,090	Edwards BFZ Aquifer
City of Sweetwater	2,604	1,120	Dockum Aquifer, Lakes Sweetwater, Trammel, Oak Creek
City of Waco	8,587	1,278	Lake Waco
Colorado River MWD	15,000	0	Lake Ivie (to Brazos G)
Eastland County WSD	2,621	1,762	Lake Leon
Lower Colorado River Auth.	49,400[2]	8,524[2]	Lake Travis (to Brazos G)
North Central Texas MWA	1,319	1,410	Millers Creek Lake
Palo Pinto County MWD No. 1	6,574	7,994	Lake Palo Pinto
Upper Leon MWD	3,435	2,445	Lake Proctor
West Central Texas MWD	27,766	24,230	Hubbard Creek Reservoir

[1] Includes contracts in other regions.
[2] Region G contracts only.

water to municipal, industrial, and agricultural water customers in the BGRWPA and other regions. The BRA's largest municipal customers in 2000 included Bell County Water Control and Improvement District No. 1, the City of Round Rock, and the Central Texas Water Supply Corporation.

In 2004, the BRA submitted a water rights application to the TCEQ requesting an additional firm supply appropriation of up to 421,449 acft/yr and an interruptible supply of up to 670,000 acft/yr. These additional supplies would be made available through coordinated operation of the BRA's system of reservoirs, as further described in Section 4B.4. The water right application is pending with the TCEQ.

1.4.1.2 Lower Colorado River Authority

The Lower Colorado River Authority (LCRA) manages much of the lower Colorado River Basin and is a significant regional water provider in Region K. In the BGRWPA, LCRA provides raw water to the City of Cedar Park from Lake Travis in Travis County (Region K). The BRA and the LCRA have formed the Brazos-Colorado Water Alliance to identify water supply and treatment alternatives to meet the future needs of the Brazos and Colorado River Basins.

1.4.2 Districts and Water Supply Corporations

1.4.2.1 Aquilla Water Supply District

Aquilla Water Supply District is located in Hill County, and obtains raw water from Lake Aquilla through a contract with the BRA. The district supplies treated water to six wholesale customers. The City of Hillsboro is the district's largest customer, and purchased 3,889 acft in 2000. Total sales for Aquilla Water Supply District in 2000 were 4,844 acft.

1.4.2.2 Bell County WCID No. 1

Bell County WCID No. 1 obtains raw water from Lake Belton for distribution to its customers. Major customers include the U.S. Department of the Army (Fort Hood) and the Cities of Belton, Copperas Cove, Harker Heights, and Killeen. Wholesale sales in 2000 totaled 26,211 acft.

1.4.2.3 Bluebonnet Water Supply Corporation

The Bluebonnet Water Supply Corporation (WSC) is located in Bell County. The WSC obtains raw water from Lake Belton, and sells treated water to nine entities in the BGRWPA. The largest customer is the City of McGregor, which purchased 943 acft in 2000. Wholesale sales in year 2000 totaled 2,848 acft.

1.4.2.4 Central Texas Water Supply Corporation

Central Texas WSC contracts with the BRA to obtain raw water from Lake Stillhouse Hollow. This provider sold a total of 6,900 acft of treated water to 16 water-supply entities in 2000. Its largest customer was Kempner Water Supply Corporation, which purchased about 3,300 acft.

1.4.2.5 Colorado River Municipal Water District

Colorado River Municipal Water District (CRMWD) provides water to customers in the upper Colorado River Basin (Region F) and the City of Abilene in the BGRWPA. Treated water from the City of Snyder, a CRMWD member city, is supplied to the City of Rotan in Fisher County in the BGRWPA. The district owns and operates multiple sources of raw water including three reservoirs (O.H. Ivie, J.B. Thomas and Spence) and several groundwater well fields. In the BGRWPA, the district is contracted to provide up to 15,000 acft of raw water per year to the City of Abilene from Lake Ivie. The pipeline from Lake Ivie to Abilene became operational in September 2003, so there are no reported sales to customers in the BGRWPA in 2000.

1.4.2.6 Eastland County Water Supply District

The Eastland County Water Supply District owns and operates Lake Leon and has a water right to divert 5,800 acft for municipal and industrial purposes and 500 acft for irrigation. The district currently provides treated water to entities in Eastland County through the Cities of Eastland and Ranger. Total water sales in 2000 were 1,762 acft.

1.4.2.7 North Central Texas Municipal Water Authority

North Central Texas Municipal Water Authority supplies treated water to entities in Knox, Haskell and Stonewall Counties. The district has water rights to divert 5,000 acft of raw water from Millers Creek Reservoir for municipal, industrial, and mining purposes. Wholesale water sales totaled 1,410 acft in 2000.

1.4.2.8 Palo Pinto Municipal Water District

Palo Pinto Municipal Water District owns and operates Lake Palo Pinto, which is used to supply water to entities in Palo Pinto and Parker Counties. The district has rights to 18,500 acft a year for municipal and steam electric power uses. Treated water is supplied to the City of Mineral Wells (and its customers) and Lake Palo Pinto Water Association. Wholesale municipal sales totaled 4,616 acft in 2000 and steam electric power sales were 1,378 acft.

1.4.2.9 Upper Leon Municipal Water District

The Upper Leon Municipal Water District obtains water from Lake Proctor through contracts with the BRA. The MWD provides treated water to the Cities of Comanche, De Leon, Dublin, Gorman, and Hamilton. The MWD also has a contract to sell water to Stephenville, but the infrastructure is not complete. Total 2000 sales were 2,445 acft.

1.4.2.10 West Central Texas Municipal Water District

The West Central Texas Municipal Water District diverts raw water from Hubbard Creek Reservoir, which it owns and operates, for distribution to the Cities of Abilene, Albany, Anson, and Breckenridge. This district has rights to 56,000 acft of water for municipal, industrial, irrigation, and mining uses. In 2000, the district provided 24,230 acft of raw water to its customer cities.

1.4.3 Municipal

1.4.3.1 City of Abilene

The City of Abilene obtains raw water from Lake Fort Phantom Hill, Lake Abilene, and Lake Kirby, all of which it owns and operates. The total permitted capacity of these reservoirs is about 94,300 acft. The City has the right to divert up to 37,365 acft/yr from these lakes for municipal, industrial, and irrigation uses. The City also uses self-supplied groundwater, surface water purchased from the West Central Texas Municipal Water District, and surface water purchased from CRMWD. The City has contracts to supply treated water to 13 entities in the BGRWPA and the Dyess Air Force Base, which is located in Abilene. The City also has a contract with the City of Hamlin to treat raw water from Hubbard Creek Lake that is purchased from the City of Anson. Wholesale water sales to these customers totaled 3,659 acft in year 2000. In addition, the City provided approximately 20,000 acft of water to retail customers.

1.4.3.2 City of Waco

In year 2000 the City of Waco obtained raw water from Lake Waco, a small amount of groundwater from the Trinity Aquifer and purchased water from Bluebonnet WSC. In 2003, the City, in cooperation with the BRA and the U.S. Army Corps of Engineers, implemented a project to raise the water level in Lake Waco to provide for additional supply. With this additional supply, the City has the right to divert 79,870 acft/yr for municipal, industrial, and irrigation uses. In 2000, the City provided 1,278 acft of treated wholesale water to the City of Hewitt, City of Woodway, and Bosqueville Green Acres WSC. Total water used by Waco in 2000 was over 30,000 acft, including wholesale sales.

1.4.3.3 City of Round Rock

The City of Round Rock obtains raw water from the Edwards (BFZ) Aquifer and purchases additional water from Lake Georgetown. The City sells wholesale water to local providers in Williamson County. Its largest customer, Brushy Creek MUD, bought 1,999 acft in 2000. In addition to the 3,090 acft of wholesale water sales in 2000, the City provided approximately 14,000 acft of treated water to retail and manufacturing customers. The City of Round Rock has contracted to purchase 18,134 acft/yr from the BRA at Stillhouse Hollow Reservoir in Bell County. The pipeline that delivers this water to Lake Georgetown was completed in late 2004.

1.4.3.4 City of Sweetwater

The City of Sweetwater owns and operates two reservoirs in the BGRWPA, Lake Sweetwater and Lake Trammel, and a groundwater well field in the Dockum Aquifer. The City also owns and operates the Oak Creek Reservoir in Coke County (Region F) in the Colorado River Basin. The City of Sweetwater provides wholesale water to entities in Nolan and Fisher Counties, and the City of Bronte in Region F. The City also has a contract with American Electric Power (AEP) for cooling water from Oak Creek Reservoir. In 2000, Sweetwater sold approximately 750 acft of wholesale water to its municipal customers and 370 acft for steam electric power. At this time, the AEP power plant on Oak Creek Reservoir is not operating due to the low lake levels from the on-going drought in the region.

1.4.3.5 City of Cedar Park

The City of Cedar Park is located in Williamson County and provides wholesale water to entities in Williamson and Travis Counties. In 2000, the City purchased all of its raw water from the LCRA and Lake Travis (Region K). The City sold 2,378 acft to its wholesale customers and provided 6,000 acft of water to retail customers. The City's largest wholesale customer in 2000 was the City of Leander.

1.5 Current Water Users and Demand Centers

1.5.1 Regional Water Use

Total water use by each county in the BGRWPA is provided in Figure 1-12 for 2000. Water use can be better understood by looking at four general types of use: municipal, industrial, agricultural, and non-consumptive. Figure 1-13 shows historical water use by municipalities, industries, and agriculture in the BGRWPA. Industrial use can be further broken down into three sub-categories: manufacturing, steam-electric cooling, and mining. Agricultural use consists of the subcategories of water used for irrigation and livestock. Historical water use in the planning area for six categories is summarized in Table 1-8.

In Appendix A, Table A-7 gives historical water-use data for all counties in the BGRWPA, and Table A-8 gives historical water-use data by category of use. Historical surface water use greater than or equal to 1,000 acft is given in Appendix D by each water-right holder.

1.5.2 Municipal Use

Municipal water use includes water consumed for residential and commercial enterprises and institutions. Residential and commercial uses are categorized together because they are similar types of uses (i.e., they both use water primarily for drinking, cleaning, sanitation, air-conditioning, and landscape watering). Generally, municipal use does not include water use by large industries. Projections for future municipal use take into account population growth and anticipated efforts at water conservation. Municipal use of 319,140 acft accounted for about 37 percent of the region's total water use in 2000. Figure 1-14 shows municipal water use in each BGRWPA county in 2000.

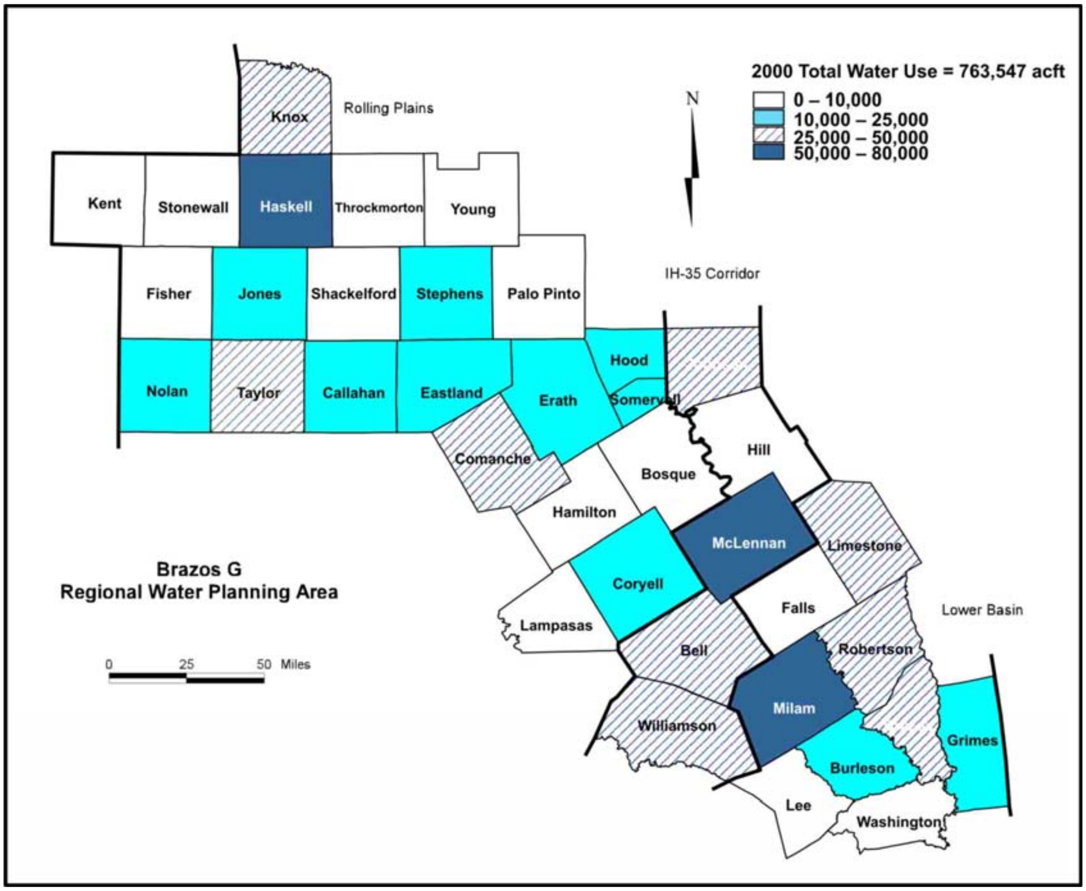

Figure 1-12. 2000 Total Water Use by County

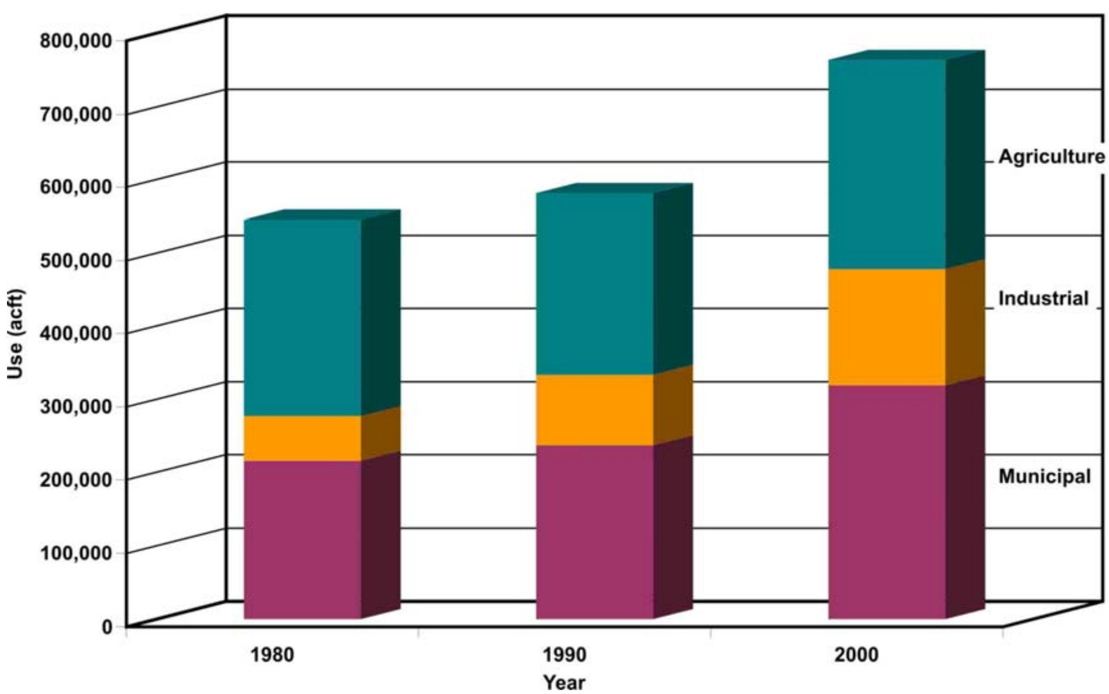

Figure 1-13. BGRWPA Historical Water Use by Type

Table 1-8.
BGRWPA Historical Water Use[1] (acft/yr)

Category	*1980*	*1990*	*2000*
Municipal Use	215,744	236,955	319,141
Manufacturing Use	21,124	32,240	56,993
Steam-Electric Use	28,686	57,657	86,963
Mining Use	11,413	6,944	15,008
Irrigation Use	229,387	200,954	232,991
Livestock Use	38,915	46,770	52,451
Total Use	545,269	581,520	763,547
Percent of State Total	**3.06**	**3.70**	**4.67**

[1] Historical data obtained from TWDB.

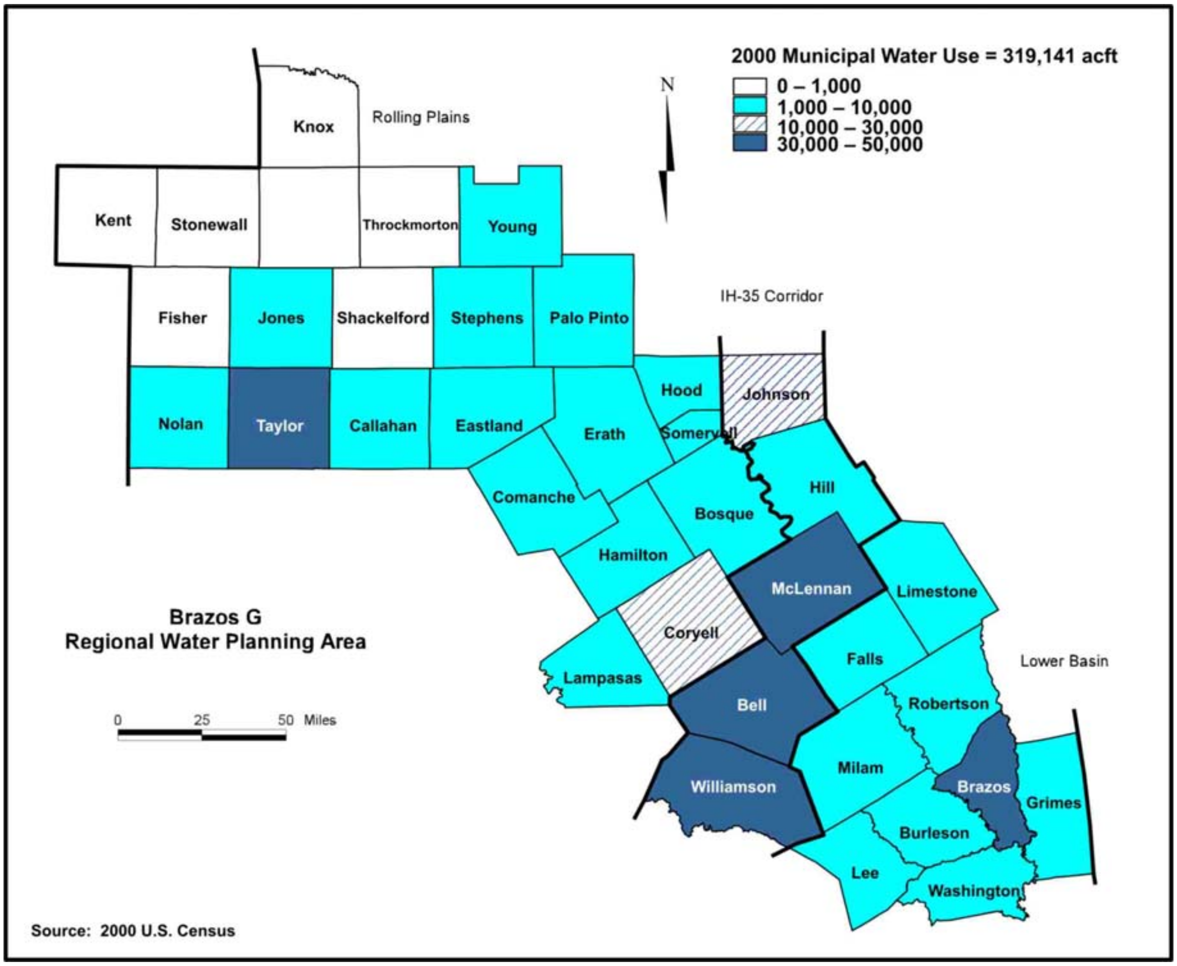

Figure 1-14. 2000 Municipal Water Use

1.5.3 Industrial Use

Industrial use consists of water used for manufacturing, for steam-electric cooling during power generation, and for mining operations. Projections for industrial use take into account expected growth of industries, population changes, available mineral reserves, and production rates. In 2000, industrial use was nearly 159,000 acft, or about 21 percent of the total water used in the BGRWPA. Refer to Figure 1-15 for 2000 industrial water use by county.

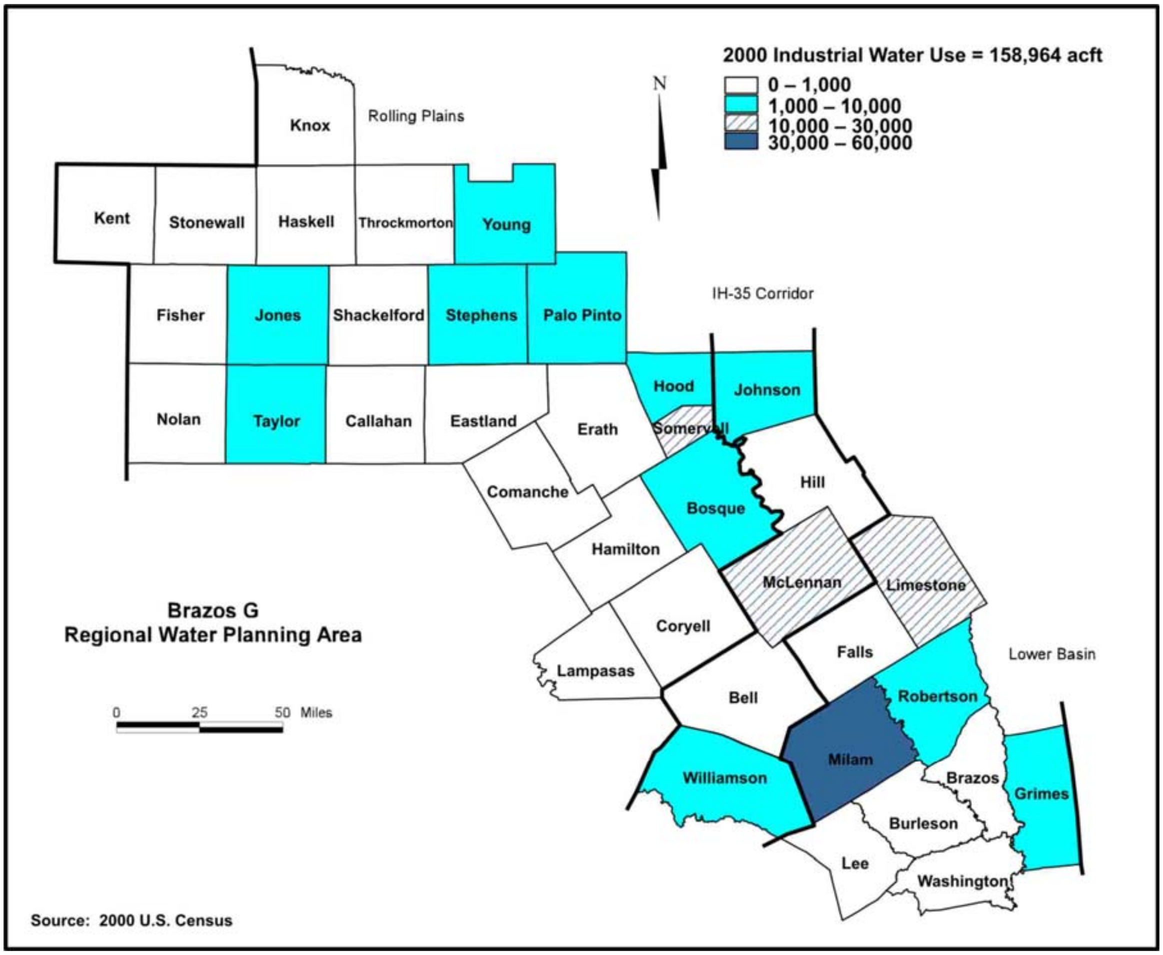

Figure 1-15. 2000 Industrial Water Use (Manufacturing, Steam-Electric Cooling, and Mining)

1.5.3.1 Manufacturing

Manufacturing use is water used for producing finished goods. Manufacturing use was 57,000 acft in 2000, or 36 percent of total industrial water usage that year.

1.5.3.2 Steam-Electric Cooling

This category is water used during the power-generation process and is typically losses due to forced evaporation during cooling. Water that is diverted and not consumed (i.e., return flow) is not included in the power-generation total. Water use for steam-electric cooling in 2000 was 86,960 acft, or 55 percent of total industrial water use.

1.5.3.3 Mining

Mining use is water consumed for exploration and production of oil and gas, and for mining of lignite, sand, gravel, and such. Mining use in 2000 was 15,000 acft, or 9 percent of the total industrial water use.

1.5.4 Agricultural Use

Agricultural use is water used for irrigation and for watering livestock. Agricultural use was 285,440 acft in 2000 or 37 percent of the BGRWPA's total water use. Refer to Figure 1-16 for agricultural water use by each county in the planning area in 2000.

1.5.4.1 Irrigation

Irrigation use in 2000 totaled 232,990 acft, or about 82 percent of the total agricultural water use. Refer to Appendix F for more detailed information about irrigation use in the BGRWPA.

1.5.4.2 Livestock Watering

The estimate of use for livestock watering is based on a determination of the total number of livestock in the region. A uniform water-consumption rate for each type of animal is applied to this total number. The categories of livestock considered are cattle and calves; poultry; sheep and lambs; and hogs and pigs. Livestock watering totaled 52,450 acft, or 18 percent of agricultural use in 2000. Refer to Appendix F for more detailed information on water used for livestock.

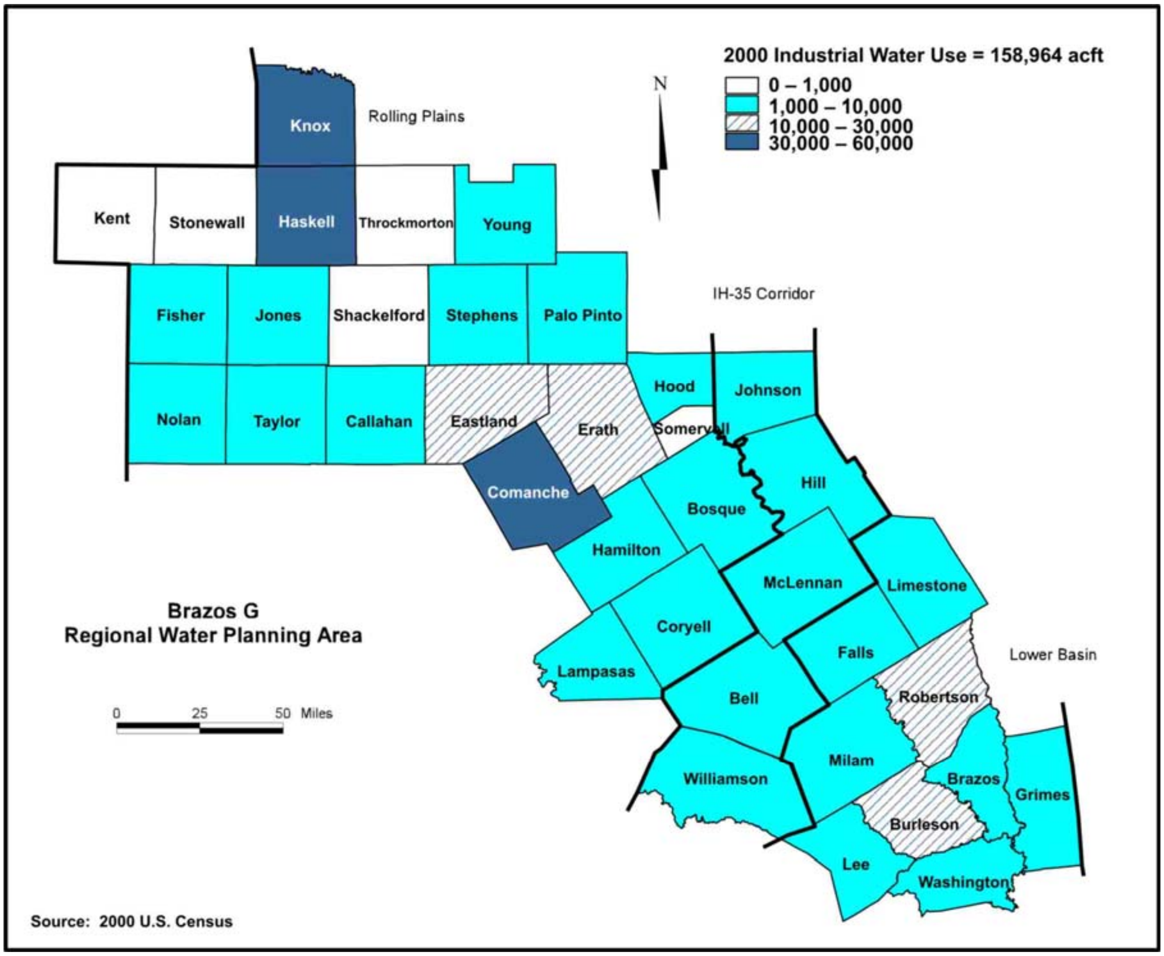

Figure 1-16. 2000 Agricultural Water Use (Livestock and Irrigation)

1.5.5 Non-Consumptive Use

Non-consumptive use is water that is diverted and then returned to the river basin with minimal change in volume and temperature, or is used but never leaves the river system. The majority of non-consumptive water use in the BGRWPA is associated with recreational use and the return flow from power generation. Water-related recreational activities include boating, camping, fishing, and swimming. Recreational use in the BGRWPA is supported by numerous state parks and by public facilities for boating and camping at various lakes and reservoirs.

Navigation is another form of non-consumptive use. Other than small watercraft used primarily for recreation on lakes and rivers, the BGRWPA includes no use of water for navigation. No water management strategy considered by the BGRWPG will affect navigation, either in the BGRWPA or in adjacent regions.

Power generation demands large amounts of water for cooling equipment. Fifteen steam-electric power-generating facilities were operating in the BGRWPA in 2000. Most of the diverted water was returned to the Brazos River Basin. Water that is lost to evaporation during the cooling process is considered industrial use, and is discussed in Section 1.5.3.

1.6 Natural Resources

1.6.1 Regional Vegetation

The BGRWPA lies within several different vegetational areas, or ecoregions.[9] Figure 1-17 shows the locations of these ecoregions, which are relatively homogenous areas in terms of geography, hydrology, and land use. The five ecoregions in the BGRWPA are the Rolling Plains, Blackland Prairies, Post Oak Savannah, Cross Timbers and Prairies, and Edwards Plateau. A general description for each ecoregion is provided below. More detailed information is provided in Appendix E.

1.6.1.1 Rolling Plains

The Rolling Plains are part of the Great Plains of the central United States. The Rolling Plains region covers about 24 million acres of gently rolling to moderately rough terrain. The region is bordered on the west by the Caprock Escarpment, on the south by the Edwards Plateau, and on the east by the Cross Timbers and Prairies region. Annual precipitation averages about 22 to 30 inches, and elevations range from 800 to 3,000 feet above sea level. The eastern part of the Rolling Plains is called the Reddish Prairie. Soils vary from coarse sands in outwash terraces near streams to tight clays or red-bed clays and shales.

1.6.1.2 Blackland Prairies

The Blackland Prairies region consists of nearly level to gently rolling topography. It covers about 11.5 million acres from Grayson and Red River Counties in northeast Texas to Bexar County in the south-central part of the State where it merges with the brush land of the Rio Grande Plains. Annual precipitation is 30 to 45 inches, and elevations range from 300 to 800 feet above sea level. The term blackland comes from the uniformly dark-colored, calcareous clays in the Alfisols (fertile mineral soils). Soils in the Blackland Prairies are interspersed with gray-colored, acidic sandy loams. This highly fertile region has widely been used for agriculture, but it

[9] Gould, F.W., *The Grasses of Texas*, Texas A&M University Press, College Station, Texas, 1975.

is increasingly used for ranching.[10] Experts estimate that less than one percent of the Blackland Prairies remain in a near-natural condition.[11]

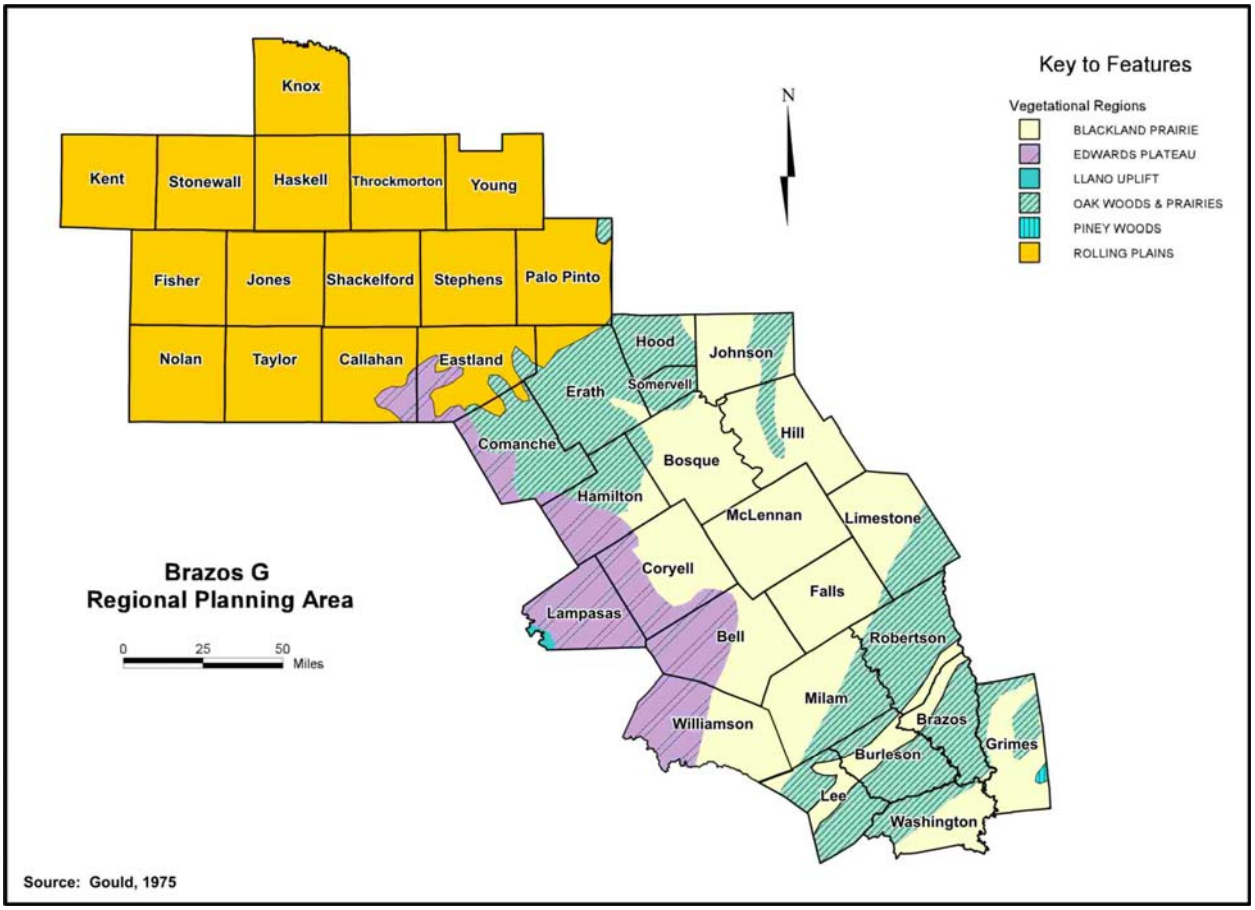

Figure 1-17. Vegetational Areas of the Brazos G Area

1.6.1.3 Post Oak Savannah

The Post Oak Savannah covers about 8.5 million acres in east-central Texas and consists of closely associated and intermingled prairies and woodlands on slightly acidic sandy or clay loams. Topography in this region is gently rolling to hilly, with moderate to deeply dissected drainage paths. Soils in uplands are generally light-colored, acidic sandy loams or sands, and soils in bottomlands are light-brown to dark-gray acidic sandy loams or clays. Much of this vegetational area is used for crops and grazing.

[10] Gould, F.W. and Schuster, J.L. and Hatch, S.L., *Texas Plants B, An Ecological Summary*, Texas Agricultural Experiment Station, Texas A&M University, College Station, Texas, 1990.
[11] Smeins and Diamond, 1986.

1.6.1.4 Cross Timbers and Prairies

The Cross Timbers and Prairies vegetational area covers about 17 million acres in north-central Texas. Geology in this area is diverse, and the topography varies from gently rolling to hilly to deeply dissected. Rapid surface drainage is typical throughout the region. Soils are typically brown, neutral-to-slightly acidic, sandy or clay loams.

1.6.1.5 Edwards Plateau

The Edwards Plateau area covers about 24 million acres. This includes a large portion of the Hill Country in west-central Texas, the Llano Uplift, and the Stockton Plateau. Average annual precipitation increases from west to east across this region. Limestone or caliche typically underlie the shallow, variably-textured soils, although granitic rock underlies soil in the Llano Uplift. Land use in this vegetational area is dominated by ranching of cattle, sheep, and goats. This region reportedly once was dominated by a grassland or an open savannah climax community, except in steep canyons and slopes where junipers and oaks were dominant. The widespread disturbance associated with grazing livestock eventually allowed brush and tree species to spread widely throughout the original grasslands and savannahs.

1.6.2 Regional Geology

Figure 1-18 shows the varied geology of the planning area. Generally, the formations in the northwest part of the planning area are the older Blaine and San Angelo Formations of the Paleozoic era. The central part of the planning area is typically dominated by younger formations from the Cretaceous era, such as the Trinity Group; the Navarro and Taylor Groups; and the Austin, Eagle Ford, Woodbine, and U. Washita Groups. The youngest formations are in the southern part of the planning area. These formations include the Cook Mountain, Weches, Sparta, and Yegua, among others. Many areas near streams and rivers are dominated by alluvial deposits.

1.6.3 Soils

The soils of the upper Brazos River Basin are agriculturally and ecologically important. Throughout the Brazos G Area, soils are varied and are influenced by both geology and surface drainage. Figure 1-19 shows the locations of different orders of soil in the BGRWPA. These soil types are briefly described in the following subsections.

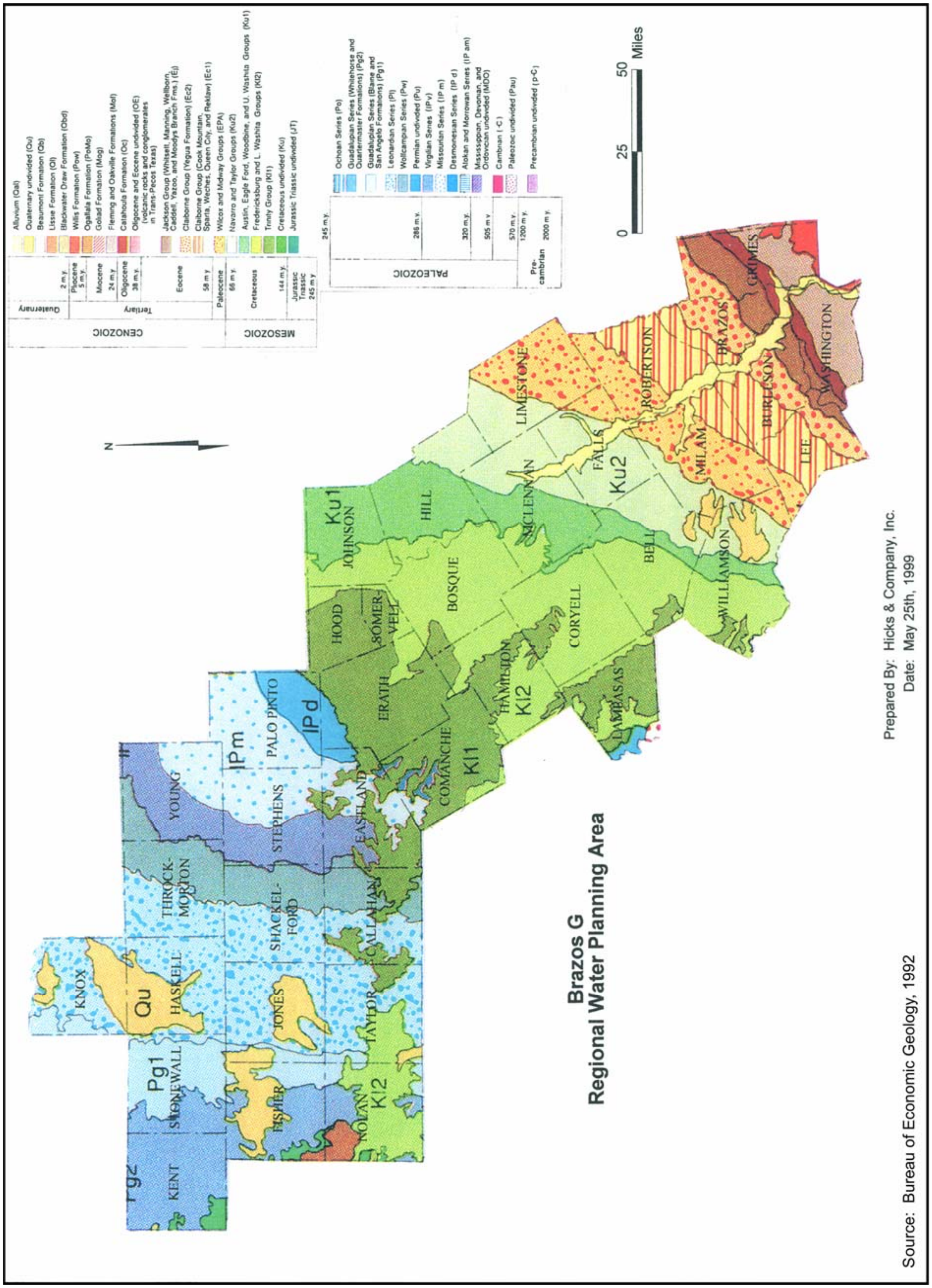

Figure 1-18. Geology of Brazos G Area

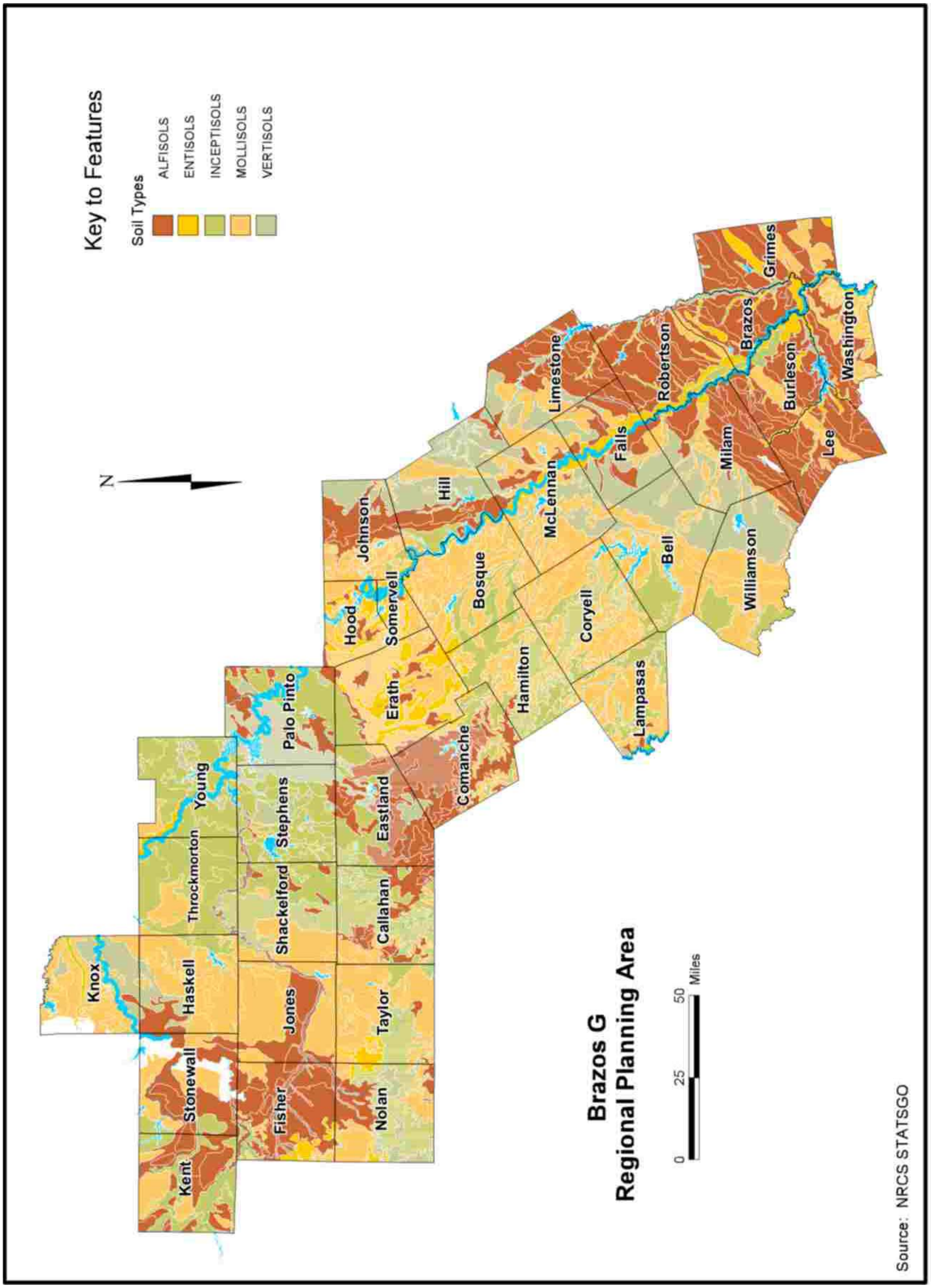

Figure 1-19. Soils of the Brazos G Area

1.6.3.1 Alfisols

Alfisols are mineral soils with a gray-to-brown surface horizon. These soils form under humid, cool-to-hot areas of native grasslands. They are productive and favor good crop yields.

1.6.3.2 Entisols

Entisols are typical of rangeland in west and southwest Texas. In this order, soils range from infertile sands and bedrock to highly productive soils on recent alluvium. A characteristic common to all Entisols is the lack of significant profile development.

1.6.3.3 Inceptisols

Inceptisols are thought to form relatively quickly from the alteration of parent material. Productivity varies among soils in this order, and it is affected by factors such as levels of organic matter and drainage. Typically, Inceptisols have slightly higher profile development than Entisols.

1.6.3.4 Mollisols

Mollisols are considered important agriculturally and are characterized by a thick, dark surface horizon. These soils develop under grassland-prairie vegetation typical of the central United States. Mollisols cover more land area in the United States than any other soil order.

1.6.3.5 Vertisols

Vertisols have a high clay content and therefore may develop deep cracks from shrinking during dry periods. The fine texture of Vertisols and their tendency to shrink excessively makes them generally unstable for building foundations and even for some agricultural uses.

1.6.4 Wetlands

Wetlands are defined by the U.S. Army Corps of Engineers as areas that, due to a combination of hydrologic and soil conditions, are capable of supporting hydrophytic vegetation. In the Brazos G Area, wetlands are found primarily in narrow strips along rivers and streams.

As a natural resource, wetlands are especially valued because of their location on the landscape, the wide variety of ecological functions they perform, and the uniqueness of their plant and animal communities. Many wetlands are also valued for their aesthetic qualities, as sites for educational research, as sites of historic and archaeological importance, and as locations for storing or conveying floodwaters. Wetlands provide high-quality habitats for wildlife, including foraging and nesting areas for birds and spawning and nursery areas for fish.

1.6.5 Water Resources

Rivers and reservoirs are important ecological resources for the Brazos G Area. These support diverse aquatic plants and animals as well as terrestrial wildlife living along the banks. Important rivers and creeks in the planning area include the Brazos, Leon, Bosque, Lampasas, San Gabriel, South Wichita, Little, Clear Fork of the Brazos, and Yegua Creek. These rivers contribute to unique vegetational communities that provide habitat for wildlife. There are more than 40 species of aquatic amphibians, reptiles, and mammals in the planning area. Waterfowl heavily use the mature, hardwood, bottomland forests and forested wetlands often associated with rivers. Aquatic habitats include riffles and pools, which support both invertebrates and fish.

Reservoirs (Figure 1-20) provide habitat for inland fish stocks and waterfowl. Many reservoirs in the planning area provide habitat for fish stocks and waterfowl include Lake Stamford, Hubbard Creek Reservoir, Possum Kingdom Lake, Lake Leon, Lake Proctor, Lake Whitney, Lake Stillhouse Hollow, Lake Belton, Lake Waco, and Lake Somerville.

Although few in number, the major springs and seeps in the planning area that produce frequent flows are often rich in wildlife habitat and ecological diversity. Springs represent a transition from groundwater to surface water. Where frequent springflow occurs, an abundance of moisture is provided, resulting in diverse vegetational communities unique to such areas. Typical vegetation includes willows, cottonwoods, hackberry, elms, rushes, sedges, and smartweed. These vegetational communities often provide optimal habitat for native wildlife.

1.6.6 Wildlife Resources

1.6.6.1 Biotic Provinces

Just as Texas has been divided into major plant zones,[12] the State has also been classified into biotic provinces based on the distribution of topographic features, climate, vegetation types, and terrestrial vertebrates [13] (Figure 1-21). The BGRWPA includes the Kansan, Austroriparian, Balconian, and Texan biotic provinces.

[12] Gould, Op. Cit., 1975.
[13] Blair, 1950.

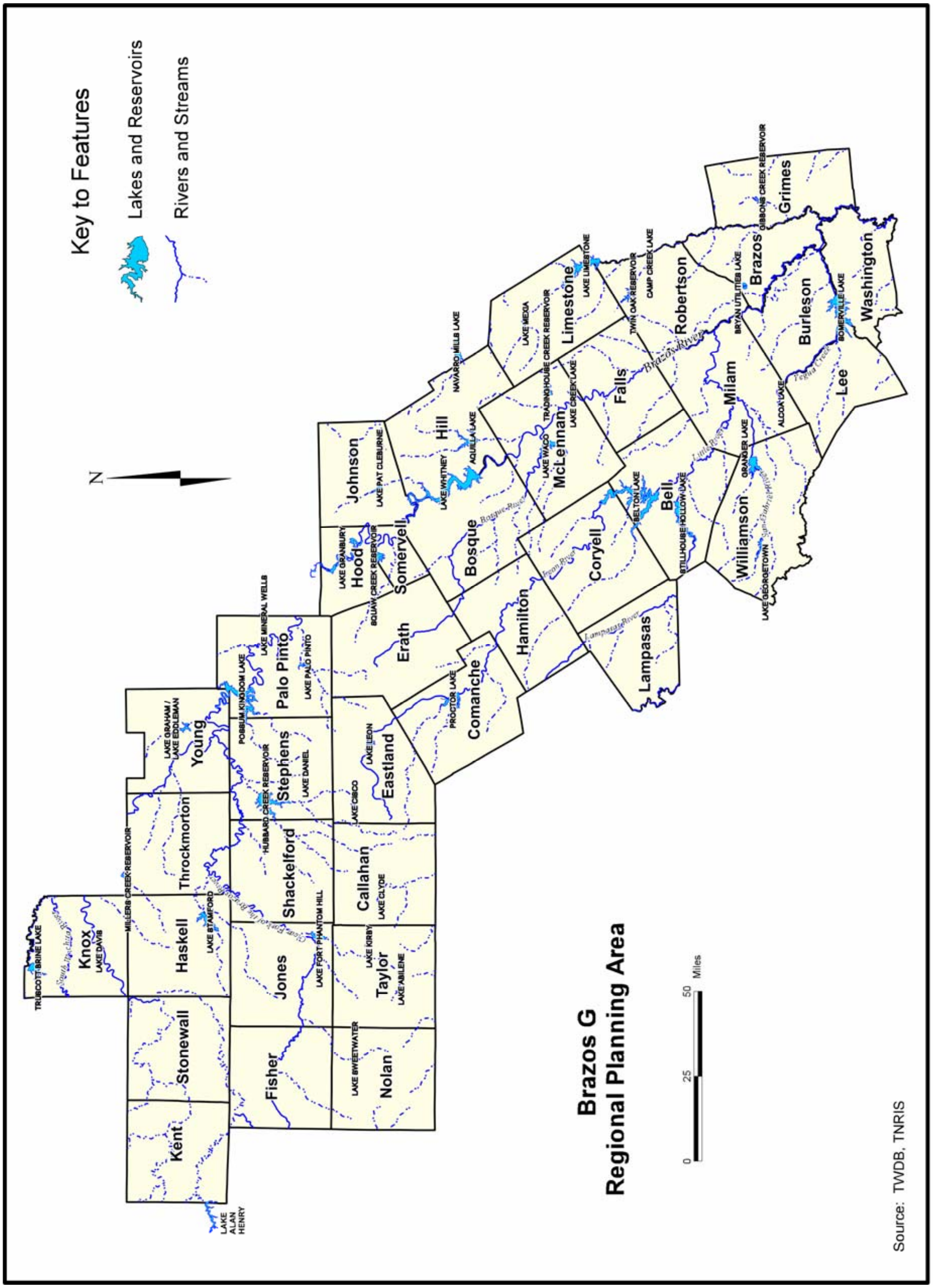

Figure 1-20. Water Resources of the Brazos G Area

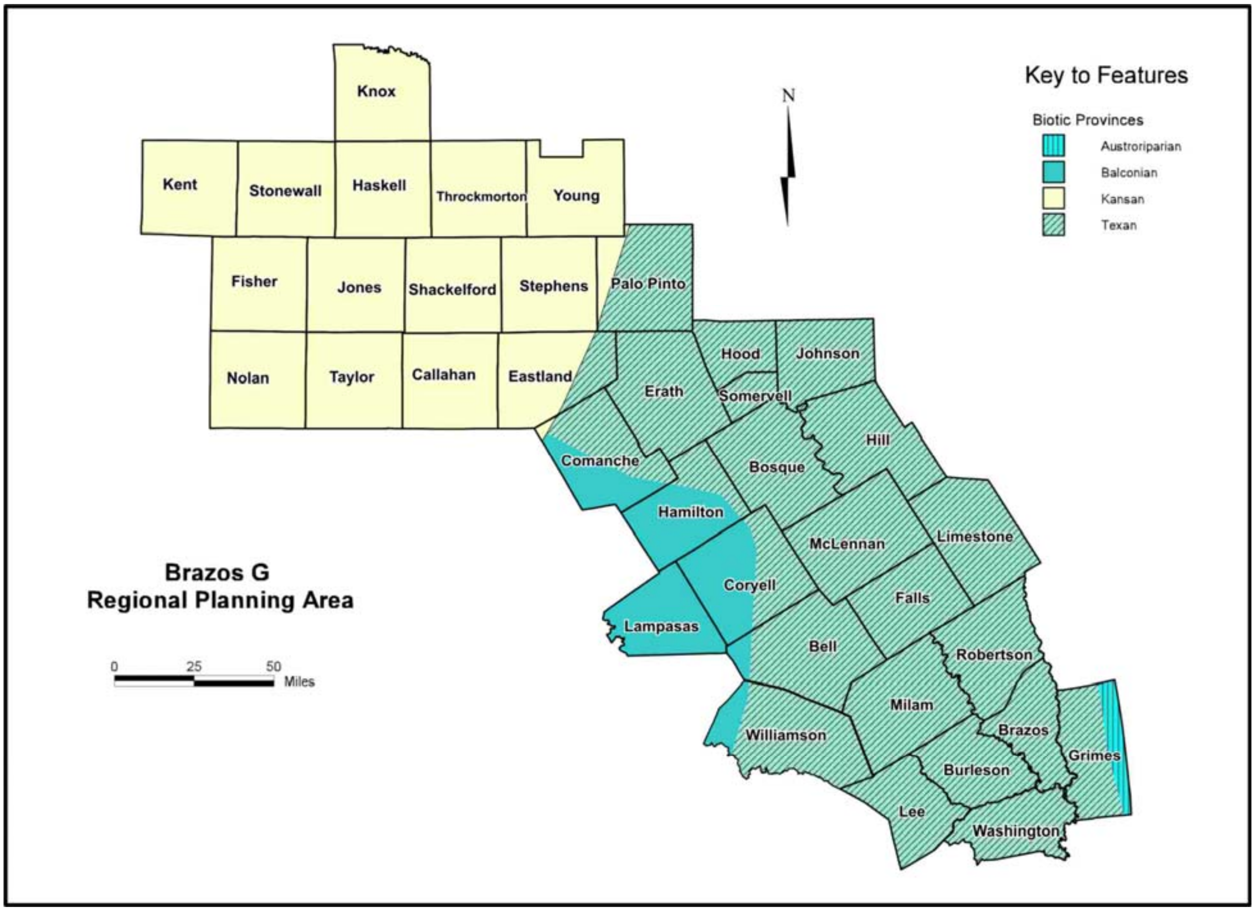

Figure 1-21. Biotic Provinces of the Brazos G Area

1.6.6.1.1 Kansan

The Kansan province runs southward from the Texas panhandle and across the Rolling Plains area of the Brazos G Area. It meets the Texan biotic province at the western boundary of the Cross Timbers and Prairies vegetational area. There is little available moisture in the province, and moisture that is available decreases from east to west. The plant associations vary. However, they fall into three general categories of associations: the mixed-grass plains, the mesquite-grass association, and the short-grass plains.

1.6.6.1.2 Austroriparian

The western fringe of the Austroriparian province extends into the southeastern rim of the Brazos G Area. This province comprises the pine and hardwood forests of the eastern Gulf

Coastal plain. The province is limited to the west due to low moisture. However, vegetational communities found in the westward extensions of the province occur along drainageways where environmental conditions allow.

1.6.6.1.3 Balconian

The Balconian province includes most of the Edwards Plateau excluding the region west of the Pecos River. The Edwards Plateau is a physio-graphically discrete unit. It has a variety of wildlife, and its vegetation is different from that found in adjacent provinces. The abundant vertebrate species are a mixture of Austroriparian, Tamaulipan, Chihuahuan, and Kansan.

Most of the Balconian province lies on Cretaceous limestone, but igneous intrusives and sediments of Precambrian age are exposed in the Llano Uplift. Limestone caverns and springs are common features of this province. Massive outcrops of limestone are characteristic of the stream canyons, and limestone fragments occur at the surface over almost the entire area.

Rainfall amounts typically decrease from east to west. The most characteristic plant association is the juniper-oak scrub. Mesquite is also distributed throughout the province.

1.6.6.1.4 Texan

The Texan biotic province has no true endemic species of vertebrates. In this area, western species tend to encroach into open habitats, and eastern species encroach along the many wooded drainageways extending through the landscape. The Texan province has supported 49 species of mammals, 39 species of snakes, 16 species of lizards, 2 types of land turtles, 18 types of toads and frogs (anurans), and 5 species of salamander (urodeles).

1.6.6.2 Threatened and Endangered Species

In planning water-management strategies, one major consideration is the potential impact on threatened and endangered species. There are a total of 16 species listed as threatened or endangered by the U. S. Fish and Wildlife Service that could potentially occur in the Brazos G planning area. Some of the more widely seen of these are the golden-cheeked warbler (Dendroica chrysoparia), the black-capped vireo (Vireo atricapillus), and the bald eagle (Haliaeetus leucocephalus). Table E-1 in Appendix E gives a complete list of threatened and endangered species in each county in the BGRWPA.

1.6.7 Agricultural Resources

Agriculture is a mainstay of the BGRWPA rural economy. Among livestock, cattle were the most significant component, approaching 2.4 million head with an additional 118,000 dairy cows in 2002. Over 17 million acres, or about 87 percent of BGRWPA's total area, were classified as farmland in 2002. Of the 17 million acres of farmland, about six million acres were classified as cropland, of which about three million acres were harvested. Refer to Appendix F for detailed listings of agricultural information for the BGRWPA.

The Texas Department of Agriculture has specified several Agricultural Statistics Districts for the purpose of keeping records. The districts within the BGRWPA are 2N and 2S (Rolling Plains), 3 (Cross Timbers), 4 (Blacklands), 5S (South East), 7 (Lampasas County), and 8N (South Central).

1.6.7.1 Rolling Plains

Counties in the Rolling Plains (Districts 2N and 2S) are Fisher, Haskell, Jones, Kent, Knox, Nolan, Stonewall, and Taylor. The major dryland products are extensive row-crops, such as cotton, and wheat. Irrigation comes from the Seymour Aquifer where available. Major crops include wheat and cotton. Hay and silage are also produced, but because of low rainfall, their acreage is much less than in other districts in the BGRWPA.

1.6.7.2 Cross Timbers

The Cross Timbers counties (District 3) are Callahan, Comanche, Eastland, Erath, Hood, Palo Pinto, Shackelford, Somervell, Stephens, Throckmorton, and Young. Combined, these counties lead the State in dairy production. This is due to several factors such as available groundwater from the Trinity Aquifer, soils suitable for forage production, topography conducive to dairy operation, and an existing infrastructure. The major crops produced in the Cross Timbers are hay and silage, with smaller amounts of peanuts, pecans, and vegetables irrigated from the Trinity Aquifer.

1.6.7.3 Blacklands

The Blacklands counties (District 4) are Bell, Bosque, Coryell, Falls, Hamilton, Hill, Johnson, Limestone, McLennan, Milam, and Williamson. Lampasas County (District 7) is included for the purposes of this analysis. The Blacklands is noted for dryland production of corn for grain, grain sorghum, wheat for grazing and grain, cotton, and hay. Irrigation in the Blacklands is limited by lack of sufficient groundwater supply.

1.6.7.4 South East and South Central Texas

South East and South Central Texas counties (District 5S and 8N) are Brazos, Burleson, Grimes, Lee, Robertson, and Washington. This subregion has limited row-crop agriculture because suitable topography and soils are limited. Hay and silage are the major agricultural products. The Brazos River Bottoms counties (Brazos, Burleson, and Robertson) produce most of the crops in the subregion, including corn for grain, grain sorghum, and cotton. The Brazos River Alluvium is the major source of groundwater for the Brazos River Bottoms.

1.7 Threats and Constraints to Water Supply

Projected population growth in the region, particularly along the IH-35 Corridor, will strain existing municipal supplies. The population of Williamson County, for example, is expected to increase more than four-fold by the year 2060 to about 1,027,400 people. Water will become even more valuable, especially in the western and central parts of the BGRWPA, due to limited options for new reservoirs and because the aquifers in these areas have limited potential for further development.

Other concerns include the high content of chloride in surface-water runoff from the upper Brazos River Basin. Water with a high chloride content is more expensive to treat and therefore places capital constraints on suppliers who obtain surface water from affected streams and reservoirs.

1.7.1 Susceptibility of Water Supplies to Drought

1.7.1.1 Groundwater

The 15 aquifers within the BGRWPA vary in drought resistance, but all tend to have more resistance than most surface-water reservoirs. Most of the thick, deep, and extensive sand aquifers with moderate to high transmissivity react very slowly to droughts. Their supplies are virtually drought-proof even during long droughts. These aquifers, such as the Carrizo-Wilcox and Gulf Coast Aquifers, store enormous amounts of water. Somewhat thinner, yet still extensive, sand aquifers with low to moderate transmissivity commonly are only slightly less drought-resistant. These aquifers include the Trinity, Woodbine, Queen City, Sparta, and Hickory.

During long droughts, shallow alluvial aquifers from which large withdrawals are made experience water level declines that are relatively large in comparison to total saturated thickness. Supplies from these aquifers, such as the Seymour and Brazos River Alluvium Aquifers, can be affected by drought but generally only by extended droughts. In extended droughts, available well yields are typically reduced, and pumps must run longer for a given level of supply.

In thin aquifers with shallow supplies, drought resistance may not be adequate. Such aquifers in the BGRWPA include the Dockum, Blaine, and Edwards-Trinity (Plateau). Also, shallow supplies in or near outcrop areas of aquifers, even of major aquifers, may have limited drought resistance.

Aquifers composed of limestone and/or dolomite are commonly the least drought-resistant. This is because these aquifers typically have only about one-tenth as much storage per cubic foot as sand aquifers. For limestone aquifers, the amount of well development is also an important factor in drought resistance. Thus, the Edwards (BFZ) Aquifer, with more developed well capacity than is available in extended droughts, is the least drought-resistant of all the aquifers in the BGRWPA. Depending on location and exact local conditions, springflows and some Edwards (BFZ) well supplies are substantially reduced in only moderate droughts. In contrast, the Marble Falls and Ellenburger-San Saba Aquifers, which are relatively undeveloped by wells, can more slowly discharge a part of their stored water during long droughts.

In the Brazos G Area, for supplies drawing from the Edwards (BFZ) Aquifer, drought planning is critical. All of the other aquifers in the region are drought resistant due to their inherent characteristics.

1.7.1.2 Surface Water

Surface water supplies in the region vary greatly, as annual rainfall ranges from 20 to 24 inches in Kent County in the northwest, to 40 to 44 inches in Grimes County in the southeast. Evaporation rates show a similarly wide variation, with the highest rates occurring in the northwestern part of the region.

Drought originates from a deficiency of precipitation over an extended period of time, usually a season or more. This deficiency results in a water shortage for some activity, group, or environmental sector. Drought should be considered relative to some long-term average condition of balance between precipitation and evapotranspiration (i.e., evaporation + transpiration). It is also related to the timing (i.e., principal season of occurrence, delays in the start of the rainy season, occurrence of rains in relation to principal crop growth stages) and the effectiveness of the rains. Other climatic factors such as high temperature, high wind, and low relative humidity are often associated with drought and can significantly aggravate its severity.

Hydrological drought is associated with the effects of periods of precipitation shortfalls on surface water supply. The frequency and severity of hydrological drought is often defined on a watershed or river basin scale. Although all droughts originate with a deficiency of precipitation, hydrologists are more concerned with how this deficiency affects the system water supply. Firm yields of reservoirs are estimated based on water that would be available through a repeat of the historic drought of record, which includes the effects of reduced runoff and high evaporation rates during the drought period. Water supply from run-of-the-river diversions are estimated based on water that would be available[14] through a repeat of the drought of record. The water supply estimates throughout this water plan are reliable through a repeat of the drought of record and are therefore not particularly susceptible to drought-induced shortages. However, the northwestern counties of the Brazos G Area are currently suffering through a particularly dry spell and data shows that in some areas the 1997 through 2000 period has produced less runoff than the first three years of the drought of record in the 1950s.

1.7.2 Identified Water Quality Problems

Water quality varies throughout the upper, middle and lower portions of the BGRWPA. Water quality is generally good in aquifers and in the tributaries of the Brazos River. However, high concentrations of chloride are found in the main stem of the Brazos River. Three factors affecting water quality in the Brazos G Area are wastewater disposal, high-density agricultural activities, and natural saline contamination.[15] Except for the third factor, these threats are associated with the growth of both population and the economy, which are expected to continue in the future.

[14] Estimates of municipal and industrial run-of-river diversions are for 100 percent reliability. For irrigation uses, run-of-river reliability less than 100 percent is often acceptable.
[15] Texas Natural Resource Conservation Commission (TNRCC), *Summary Report: Regional Assessments of Water Quality Pursuant to the Texas Clean Rivers Act (Senate Bill 818)*, 1992.

Water quality data collection and assessment studies have been conducted since 1991 through the Texas Clean Rivers Program (CRP). Through collaborative efforts with other agencies and basin residents, the BRA identifies and evaluates water quality and watershed management issues, establishes priorities for corrective actions, and implements activities to improve and protect the Brazos River basin. Identified surface water quality problems within the BGRWPA are summarized according to specific regions in the basin, and are based on information from the Texas Clean Rivers Program 2004 Basin Highlights Report.[16]

1.7.2.1 Upper Basin Region

The Upper Basin Region includes the Salt and Double Mountain Forks and the Clear Fork of the Brazos River. Water quality data reveal water quality impacts represented by high conductivity levels, along with high total dissolved solids and chloride concentrations. While this region contributes only 14 to 18 percent of the total Brazos River flow, the area contributes 45 to 55 percent of the total dissolved minerals and about 75 to 85 percent of the dissolved salts.

1.7.2.2 Upper Central Basin Activity Region

The Upper Central Basin of the Brazos River includes eight lakes, five watersheds, and a variety of land uses interconnected throughout the watersheds. The Upper Central Basin Region generally covers from Bell County north to Hood County. Numerous watershed protection and management projects are being conducted in this region to address declining water quality due to impacts from industrial, agricultural, municipal, and natural causes. On-going activities and water quality issues in this area include:

- In 2002, the BRA began a special study on Lake Granbury to assess impacts from septic systems in the coves throughout the lake.
- The BRA currently monitors Aquilla Creek at FM 933 in this watershed. TCEQ has been monitoring Lake Aquilla as a result of its placement on the State's 303 (d) list for impairments due to high concentrations of atrazine.
- The Bosque River Watershed drains approximately 1,652 square miles and discharges into Lake Waco. Elevated bacteria, nutrient and algal growth are concerns for this watershed, due to high non-point source pollution activity generally attributed to confined animal feeding operations. There are several on-going activities undertaken by the State, BRA, City of Waco, and local entities to monitor and reduce pollution in this watershed.

[16] Brazos River Authority (BRA), Texas Clean Rivers Program 2004 Highlights Report, available online at http://www.brazos.org/CleanRiversProgram/BasinReport/Executive_Summary.pdf, 2004.

- A number of sites in the Leon River watershed show concerns for elevated bacteria and nutrient concentrations, as well as depressed dissolved oxygen.
- Lake Stillhouse Hollow experiences above average water quality conditions and remains primarily undeveloped. Discharging into the Lampasas river downstream of the lake, Salado Creek is experiencing concerns from elevated nutrient concentrations.

1.7.2.3 Lower Central Basin Activity Region

Portions of the Lower Central Basin are subject to non-point source discharges and nutrient loading from agricultural activities. Data collected to date show that Cottonwood Branch in Brazos County near Bryan has very high concentrations of nutrients and elevated bacteria levels. Lakes Limestone and Granger also show concerns for nutrient loading that is contributing to increased aquatic plant growth.

1.7.2.4 Lower Basin Activity Region

The BRA monitors eight sites in Yegua Creek watershed, including two sites on Lake Somerville. The lake, which spans 11,460 acres, has experienced several fish kills. Lake Somerville has experienced both elevated and depressed pH levels, which may be attributed to fluctuations in blue-green algae populations.

1.7.3 Identified Threats to Agricultural and Natural Resources

Drought and water quality are the two primary threats to agricultural and natural resources in the Brazos G Area.

1.7.3.1 Threats to Agricultural Resources

Drought is the primary threat to agricultural resources in the Brazos G Area. During long droughts, surface water supplies for unconfined livestock are diminished. If the drought extends through the season for growing forages, production is reduced due to the lack of forageable food. Additional threats to livestock arise from the reduced water supply for rural water systems that are not interconnected or that are not supplied by a reliable source. This is especially true in the northwest part of the region. Water for confined livestock (e.g., dairy cattle and poultry) and for crop irrigation typically comes from groundwater.

Water quality can also pose a threat to agricultural resources. Increased levels of salts and total dissolved solids may damage certain crops and require additional water for irrigation. High levels of salts can accumulate on the surface soils, creating a hardpan effect that impedes percolation of irrigated water. As water quality degrades, crop selection and production may be limited. An additional threat to crop production is the migration into agricultural land of municipal well fields to supply groundwater to growing cities. Groundwater Conservation Districts and Underground Water Conservation Districts have been created in part to manage groundwater supplies that may have competing interests.

1.7.3.2 Threats to Natural Resources

The Brazos River Basin within the BGRWPA is a freshwater eco-region that is defined as primarily temperate coastal rivers and lakes habitat, with high ranking habitats for fish, reptiles and amphibian species.[17] Identified threats to these biological resources stem from the combined effects of land use disturbance, reduced stream flow from prolonged droughts as well as current and future water diversions from water supply projects, lower lake levels, and impacted quality of surface and groundwater. Declining flows can affect the availability and quality of aquatic habitats and streamside vegetation and also contribute to changes in water temperature and chemistry. As discussed in Section 1.7.2, water quality in the Brazos River Basin has been degraded by increased concentrations of chlorides, dissolved metals, ammonia, nitrates, and phosphates, pesticides, algae, and fecal coliform bacteria. Under lower flow conditions, greater effects from pesticide contamination could occur through higher concentrations of chlorinated hydrocarbons and organic-phosphates. A summary of potential effects that identified threats would have on biological resources is presented in Table 1-9. The water resources impacted by water quality concerns identified in Section 1.7.2 within the Brazos River Basin are presented in Table 1-10.

Reduced stream flows and reservoir levels, which are brought on by drought and increases in water use, pose the greatest potential threat to aquatic species in the region. Lower stream flows would alter the proportion of stream runs, riffles, pools, and backwater sloughs and decrease the wetted perimeter (total available habitat). These changes in habitat may benefit some species, primarily hardy, generalist species, but would negatively impact most species and

[17] Abell, R.A, D.M. Olson, E. Dinerstein, P.T. Hurley, J.T. Diggs, W. Eichbaum, S. Walters, W. Wettengel, T. Allnutt, C.J. Loucks, and P. Hedao. 2000. Freshwater Eco-regions of North America – A Conservation Assessment. World Wildlife Fund. Island Press. Washington D.C. 320 pp.

result in reduced species richness. Riparian vegetation is also threatened by less over bank flooding and a shift to more mesic (drier) conditions with a decline in those species that are dependent on flooding processes (cottonwood, willow, and pecan) and an increase in species tolerating drier conditions (hackberry and mesquite).

Table 1-9.
Summary of Regional Threats to Biological Resources in the Brazos River Basin

Threat	*Potential Effects to Aquatic Organisms*	*Potential Effects to Riparian Vegetation*
Rivers & Streams		
Lower Streamflows	Decreased stream runs, riffles, pools, and backwater sloughs resulting in lower habitat diversity and species richness.	Less overbank flooding and shift to more mesic (drier) conditions with decline in species dependent on flooding processes and increase in species tolerating drier conditions.
Lower Water Quality	Lower habitat suitability; lower habitat diversity, species richness, and abundance; possible direct and indirect adverse effects from point and non-point source contaminants.	Potentially enhanced growth from higher concentrations of phosphorus, nitrates, and other nutrients; but increased growth could be suppressed by lower water tables from declining flows, increased salinities or exposure to contaminants.
Reservoirs		
Lower Reservoir Levels	If prolonged, less available habitat resulting in lower species diversity & species abundance. If seasonal, potential positive effects through enhanced fishery production, depending on timing and duration of subsequent rising lake levels.	Increase in growth of shoreline herbaceous and woody vegetation during lower lake levels, but growth suppressed or reversed by rising lake levels and seasonal inundation.
Lower Water Quality	Lower habitat suitability; lower habitat diversity, species richness, and species abundance.	Potentially enhanced growth from higher concentrations of phosphorus, nitrates, and other nutrients; but growth suppressed or reversed through lower water tables from declining flows, increased salinities or exposure to contaminants.
Bays & Estuaries		
Reduced freshwater inflows	Possible change in hydrological dynamics of estuary. Projected effects would be minimal due to limited coastal marsh habitats associated with the Brazos River Estuary.	Effects considered minimal due to limited coverage resulting from previous levee construction and river channelization.

Table 1-10.
Location of Threats to Biological Resources Related to Water Quality in the Brazos Basin

Identified Threats	Upper Basin	Upper Central Basin	Lower Central Basin	Lower Basin
Increased Chlorides	Salt and Double Mountain Forks; Clear Fork; White River Lake.	Upper Brazos River	Lake Limestone	
Fecal Coliform Bacteria	Millers Creek;	Upper Brazos River; Possum Kingdom Lake; Lake Granbury; Lake Whitney; Bosque River; Lake Waco; Lake Proctor; Leon River; Lake Belton	Central Brazos River	Lower Brazos River
Dissolved Oxygen				Lower Brazos River
Increased Nutrients[1]	Clear Fork of the Brazos; Deadman Creek; California Creek	Bosque River; Lake Waco; Lake Proctor, Leon River; Lake Belton; Salado Creek	Central Brazos River; Still Creek/Thompson Creek; Lake Limestone; Lake Granger	Lower Brazos River
Algae		Upper Brazos River; Bosque River; Lake Waco		Lower Brazos River
Pesticides & Heavy Metals	Upper Brazos River	Upper Brazos River; Aquilla Creek		

[1] Includes: Ammonia, Phosphorus, Nitrogen, Nitrate-Nitrogen

1.8 Drought Preparations

Drought contingency plans are required by the State for wholesale water suppliers, irrigation districts, and retail water suppliers. For surface water right-holders that supply 1,000 acft/yr or more for non-irrigation use and 10,000 acft/yr for irrigation use, SB1 requires a water conservation plan. To aid entities in the region with the development of these plans, example water conservation and drought management plans are provided in Appendices J and K.

In addition, conservation plans are commonly included in the management plans of Groundwater Conservation Districts or Underground Water Conservation Districts. Within the BGRWPA, eleven districts have been created and are shown on Figure 1-22: the Salt Fork Underground Water Conservation District (UWCD) in Kent County, the Rolling Plains Groundwater Conservation District (GCD) in Knox and Haskell Counties, the Clear Fork GCD in Fisher County, the Wes-Tex GCD in Nolan County, the Middle Trinity GCD in Comanche and Erath Counties, the Saratoga UWCD in Lampasas County, the Clearwater UWCD in Bell County, the Lost Pines GCD in Lee County, the Post Oak Savannah GCD in Milam and Burleson Counties, the Brazos Valley UWCD in Robertson and Brazos Counties, and the Bluebonnet GCD in Grimes County.

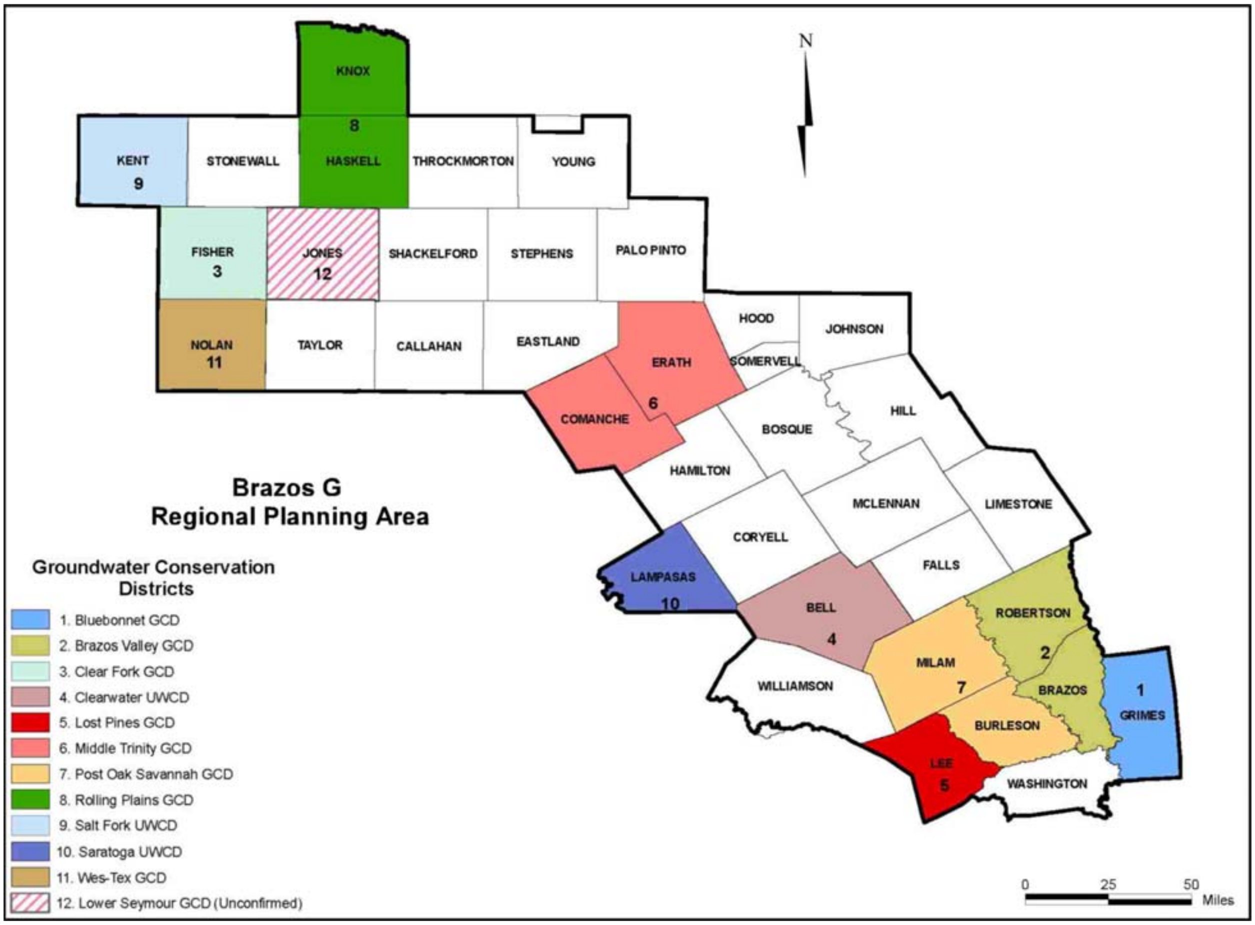

Figure 1-22. Groundwater Conservation Districts in BGRWPA

1.9 Existing Programs and Goals

1.9.1 Texas Clean Rivers Act

In 1991, the 72nd Legislature passed the Texas Clean Rivers Act [18] to establish for the first time a watershed basis for water quality planning in Texas.[19,20] The Act requires each river

[18] Senate Bill 818, amending the Texas Water Code, Sections 5.103, 5.105, 26.011; T.A.C. Sections 320.1-320.9
[19] TNRCC, Op. Cit., 1992.
[20] TNRCC, Op. Cit., 1999.

basin in the State to be assessed for water quality and management strategies on an on-going basis. It also requires reports to be provided to the TCEQ every even-numbered year.[21] The Act provides specific guidelines for accomplishing the water quality assessments, including: (1) comprehensive assessments on a watershed basis with emphasis on non-point sources, nutrients, and toxic materials; (2) delegation of responsibility for assessments to river authorities; (3) formation of river basin steering committees; (4) discharge permitting on a basin-wide basis; and (5) assessment fees charged to wastewater- and water-rights permittees.

The BRA is a partner with the TCEQ in the Clean Rivers Program for the BGRWPA. The program provides funding for BRA staff to assess water quality in the Brazos River Basin and to document local problems. Also, the program provides fee payers with site-specific information on water quality such as receiving water assessments and flow data. The 2004 Report[22] for the Brazos River Basin provides an assessment of water quality for the basin, drawing attention to: (1) the need for more long-term data on water quality, (2) a continued emphasis on the Basin Steering Committee for direction and comment on the water quality assessment program, (3) continued assistance in water quality monitoring from local partners in the Basin Monitoring Program, (4) emphasis on assessing and maintaining data, and (5) development of a geographical information system for the basin. The 2004 Report provides detailed findings about water quality and related items for selected sub-watersheds of the basin. The findings most relevant to the BGRWPA were summarized in Section 1.7.2.

1.9.2 Clean Water Act

The 1972 Federal Water Pollution Control Act, which as amended is called the Clean Water Act, is the federal law with the most impact on water quality protection in the BGRWPA. As amended in 1977 and again in 1987, the Clean Water Act: (1) establishes the framework for monitoring and controlling industrial and municipal point-source discharges through the National Pollutant Discharge Elimination System (NPDES), (2) authorizes federal assistance for the construction of municipal wastewater treatment facilities, and (3) requires cities to obtain permits for stormwater or non-point-source discharges.[23] The Clean Water Act also includes provisions to protect specific aquatic resources. Section 303 establishes a non-degradation policy for high

[21] BRA, "Planning and Environmental Division", [Online] Available URL: http://www.brazos.org/home.htm, 1999.
[22] BRA, Op. Cit., 2004.
[23] 33 USCA, Sections 1251 through 1387.

quality waters and provides for establishment of state standards for receiving water quality. Section 401 allows states to enforce water quality requirements for federal projects such as dams. Section 404 provides safeguards for wetlands and other waters from the discharge of dredged or fill material. Section 305 calls for the TCEQ to prepare and submit a water quality inventory to the U.S. Environmental Protection Agency.[24] Other provisions protect particular types of ecosystems such as lakes (Section 314), estuaries (Section 320), and oceans (Section 403).[25] Several of these provisions are relevant to specific water quality concerns in the BGRWPA.

1.9.3 Safe Drinking Water Act

The Safe Drinking Water Act, passed in 1974 and amended in 1986 and 1996, allows the U.S. Environmental Protection Agency to set standards for drinking water quality. These standards are divided into two categories: National Primary Drinking Water Regulations (primary standards that must be met by all public water suppliers) and National Secondary Water Regulations (secondary standards that are not enforceable, but are recommended). Primary standards protect water quality by limiting levels of contaminants that are known to adversely affect public health and that are anticipated to occur in water. Secondary standards have been set for contaminants that may affect cosmetic or aesthetic qualities of water (e.g., taste, odor, or color). For some constituents, the State of Texas has secondary standards that differ from the National standards.

1.9.4 Source Water Assessment and Protection Program

The TCEQ's Source Water Assessment and Protection (SWAP) Program can be an important part of water resource management. The SWAP Program, authorized by the Safe Drinking Water Act, assists local jurisdictions in preventing contamination of drinking water supplies. It identifies sources of public drinking water, determines potential contaminants, assesses water systems' susceptibility to contamination, and informs the public of the results. It is part of a comprehensive, integrated approach to clean ground and surface water undertaken by the TCEQ.

The centerpiece of the SWAP Program is a focus on prevention. Water can be easily contaminated, but it is difficult and expensive to clean up. Through the SWAP Program, by

[24] TWDB, 1997.
[25] Adler, R.W., Landman, J. and Cameron, D., *The Clean Water Act: Twenty Years Later*, Island Press, Washington D.C., 1993.

preventing contamination, jurisdictions are able to avoid the cost of removing contamination and maintain clean, reliable sources for drinking water.

The SWAP Program is designed to assist Texas communities in protecting their drinking water sources. Its goal is to increase public awareness of the importance of protecting drinking water sources and actions that can be taken to protect those sources. The SWAP Process involves seven steps:

1. Delineation (or mapping) of source water protection areas, any areas surrounding a drinking water source, whether from ground or surface water;
2. Conducting an inventory of actual or potential sources of contamination in the delineated area;
3. Conducting an analysis of the relative susceptibility of the water supply to those contamination sources and presenting the results to the public water supply in the form of a Source Water Susceptibility Assessment Report. These results provide insights into activities near your water sources and serve as the starting point for implementing source water protection.
4. Working with selected local communities to make information available to the public;
5. Voluntary application of best management practices to prevent contamination, such as land use practices, regulations and permits, structural measures, good housekeeping practices, public education and emergency response planning;
6. Monitoring and continually assessing source water supplies; and,
7. Conducting triennial sampling and continually monitoring, assessing and conducting protection activities.

By conducting continual monitoring, assessment and protection activities, communities can minimize potential sources of contamination and protect source water supplies over the long-term.

1.10 Previous Water Supply Planning in the Brazos G Area

As discussed in previous sections, the Brazos G Area is a large diverse area with varying needs of water users in the different parts of the region. In response to these different needs, the region has a history of successful local water supply planning and development. The 2001 *Brazos G Regional Water Plan*[26] was a first step in evaluating and compiling the different water needs of users in the region and identifying a comprehensive plan to meet these needs. Since this plan was completed, several local studies have been initiated, including:

[26] HDR, January 2001, Brazos G Regional Water Planning Area, Regional Water Plan.

- Bosque County water treatment and distribution study to address water needs in Bosque County in the central Brazos River Basin. The study was completed in March 2004.[27]
- The Brazos River Authority and Tarrant Regional Water District sponsored a water supply study for Parker and Johnson Counties in the central Brazos River Basin to meet the growing needs of this area. Phase 1 of the study was completed in April 2004.[28]
- The West Central Brazos River Basin Regional Water Treatment and Distribution Facility Study evaluated water needs in the upper Brazos River Basin. This study was completed in August 2004.[29]
- The City of Abilene, in cooperation with the West Central Texas Municipal Water District, has initiated a long-range water supply study for the city and District. This study is evaluating several water supply options and the final recommendations have not been published.

Brief summaries of the 2001 *Brazos G Regional Water Plan* and the completed studies to date are presented in the following sections.

1.10.1 2001 Brazos G Regional Water Plan and the 2002 State Water Plan

The Brazos G Regional Water Plan was completed in January 2001, and amended in 2002 and 2005. This plan was incorporated into the 2002 State Water Plan,[30] along with the other 15 regional water plans. Highlights of the findings and the most significant recommendations for Brazos G Area in the 2001 *Regional Water Plan* and the 2002 State Water Plan are summarized below. (A more detailed discussion of the recommendations is available in the original documents.)

The Brazos G Regional Water Plan found that on a regional basis, there are sufficient water supplies to meet the projected demands. In year 2050, the region was projected to have a surplus of about 500,000 acre-feet per year, yet there were some entities that did not have enough water to meet projected needs. The highest growth areas were identified along the I-35 corridor in the central part of the region, straining existing groundwater supplies. Slower economic

[27] Carter-Burgess, March 2004, Bosque County Regional Water Treatment and Distribution Facilities Plan, Final Report to the Brazos River Authority.
[28] Freese and Nichols, April 2004, Regional Water Supply and Wastewater Service Study for Johnson and Parker Counties, Phase I.
[29] Freese and Nichols, August 2004, West Central Brazos River Basin Regional Water Treatment and Distribution Facility Plan.
[30] Texas Water Development Board, January 2002, Texas State Water Plan.

growth and implementation of previous long-term planning in the upper Brazos G Area resulted in fewer municipal needs in this part of the region. However, water quality concerns in the upper Brazos River Basin can limit water supplies. The plan identified the biggest challenge to many communities in the Brazos G Area is financing the construction of conveyance and treatment facilities, rather than securing new water sources.

The major recommended strategies in the 2001 plan include four new major reservoirs, reallocation of hydropower storage in Lake Whitney, coordinated operation of reservoir systems for the Brazos River Authority and the City of Abilene, chloride control in the upper Brazos River Basin, and further development of groundwater from the Carrizo-Wilcox aquifer. Since the plan was completed, the California Creek Diversion Project for the City of Stamford and Lake Stamford has been constructed and is operational. Other smaller projects also have been completed or are in the design phase.

The recommended new major reservoirs include:

- Millican Reservoir (Bundic Dam Site):
  - Located on the Navasota River with a conservation storage of 228,000 acft.
  - Yield of 73,800 acft/yr for the Brazos River Authority
- Little River Reservoir:
  - Located on the main stem of the Little River just upstream from its mouth into the Brazos River. It has a conservation storage of 903,000 acft.
  - Yield of 169,800 acft/yr for the Brazos River Authority
- South Bend Reservoir (long-term strategy):
  - Located in Young County immediately upstream from the confluence of the main stem and the Clear Fork of the Brazos River. It has a conservation storage of 745,800 acft.
  - Yield of 106,700 acft/yr for the Brazos River Authority
- Breckenridge Reservoir (long-term strategy):
  - Located in Throckmorton County on the Clear Fork of the Brazos downstream from the mouth of Paint Creek. It has a conservation storage capacity of 600,000 acft.
  - Yield of 20,000 acft/yr.

1.10.2 Bosque County Regional Water Treatment and Distribution Facilities Plan

The *2001 Brazos G Regional Water Plan* identified several water users in Bosque County with shortages over the planning period. In an attempt to address this widely known shortage, the Brazos River Authority, Texas Water Development Board, and the Cities of Clifton and Meridian jointly sponsored a study to determine the regional water needs and to evaluate existing and proposed water facilities.

The study evaluated four alternatives to supply water to the different users, including individual treatment and delivery systems to a regional facility that would serve all participants. The study recommended the regional facility, which would include expansion of the City of Clifton's water treatment plant and interconnections to the other participants, including Clifton, Childress WSC, Meridian, Valley Mills and Walnut Springs.

1.10.3 Regional Water Supply and Wastewater Service Study for Johnson and Parker Counties, Phase I

The Brazos River Authority and Tarrant Regional Water District (TRWD) jointly commissioned a study to investigate the feasibility of developing regional water supply and wastewater treatment facilities to serve the unmet needs of the two counties. The first phase of an anticipated two-phase study was completed in April 2004. The primary objective of the first phase was to identify and evaluate raw water supply and water and wastewater treatment concepts of mutual interest to the Authority, TRWD and their primary wholesale customers. Subject to the Phase I identification of concepts deemed worthy of additional study, a Phase II study may further study those options that show promise from an engineering, economic, water quality and institutional standpoint.

Phase I of the study identified several water supply scenarios to serve water user groups with projected shortages in each county. The study focused on concepts that would blend the higher TDS water from the Brazos Basin with lower TDS water from the Trinity River Basin to reduce the need to desalinate the Brazos Basin water. The study concluded that a regional water treatment plant in northwest Johnson County treating a blend of BRA and TRWD water could economically serve a large area of northwest Johnson, southwest Tarrant and southeast Parker counties, including the new growth in Fort Worth's extraterritorial jurisdiction. A second option involved a plant in northeast Johnson County which could supply a large area with unmet needs including the rapidly growing areas around Mansfield and Burleson. Phase II of the study is intended to provide more detailed information required by stakeholders to allow them to further evaluate these concepts in relation to their own interests and potential participation in a regional system. Phase II has not been initiated to date.

1.10.4 West Central Brazos River Basin Regional Water Treatment and Distribution Facility Study

The Brazos River Authority, Texas Water Development Board, and the U.S. Economic Development Administration sponsored a water treatment and distribution study for water users in the upper Brazos River Basin. This study was initiated in response to the significant drought that occurred in the late 1990s and subsequent years, and developed a plan to meet demands 25 percent greater than projected needs in order to account for the future uncertainties of droughts.

The West Central Brazos River Basin Regional Water Treatment and Distribution Facility Plan evaluated the water needs in an 18-county area, assessed the economic impacts of water shortages and identified a plan to develop and efficiently utilize the water resources in the area. Specific concerns identified in the study included water quality of surface water sources, limited groundwater sources, and limited existing infrastructure to move water from areas with supply to areas with needs.

Recognizing the vulnerability of small surface lakes and the uncertainty of groundwater, this study focused on interconnecting existing supply sources and developing new supplies to provide a safe level of supply to water users and increase the reliability of existing sources to promote economic growth in the region. Collectively, over 25 potential water management strategies were evaluated to meet specific needs in the region. In addition, three general strategies (brush control, weather modification and salt water control) were reviewed as potential means to improve water quality and quantity in the region.

The study conducted numerous hydraulic analyses to evaluate the possibility of moving water through existing and improved infrastructure, including the West Central Brazos Distribution System in Stephens County (formerly the Kerr-McKee pipeline). Two scenarios demonstrated the greatest potential impact to the region:

- Interconnection between Abilene and North Central Texas MWA
- Interconnections among Shackelford WSC, Stephens County Rural WSC and the City of Throckmorton using the West Central Brazos Distribution System

Other major strategies recommended in this study include:

- Regional water treatment plant to treat water from Possum Kingdom Lake
- Connection from Lake Stamford to Throckmorton
- Turkey Peak Reservoir in Palo Pinto County
- Diverting water from the Clear Fork of the Brazos River to Hubbard Creek Lake and increasing the capacity to transport water to Abilene

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Section 2
Current and Projected Population and Water Demand Data for the Region [31 TAC §357.7(a)(2)]

2.1 Introduction

In July and December 2002, the TWDB published the population and water demand projections, respectively, for each county in the state. Population projections were developed for cities with a population greater than 500 in 2000, water supply corporations and special utility districts using volumes of 280 acft or more in 2000, and 'county-other' to capture those people living outside the cities or water supply corporation/special utility districts for each county. In the Brazos G Area, population projections were completed for 221 entities. Water demand projections were developed by type of use—specific municipal demands for cities and other water utilities (along with a 'county-other' for each county) and countywide demands for manufacturing, steam-electric, mining, irrigation, and livestock.

The TWDB has adopted several revisions to the population and water demand projections for the BGRWPA, as forwarded by the Brazos G RWPG. Revisions have been made to the consensus-based population projections, and municipal, manufacturing, mining, and steam-electric water demand projections. Revisions to the population and municipal water demand projections for cities resulted from supported requests from individual cities. Finally, water demand projections for manufacturing, mining, and steam-electric categories were revised with input from representatives of these industries.

2.2 Population Projections

As shown in Figure 2-1, the population of the 37-county region is projected to increase from 1,621,961 in 2000 to 3,332,100 in 2060, an increase of 105 percent (1.21 percent annual growth). This is somewhat less than the projected statewide population growth during the same period of 117 percent, (1.30 percent annually). In 2060, it is projected that 31 percent of the Brazos G Area population will live in Williamson County, 13 percent in Bell County, 10 percent in Johnson County, 9 percent in McLennan County, 8 percent in Brazos County, 4 percent in Coryell County, 4 percent in Taylor County, and less than 3 percent in each of the remaining counties. Projections and growth rates for each of the 37 counties and 221 cities, other utilities, and "county-other" in the region are presented in Table 2-1.

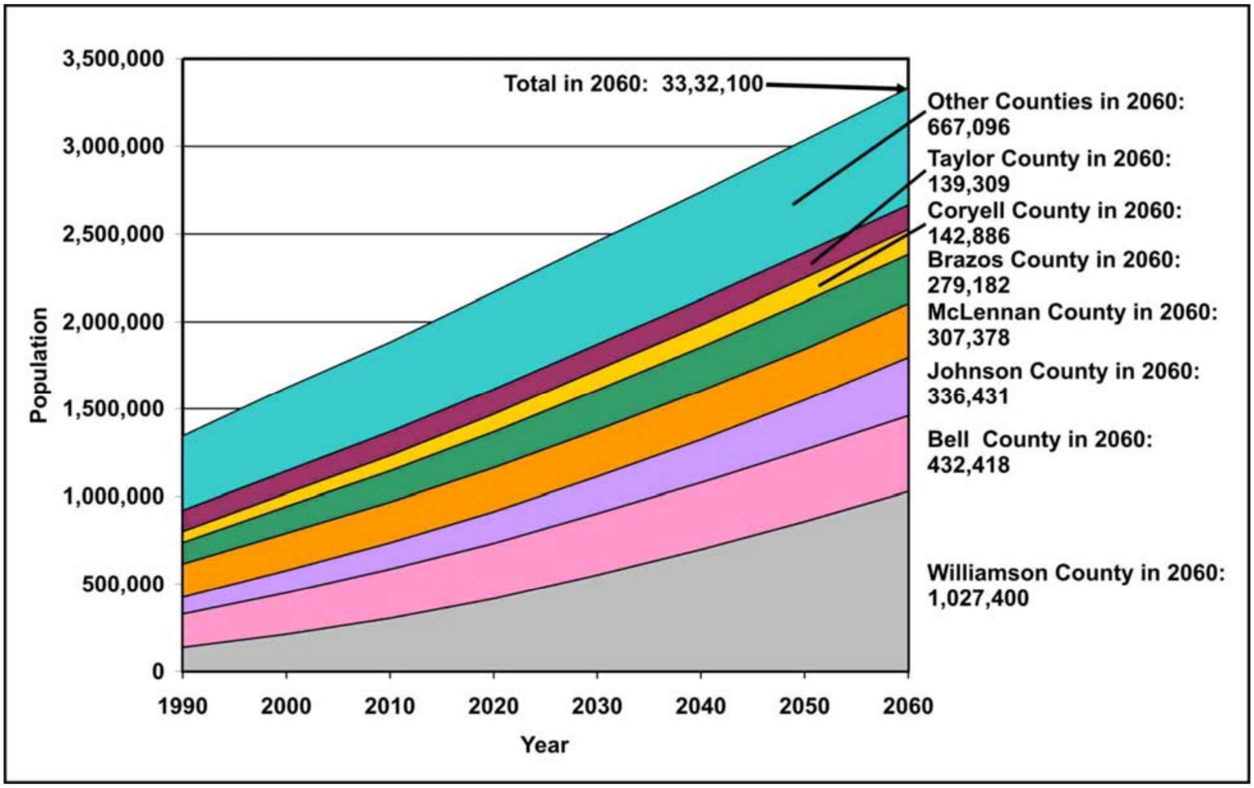

Figure 2-1. Population Projections

Table 2-1.
Historical and Projected Population by City/County

City/County	*Historical*		*Projections[1]*						*Percent Growth[2]*	*Percent Growth[2]*
	1990	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*	*1990-00*	*2000-60*
Bell County										
439 WSC		**5,274**	**6,765**	**7,802**	**8,740**	**9,345**	**9,735**	**10,018**	**N/A**	**1.08%**
Bartlett (P)	**621**	**818**	**932**	**1,011**	**1,083**	**1,129**	**1,159**	**1,181**	**2.79%**	**0.61%**
Bell-Milam-Falls WSC (P)		**1,980**	**2,350**	**2,607**	**2,840**	**2,990**	**3,087**	**3,157**	**N/A**	**0.78%**
Belton	**12,476**	**14,623**	**17,633**	**20,399**	**22,914**	**24,617**	**25,815**	**26,116**	**1.60%**	**0.97%**
Chisholm Trail SUD (P)		**454**	**649**	**784**	**906**	**985**	**1,036**	**1,073**	**N/A**	**1.44%**
Dog Ridge WSC		**3,534**	**4,434**	**5,060**	**5,626**	**5,991**	**6,226**	**6,397**	**N/A**	**0.99%**
East Bell County WSC (P)		**2,274**	**2,502**	**2,661**	**2,805**	**2,898**	**2,958**	**3,001**	**N/A**	**0.46%**
Elm Creek WSC (P)		**1,445**	**1,824**	**2,088**	**2,326**	**2,480**	**2,579**	**2,651**	**N/A**	**1.02%**
Fort Hood CDP (P)	**17,021**	**17,282**	**17,282**	**17,282**	**17,282**	**17,282**	**17,282**	**17,282**	**0.15%**	**0.00%**
Harker Heights	**12,841**	**17,308**	**22,477**	**29,147**	**34,822**	**39,636**	**41,096**	**41,818**	**3.03%**	**1.48%**
Holland	**1,118**	**1,102**	**1,102**	**1,102**	**1,102**	**1,102**	**1,102**	**1,102**	**-0.14%**	**0.00%**
Jarrell-Schwertner WSC (P)		**1,231**	**1,518**	**1,717**	**1,897**	**2,013**	**2,088**	**2,142**	**N/A**	**0.93%**
Kempner WSC (P)		**2,671**	**3,388**	**3,887**	**4,338**	**4,629**	**4,816**	**4,952**	**N/A**	**1.03%**
Killeen	**63,535**	**86,911**	**104,528**	**117,239**	**130,315**	**142,772**	**156,151**	**169,937**	**3.18%**	**1.12%**
Little River-Academy	**1,390**	**1,645**	**1,793**	**1,896**	**1,989**	**2,049**	**2,088**	**2,116**	**1.70%**	**0.42%**
Moffat WSC		**3,732**	**4,434**	**4,922**	**5,364**	**5,649**	**5,832**	**5,965**	**N/A**	**0.78%**
Morgans Point Resort	**1,766**	**2,989**	**3,698**	**4,191**	**4,637**	**4,924**	**5,109**	**5,243**	**5.40%**	**0.94%**
Nolanville	**1,834**	**2,150**	**2,333**	**2,460**	**2,575**	**2,649**	**2,697**	**2,732**	**1.60%**	**0.40%**
Pendleton WSC		**2,431**	**2,785**	**3,031**	**3,254**	**3,398**	**3,491**	**3,558**	**N/A**	**0.64%**
Rodgers	**1,131**	**1,117**	**1,117**	**1,117**	**1,117**	**1,117**	**1,117**	**1,117**	**-0.12%**	**0.00%**
Salado WSC		**3,847**	**4,743**	**5,366**	**5,930**	**6,294**	**6,528**	**6,698**	**N/A**	**0.93%**
Temple	**46,109**	**54,514**	**62,382**	**71,350**	**80,830**	**89,247**	**97,774**	**105,519**	**1.69%**	**1.11%**
Troy	**1,395**	**1,378**	**1,378**	**1,378**	**1,378**	**1,378**	**1,378**	**1,378**	**-0.12%**	**0.00%**
West Bell County WSC		**5,456**	**5,456**	**5,456**	**5,456**	**5,456**	**5,456**	**5,456**	**N/A**	**0.00%**
County-Other	**29,851**	**1,808**	**1,810**	**1,813**	**1,810**	**1,809**	**1,808**	**1,809**	**-24.45%**	**0.00%**
Bell County Total	**191,088**	**237,974**	**279,313**	**315,766**	**351,336**	**381,839**	**408,408**	**432,418**	**2.22%**	**1.00%**

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Table 2-1 (continued)

City/County	Historical		Projections[1]						Percent Growth[2] 1990-00	Percent Growth[2] 2000-60
	1990	2000	2010	2020	2030	2040	2050	2060		
Bosque County										
Childress Creek WSC		2,091	2,459	2,853	3,130	3,234	3,276	3,327	N/A	0.78%
Clifton	3,195	3,542	3,980	4,450	4,780	4,904	4,955	5,016	1.04%	0.58%
Cross Country WSC (P)		178	226	277	313	327	333	340	N/A	1.08%
Lake Whitney Water Company (P)		3,294	3,374	3,459	3,519	3,541	3,550	3,561	N/A	0.13%
Meridian	1,390	1,491	1,619	1,756	1,852	1,888	1,903	1,921	0.70%	0.42%
Valley Mills (P)	1,085	1,120	1,164	1,211	1,244	1,256	1,261	1,267	0.32%	0.21%
Walnut Springs		755	804	857	894	908	914	921	N/A	0.33%
County-Other	9,455	4,733	6,205	7,783	8,890	9,306	9,475	9,679	-6.69%	1.20%
Bosque County Total	15,125	17,204	19,831	22,646	24,622	25,364	25,667	26,032	1.30%	0.69%
Brazos County										
Bryan	55,002	65,660	74,650	84,038	92,672	99,339	107,239	109,881	1.79%	0.86%
College Station	52,456	67,890	80,920	94,526	107,040	116,703	128,152	131,981	2.61%	1.11%
Wellborn SUD		6,550	8,448	10,430	12,253	13,660	15,328	15,886	N/A	1.49%
Wickson Creek SUD (P)		5,743	8,304	10,978	13,437	15,336	17,586	18,339	N/A	1.95%
County-Other	14,404	6,572	5,865	5,127	4,448	3,924	3,303	3,095	-7.55%	-1.25%
Brazos County Total	121,862	152,415	178,187	205,099	229,850	248,962	271,608	279,182	2.26%	1.01%
Burleson County										
Caldwell	3,181	3,449	3,638	3,844	3,993	4,108	4,192	4,266	0.81%	0.35%
Milano WSC (P)		1,447	1,667	1,907	2,081	2,214	2,312	2,398	N/A	0.85%
Snook		568	624	685	729	763	788	810	N/A	0.59%
Somerville	1,542	1,704	1,818	1,942	2,032	2,101	2,152	2,197	1.00%	0.42%
Southwest Milam WSC (P)		293	354	420	468	505	532	556	N/A	1.07%
County-Other	8,902	9,009	10,376	11,865	12,946	13,774	14,382	14,919	0.12%	0.84%
Burleson County Total	13,625	16,470	18,477	20,663	22,249	23,465	24,358	25,146	1.91%	0.71%
Callahan County										
Baird	1,658	1,623	1,623	1,623	1,623	1,623	1,623	1,623	-0.21%	0.00%
Clyde	3,002	3,344	3,320	3,368	3,296	3,215	3,125	3,050	1.08%	-0.15%
Coleman County WSC (P)		392	378	405	363	316	264	221	N/A	-0.95%
Cross Plains	1,063	1,068	1,068	1,069	1,068	1,067	1,066	1,065	0.05%	0.00%
Potosi WSC (P)		70	69	72	68	63	58	54	N/A	-0.43%
County-Other	6,136	6,408	6,371	6,443	6,332	6,208	6,070	5,955	0.43%	-0.12%
Callahan County Total	11,859	12,905	12,829	12,980	12,750	12,492	12,206	11,968	0.85%	-0.13%
Comanche County										
Comanche	4,087	4,482	4,561	4,704	4,749	4,734	4,634	4,488	0.93%	0.00%
De Leon	2,190	2,433	2,476	2,554	2,578	2,570	2,516	2,436	1.06%	0.00%
County-Other	7,104	7,111	7,236	7,463	7,533	7,512	7,353	7,121	0.01%	0.00%
Comanche County Total	13,381	14,026	14,273	14,721	14,860	14,816	14,503	14,045	0.47%	0.00%
Coryell County										
Copperas Cove (P)	24,079	29,455	34,762	40,893	46,866	51,092	54,790	57,765	2.04%	1.13%
Elm Creek WSC (P)		320	470	643	812	931	1,036	1,120	N/A	2.11%
Fort Gates WSC		2,000	2,279	2,602	2,916	3,138	3,333	3,490	N/A	0.93%
Fort Hood CDP (P)	18,559	16,429	16,429	16,429	16,429	16,429	16,429	16,429	-1.21%	0.00%
Gatesville	11,492	15,591	19,637	24,312	28,866	32,088	34,908	37,177	3.10%	1.46%
Kempner WSC		3,409	5,039	6,922	8,756	10,054	11,190	12,104	N/A	2.13%
County-Other	10,083	7,774	9,091	10,613	12,096	13,146	14,063	14,801	-2.57%	1.08%
Coryell County Total	64,213	74,978	87,707	102,414	116,741	126,878	135,749	142,886	1.56%	1.08%
Eastland County										
Cisco	3,813	3,851	3,859	3,869	3,801	3,697	3,576	3,415	0.10%	-0.20%
Eastland	3,690	3,769	3,777	3,787	3,720	3,618	3,500	3,342	0.21%	-0.20%
Gorman	1,290	1,236	1,239	1,242	1,220	1,187	1,148	1,096	-0.43%	-0.20%
Ranger	2,803	2,584	2,590	2,596	2,551	2,481	2,399	2,292	-0.81%	-0.20%
Rising Star	859	835	837	839	824	802	775	740	-0.28%	-0.20%
Stephens County Rural WSC (P)		13	13	13	13	12	12	12	N/A	-0.13%
County-Other	6,033	6,009	6,021	6,036	5,932	5,769	5,579	5,329	-0.04%	-0.20%
Eastland County Total	18,488	18,297	18,336	18,382	18,061	17,566	16,989	16,226	-0.10%	-0.20%

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Table 2-1 (continued)

City/County	Historical		Projections[1]						Percent Growth[2]	Percent Growth[2]
	1990	2000	2010	2020	2030	2040	2050	2060	1990-00	2000-60
Erath County										
Dublin	3,190	3,754	4,167	4,611	5,011	5,413	6,479	7,149	1.64%	1.08%
Stephenville	13,502	14,921	15,959	17,076	18,082	19,094	21,775	23,462	1.00%	0.76%
County-Other	11,299	14,326	16,540	18,922	21,067	23,227	28,946	32,544	2.40%	1.38%
Erath County Total	27,991	33,001	36,666	40,609	44,160	47,734	57,200	63,155	1.66%	1.09%
Falls County										
Bell-Milam-Falls WSC (P)		915	1,223	1,609	2,004	2,351	2,627	2,952	N/A	1.97%
Bruceville-Eddy (P)		2	4	6	8	10	12	14	N/A	3.30%
East Bell County WSC (P)		612	729	876	1,026	1,158	1,263	1,386	N/A	1.37%
Elm Creek WSC (P)		32	46	64	83	99	112	127	N/A	2.32%
Lott		724	724	724	724	724	724	724	N/A	0.00%
Marlin	6,386	6,628	6,862	7,155	7,455	7,718	7,927	8,173	0.37%	0.35%
Rosebud	1,638	1,493	1,493	1,493	1,493	1,493	1,493	1,493	-0.92%	0.00%
Tri-County SUD (P)		2,614	2,975	3,428	3,891	4,298	4,622	5,003	N/A	1.09%
West Brazos WSC (P)		1,820	2,298	2,898	3,511	4,050	4,478	4,982	N/A	1.69%
County-Other	9,688	3,736	3,246	2,631	2,001	1,449	1,009	492	-9.09%	-3.32%
Falls County Total	17,712	18,576	19,600	20,884	22,196	23,350	24,267	25,346	0.48%	0.52%
Fisher County										
Bitter Creek WSC (P)		1,150	1,165	1,166	1,196	1,219	1,230	1,266	N/A	0.16%
Roby	616	673	682	683	702	716	723	745	0.89%	0.17%
Rotan	1,913	1,611	1,562	1,559	1,461	1,385	1,347	1,230	-1.70%	-0.45%
County-Other	2,313	910	855	851	738	652	610	476	-8.91%	-1.07%
Fisher County Total	4,842	4,344	4,264	4,259	4,097	3,972	3,910	3,717	-1.08%	-0.26%
Grimes County										
Navasota	6,296	6,789	7,111	7,470	7,753	7,950	8,107	8,262	0.76%	0.33%
Wickson Creek SUD (P)		2,792	4,614	6,646	8,249	9,363	10,253	11,128	N/A	2.33%
County-Other	12,532	13,971	14,910	15,957	16,783	17,357	17,816	18,267	1.09%	0.45%
Grimes County Total	18,828	23,552	26,635	30,073	32,785	34,670	36,176	37,657	2.26%	0.79%
Hamilton County										
Hamilton	2,937	2,977	2,942	2,933	2,926	2,928	2,919	2,918	0.14%	-0.03%
Hico	1,342	1,341	1,341	1,341	1,341	1,341	1,341	1,341	-0.01%	0.00%
County-Other	3,454	3,911	3,507	3,407	3,329	3,355	3,252	3,245	1.25%	-0.31%
Hamilton County Total	7,733	8,229	7,790	7,681	7,596	7,624	7,512	7,504	0.62%	-0.15%
Haskell County										
Haskell	3,362	3,106	3,024	2,982	2,925	2,895	2,842	2,752	-0.79%	-0.20%
Rule	783	698	671	657	638	628	610	580	-1.14%	-0.31%
Stamford (P)	36	43	45	46	48	49	50	52	1.79%	0.32%
County-Other	2,639	2,246	2,120	2,056	1,969	1,924	1,843	1,705	-1.60%	-0.46%
Haskell County Total	6,820	6,093	5,860	5,741	5,580	5,496	5,345	5,089	-1.12%	-0.30%
Hill County										
Brandon-Irene WSC (P)		2,009	2,059	2,128	2,207	2,285	2,369	2,462	N/A	0.34%
Fills Valley WSC (P)		1,963	1,997	2,045	2,100	2,154	2,212	2,277	N/A	0.25%
Hillsboro	7,072	8,232	8,477	8,820	9,208	9,595	10,008	10,467	1.53%	0.40%
Hubbard	1,589	1,586	1,586	1,586	1,586	1,586	1,586	1,586	-0.02%	0.00%
Itasca	1,523	1,503	1,499	1,493	1,487	1,481	1,474	1,466	-0.13%	-0.04%
Johnson County Rural WSC (P)		177	191	211	233	255	279	305	N/A	0.91%
Lake Whitney Water Company (P)		5,374	5,396	5,426	5,460	5,494	5,530	5,570	N/A	0.06%
Parker WSC (P)		371	391	419	451	483	517	555	N/A	0.67%
White Bluff Community WS		1,000	1,211	1,507	1,841	2,175	2,531	2,927	N/A	1.81%
Whitney	1,626	1,833	2,046	2,112	2,187	2,262	2,343	2,432	1.21%	0.47%
Woodrow-Osceola WSC		5,396	5,671	6,056	6,491	6,925	7,389	7,904	N/A	0.64%
County-Other	15,336	2,877	2,892	3,144	3,428	3,712	4,014	4,349	-15.41%	0.69%
Hill County Total	27,146	32,321	33,416	34,947	36,679	38,407	40,252	42,300	1.76%	0.45%

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Table 2-1 (continued)

City/County	Historical 1990	Historical 2000	Projections[1] 2010	2020	2030	2040	2050	2060	Percent Growth[2] 1990-00	Percent Growth[2] 2000-60
Hood County										
Acton MUD (P)		12,222	15,036	18,435	21,599	24,913	29,088	33,909	N/A	1.72%
Granbury	4,045	5,718	6,843	8,202	9,467	10,792	12,461	14,388	3.52%	1.55%
Oak Trail Shores Subdivision		2,985	3,512	3,512	3,512	3,512	3,512	3,512	N/A	0.27%
Tolar		504	504	504	504	504	504	504	N/A	0.00%
County-Other	24,936	19,671	23,312	27,711	31,806	36,093	41,494	47,732	-2.34%	1.49%
Hood County Total	28,981	41,100	49,207	58,364	66,888	75,814	87,059	100,045	3.56%	1.49%
Johnson County										
Acton MUD (P)		101	133	171	211	255	309	376	N/A	2.21%
Alvarado	2,918	3,288	3,595	3,957	4,337	4,752	5,267	5,899	1.20%	0.98%
Bethany WSC		3,000	3,373	3,813	4,275	4,780	5,406	6,174	N/A	1.21%
Bethesda WSC (P)		14,650	19,035	24,199	29,625	35,552	42,905	51,926	N/A	2.13%
Burleson (P)	14,153	17,514	20,303	23,588	27,039	30,809	35,486	41,224	2.15%	1.44%
Cleburne	22,205	26,005	29,158	32,872	36,774	41,036	46,324	52,812	1.59%	1.19%
Godley		879	1,136	1,439	1,757	2,105	2,536	3,065	N/A	2.10%
Grandview	1,245	1,358	1,452	1,562	1,678	1,805	1,962	2,155	0.87%	0.77%
Johnson County FWSD #1		5,323	6,437	7,750	9,129	10,635	12,504	14,797	N/A	1.72%
Johnson County Rural WSC (P)		28,333	37,546	48,397	59,797	72,250	87,701	106,657	N/A	2.23%
Joshua	3,828	4,528	5,114	5,805	6,531	7,324	8,308	9,515	1.69%	1.25%
Keene	3,944	5,003	5,882	6,917	8,004	9,192	10,666	12,474	2.41%	1.53%
Mansfield (P)	617	622	626	631	636	642	649	658	0.08%	0.09%
Mountain Peak WSC (P)		1,200	1,733	2,360	3,019	3,739	4,632	5,728	N/A	2.64%
Parker WSC (P)		1,753	2,187	2,697	3,233	3,818	4,545	5,436	N/A	1.90%
Rio Vista		656	751	863	981	1,110	1,270	1,466	N/A	1.35%
Venus (P)	979	1,892	1,892	1,892	1,892	1,892	1,892	1,892	6.81%	0.00%
County-Other	47,276	10,706	11,115	11,596	12,102	12,653	13,338	14,177	-13.80%	0.47%
Johnson County Total	97,165	126,811	151,468	180,509	211,020	244,349	285,700	336,431	2.70%	1.64%
Jones County										
Abilene (P)	797	5,488	5,600	5,737	5,728	5,641	5,476	5,263	21.28%	-0.07%
Anson	2,644	2,556	2,608	2,672	2,668	2,627	2,550	2,451	-0.34%	-0.07%
Hamlin	2,788	2,248	2,294	2,350	2,346	2,311	2,243	2,156	-2.13%	-0.07%
Hawley		646	659	675	674	664	645	620	N/A	-0.07%
Hawley WSC (P)		5,006	5,109	5,233	5,225	5,146	4,995	4,801	N/A	-0.07%
Stamford (P)	3,781	3,593	3,667	3,756	3,750	3,693	3,585	3,446	-0.51%	-0.07%
County-Other	6,480	1,248	1,274	1,306	1,304	1,284	1,244	1,196	-15.19%	-0.07%
Jones County Total	16,490	20,785	21,211	21,729	21,695	21,366	20,738	19,933	2.34%	-0.07%
Kent County										
Jayton	608	513	501	489	434	352	310	270	-1.68%	-1.06%
County-Other	402	346	339	332	299	250	225	202	-1.49%	-0.89%
Kent County Total	1,010	859	840	821	733	602	535	472	-1.61%	-0.99%
Knox County										
Knox City	1,440	1,219	1,198	1,239	1,241	1,245	1,243	1,226	-1.65%	0.01%
Munday	1,600	1,527	1,520	1,534	1,535	1,536	1,535	1,530	-0.47%	0.00%
County-Other	1,797	1,507	1,479	1,532	1,534	1,540	1,538	1,516	-1.74%	0.01%
Knox County Total	4,837	4,253	4,197	4,305	4,310	4,321	4,316	4,272	-1.28%	0.01%
Lampasas County										
Copperas Cove (P)		137	213	293	351	394	422	440	N/A	1.96%
Kempner		1,004	1,286	1,584	1,800	1,960	2,065	2,131	N/A	1.26%
Kempner WSC (P)		3,081	3,836	4,633	5,211	5,639	5,920	6,098	N/A	1.14%
Lampasas	6,382	6,786	7,010	7,246	7,417	7,544	7,627	7,680	0.62%	0.21%
Lometa		782	869	961	1,028	1,078	1,110	1,130	N/A	0.62%
County-Other	7,139	5,972	6,900	7,879	8,589	9,116	9,462	9,681	-1.77%	0.81%
Lampasas County Total	13,521	17,762	20,114	22,596	24,396	25,731	26,606	27,160	2.77%	0.71%

Table 2-1 (continued)

City/County	Historical 1990	Historical 2000	Projections[1] 2010	2020	2030	2040	2050	2060	Percent Growth[2] 1990-00	Percent Growth[2] 2000-60
Lee County										
Aqua WSC (P)		2,604	2,949	3,365	3,708	3,985	4,226	4,430	N/A	0.89%
Giddings	4,093	5,105	5,875	6,804	7,569	8,187	8,725	9,180	2.23%	0.98%
Lee County WSC (P)		4,125	4,913	5,864	6,648	7,280	7,831	8,297	N/A	1.17%
Lexington	953	1,178	1,349	1,556	1,726	1,863	1,983	2,084	2.14%	0.96%
Manville WSC (P)		102	143	193	234	267	296	320	N/A	1.92%
Southwest Milam WSC (P)		227	271	324	368	403	434	460	N/A	1.18%
County-Other	7,808	2,316	2,289	2,256	2,230	2,209	2,190	2,175	-11.44%	-0.10%
Lee County Total	12,854	15,657	17,789	20,362	22,483	24,194	25,685	26,946	1.99%	0.91%
Limestone County										
Biston MWSD		552	552	552	552	552	552	552	N/A	0.00%
Coolidge		848	957	1,096	1,172	1,230	1,287	1,362	N/A	0.79%
Groesbeck	3,185	4,291	5,303	6,595	7,299	7,838	8,373	9,068	3.03%	1.25%
Mexia	6,933	6,563	6,892	7,237	7,600	7,980	8,380	8,800	-0.55%	0.49%
Thornton		524	524	524	524	524	524	524	N/A	0.00%
Tri-County SUD (P)		1,059	1,210	1,403	1,508	1,588	1,668	1,772	N/A	0.86%
County-Other	10,828	8,214	7,884	7,537	7,173	6,793	6,393	5,972	-2.73%	-0.53%
Limestone County Total	20,946	22,051	23,322	24,944	25,828	26,505	27,177	28,050	0.52%	0.40%
McLennan County										
Bellmead	8,336	9,214	9,875	10,541	11,102	11,684	12,054	12,591	1.01%	0.52%
Beverly Hills	2,048	2,113	2,162	2,211	2,253	2,296	2,323	2,363	0.31%	0.19%
Bruceville-Eddy (P)	1,074	1,488	1,800	2,114	2,379	2,653	2,827	3,080	3.31%	1.22%
Chalk Bluff WSC		2,700	3,487	4,280	4,948	5,641	6,081	6,720	N/A	1.53%
Crawford		705	761	817	864	913	944	989	N/A	0.57%
Cross County WSC (P)		2,372	2,757	3,146	3,473	3,812	4,028	4,341	N/A	1.01%
Elm Creek WSC (P)		1,343	1,822	2,305	2,712	3,134	3,402	3,791	N/A	1.74%
Gholson		922	1,095	1,270	1,417	1,569	1,666	1,807	N/A	1.13%
Hallsburg		518	569	621	664	709	738	780	N/A	0.68%
Hewitt	8,983	11,085	12,667	14,262	15,606	16,999	17,884	19,170	2.12%	0.92%
Lacy-Lakeview	3,617	5,764	7,380	9,009	10,382	11,805	12,709	14,023	4.77%	1.49%
Lorena	1,158	1,433	1,640	1,849	2,025	2,207	2,323	2,491	2.15%	0.93%
Mart	2,004	2,273	2,475	2,679	2,851	3,029	3,142	3,307	1.27%	0.63%
McGregor	4,683	4,727	4,760	4,793	4,821	4,850	4,869	4,896	0.09%	0.06%
Moody	1,329	1,400	1,453	1,507	1,552	1,599	1,629	1,672	0.52%	0.30%
North Bosque WSC		1,350	1,818	2,290	2,688	3,100	3,362	3,743	N/A	1.71%
Riesel		973	1,074	1,176	1,262	1,351	1,407	1,489	N/A	0.71%
Robinson	7,111	7,845	8,397	8,954	9,423	9,910	10,219	10,668	0.99%	0.51%
Tri-County SUD (P)		112	136	160	180	201	214	234	N/A	1.24%
Valley Mills (P)	10	3	3	3	3	3	3	3	-11.34%	0.00%
Waco	103,590	113,726	121,355	129,046	135,528	142,247	146,514	152,715	0.94%	0.49%
West	2,515	2,692	2,825	2,959	3,072	3,189	3,264	3,372	0.68%	0.38%
West Brazos WSC (P)		1,614	1,944	2,277	2,558	2,849	3,034	3,303	N/A	1.20%
Western Hills WS		2,744	3,569	4,401	5,102	5,829	6,290	6,961	N/A	1.56%
Woodway	8,695	8,733	8,762	8,791	8,815	8,840	8,856	8,879	0.04%	0.03%
County-Other	33,970	25,668	27,296	28,937	30,322	31,758	32,667	33,990	-2.76%	0.47%
McLennan County Total	189,123	213,517	231,882	250,398	266,002	282,177	292,449	307,378	1.22%	0.61%
Milam County										
Bell-Milam-Falls WSC (P)		1,327	1,683	2,024	2,255	2,408	2,477	2,522	N/A	1.08%
Cameron	5,580	5,634	5,634	5,634	5,634	5,634	5,634	5,634	0.10%	0.00%
Milano WSC (P)		1,568	1,829	2,079	2,248	2,360	2,411	2,444	N/A	0.74%
Rockdale	5,235	5,439	5,596	5,746	5,848	5,915	5,946	5,966	0.38%	0.15%
Southwest Milam WSC (P)		5,419	6,643	7,813	8,606	9,130	9,368	9,521	N/A	0.94%
Thorndale	1,092	1,278	1,421	1,558	1,651	1,712	1,740	1,758	1.59%	0.53%
County-Other	11,039	3,573	2,650	1,966	1,457	1,080	800	592	-10.67%	-2.95%
Milam County Total	22,946	24,238	25,456	26,820	27,699	28,239	28,376	28,437	0.55%	0.27%

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Table 2-1 (continued)

City/County	Historical 1990	Historical 2000	Projections[1] 2010	2020	2030	2040	2050	2060	Percent Growth[2] 1990-00	Percent Growth[2] 2000-60
Nolan County										
Bitter Creek WSC (P)		1,150	1,205	1,250	1,271	1,267	1,219	1,161	N/A	0.02%
Roscoe	1,446	1,378	1,443	1,498	1,523	1,518	1,460	1,391	-0.48%	0.02%
Sweetwater	11,967	11,415	11,955	12,408	12,616	12,578	12,098	11,525	-0.47%	0.02%
County-Other	3,181	1,859	1,947	2,021	2,054	2,049	1,970	1,877	-5.23%	0.02%
Nolan County Total	16,594	15,802	16,550	17,177	17,464	17,412	16,747	15,954	-0.49%	0.02%
Palo Pinto County										
Fort Belknap WSC (P)		11	17	24	30	36	43	51	N/A	2.59%
Graford		578	594	613	629	645	664	686	N/A	0.29%
Mineral Wells (P)	14,388	14,770	15,074	16,200	17,123	17,955	18,873	19,901	0.26%	0.50%
Stephens County Rural WSC (P)		13	13	13	13	13	13	13	N/A	0.00%
Strawn		739	767	801	830	858	891	929	N/A	0.38%
County-Other	10,667	10,915	12,430	13,496	14,423	15,390	16,590	18,009	0.23%	0.84%
Palo Pinto County Total	25,055	27,026	28,895	31,147	33,048	34,897	37,074	39,589	0.76%	0.64%
Robertson County										
Bremond	1,110	876	876	876	876	876	876	876	-2.34%	0.00%
Calvert	1,536	1,426	1,426	1,426	1,426	1,426	1,426	1,426	-0.74%	0.00%
Franklin	1,336	1,470	1,592	1,754	1,856	1,925	1,934	1,927	0.96%	0.45%
Hearne	5,132	4,690	4,690	4,690	4,690	4,690	4,690	4,690	-0.90%	0.00%
Robertson County WSC		2,529	3,195	4,076	4,631	5,009	5,057	5,019	N/A	1.15%
Tri-County SUD (P)		838	909	1,003	1,062	1,102	1,107	1,103	N/A	0.46%
Wickson Creek SUD (P)		93	151	227	275	308	312	309	N/A	2.02%
County-Other	6,397	4,078	4,325	4,652	4,858	4,999	5,017	5,003	-4.40%	0.34%
Robertson County Total	15,511	16,000	17,164	18,704	19,674	20,335	20,419	20,353	0.31%	0.40%
Shackelford County										
Albany	1,962	1,921	2,011	2,116	2,096	1,982	1,744	1,464	-0.21%	-0.45%
Hawley WSC (P)		61	64	67	67	63	55	46	N/A	-0.47%
Stephens County Rural WSC (P)		13	14	14	14	13	12	10	N/A	-0.44%
County-Other	1,354	1,307	1,367	1,441	1,426	1,348	1,186	996	-0.35%	-0.45%
Shackelford County Total	3,316	3,302	3,456	3,638	3,603	3,406	2,997	2,516	-0.04%	-0.45%
Somervell County										
Glen Rose	1,949	2,122	2,210	2,312	2,396	2,451	2,473	2,481	0.85%	0.26%
County-Other	3,411	4,687	5,332	6,081	6,698	7,103	7,267	7,323	3.23%	0.75%
Somervell County Total	5,360	6,809	7,542	8,393	9,094	9,554	9,740	9,804	2.42%	0.61%
Stephens County										
Breckenridge	5,665	5,868	5,989	6,084	6,128	6,069	5,838	5,654	0.35%	-0.06%
Fort Belknap WSC (P)		35	36	36	37	36	35	34	N/A	-0.05%
Stephens County Rural WSC (P)		2,482	2,533	2,573	2,592	2,567	2,469	2,391	N/A	-0.06%
County-Other	3,345	1,289	1,315	1,337	1,345	1,333	1,282	1,242	-9.10%	-0.06%
Stephens County Total	9,010	9,674	9,873	10,030	10,102	10,005	9,624	9,321	0.71%	-0.06%
Stonewall County										
Aspermont	1,214	1,021	1,017	985	937	877	823	771	-1.72%	-0.47%
County-Other	799	672	670	649	618	578	542	508	-1.72%	-0.47%
Stonewall County Total	2,013	1,693	1,687	1,634	1,555	1,455	1,365	1,279	-1.72%	-0.47%
Taylor County										
Abilene (P)	105,857	110,438	119,007	124,483	127,092	127,873	125,467	121,572	0.42%	0.16%
Coleman County WSC (P)		140	151	158	161	162	159	154	N/A	0.16%
Hawley WSC (P)		677	730	763	779	784	769	745	N/A	0.16%
Merkel	2,469	2,637	2,842	2,972	3,035	3,053	2,996	2,903	0.66%	0.16%
Potosi WSC (P)		3,430	3,696	3,866	3,947	3,971	3,897	3,776	N/A	0.16%
Steamboat Mountain WSC		3,342	3,601	3,767	3,846	3,870	3,797	3,679	N/A	0.16%
Tuscola		714	769	804	822	827	812	786	N/A	0.16%
Tye	1,088	1,158	1,248	1,305	1,333	1,341	1,316	1,275	0.63%	0.16%
County-Other	10,241	4,015	4,326	4,527	4,619	4,648	4,559	4,419	-8.94%	0.16%
Taylor County Total	119,655	126,551	136,370	142,645	145,634	146,529	143,772	139,309	0.56%	0.16%

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Table 2-1 (concluded)

City/County	Historical		Projections[1]						Percent Growth[2]	Percent Growth[2]
	1990	2000	2010	2020	2030	2040	2050	2060	1990-00	2000-60
Throckmorton County										
Fort Belknap WSC (P)		105	105	102	97	90	84	80	N/A	-0.45%
Stephens County Rural WSC (P)		79	79	77	73	68	63	60	N/A	-0.46%
Throckmorton	1,036	905	905	877	838	775	725	688	-1.34%	-0.46%
County-Other	844	761	762	737	705	651	611	579	-1.03%	-0.45%
Throckmorton County Total	1,880	1,850	1,851	1,793	1,713	1,584	1,483	1,407	-0.16%	-0.46%
Washington County										
Brenham	11,952	13,507	14,313	15,306	15,940	16,285	16,594	16,844	1.23%	0.37%
County-Other	14,202	16,866	18,246	19,947	21,033	21,623	22,153	22,582	1.73%	0.49%
Washington County Total	26,154	30,373	32,559	35,253	36,973	37,908	38,747	39,426	1.51%	0.44%
Williamson County										
Aqua WSC (P)		420	504	603	721	849	989	1,139	N/A	1.68%
Bartlett (P)	818	857	893	936	987	1,043	1,103	1,168	0.47%	0.52%
Bell-Milam-Falls WSC (P)		274	362	467	592	727	874	1,032	N/A	2.23%
Blockhouse MUD		4,452	7,197	10,452	14,322	18,530	23,108	28,018	N/A	3.11%
Brushy Creek MUD		11,322	16,270	22,138	23,823	23,823	23,823	23,823	N/A	1.25%
Cedar Park (P)	5,161	25,508	52,700	73,421	102,705	128,373	154,089	187,931	17.33%	3.38%
Chisholm Trail SUD (P)		11,202	19,019	28,290	39,312	51,297	64,336	78,320	N/A	3.29%
Fern Bluff MUD		5,319	9,801	15,117	21,437	28,309	35,785	43,803	N/A	3.58%
Florence		1,054	1,263	1,511	1,806	2,127	2,476	2,850	N/A	1.67%
Georgetown	14,842	28,339	40,888	55,770	73,463	92,702	113,633	136,082	6.68%	2.65%
Granger	1,190	1,299	1,400	1,520	1,663	1,818	1,987	2,168	0.88%	0.86%
Hutto		1,250	1,826	2,510	3,323	4,207	5,168	6,199	N/A	2.70%
Jarrell-Schwertner WSC (P)		2,720	3,795	5,070	6,585	8,233	10,026	11,949	N/A	2.50%
Jonah Water SUD		7,962	10,685	13,915	17,755	21,930	26,472	31,344	N/A	2.31%
Leander	3,398	7,596	11,499	16,128	21,631	27,615	34,125	41,107	8.38%	2.85%
Liberty Hill		1,409	2,440	3,663	5,117	6,698	8,418	10,263	N/A	3.36%
Manville WSC (P)		5,273	7,979	11,188	15,003	19,151	23,664	28,504	N/A	2.85%
Round Rock (P)	30,923	60,060	87,187	119,358	157,606	199,196	244,442	292,970	6.86%	2.68%
Southwest Milam (P)		1,245	1,584	1,986	2,464	2,984	3,550	4,157	N/A	2.03%
Taylor	11,472	13,575	15,530	17,849	20,606	23,604	26,865	30,363	1.70%	1.35%
Thrall		710	859	1,035	1,245	1,473	1,721	1,987	N/A	1.73%
Weir		591	936	1,345	1,831	2,360	2,935	3,552	N/A	3.03%
Wells Branch MUD (P)		168	168	168	168	168	168	168	N/A	0.00%
Williamson-Travis Co. MUD #1 (P)		4,179	6,611	9,495	12,924	16,653	20,710	25,061	N/A	3.03%
County-Other	68,991	14,690	2,758	2,187	3,057	12,542	25,493	33,442	-14.33%	1.38%
Williamson County Total	136,795	211,474	304,154	416,122	550,146	696,412	855,960	1,027,400	4.45%	2.67%
Young County										
Fort Belknap WSC (P)		3,349	3,382	3,455	3,460	3,420	3,370	3,339	N/A	0.00%
Graham	8,986	8,716	8,800	8,993	9,006	8,903	8,772	8,690	-0.30%	0.00%
Newcastle		575	581	593	594	587	579	573	N/A	-0.01%
Stephens County Rural WSC (P)		13	13	13	13	13	13	13	N/A	0.00%
County-Other	5,621	1,336	1,349	1,379	1,380	1,364	1,345	1,332	-13.38%	0.00%
Young County Total	14,607	13,989	14,125	14,433	14,453	14,287	14,079	13,947	-0.43%	-0.01%
Total For Region	1,344,536	1,621,961	1,882,896	2,168,682	2,458,075	2,739,717	3,034,798	3,332,100	1.89%	1.21%
Total for Texas	16,986,510	20,851,790	24,890,040	29,072,272	32,988,142	36,762,760	40,878,453	45,308,928	2.07%	1.30%

(P) Partial
1 Projections from Texas Water Development Board
2 Compound annual growth rate

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Growth in the BGRWPA is concentrated along the I-35 corridor, stretching from Williamson County in the south to Johnson County in the north. Growth is also taking place along US Highway 183 in Williamson and Lampasas Counties, Taylor and Jones Counties (Abilene area), and Brazos County (Bryan/College Station area). Williamson County is projected to be the fastest growing county in the next 60 years at 2.67 percent annually. Bell, Brazos, Coryell, Erath, Hood, and Johnson Counties are all projected to grow at more than 1.0 percent annually. A comparison of the annual growth rates for all the counties is shown in Figure 2-2.

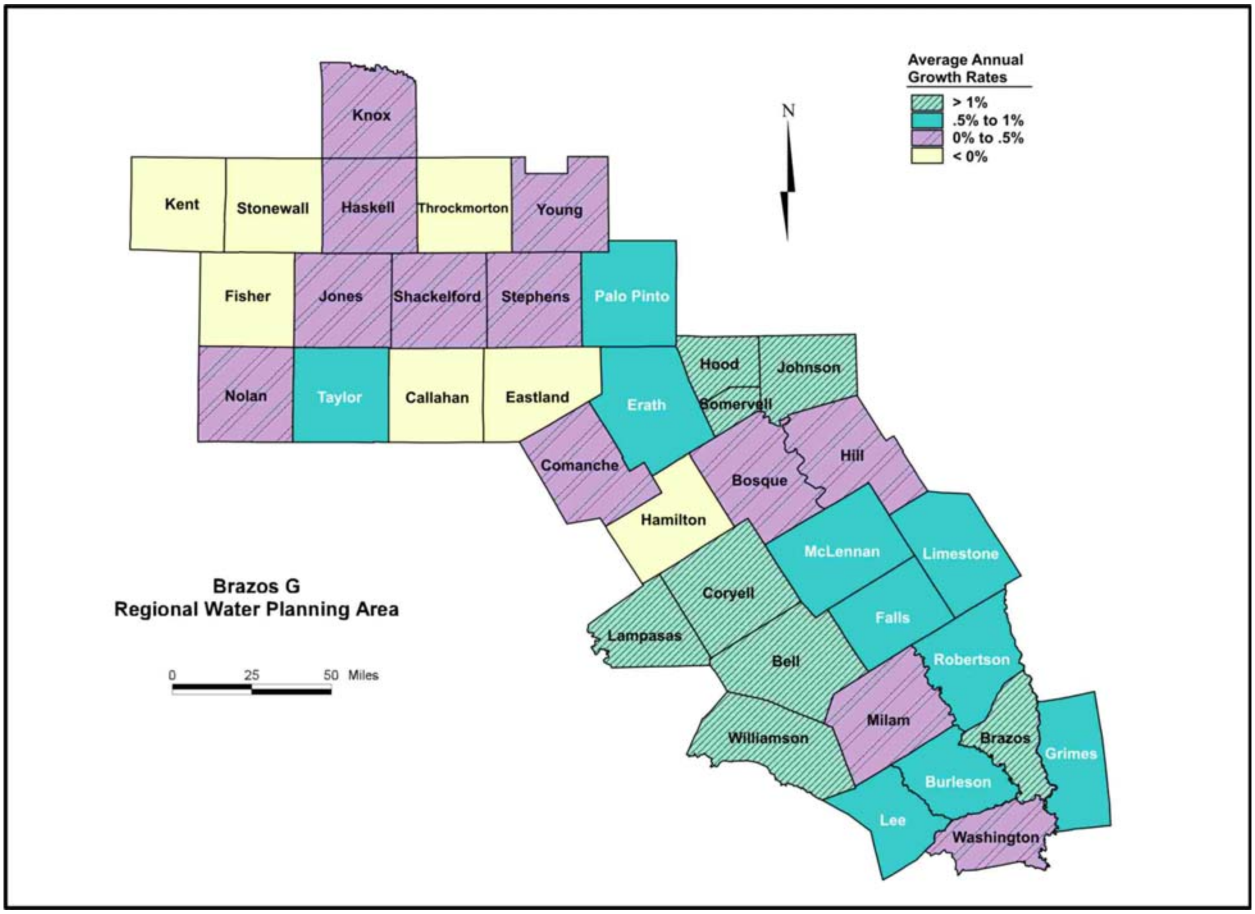

Figure 2-2. Projected Annual County Growth Rates in the Brazos G Regional Water Planning Area

2.2.1 Alternative Population Projections

The Brazos G RWPG conducted a review of the Preliminary Population Projections for use in the development of the 2006 Regional Water Plans by forwarding (a) the Draft Population Projections for the Water User Groups of the BGRWPA to each of the 37 county judges in the BGRWPA, the 184 individual municipal water user groups, and 7 councils of government for review and comment, and (b) holding a public meeting on August 14, 2002, at which Dr. Dan Hardin of TWDB explained the population projections and responded to questions.

Three counties, 11 water user groups, and 3 councils of government requested that specific population projections be increased. No entity requested a decrease in any of the population projections. Those who requested population projection increases are:

1. Bell County Entities;
2, City of Cedar Park;
3. Brushy Creek MUD;
4, Central Texas Council of Governments on behalf of Bell, Coryell, Hamilton, Lampasas, and Milam Counties;
5, City of Mexia;
6. City of Mineral Wells;
7. City of Whitney.

The TWDB approved many of the requests. However, not all of the revision requests were approved. No revisions were made for entities in Coryell, Hamilton, Lampasas, or Milam Counties, and the population projection revision requests for Bell County entities were only partially approved. The final population projections approved for Cedar Park (Williamson County) and for specific Bell County entities were lower than what was requested.

The population revision requests, which were <u>not</u> approved, are shown in Table 2-2. In addition, the Aquilla Water Supply District has also notified the BGRWPG that it disagrees with the population projections for entities in Hill County, and the Department of the Army has notified the BGRWPG that it disagrees with the population projections for Fort Hood in Bell and Coryell Counties.

Table 2-2.
Requested Population Projected Revisions That Were Not Accepted by the TWDB

Entity	2000	2010	2020	2030	2040	2050	2060
Requested Projections for Specific Bell County Entities[1]							
City of Bartlett	818	1,059	1,227	1,377	1,496	1,573	1,603
City of Belton	14,623	20,088	23,236	26,008	28,188	29,593	29,975
City of Harker Heights	17,308	26,154	35,000	41,500	48,000	49,313	50,265
City of Holland	1,102	1,694	1,916	2,096	2,220	2,277	2,277
City of Killeen	86,911	110,212	122,953	137,167	153,025	170,716	190,452
City of Little River-Academy	1,645	1,897	2,144	2,343	2,478	2,538	2,572
City of Nolanville	2,150	2,878	3,324	3,716	4,023	4,218	4,273
City of Rodgers	1,117	1,513	1,730	1,913	2,049	2,126	2,126
City of Temple	54,514	66,600	78,040	89,480	100,920	112,360	123,800
City of Troy	1,378	1,982	2,266	2,507	2,686	2,787	2,787
Requested Projections for Specific Hamilton County Entities							
City of Hamilton	2,977	3,309	3,342	3,344	3,351	3,358	3,370
City of Hico	1,341	1,508	1,508	1,508	1,508	1,508	1,508
County-Other	3,911	3,945	4,307	4,337	4,422	4,507	4,590
Requested Projections for Specific Lampasas County Entities							
City of Copperas Cove	137	232	365	466	521	540	561
City of Kempner	1,004	1,400	1,895	2,272	2,475	2,549	2,624
Kempner WSC	3,081	4,177	5,500	6,510	7,053	7,251	7,453
City of Lampasas	6,786	7,632	8,024	8,323	8,484	8,543	8,603
City of Lometa	782	946	1,099	1,216	1,279	1,302	1,325
County-Other	5,972	7,513	9,138	10,379	11,047	11,291	11,540
Requested Projections for Specific Coryell County Entities							
City of Copperas Cove	29,455	39,306	51,709	65,839	80,552	83,856	86,432
Elm Creek WSC	320	531	881	1,281	1,696	1,789	1,862
Fort Gates WSC	2,000	2,577	3,230	3,973	4,746	4,920	5,056
Fort Hood (CDP)	16,429	18,577	18,577	18,577	18,577	18,577	18,577
City of Gatesville	15,591	22,204	31,662	42,434	53,652	56,171	58,136
Kempner WSC	3,409	5,698	9,507	13,845	18,365	19,379	20,171
County-Other	7,774	10,279	13,358	16,867	20,522	21,341	21,981
Requested Projections for Specific Milam County Entities							
Bell-Milam Falls WSC	1,327	1,728	2,072	2,132	2,274	2,416	2,606
City of Cameron	5,634	5,783	5,783	5,783	5,783	5,783	5,783
Milano WSC	1,568	1,877	2,130	2,174	2,278	2,383	2,518
City of Rockdale	5,439	5,744	5,896	5,922	5,985	6,048	6,093
Southwest Milam WSC	5,419	6,819	8,000	8,207	8,694	9,184	9,822
City of Thorndale	1,278	1,459	1,597	1,621	1,678	1,736	1,805
County-Other	3,573	2,720	2,030	1,897	1,547	970	179

[1] Some of the Bell County requested revisions were partially accepted by the TWDB.

2.3 Water Demand Projections

Water demand projections have been compiled for each type of consumptive water use—municipal, manufacturing, steam-electric, mining, irrigation, and livestock; projections for non-consumptive water uses, such as navigation, hydroelectric generation, environmental flows, and recreation, are not presented. As shown in Table 2-3, total water use for the region is projected to increase from 795,183 acft in 2000 to 1,150,973 acft in 2060, a 44 percent increase. The trend in total water use is shown in Figure 2-3. The six types of water use as percentages of total water use are shown for 2000 and 2060 in Figure 2-4. The projections indicate that municipal, manufacturing, and steam-electric water use as percentages of the total water use increase from 2000 to 2060, while mining, irrigation, and livestock water use are projected to decrease as percentages of the total. A water demand projection summary sheet for each county—broken down by type of use—is presented in Section 4.

Table 2-3.
Brazos G Area Total Water Demand by Type of Use
(acft/yr)

Water Use	Historical		Projections[1]					
	1990	2000	2010	2020	2030	2040	2050	2060
Municipal	236,955	316,798	347,389	397,090	444,820	491,312	542,172	595,482
Manufacturing	32,240	16,939	19,787	23,201	25,077	26,962	30,191	31,942
Steam-Electric	57,657	103,330	147,734	158,789	171,489	191,968	219,340	242,344
Mining	6,944	72,854	36,664	37,591	38,037	27,251	20,744	21,243
Irrigation	200,954	233,686	232,541	227,697	222,691	217,859	213,055	208,386
Livestock	47,070	51,576	51,576	51,576	51,576	51,576	51,576	51,576
Total for Region	**581,820**	**795,183**	**835,691**	**895,944**	**953,690**	**1,006,928**	**1,077,078**	**1,150,973**

[1] Projections from Texas Water Development Board

2.3.1 Municipal Water Demand

Municipal water use is defined as water that is used by households (e.g., drinking, bathing, food preparation, dishwashing, laundry, flushing toilets, lawn watering and landscaping, swimming pools), commercial establishments, (e.g., restaurants, car washes, hotels, laundromats, and office buildings) and for fire protection, public recreation and sanitation. This type of water must meet safe-drinking water standards as specified by Federal and State laws and regulations.

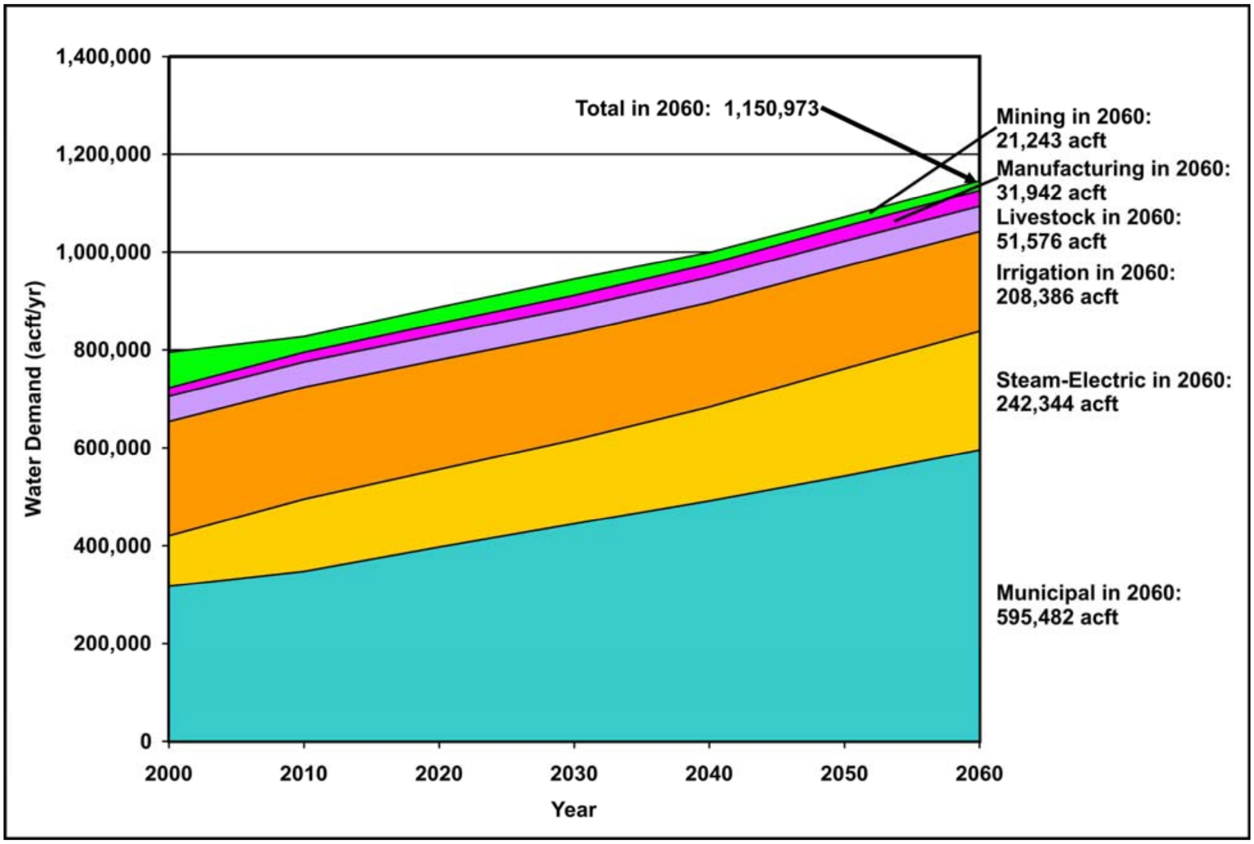

Figure 2-3. Projected Total Water Demand

Municipal water demand projections are computed by multiplying the projected population of an entity by the entity's projected per capita water use, adjusted downward for expected conservation savings due primarily to continued implementation of the 1991 State Water-Efficient Plumbing Act. Full implementation of the Act – retrofit of all existing fixtures with water-efficient fixtures and water-efficient fixtures installed in all new construction – was assumed to occur by Year 2045.

Table 2-4 presents projected per capita water use for water user groups in the Brazos G Area. These per capita water use rates reflect reductions due to implementation of the 1991 State Water-Efficient Plumbing Act. These reductions vary depending on the rural/urban nature of each Water User Group and projected growth, and range from 0 gpcd to 20 gpcd. Per capita water use varies widely, ranging between 49 gpcd to 413 gpcd in the region. The regional average in 2010 is projected to be 146 gpcd. Lower per capita water uses are typically associated

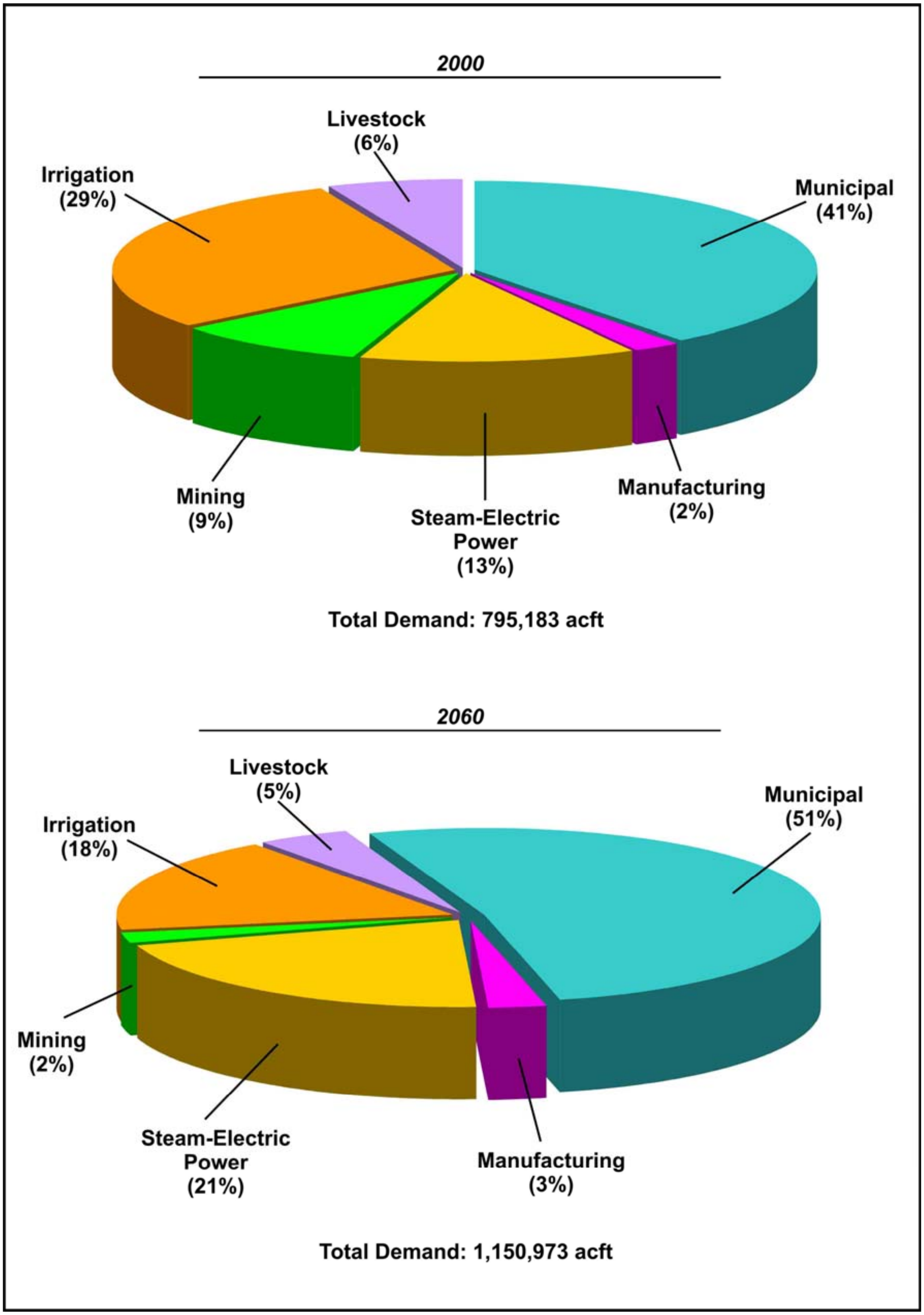

Figure 2-4. Total Water Demand by Type of Use in 2000 and 2060

Table 2-4.
Per Capita Water Use for Water User Groups
in the Brazos G Regional Water Planning Area

Water User Group	Per Capita Use Rates (gpcd)							Reduction Due to Plumbing Fixtures Act (2010 to 2060)
	Base[1] (2000)	2010	2020	2030	2040	2050	2060	
439 WSC	100	106	104	102	101	100	100	6
Abilene	304	164	161	158	155	154	154	10
Acton MUD	148	144	141	139	138	137	137	7
Albany	298	295	291	288	286	284	284	11
Alvarado	125	121	117	115	112	111	111	10
Anson	146	142	139	136	133	131	131	11
Aqua WSC	123	134	131	128	127	126	126	8
Aqua WSC	123	135	130	128	127	126	126	8
Aspermont	180	177	174	171	168	166	166	11
Baird	218	214	211	208	205	203	203	11
Bartlett	180	176	173	170	167	166	166	10
Bellmead	240	237	233	231	228	227	227	10
Bell-Milam Falls WSC	135	130	127	125	124	123	123	7
Belton	134	143	140	138	135	134	134	9
Bethany WSC	100	96	93	90	88	87	87	9
Bethesda WSC	134	129	126	124	123	122	122	7
Beverly Hills	174	171	168	165	161	160	160	11
Biston MWSD	242	239	236	233	230	228	228	11
Bitter Creek WSC	94	90	87	84	81	80	80	10
Blockhouse MUD	116	112	110	109	108	108	108	4
Brandon-Irene WSC	113	109	106	103	100	99	99	10
Breckenridge	149	181	179	177	175	174	174	7
Bremond	163	160	157	154	151	149	149	11
Brenham	195	192	188	185	182	181	181	11
Bruceville-Eddy	413	409	406	404	402	401	401	8
Brushy Creek MUD	150	145	145	145	145	145	145	0
Bryan	147	143	140	137	135	134	134	9
Burleson	150	146	142	140	138	137	137	9
Caldwell	163	198	194	191	188	187	187	11
Calvert	208	205	202	199	196	194	194	11
Cameron	233	230	227	224	221	219	219	11
Cedar Park	185	182	181	180	180	180	180	2
Chalk Bluff WSC	117	113	110	108	107	106	106	7
Childress Creek WSC	121	117	113	111	109	108	108	9
Chisholm Trail SUD	110	142	145	147	150	152	152	0
Cisco	172	169	166	163	160	158	158	11
Cleburne	143	176	173	170	168	167	167	9
Clifton	163	159	155	153	150	149	149	10
Clyde	76	73	70	67	64	62	62	11

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Table 2-4 (continued)

Water User Group	Per Capita Use Rates (gpcd)							Reduction Due to Plumbing Fixtures Act (2010 to 2060)
	Base[1] (2000)	2010	2020	2030	2040	2050	2060	
Coleman County WSC	117	115	112	109	106	105	105	10
College Station	225	221	217	215	213	212	212	9
Comanche	110	124	120	117	114	113	113	11
Coolidge	92	88	84	82	80	79	79	9
Copperas Cove	88	93	90	87	85	84	84	9
Copperas Cove	88	92	91	86	86	85	83	9
Bell County-Other	139	138	136	134	133	132	132	6
Bosque County-Other	121	116	113	111	110	109	109	7
Brazos County-Other	124	123	121	119	116	114	114	9
Burleson County-Other	102	98	95	93	91	90	90	8
Callahan County-Other	82	79	76	73	71	69	69	10
Comanche County-Other	117	113	110	107	104	102	102	11
Coryell County-Other	248	244	240	237	235	234	234	10
Eastland County-Other	124	121	118	115	112	110	110	11
Erath County-Other	96	92	89	87	85	84	84	8
Falls County-Other	100	99	97	95	90	86	86	13
Fisher County-Other	195	193	190	187	183	181	181	12
Grimes County-Other	79	76	72	70	67	66	66	10
Hamilton County-Other	114	112	109	105	102	100	100	12
Haskell County-Other	102	99	96	92	89	87	87	12
Hill County-Other	117	115	112	110	109	108	108	7
Hood County-Other	146	143	140	138	137	136	136	7
Johnson County-Other	226	223	221	219	217	216	216	7
Jones County-Other	89	86	83	80	77	75	75	11
Kent County-Other	114	111	108	106	102	100	100	11
Knox County-Other	134	131	128	125	122	120	120	11
Lampasas County-Other	152	149	146	144	142	141	141	8
Lee County-Other	131	128	125	122	119	117	117	11
Limestone County-Other	104	100	97	94	91	90	90	10
McLennan County-Other	221	217	213	211	208	207	207	10
Milam County-Other	138	135	132	129	126	124	124	11
Nolan County-Other	94	91	87	84	81	80	80	11
Palo Pinto County-Other	134	130	126	123	121	120	120	10
Robertson County-Other	120	117	114	112	110	109	109	8
Shackelford County-Other	194	190	186	183	181	179	179	11
Somervell County-Other	92	88	86	84	82	81	81	7
Stephens County-Other	167	164	161	158	155	153	153	11
Stonewall County-Other	124	120	117	114	111	109	109	11
Taylor County-Other	86	82	79	76	73	72	72	10
Throckmorton County-Other	116	112	110	107	104	102	102	10
Washington County-Other	111	107	104	101	99	98	98	9
Williamson County-Other	141	139	136	132	129	127	127	12

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Table 2-4 (continued)

Water User Group	Per Capita Use Rates (gpcd)							Reduction Due to Plumbing Fixtures Act (2010 to 2060)
	Base[1] (2000)	2010	2020	2030	2040	2050	2060	
Young County-Other	203	199	196	193	190	188	188	11
Crawford	80	76	73	70	67	66	66	10
Cross Country WSC	149	144	141	139	137	136	136	8
Cross Plains	143	140	137	134	131	129	129	11
De Leon	105	101	98	95	92	91	91	10
Dog Ridge WSC	148	144	141	139	138	137	137	7
Dublin	108	104	100	97	95	94	94	10
East Bell County WSC	98	94	91	88	86	85	85	9
Eastland	208	204	201	198	195	193	193	11
Elm Creek WSC	95	90	88	86	85	84	84	6
Fern Bluff MUD	125	122	121	120	120	120	120	2
Files Valley WSC	188	185	182	179	176	175	175	10
Florence	163	158	155	152	150	149	149	9
Fort Belknapp WSC	91	88	86	84	82	81	81	7
Fort Gates WSC	130	126	123	120	118	117	117	9
Fort Hood (CDP)[2]	197	227	224	221	218	216	216	11
Franklin	197	193	190	187	184	183	183	10
Gatesville	159	155	152	150	149	148	148	7
Georgetown	193	188	186	184	183	183	183	5
Gholson	126	122	119	116	115	114	114	8
Giddings	172	168	165	163	161	160	160	8
Glen Rose	223	220	216	213	210	209	209	11
Godley	135	131	128	127	125	125	125	6
Gorman	103	99	96	93	90	88	88	11
Graford	100	97	94	91	88	87	87	10
Graham	159	155	152	149	146	144	144	11
Granbury	313	309	306	303	302	301	301	8
Grandview	132	128	125	122	119	118	118	10
Granger	122	118	115	112	109	108	108	10
Groesbeck	132	128	125	123	122	121	121	7
Hallsburg	222	218	215	212	209	208	208	10
Hamilton	171	168	165	162	159	157	157	11
Hamlin	145	141	138	135	132	130	130	11
Harker Heights	137	146	143	140	138	137	137	9
Haskell	168	165	161	158	155	153	153	12
Hawley	232	229	225	222	220	218	218	11
Hawley WSC	72	70	67	65	63	62	62	8
Hearne	218	214	211	208	205	203	203	11
Hewitt	148	143	140	137	135	134	134	9
Hico	194	190	187	184	181	179	179	11
Hillsboro	185	182	179	176	173	172	172	10

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Table 2-4 (continued)

Water User Group	Per Capita Use Rates (gpcd)							Reduction Due to Plumbing Fixtures Act (2010 to 2060)
	Base[1] (2000)	2010	2020	2030	2040	2050	2060	
Holland	105	101	98	95	92	90	90	11
Hubbard	104	101	98	95	92	90	90	11
Hutto	126	121	119	118	117	117	117	4
Itasca	127	123	120	117	114	112	112	11
Jarrell-Schwertner WSC	186	181	179	177	175	175	175	6
Jayton	204	200	197	195	191	189	189	11
Johnson County FWSD #1	122	117	114	111	110	109	109	8
Johnson County Rural WSC	171	167	164	162	160	160	160	7
Jonah Water SUD	130	140	143	141	139	138	138	2
Joshua	134	130	126	123	121	120	120	10
Keene	98	94	91	89	87	86	86	8
Kempner	212	208	206	204	203	202	202	6
Kempner WSC	305	301	298	297	296	295	295	6
Killeen	120	154	179	177	174	170	167	0
Knox City	171	168	165	162	159	157	157	11
Lacy-Lakeview	105	101	98	96	95	94	94	7
Lake Whitney Water Co.	106	103	100	97	94	92	92	11
Lampasas	161	200	195	190	185	183	180	20
Leander	158	153	151	149	148	148	148	5
Lee County WSC	136	131	127	125	124	123	123	8
Lexington	183	179	175	173	171	170	170	9
Liberty Hill	170	166	164	164	163	163	163	3
Little River-Academy	141	137	134	131	128	127	127	10
Lometa	138	134	131	128	126	125	125	9
Lorena	206	201	197	194	192	191	191	10
Lott	122	119	116	113	110	108	108	11
Mansfield	147	235	243	241	241	241	242	0
Manville WSC	124	119	117	115	114	114	114	5
Marlin	350	346	343	340	337	336	336	10
Mart	125	121	118	115	113	112	112	9
McGregor	179	175	172	169	166	164	164	11
Meridian	130	126	123	120	117	116	116	10
Merkel	148	144	141	138	135	134	134	10
Mexia	165	162	159	156	152	150	150	12
Milano WSC	99	95	91	89	87	86	86	9
Mineral Wells	175	171	168	166	163	162	162	9
Moffat WSC	84	81	78	76	74	73	73	8
Moody	127	124	120	117	114	113	113	11
Morgans Point Resort	104	100	97	95	94	93	93	7
Mountain Peak WSC	166	161	159	158	156	156	156	5
Munday	161	157	154	151	148	146	146	11
Navasota	182	179	175	172	169	168	168	11

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Table 2-4 (continued)

Water User Group	Per Capita Use Rates (gpcd)							Reduction Due to Plumbing Fixtures Act (2010 to 2060)
	Base[1] (2000)	2010	2020	2030	2040	2050	2060	
Newcastle	93	90	86	83	81	79	79	11
Nolanville	110	119	116	113	110	109	109	10
North Bosque WSC	185	180	177	176	175	174	174	6
Oak Trail Shores Subdivision	134	130	128	125	123	122	122	8
Parker WSC	121	117	114	111	110	109	109	8
Pendleton WSC	85	80	78	75	73	72	72	8
Potosi WSC	103	100	97	95	92	91	91	9
Ranger	113	109	106	103	100	98	98	11
Riesel	95	91	88	85	83	82	82	9
Rio Vista	88	84	80	77	75	74	74	10
Rising Star	82	79	76	73	70	68	68	11
Robertson County WSC	77	72	69	67	66	65	65	7
Robinson	122	118	115	112	109	108	108	10
Roby	103	100	98	95	92	91	91	9
Rockdale	188	200	200	200	200	200	200	0
Rogers	159	156	153	150	147	145	145	11
Roscoe	121	117	113	110	107	106	106	11
Rosebud	106	102	99	96	93	91	91	11
Rotan	161	159	155	152	149	147	147	12
Round Rock	201	197	194	192	191	191	191	6
Rule	110	108	104	101	98	96	96	12
Salado WSC	229	225	222	220	219	218	218	7
Snook	215	211	208	205	203	202	202	9
Somerville	165	161	158	155	152	151	151	10
Southwest Milam WSC	150	146	143	140	139	138	138	8
Stamford	159	155	152	149	146	145	145	10
Steamboat Mountain WSC	70	67	64	62	60	59	59	8
Stephens County Rural WSC	88	112	109	106	103	101	101	11
Stephenville	157	152	149	146	143	142	142	10
Strawn	188	186	183	180	177	176	176	10
Sweetwater	228	225	221	218	215	214	214	11
Taylor	150	145	142	139	137	136	136	9
Temple	224	301	288	278	269	263	259	42
Thorndale	126	121	118	115	112	111	111	10
Thornton	95	92	89	86	83	81	81	11
Thrall	133	128	125	123	121	120	120	8
Throckmorton	233	229	226	223	220	218	218	11
Tolar	174	170	167	164	161	159	159	11
Tri-County SUD	80	76	73	70	68	67	67	9
Troy	124	120	117	114	111	109	109	11
Tuscola	90	86	83	81	78	77	77	9
Tye	132	127	124	121	118	117	117	10

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Table 2-4 (concluded)

Water User Group	*Per Capita Use Rates (gpcd)* Base[1] (2000)	2010	2020	2030	2040	2050	2060	*Reduction Due to Plumbing Fixtures Act (2010 to 2060)*
Valley Mills	188	185	181	178	175	174	174	11
Venus	102	133	131	128	126	125	125	8
Waco	183	183	183	183	183	183	183	0
Walnut Springs	111	108	104	101	98	97	97	11
Weir	153	149	148	147	146	146	146	3
Wellborn SUD	117	113	110	108	107	106	106	7
Wells Branch MUD	166	164	162	160	157	156	156	8
West	148	145	141	138	135	134	134	11
West Bell County WSC	111	108	105	102	99	98	98	10
West Brazos WSC	78	74	71	68	67	66	66	8
Western Hills Ws	100	96	93	91	90	89	89	7
White Bluff Community Ws	274	272	270	268	267	267	267	5
Whitney	154	151	148	145	142	141	141	10
Wickson Creek SUD	97	121	118	113	112	112	112	9
Williamson-Travis County MUD #1	109	104	102	101	100	100	100	4
Woodrow-Osceola WSC	49	45	42	39	37	36	36	9
Woodway	304	300	297	294	291	289	289	11
Min.	**49**	**45**	**42**	**39**	**37**	**36**	**36**	
Max.	**413**	**409**	**406**	**404**	**402**	**401**	**401**	
Mean	**148**	**146**	**143**	**141**	**139**	**137**	**137**	

[1] Per capita use rates for years 2010 to 2060 reflect revisions requested by entities and accepted by the TWDB. Base (year 2000) rates were not revised by the TWDB and reflect the original water use rates prior to requested revisions. In some cases, the year 2000 rate is inconsistent with ensuing decades.

[2] For Fort Hood in year 2000, the 197 gpcd rate was divided into an assumed rate of 145 gpcd (Brazos G average) for personnel living on-post, with the remaining 52 gpcd assigned to personnel working on the post but living off-post. The total per capita water use rate is necessarily applied to only that population living on-post. Future increases in per capita water use reflect increased demands from Fort Hood-supplied population projections applied against the lower TWDB population projections.

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with smaller, rural water utilities where outside water use for lawns or landscaping is limited, or is supplemented with individual residential wells and/or stock tanks. Larger per capita water use is typically associated with areas having large suburban residential growth or established urban areas having significant commercial water use. The Conservation Task Force formed by the 78th Texas Legislature has recommended a target per capita water use of 140 gpcd.[1]

Municipal water use for the region is projected to increase by 278,684 acft between 2000 and 2060, from 316,798 acft to 595,482 acft, an 88 percent increase. As can be seen in Figure 2-5, seven counties—Bell, Brazos, Coryell, Johnson, McLennan, Taylor, and

[1] Water Conservation Implementation Task Force, Report to the 79th Texas Legislature, Texas Water Development Board, Special Report, Austin, Texas, November 2004.

Williamson—are projected to account for 83 percent of the total municipal water use in 2060. Municipal water use projections for all 37 counties and 221 cities, other utilities, and "county-other" in the region are presented in Table 2-5.

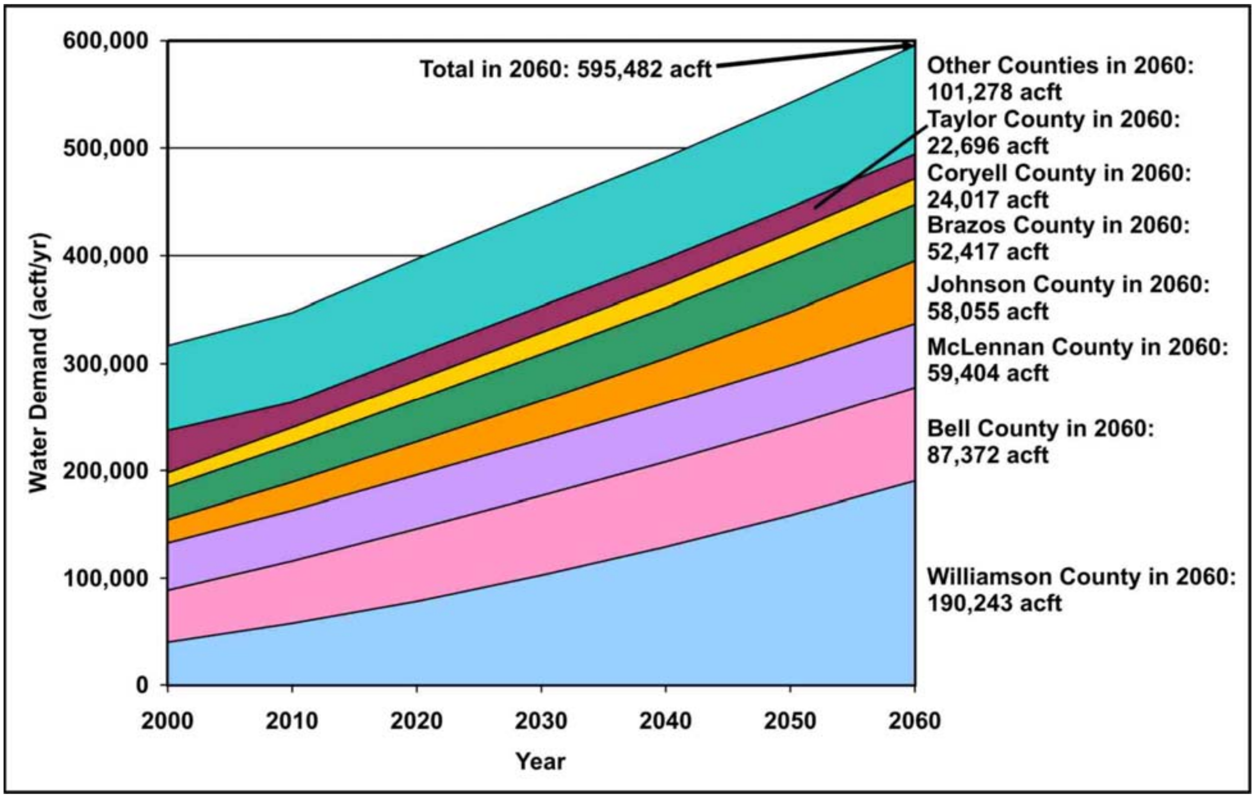

Figure 2-5. Municipal Water Demand Projections

The 88 percent projected increase in municipal water demand over the 60-year planning horizon is lower than the projected population increase of 105 percent due to expected savings in per capita water use resulting from continued implementation of the 1991 State Water-Efficient Plumbing Act.

2.3.2 Manufacturing Water Demand

Manufacturing is an integral part of the economy of the Brazos G Area, and for many industries water is key to the manufacturing process. It can be used in a variety of ways, including as a component of the final product, as a cooling agent during the manufacturing process, or for cleaning/wash-down of parts and/or products. In the Brazos G Area, industries that are major water users include food and kindred products, apparel, fabricated metal, machinery, and stone and concrete production.

Table 2-5.
Historical and Projected Municipal Water Demand by WUG/County in the Brazos G Area (acft/yr)

City/County	Historical		Projections[1]					
	1990	2000[2]	2010	2020	2030	2040	2050	2060
Bell County								
439 WSC		649	803	909	999	1,057	1,090	1,122
Bartlett (P)	128	165	184	196	206	211	216	220
Bell-Milam-Falls WSC (P)		299	342	371	398	415	425	435
Belton	2,194	2,412	2,824	3,199	3,542	3,723	3,875	3,920
Chisholm Trail SUD (P)		56	103	127	149	166	176	183
Dog Ridge WSC		586	715	799	876	926	955	982
East Bell County WSC (P)		250	263	271	276	279	282	286
Elm Creek WSC (P)		154	184	206	224	236	243	249
Fort Hood CDP (P)	3,227	3,822	4,395	4,337	4,279	4,221	4,182	4,182
Harker Heights	1,985	2,908	3,676	4,669	5,461	6,127	6,307	6,417
Holland	115	130	125	121	117	114	111	111
Jarrell-Schwertner WSC (P)		256	308	344	376	395	409	420
Kempner WSC (P)		913	1,142	1,297	1,443	1,535	1,591	1,636
Killeen	7,953	12,882	18,031	23,507	25,837	27,827	29,735	31,789
Little River-Academy	222	260	275	285	292	294	297	301
Moffat WSC		351	402	430	457	468	477	488
Morgans Point Resort	264	348	414	455	493	518	532	546
Nolanville	233	299	311	320	326	326	329	334
Pendleton WSC		231	250	265	273	278	282	287
Rodgers	203	199	195	191	188	184	181	181
Salado WSC		987	1,195	1,334	1,461	1,544	1,594	1,636
Temple	10,492	21,234	21,033	23,018	25,170	26,892	28,804	30,613
Troy	167	191	185	181	176	171	168	168
West Bell County WSC		678	660	642	623	605	599	599
County-Other	5,980	282	280	276	272	270	267	267
Bell County Total	33,163	48,665	58,295	67,750	73,914	78,782	83,127	87,372
Bosque County								
Childress Creek WSC		283	322	361	389	395	396	402
Clifton	495	647	709	773	819	824	827	837
Cross Country WSC (P)		30	36	44	49	50	51	52
Lake Whitney Water Company (P)		391	389	387	382	373	366	367
Meridian	233	217	229	242	249	247	247	250
Valley Mills (P)	162	236	241	246	248	246	246	247
Walnut Springs		94	97	100	101	100	99	100
County-Other	1,324	641	806	985	1,105	1,147	1,157	1,182
Bosque County Total	2,214	2,539	2,829	3,138	3,342	3,382	3,389	3,437
Brazos County								
Bryan	9,440	10,812	11,957	13,179	14,221	15,022	16,096	16,493
College Station	14,351	17,110	20,032	22,977	25,779	27,844	30,432	31,342
Wellborn SUD		858	1,069	1,285	1,482	1,637	1,820	1,886
Wickson Creek SUD (P)		624	1,126	1,451	1,701	1,924	2,206	2,301
County-Other	1,853	913	808	695	593	510	422	395
Brazos County Total	25,644	30,317	34,992	39,587	43,776	46,937	50,976	52,417

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Table 2-5 (continued)

City/County	Historical		Projections[1]					
	1990	2000	2010	2020	2030	2040	2050	2060
Burleson County								
Caldwell	627	630	807	835	854	865	878	894
Milano WSC (P)		160	177	194	207	216	223	231
Snook		137	147	160	167	173	178	183
Somerville	248	315	328	344	353	358	364	372
Southwest Milam WSC (P)		49	58	67	73	79	82	86
County-Other	993	1,029	1,139	1,263	1,349	1,404	1,450	1,504
Burleson County Total	1,868	2,320	2,656	2,863	3,003	3,095	3,175	3,270
Callahan County								
Baird	270	396	389	384	378	373	369	369
Clyde	439	285	271	264	247	230	217	211
Coleman County WSC (P)		51	49	51	44	38	31	26
Cross Plains	176	171	167	164	160	157	154	154
Potosi WSC (P)		8	8	8	7	6	6	6
County-Other	694	589	563	548	517	494	470	460
Callahan County Total	1,579	1,500	1,447	1,419	1,353	1,298	1,247	1,226
Comanche County								
Comanche	575	552	634	632	622	605	587	568
De Leon	299	286	280	280	274	265	256	248
County-Other	899	932	916	920	902	875	840	814
Comanche County Total	1,773	1,770	1,830	1,832	1,798	1,745	1,683	1,630
Coryell County								
Copperas Cove (P)	2,881	3,224	3,621	4,122	4,567	4,864	5,155	5,436
Elm Creek WSC (P)		34	47	63	78	89	97	105
Fort Gates WSC		291	322	358	392	415	437	457
Fort Hood CDP (P)	3,519	3,633	4,178	4,123	4,068	4,013	3,976	3,976
Gatesville	1,715	2,777	3,409	4,139	4,850	5,356	5,787	6,163
Kempner WSC		1,165	1,699	2,311	2,913	3,334	3,698	4,000
County-Other	1,487	2,160	2,485	2,853	3,211	3,460	3,686	3,880
Coryell County Total	9,602	13,284	15,761	17,969	20,079	21,531	22,836	24,017
Eastland County								
Cisco	498	742	731	719	694	663	633	604
Eastland	845	878	863	853	825	790	757	722
Gorman	158	143	137	134	127	120	113	108
Ranger	359	327	316	308	294	278	263	252
Rising Star	78	77	74	71	67	63	59	56
Stephens County Rural WSC (P)		1	2	2	2	1	1	1
County-Other	1,128	835	816	798	764	724	687	657
Eastland County Total	3,066	3,003	2,939	2,885	2,773	2,639	2,513	2,400
Erath County								
Dublin	428	454	485	516	544	576	682	753
Stephenville	2,397	2,624	2,717	2,850	2,957	3,058	3,464	3,732
County-Other	1,388	1,541	1,705	1,886	2,053	2,211	2,724	3,062
Erath County Total	4,213	4,619	4,907	5,252	5,554	5,845	6,870	7,547

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Table 2-5 (continued)

City/County	Historical 1990	Historical 2000	Projections[1] 2010	2020	2030	2040	2050	2060
Falls County								
Bell-Milam-Falls WSC (P)		138	178	229	281	327	362	407
Bruceville-Eddy (P)		1	2	3	4	5	5	6
East Bell County WSC (P)		67	77	89	101	112	120	132
Elm Creek WSC (P)		3	5	6	8	9	11	12
Lott		99	97	94	92	89	88	88
Marlin	1,281	2,599	2,660	2,749	2,839	2,913	2,983	3,076
Rosebud	182	177	171	166	161	156	152	152
Tri-County SUD (P)		234	253	280	305	327	347	375
West Brazos WSC (P)		159	190	230	267	304	331	368
County-Other	1,250	418	360	286	213	146	97	47
Falls County Total	2,713	3,895	3,993	4,132	4,271	4,388	4,496	4,663
Fisher County								
Bitter Creek WSC (P)		121	117	114	113	111	110	113
Roby	54	78	76	75	75	74	74	76
Rotan	214	291	278	271	249	231	222	203
County-Other	457	199	185	181	155	134	124	97
Fisher County Total	725	689	656	641	592	550	530	489
Grimes County								
Navasota	1,210	1,384	1,426	1,464	1,494	1,505	1,526	1,555
Wickson Creek SUD (P)		303	625	878	1,044	1,175	1,286	1,396
County-Other	1,564	1,236	1,269	1,287	1,317	1,303	1,317	1,351
Grimes County Total	2,774	2,923	3,320	3,629	3,855	3,983	4,129	4,302
Hamilton County								
Hamilton	637	570	554	542	531	521	513	513
Hico	241	291	285	281	276	272	269	269
County-Other	471	499	440	416	392	383	364	363
Hamilton County Total	1,349	1,360	1,279	1,239	1,199	1,176	1,146	1,145
Haskell County								
Haskell	450	585	559	538	518	503	487	472
Rule	127	86	81	77	72	69	66	62
Stamford (P)	8	8	8	8	8	8	8	8
County-Other	240	257	235	221	203	192	180	166
Haskell County Total	825	936	883	844	801	772	741	708
Hill County								
Brandon-Irene WSC (P)		254	251	253	255	256	263	273
Fills Valley WSC (P)		413	413	417	421	424	433	447
Hillsboro	1,095	1,706	1,728	1,768	1,815	1,859	1,928	2,017
Hubbard	183	185	179	174	169	163	160	160
Itasca	165	214	206	201	194	189	185	184
Johnson County Rural WSC (P)		34	37	41	46	53	59	65
Lake Whitney Water Company (P)		638	623	608	593	578	570	574
Parker WSC (P)		50	51	53	56	59	64	68
White Bluff Community WS		307	369	456	553	650	757	875
Whitney	196	316	346	350	355	360	370	384
Woodrow-Osceola WSC		296	286	285	284	287	298	319
County-Other	2,014	377	373	394	423	453	486	526
Hill County Total	3,653	4,790	4,862	5,000	5,164	5,331	5,573	5,892

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Table 2-5 (continued)

City/County	Historical		Projections[1]					
	1990	2000	2010	2020	2030	2040	2050	2060
Hood County								
Acton MUD (P)		2,026	2,425	2,912	3,363	3,851	4,464	5,204
Granbury	851	2,005	2,369	2,811	3,213	3,651	4,201	4,851
Oak Trail Shores Subdivision		448	511	504	492	484	480	480
Tolar		98	96	94	93	91	90	90
County-Other	2,974	3,217	3,734	4,345	4,916	5,539	6,322	7,272
Hood County Total	3,825	7,794	9,135	10,666	12,077	13,616	15,557	17,897
Johnson County								
Acton MUD (P)		17	21	27	33	39	47	58
Alvarado	310	460	487	519	559	596	655	733
Bethany WSC		336	363	397	431	471	527	602
Bethesda WSC (P)		2,199	2,751	3,415	4,115	4,898	5,863	7,096
Burleson (P)	1,760	2,943	3,320	3,752	4,240	4,762	5,446	6,326
Cleburne	3,421	4,165	5,748	6,370	7,003	7,722	8,666	9,879
Godley		133	167	206	250	295	355	429
Grandview	176	201	208	219	229	241	259	285
Johnson County FWSD #1		727	844	990	1,135	1,310	1,527	1,807
Johnson County Rural WSC (P)		5,427	7,192	9,433	11,923	14,891	18,665	22,699
Joshua	347	680	744	819	899	992	1,117	1,279
Keene	457	549	620	705	798	896	1,028	1,202
Mansfield (P)	82	148	165	172	172	173	175	178
Mountain Peak WSC (P)		223	313	420	534	653	809	1,001
Parker WSC (P)		238	287	344	402	470	555	664
Rio Vista		65	71	77	85	93	105	122
Venus (P)	123	286	282	278	271	267	265	265
County-Other	5,595	2,710	2,776	2,871	2,969	3,076	3,228	3,430
Johnson County Total	12,271	21,507	26,359	31,014	36,048	41,845	49,292	58,055
Jones County								
Abilene (P)	193	1,869	1,029	1,035	1,014	979	945	908
Anson	424	418	415	416	406	391	374	360
Hamlin	640	365	362	363	355	342	327	314
Hawley		168	169	170	168	164	158	151
Hawley WSC (P)		404	401	393	380	363	347	333
Stamford (P)	783	640	637	640	626	604	582	560
County-Other	686	124	123	121	117	111	105	100
Jones County Total	2,726	3,988	3,136	3,138	3,066	2,954	2,838	2,726
Kent County								
Jayton	139	117	112	108	95	75	66	57
County-Other	49	44	42	40	36	29	25	23
Kent County Total	188	161	154	148	131	104	91	80
Knox County								
Knox City	235	233	225	229	225	222	219	216
Munday	267	275	267	265	260	255	251	250
County-Other	311	226	217	219	215	210	207	203
Knox County Total	813	734	709	713	700	687	677	669

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Table 2-5 (continued)

City/County	Historical		Projections[1]					
	1990	2000	2010	2020	2030	2040	2050	2060
Lampasas County								
Copperas Cove (P)		15	22	30	34	38	40	41
Kempner		238	300	366	411	446	467	482
Kempner WSC (P)		1,053	1,293	1,547	1,734	1,870	1,956	2,015
Lampasas	1,280	1,224	1,570	1,583	1,579	1,563	1,563	1,548
Lometa		121	130	141	147	152	155	159
County-Other	1,037	1,016	1,152	1,289	1,385	1,450	1,494	1,529
Lampasas County Total	2,317	3,667	4,467	4,956	5,290	5,519	5,675	5,774
Lee County								
Aqua WSC (P)		405	443	494	532	567	596	625
Giddings	1,299	984	1,106	1,258	1,382	1,476	1,564	1,645
Lee County WSC (P)		628	721	834	931	1,011	1,079	1,143
Lexington	226	241	270	305	334	357	378	397
Manville WSC (P)		14	19	25	30	34	38	41
Southwest Milam WSC (P)		38	44	52	58	63	67	71
County-Other	1,466	340	329	316	305	294	287	285
Lee County Total	2,991	2,650	2,932	3,284	3,572	3,802	4,009	4,207
Limestone County								
Biston MWSD		150	148	146	144	142	141	141
Coolidge		88	95	103	108	110	114	120
Groesbeck	612	634	760	923	1,006	1,071	1,135	1,229
Mexia	989	1,213	1,250	1,289	1,328	1,358	1,408	1,479
Thornton		56	54	52	50	49	48	48
Tri-County SUD (P)		95	103	115	118	121	125	133
County-Other	1,372	957	883	819	756	693	645	602
Limestone County Total	2,973	3,193	3,293	3,447	3,510	3,544	3,616	3,752
McLennan County								
Bellmead	1,170	2,477	2,622	2,751	2,873	2,984	3,065	3,202
Beverly Hills	453	412	414	416	416	414	416	424
Bruceville-Eddy (P)	516	688	825	961	1,077	1,195	1,270	1,383
Chalk Bluff WSC		354	441	527	599	676	722	798
Crawford		63	65	67	68	69	70	73
Cross County WSC (P)		396	445	497	541	585	614	661
Elm Creek WSC (P)		143	184	227	261	298	320	357
Gholson		130	150	169	184	202	213	231
Hallsburg		129	139	150	158	166	172	182
Hewitt	1,154	1,838	2,029	2,237	2,395	2,571	2,684	2,877
Lacy-Lakeview	334	678	835	989	1,116	1,256	1,338	1,477
Lorena	180	331	369	408	440	475	497	533
Mart	338	318	335	354	367	383	394	415
McGregor	904	948	933	923	913	902	894	899
Moody	181	199	202	203	203	204	206	212
North Bosque WSC		280	367	454	530	608	655	730
Riesel		104	109	116	120	126	129	137
Robinson	919	1,072	1,110	1,153	1,182	1,210	1,236	1,291
Tri-County SUD (P)		10	12	13	14	15	16	18
Valley Mills (P)	2	1	1	1	1	1	1	1
Waco	22,931	23,312	24,876	26,453	27,781	29,159	30,033	31,304
West	526	446	459	467	475	482	490	506
West Brazos WSC (P)		141	161	181	195	214	224	244
Western Hills WS		307	384	458	520	588	627	694
Woodway	2,175	2,974	2,944	2,925	2,903	2,882	2,867	2,874
County-Other	5,429	6,354	6,635	6,904	7,167	7,399	7,574	7,881
McLennan County Total	37,212	44,105	47,046	50,004	52,499	55,064	56,727	59,404

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Table 2-5 (continued)

City/County	Historical 1990	Historical 2000	Projections[1] 2010	2020	2030	2040	2050	2060
Milam County								
Bell-Milam-Falls WSC (P)		201	245	288	316	334	341	347
Cameron	1,064	1,470	1,452	1,433	1,414	1,395	1,382	1,382
Milano WSC (P)		174	195	212	224	230	232	235
Rockdale	1,491	1,145	1,254	1,287	1,310	1,325	1,332	1,337
Southwest Milam WSC (P)		911	1,086	1,251	1,350	1,422	1,448	1,472
Thorndale	121	180	193	206	213	215	216	219
County-Other	1,375	552	401	291	211	152	111	82
Milam County Total	4,051	4,633	4,826	4,968	5,038	5,073	5,062	5,074
Nolan County								
Bitter Creek WSC (P)		122	122	122	120	115	109	104
Roscoe	236	187	189	190	188	182	173	165
Sweetwater	3,164	2,915	3,013	3,072	3,081	3,029	2,900	2,763
County-Other	602	195	199	197	193	186	177	168
Nolan County Total	4,002	3,419	3,523	3,581	3,582	3,512	3,359	3,200
Palo Pinto County								
Fort Belknap WSC (P)		1	2	2	3	3	4	5
Graford		65	65	65	64	64	65	67
Mineral Wells (P)	2,823	2,895	2,887	3,049	3,184	3,278	3,425	3,611
Stephens County Rural WSC (P)		1	2	2	2	1	1	1
Strawn		156	160	164	167	170	176	183
County-Other	1,342	1,638	1,810	1,905	1,987	2,086	2,230	2,421
Palo Pinto County Total	4,165	4,756	4,926	5,187	5,407	5,602	5,901	6,288
Robertson County								
Bremond	133	160	157	154	151	148	146	146
Calvert	426	332	327	323	318	313	310	310
Franklin	173	324	344	373	389	397	396	395
Hearne	1,106	1,145	1,124	1,108	1,093	1,077	1,066	1,066
Robertson County WSC		218	258	315	348	370	368	365
Tri-County SUD (P)		75	77	82	83	84	83	83
Wickson Creek SUD (P)		10	20	30	35	39	39	39
County-Other	772	548	567	594	609	616	613	611
Robertson County Total	2,610	2,812	2,874	2,979	3,026	3,044	3,021	3,015
Shackelford County								
Albany	582	641	665	690	676	635	555	466
Hawley WSC (P)		5	5	5	5	4	4	3
Stephens County Rural WSC (P)		1	2	2	2	1	1	1
County-Other	206	284	291	300	292	273	238	200
Shackelford County Total	788	931	963	997	975	913	798	670
Somervell County								
Glen Rose	358	530	545	559	572	577	579	581
County-Other	413	483	526	586	630	652	659	664
Somervell County Total	771	1,013	1,071	1,145	1,202	1,229	1,238	1,245

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Table 2-5 (continued)

City/County	Historical 1990	Historical 2000	Projections[1] 2010	2020	2030	2040	2050	2060
Stephens County								
Breckenridge	1,352	979	1,214	1,220	1,215	1,190	1,138	1,102
Fort Belknap WSC (P)		4	4	3	3	3	3	3
Stephens County Rural WSC (P)		245	318	314	308	296	279	271
County-Other	470	241	242	241	238	231	220	213
Stephens County Total	1,822	1,469	1,778	1,778	1,764	1,720	1,640	1,589
Stonewall County								
Aspermont	260	206	202	192	179	165	153	143
County-Other	96	93	90	85	79	72	66	62
Stonewall County Total	356	299	292	277	258	237	219	205
Taylor County								
Abilene (P)	25,608	37,607	21,862	22,450	22,493	22,202	21,643	20,971
Coleman County WSC (P)		18	19	20	20	19	19	18
Hawley WSC (P)		55	57	57	57	55	53	52
Merkel	309	437	458	469	469	462	450	436
Potosi WSC (P)		396	414	420	420	409	397	385
Steamboat Mountain WSC		262	271	270	267	260	251	243
Tuscola		72	74	74	74	73	70	68
Tye	144	171	178	181	181	177	172	167
County-Other	1,312	386	398	400	393	380	368	356
Taylor County Total	27,373	39,404	23,731	24,341	24,374	24,037	23,423	22,696
Throckmorton County								
Fort Belknap WSC (P)		11	10	10	9	8	8	7
Stephens County Rural WSC (P)		8	10	9	9	8	7	7
Throckmorton	198	236	232	222	209	191	177	168
County-Other	91	99	96	91	84	76	70	66
Throckmorton County Total	289	354	348	332	311	283	262	248
Washington County								
Brenham	2,243	2,950	3,078	3,223	3,303	3,320	3,364	3,415
County-Other	1,781	2,097	2,187	2,323	2,379	2,397	2,431	2,478
Washington County Total	4,024	5,047	5,265	5,546	5,682	5,717	5,795	5,893

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Table 2-5 (concluded)

City/County	*Historical*		*Projections[1]*					
	1990	*2000*	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Williamson County								
Aqua WSC (P)		65	76	88	103	121	140	161
Bartlett (P)	169	173	176	181	188	195	205	217
Bell-Milam-Falls WSC (P)		41	53	66	83	101	120	142
Blockhouse MUD		578	903	1,288	1,749	2,242	2,796	3,389
Brushy Creek MUD		1,902	2,643	3,596	3,869	3,869	3,869	3,869
Cedar Park (P)	566	5,286	10,744	14,886	20,708	25,883	31,068	37,892
Chisholm Trail SUD (P)		1,380	3,025	4,595	6,473	8,619	10,954	13,335
Fern Bluff MUD		745	1,339	2,049	2,882	3,805	4,810	5,888
Florence		192	224	262	307	357	413	476
Georgetown	3,369	6,127	8,610	11,619	15,141	19,003	23,293	27,895
Granger	168	178	185	196	209	222	240	262
Hutto		176	247	335	439	551	677	812
Jarrell-Schwertner WSC (P)		567	769	1,017	1,306	1,614	1,965	2,342
Jonah Water SUD		1,159	1,676	2,229	2,804	3,415	4,092	4,845
Leander	574	1,344	1,971	2,728	3,610	4,578	5,657	6,815
Liberty Hill		268	454	673	940	1,223	1,537	1,874
Manville WSC (P)		732	1,064	1,466	1,933	2,446	3,022	3,640
Round Rock (P)	6,055	13,522	19,239	25,937	33,896	42,617	52,298	62,680
Southwest Milam (P)		209	259	318	386	465	549	643
Taylor	2,038	2,281	2,522	2,839	3,208	3,622	4,093	4,625
Thrall		106	123	145	172	200	231	267
Weir		101	156	223	301	386	480	581
Wells Branch MUD (P)		31	31	30	30	30	29	29
Williamson-Travis County MUD #1 (P)		510	770	1,085	1,462	1,865	2,320	2,807
County-Other	10,813	2,320	429	333	452	1,812	3,627	4,757
Williamson County Total	23,752	39,993	57,688	78,184	102,651	129,241	158,485	190,243
Young County								
Fort Belknap WSC (P)		342	334	333	325	314	306	303
Graham	1,666	1,552	1,528	1,531	1,503	1,456	1,415	1,402
Newcastle		60	59	57	55	53	51	51
Stephens County Rural WSC (P)		1	2	2	2	1	1	1
County-Other	809	304	301	302	298	291	283	280
Young County Total	2,475	2,259	2,224	2,225	2,183	2,115	2,056	2,037
Total For Region	**236,955**	**316,798**	**347,389**	**397,090**	**444,820**	**491,312**	**542,172**	**595,482**

(P) Partial
[1] Projections from Texas Water Development Board.
[2] Water demands for years 2010 through 2060 reflect revisions requested by entities and accepted by the TWDB. Historical demands for year 2000 were not revised by the TWDB and reflect original demands prior to the revisions.

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Manufacturing water demand was projected by the TWDB by taking industry-specific water demand coefficients, adjusted for water-use efficiencies (recycling/reuse), and applying them to growth trends for each industry. These growth trends assume expansion of existing capacity and building of new facilities; continuation of historical trends of interaction between oil price changes and industrial activity; and that the makeup of each county's manufacturing base remains constant throughout the 60-year planning horizon.

Manufacturing use is projected to increase 88.6 percent, from 16,939 acft in 2000 to 31,942 acft in 2060 (Table 2-6). The trend in manufacturing use by county is shown in Figure 2-6. Bosque, Johnson, McLennan, Milam, and Williamson Counties account for 76.2 percent of the total use in 2060. The projections for manufacturing use in Milam County were revised from the original TWDB issued projections. The Aluminum Company of America (ALCOA), in Milam County, uses water for three separate processes: manufacturing, mining, and steam-electric. With input from the company's representatives it was determined that the TWDB draft manufacturing water demand projections reflected water use for mining and steam-electric uses as well as manufacturing. The revised projections for manufacturing water use reported in Table 2-6 for Milam County have been revised to show the manufacturing use portion only.

2.3.3 Steam-Electric Water Demand

The projections for steam-electric water demand were developed by the TWDB and are based on power generation projections—determined by population and manufacturing growth—and on power generation capacity and fresh water use for that projected capacity. The steam-electric generation process uses water in boilers and for cooling. Grimes, Hood, Limestone, McLennan, Robertson, and Somervell Counties account for 79.8 percent of total steam-electric water use in 2060. The reported use in the year 2000 was 103,330 acft, increasing to 242,344 acft by 2060, a 135 percent increase (Table 2-7). This more than doubling (Figure 2-7) in water use is attributable to the growing population in the State, and increased energy needs for manufacturing. In addition to expansion of existing plant capacity to meet the increased needs, there are new generating plants slated to open in Bell, Bosque, and McLennan Counties.

2.3.4 Mining Water Demand

Projections for mining water demand were developed by the TWDB and are based on projected production of mineral commodities, and historic rates of water use, moderated by water requirements of technological processes used in mining.

Mining use in the Brazos G Area is expected to decrease 70.8 percent between 2000 and 2060, from 72,854 acft to 21,243 acft, largely due to the projected closure of the Sandow Mine in Milam County (Table 2-8). Stephens and Williamson Counties account for 69.0 percent of total mining water use in 2060 (Figure 2-8).

Table 2-6.
Historical and Projected Manufacturing Water Demand in the Brazos G Area (acft/yr)

County	Historical		Projections[1]					
	1990	2000	2010	2020	2030	2040	2050	2060
Bell	966	800	980	1,085	1,180	1,273	1,355	1,463
Bosque	766	794	1,005	1,151	1,285	1,417	1,531	1,664
Brazos	168	244	316	365	413	462	506	549
Burleson	117	150	196	233	270	307	340	370
Callahan	0	0	0	0	0	0	0	0
Comanche	23	26	31	34	37	39	41	44
Coryell	8	7	9	10	11	12	13	14
Eastland	15	36	43	47	50	53	55	59
Erath	86	57	73	82	90	98	105	114
Falls	0	2	2	2	2	2	2	2
Fisher	129	158	192	225	255	284	310	336
Grimes	248	197	257	297	336	375	410	445
Hamilton	0	3	4	5	6	7	8	9
Haskell	0	0	0	0	0	0	0	0
Hill	62	67	85	97	108	119	129	140
Hood	9	20	25	28	30	32	34	37
Johnson	948	1,533	2,121	2,517	2,903	3,295	3,646	3,994
Jones	306	0	0	0	0	0	0	0
Kent	0	0	0	0	0	0	0	0
Knox	0	0	0	0	0	0	0	0
Lampasas	106	108	129	142	153	164	174	187
Lee	5	11	13	14	15	16	17	18
Limestone	368	39	48	53	58	63	67	72
McLennan	2,698	2,804	3,526	4,068	4,577	5,096	5,561	6,022
Milam	22,047	6,820	6,820	8,250	8,250	8,250	9,800	9,800
Nolan	499	643	779	915	1,038	1,159	1,266	1,372
Palo Pinto	56	23	29	33	36	39	42	46
Robertson	34	65	85	101	117	134	150	163
Shackelford	0	0	0	0	0	0	0	0
Somervell	0	5	6	7	8	9	10	11
Stephens	7	6	7	8	9	10	11	12
Stonewall	0	0	0	0	0	0	0	0
Taylor	1,638	789	972	1,081	1,177	1,270	1,349	1,462
Throckmorton	0	0	0	0	0	0	0	0
Washington	470	334	414	461	504	547	585	633
Williamson	326	1,171	1,587	1,854	2,120	2,388	2,630	2,856
Young	135	27	33	36	39	42	44	48
Total for Region	**32,240**	**16,939**	**19,787**	**23,201**	**25,077**	**26,962**	**30,191**	**31,942**

[1] Projections from Texas Water Development Board

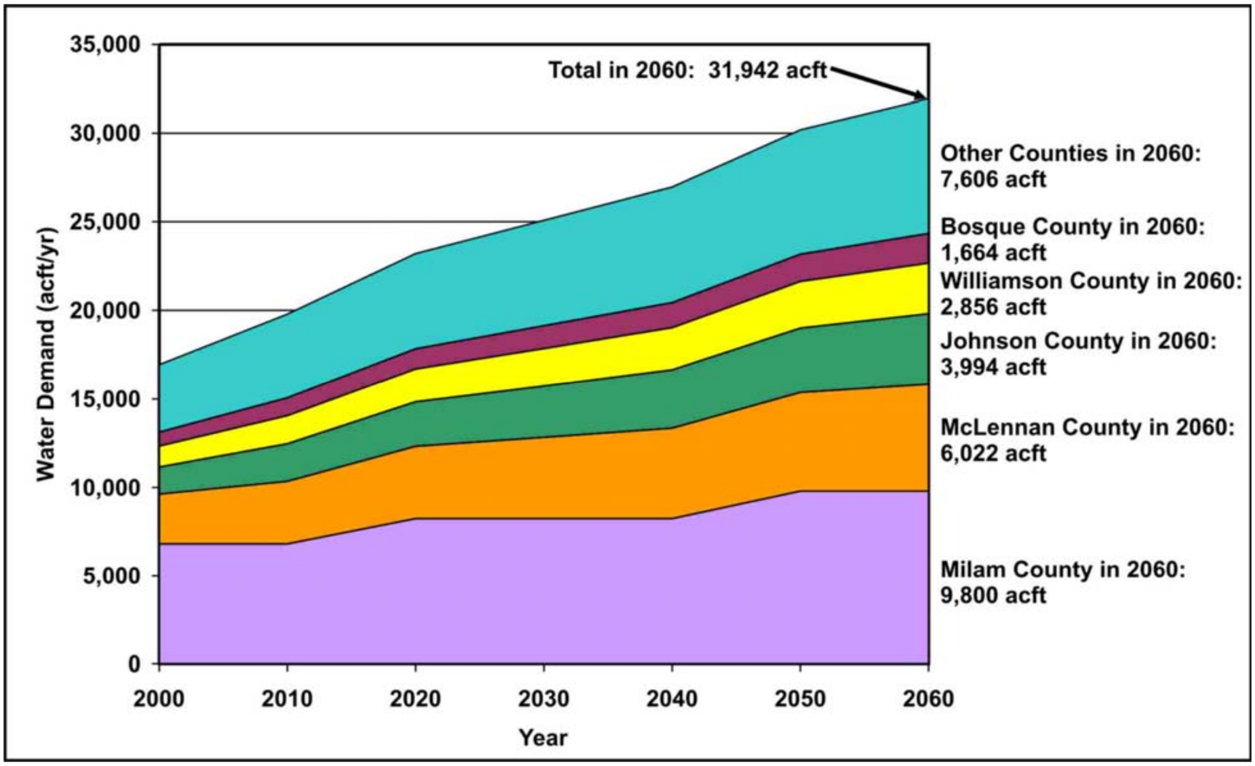

Figure 2-6. Manufacturing Water Demand Projections

2.3.5 Irrigation Water Demand

The irrigation water demand projections were developed by the TWDB and are based on specific assumptions regarding resource constraints, crop prices, crop yields, agricultural policy, and technological advances in irrigation systems.

Major crops grown in the region include feed grains, small grains, cotton, pecans, and peanuts. Table 2-9 shows that irrigation water demand will decline 12.5 percent from 2000 to 2060. This is attributable to technological advances in irrigation techniques as well as projected reductions in irrigated land. Figure 2-9 shows the trend in irrigation use, with Comanche, Eastland, Haskell, and Knox Counties accounting for 63.5 percent of total irrigation water use in 2060.

Table 2-7.
Historical and Projected Steam-Electric Water Demand in the Brazos G Area (acft/yr)

County	Historical		Projections[1]					
	1990	2000	2010	2020	2030	2040	2050	2060
Bell	0	0	0	3,674	4,296	5,053	5,977	7,102
Bosque	0	521	4,323	6,188	7,235	8,510	10,065	11,961
Brazos	3,953	545	453	361	422	497	588	698
Burleson	0	0	0	0	0	0	0	0
Callahan	0	0	0	0	0	0	0	0
Comanche	0	0	0	0	0	0	0	0
Coryell	0	0	0	0	0	0	0	0
Eastland	0	0	0	0	0	0	0	0
Erath	0	0	0	0	0	0	0	0
Falls	0	0	0	0	0	0	0	0
Fisher	0	0	0	0	0	0	0	0
Grimes	11,088	4,405	9,302	11,768	13,758	16,184	19,141	22,746
Hamilton	0	0	0	0	0	0	0	0
Haskell	546	507	422	336	393	462	547	650
Hill	0	0	0	0	0	0	0	0
Hood	4,212	2,573	6,594	8,098	9,467	11,137	13,172	15,653
Johnson	0	0	1,200	1,200	1,200	1,200	1,200	1,200
Jones	2,041	1,510	1,255	1,001	1,170	1,376	1,628	1,935
Kent	0	0	0	0	0	0	0	0
Knox	0	0	0	0	0	0	0	0
Lampasas	0	0	0	0	0	0	0	0
Lee	0	0	0	0	0	0	0	0
Limestone	4,692	22,065	22,332	22,598	26,420	31,079	36,758	43,681
McLennan	14,366	24,412	37,098	32,983	35,720	39,056	43,123	48,081
Milam	2,716	8,680	8,680	12,500	12,500	12,500	16,000	16,000
Nolan	0	1,093	1,315	1,882	2,200	2,588	3,061	3,638
Palo Pinto	1,898	1,378	1,365	1,250	1,461	1,719	2,033	2,416
Robertson	0	15,000	28,000	30,000	30,000	35,000	40,000	40,000
Shackelford	0	0	0	0	0	0	0	0
Somervell	9,845	18,000	23,200	23,200	23,200	23,200	23,200	23,200
Stephens	0	0	0	0	0	0	0	0
Stonewall	0	0	0	0	0	0	0	0
Taylor	0	31	25	20	24	28	33	39
Throckmorton	0	0	0	0	0	0	0	0
Washington	0	0	0	0	0	0	0	0
Williamson	0	0	0	0	0	0	0	0
Young	2,300	2,610	2,170	1,730	2,023	2,379	2,814	3,344
Total for Region	**57,657**	**103,330**	**147,734**	**158,789**	**171,489**	**191,968**	**219,340**	**242,344**

[1] Projections from Texas Water Development Board

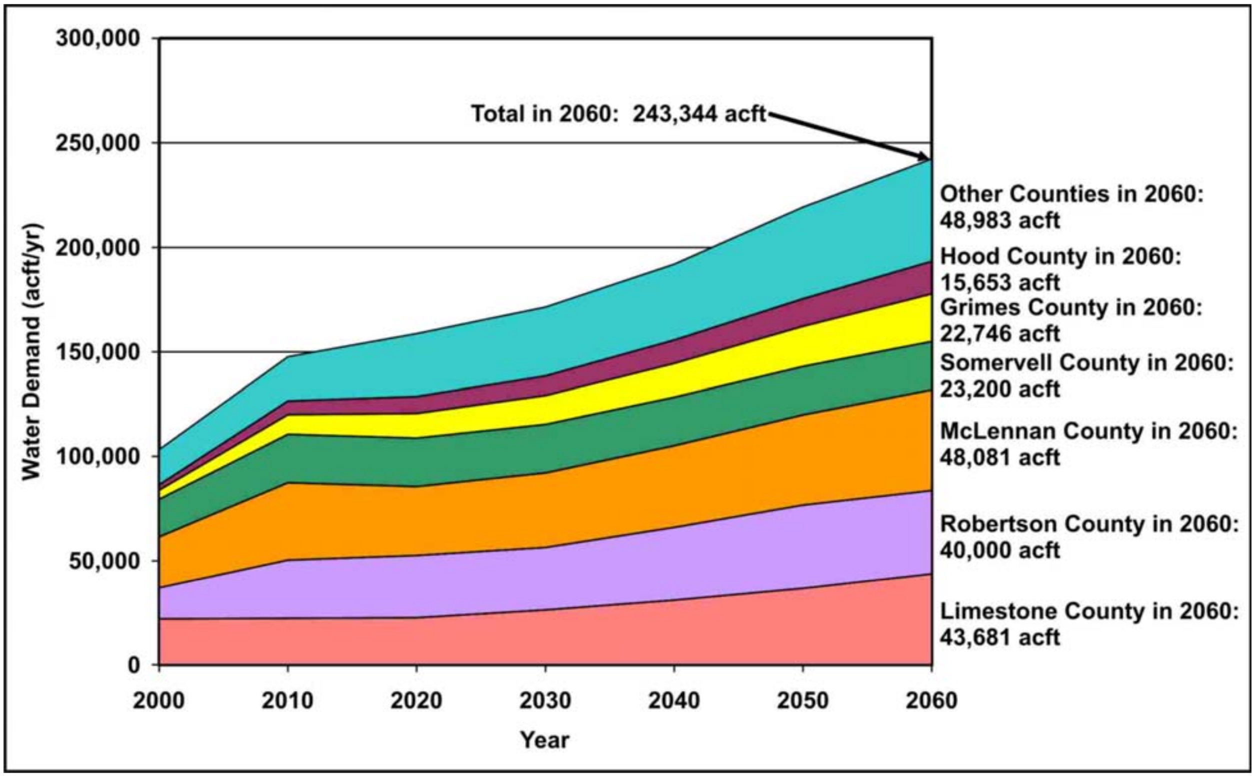

Figure 2-7. Steam-Electric Water Demand Projections

2.3.6 Livestock Water Demand

In the 37-county Brazos G Area, the principal livestock type is dairy, with some beef cattle.

The Brazos G Area contains widespread cow-calf operators, with concentrated dairy production in Comanche and Erath Counties. The livestock water demand projections developed by the TWDB are based upon estimates of the maximum carrying capacity of the rangeland of the area and the estimated number of gallons of water per head of livestock per day. Additionally, economics of milk production and environmental impacts of the operation are major factors in the projections of the water demands for this category of livestock.

Livestock drinking water is obtained from wells, stock watering ponds, and streams. As can be seen in Table 2-10, it is projected that livestock water demand will remain constant at 51,576 acft for the 60-year planning horizon. Figure 2-10 shows the trend in livestock use, with Comanche, Erath, and Johnson Counties accounting for 30.4 percent of total livestock water use in 2060.

Table 2-8.
Historical and Projected Mining Water Demand
in the Brazos G Area
(acft/yr)

County	Historical		Projections[1]					
	1990	2000	2010	2020	2030	2040	2050	2060
Bell	0	174	155	150	147	144	141	139
Bosque	61	276	210	197	189	182	176	172
Brazos	21	25	27	28	29	30	31	31
Burleson	11	29	25	24	24	24	24	24
Callahan	137	81	92	96	98	100	101	103
Comanche	74	80	54	51	50	49	48	47
Coryell	86	100	108	111	113	115	117	118
Eastland	295	79	95	102	105	108	111	115
Erath	0	0	0	0	0	0	0	0
Falls	55	133	101	95	91	88	85	83
Fisher	278	468	375	359	354	349	344	337
Grimes	0	158	166	169	171	173	174	175
Hamilton	0	0	0	0	0	0	0	0
Haskell	141	101	93	91	90	89	88	87
Hill	0	118	100	96	94	92	90	89
Hood	73	167	162	161	160	159	158	157
Johnson	27	324	370	390	403	415	427	436
Jones	169	290	300	303	304	305	306	307
Kent	799	686	464	436	427	418	410	399
Knox	11	26	26	26	26	26	26	26
Lampasas	87	193	152	144	139	135	131	128
Lee	0	20,000	5,450	5,450	5,450	5,450	13	13
Limestone	0	360	380	387	392	396	400	403
McLennan	0	481	416	399	389	380	371	366
Milam	7	30,008	4,000	4,000	4,000	3,000	1,500	1,500
Nolan	378	277	278	278	278	278	278	278
Palo Pinto	1	2	2	2	2	2	2	2
Robertson	20	7,500	10,300	10,300	10,300	78	77	76
Shackelford	279	524	656	724	752	779	806	845
Somervell	330	393	304	287	278	270	263	257
Stephens	660	7,315	8,715	9,328	9,567	9,798	10,024	10,347
Stonewall	410	14	15	15	15	15	15	15
Taylor	170	242	285	304	313	322	330	340
Throckmorton	20	40	49	53	55	57	59	61
Washington	93	157	185	198	206	213	220	226
Williamson	1,713	1,874	2,354	2,615	2,795	2,972	3,149	3,280
Young	538	159	200	222	231	240	249	261
Total for Region	**6,944**	**72,854**	**36,664**	**37,591**	**38,037**	**27,251**	**20,744**	**21,243**

[1] Projections from Texas Water Development Board

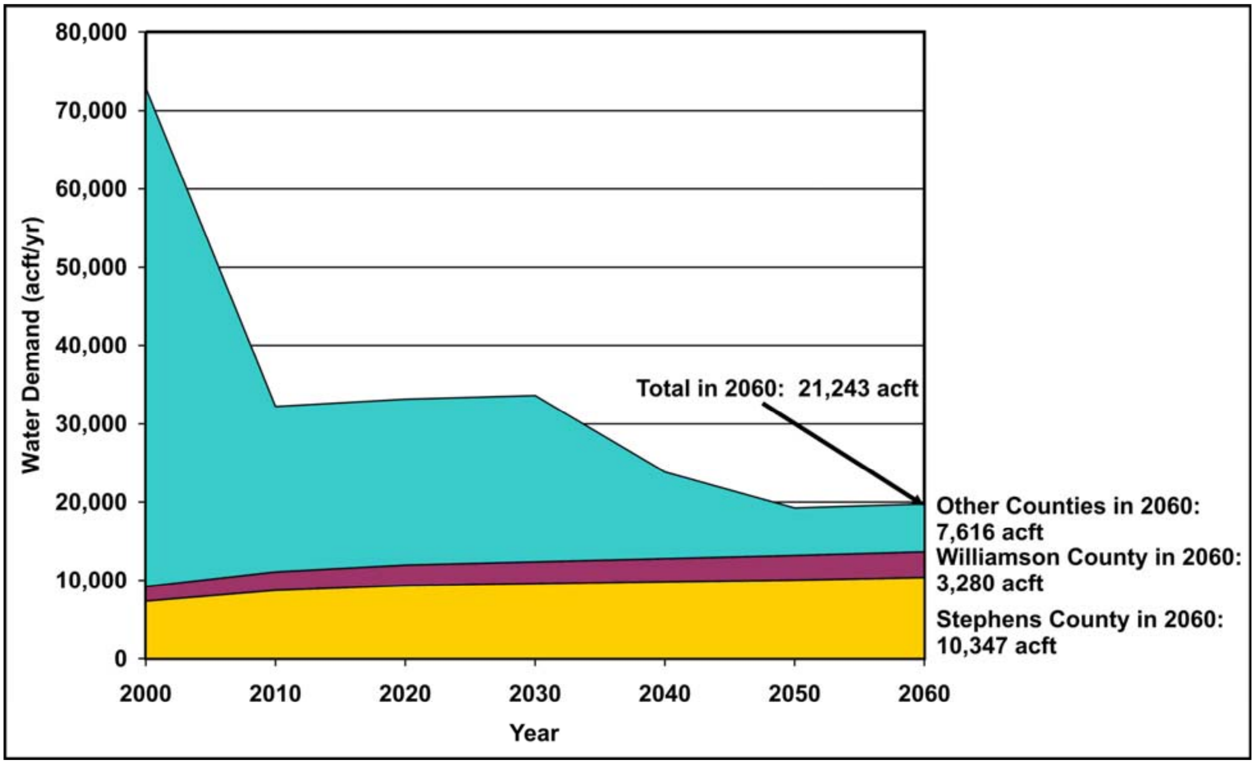

Figure 2-8. Mining Water Demand Projections

Table 2-9.
Historical and Projected Irrigation Water Demand
in the Brazos G Area
(acft/yr)

County	Historical		Projections[1]					
	1990	2000	2010	2020	2030	2040	2050	2060
Bell	755	1,679	1,656	1,634	1,611	1,591	1,569	1,546
Bosque	1,134	2,543	2,504	2,466	2,427	2,388	2,352	2,316
Brazos	9,875	6,918	6,584	6,267	5,964	5,676	5,403	5,142
Burleson	6,900	18,239	17,480	16,749	16,052	15,431	14,741	14,082
Callahan	662	819	806	793	780	767	755	742
Comanche	50,625	35,969	35,598	35,230	34,867	34,507	34,151	33,798
Coryell	330	0	0	0	0	0	0	0
Eastland	12,200	16,274	16,302	16,327	16,352	16,370	16,377	16,385
Erath	9,705	10,816	10,658	10,502	10,349	10,197	10,048	9,901
Falls	6,425	1,928	1,866	1,806	1,748	1,691	1,637	1,584
Fisher	2,591	2,459	2,386	2,314	2,245	2,178	2,113	2,049
Grimes	125	241	241	241	241	241	241	241
Hamilton	1,659	483	475	467	464	456	434	413
Haskell	22,320	50,820	49,309	47,844	46,422	45,040	43,702	42,405
Hill	283	43	43	42	42	42	42	41
Hood	6,926	3,240	3,179	3,120	3,062	3,005	2,948	2,893
Johnson	0	164	240	240	240	240	240	240
Jones	3,940	4,381	4,250	4,124	4,000	3,881	3,765	3,653
Kent	665	532	517	503	488	475	462	449
Knox	32,323	43,124	42,065	41,033	40,025	39,041	38,082	37,147
Lampasas	180	170	168	166	164	162	160	159
Lee	283	965	940	916	891	867	842	818
Limestone	0	0	0	0	0	0	0	0
McLennan	3,070	2,819	2,816	2,814	2,812	2,809	2,806	2,803
Milam	1,412	2,391	2,372	2,352	2,333	2,312	2,294	2,275
Nolan	1,885	5,276	5,138	5,003	4,871	4,741	4,618	4,497
Palo Pinto	479	947	935	923	911	901	889	877
Robertson	21,253	16,572	16,175	16,019	15,561	15,115	14,682	14,261
Shackelford	237	195	189	183	178	173	168	163
Somervell	350	475	474	471	468	467	464	461
Stephens	500	802	791	781	771	760	750	740
Stonewall	538	347	336	326	317	307	298	290
Taylor	486	174	170	166	162	158	154	150
Throckmorton	0	0	4,000	4,000	4,000	4,000	4,000	4,000
Washington	205	1,724	1,724	1,724	1,724	1,724	1,724	1,724
Williamson	160	80	80	80	80	80	80	80
Young	473	77	74	71	69	66	64	61
Total for Region	**200,954**	**233,686**	**232,541**	**227,697**	**222,691**	**217,859**	**213,055**	**208,386**

[1] Projections from Texas Water Development Board

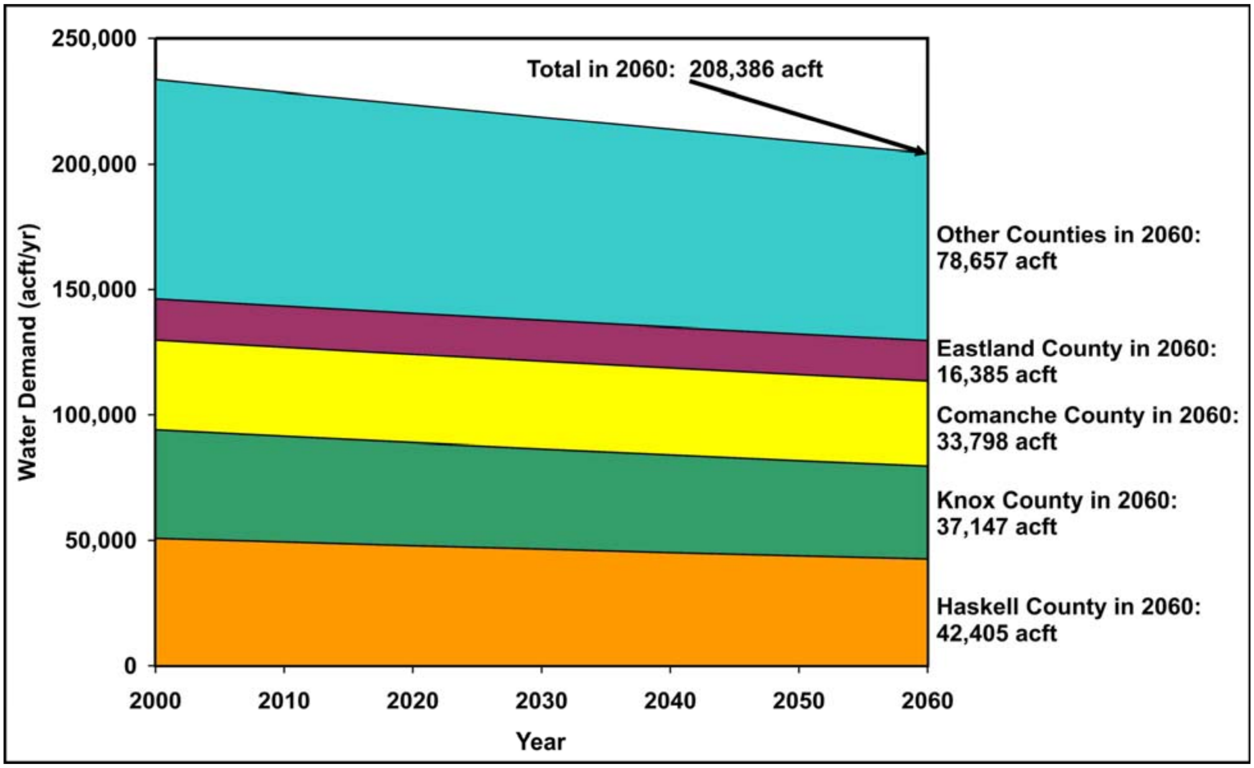

Figure 2-9. Irrigation Water Demand Projections

Table 2-10.
Historical and Projected Livestock Water Demand in the Brazos G Area (acft/yr)

County	Historical		Projections[1]					
	1990	2000	2010	2020	2030	2040	2050	2060
Bell	982	953	953	953	953	953	953	953
Bosque	1,228	1,048	1,048	1,048	1,048	1,048	1,048	1,048
Brazos	1,603	1,032	1,032	1,032	1,032	1,032	1,032	1,032
Burleson	1,060	1,422	1,422	1,422	1,422	1,422	1,422	1,422
Callahan	1,018	976	976	976	976	976	976	976
Comanche	2,355	4,253	4,253	4,253	4,253	4,253	4,253	4,253
Coryell	1,176	1,339	1,339	1,339	1,339	1,339	1,339	1,339
Eastland	915	1,121	1,121	1,121	1,121	1,121	1,121	1,121
Erath	5,898	9,321	9,321	9,321	9,321	9,321	9,321	9,321
Falls	1,773	1,626	1,626	1,626	1,626	1,626	1,626	1,626
Fisher	907	585	585	585	585	585	585	585
Grimes	1,734	1,554	1,554	1,554	1,554	1,554	1,554	1,554
Hamilton	1,468	1,961	1,961	1,961	1,961	1,961	1,961	1,961
Haskell	340	492	492	492	492	492	492	492
Hill	1,288	1,401	1,401	1,401	1,401	1,401	1,401	1,401
Hood	560	623	623	623	623	623	623	623
Johnson	1,936	2,117	2,117	2,117	2,117	2,117	2,117	2,117
Jones	521	786	786	786	786	786	786	786
Kent	264	459	459	459	459	459	459	459
Knox	927	1,040	1,040	1,040	1,040	1,040	1,040	1,040
Lampasas	660	688	688	688	688	688	688	688
Lee	1,398	1,547	1,547	1,547	1,547	1,547	1,547	1,547
Limestone	1,733	1,487	1,487	1,487	1,487	1,487	1,487	1,487
McLennan	1,588	1,151	1,151	1,151	1,151	1,151	1,151	1,151
Milam	1,901	1,779	1,779	1,779	1,779	1,779	1,779	1,779
Nolan	625	464	464	464	464	464	464	464
Palo Pinto	468	909	909	909	909	909	909	909
Robertson	1,587	1,508	1,508	1,508	1,508	1,508	1,508	1,508
Shackelford	768	760	760	760	760	760	760	760
Somervell	128	166	166	166	166	166	166	166
Stephens	608	576	576	576	576	576	576	576
Stonewall	415	469	469	469	469	469	469	469
Taylor	1,906	1,305	1,305	1,305	1,305	1,305	1,305	1,305
Throckmorton	1,166	752	752	752	752	752	752	752
Washington	1,605	1,554	1,554	1,554	1,554	1,554	1,554	1,554
Williamson	1,507	1,344	1,344	1,344	1,344	1,344	1,344	1,344
Young	1,054	1,008	1,008	1,008	1,008	1,008	1,008	1,008
Total for Region	**47,070**	**51,576**	**51,576**	**51,576**	**51,576**	**51,576**	**51,576**	**51,576**

[1] Projections from Texas Water Development Board

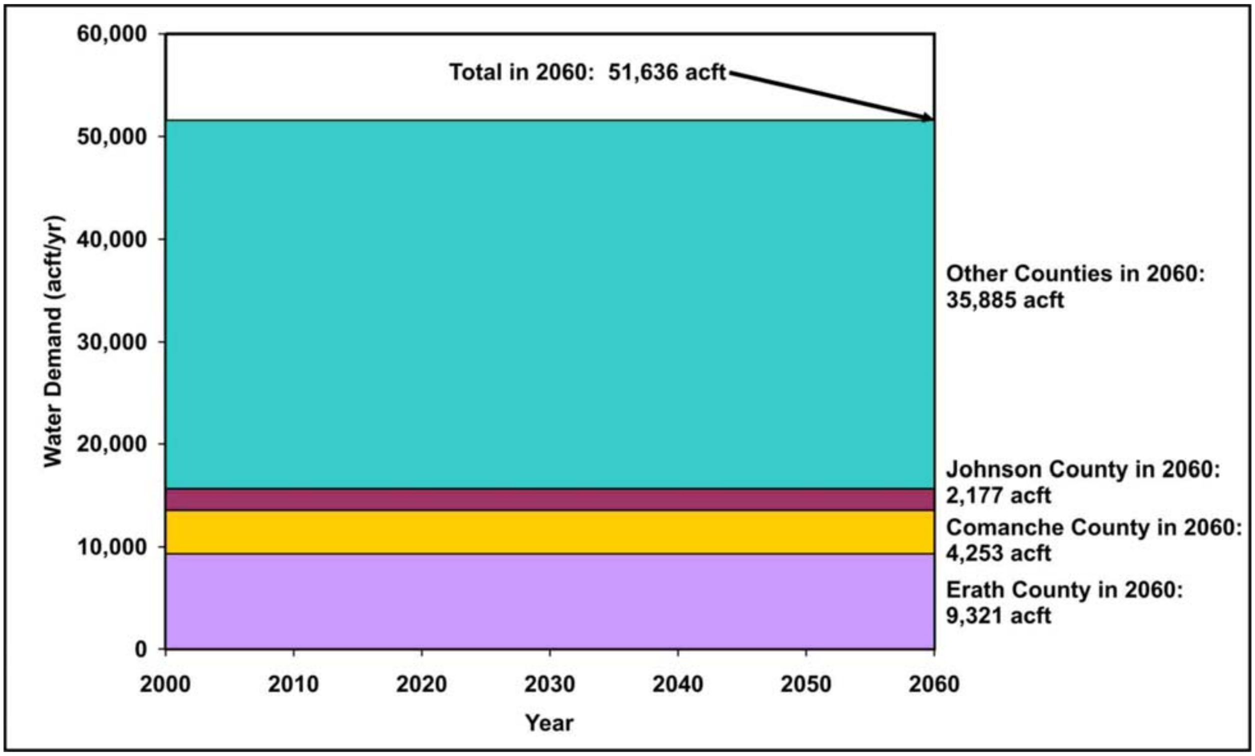

Figure 2-10. Livestock Water Demand Projections

Section 3
Evaluation of Current
Water Supplies in the Region
[31 TAC §357.7(a)(3)]

3.1 Surface Water Supplies

Streamflow in the Brazos River and its tributaries, along with reservoirs in the Brazos River Basin, comprise a vast supply of surface water in the Brazos G Area. Diversions and use of this surface water occurs throughout the entire region with over 1,000 water rights currently issued. These water rights provide authorization for an owner to divert, store and use the water, however, they do not guarantee that a dependable supply will be available from the water source. The availability of water to a water right is dependent on several factors including hydrologic conditions (i.e., rainfall, runoff, springflow), priority date of the water right, quantity of authorized storage, and any special conditions associated with the water right (i.e., instream flow conditions, maximum diversion rate).

3.1.1 Texas Water Right System

The State of Texas owns the surface water within the state watercourses and is responsible for the appropriation of these waters. Surface water is currently allocated by the Texas Commission on Environmental Quality (TCEQ) for the use and benefit of all people of the state. Historically, Texas water law is based on the riparian and prior appropriation doctrines. The riparian doctrine extends from the Spanish and Mexican governments that ruled Texas prior to 1836. After 1840, the riparian doctrine provided landowners the rights to make reasonable use of water for irrigation or for other consumptive uses. In 1889, the prior appropriation doctrine was first adopted by Texas, which is based on the concept of "first in time is first in right." Over the years, the combination of riparian and prior appropriation doctrines resulted in an essentially unmanageable system. Various types of water rights existed simultaneously and many rights were unrecorded. In 1967, the Texas Legislature passed the Water Rights Adjudication Act that merged the riparian water rights into the prior appropriation system, creating a unified water rights system. The adjudication process has taken many years, and is essentially complete, pending some final adjudications in the Rio Grande Basin. In the end, Certificates of Adjudication have been issued for entities recognized as having legitimate water rights. Today, individuals or groups seeking a new water right must submit an application to the TCEQ. The TCEQ determines if the water right will be issued and under what conditions. The water rights grant a certain quantity of water to be diverted and/or stored, a priority date, and often come with some restrictions on when and how the right may be utilized. Restrictions may include a maximum diversion rate and/or an instream flow restriction to protect existing water rights and provide environmental protection.

The priority date of a water right is essential to the operation of the water rights system. Each right is issued a priority date based on the date of first capture, or the appropriation date. The established priority system must be adhered to by all water right holders when diverting or storing water for use. A right holder must pass all water to downstream senior water rights when conditions are such that the senior water rights would not be satisfied otherwise.

3.1.2 Types of Water Rights

There are various types of water rights: Certificates of Adjudication, permits, term permits, and temporary permits. Certificates of Adjudication were issued in perpetuity for approved claims during the adjudication process. This type of water right was issued based on historical use rather than water availability. As a consequence, the amount of water to which rights exist exceeds the amount of water available during a drought for some streams. The TCEQ issues new permits only where drought flows are sufficient to meet the requested amount. Permits, like Certificates of Adjudication, are issued in perpetuity and may be bought and sold like other property interests. Term permits may be issued by the TCEQ in areas where waters are fully appropriated, but not yet being fully used. Term permits are usually issued for 10 years and may be renewed if, after 10 years, other water right holders are still not fully utilizing the water in the basin. Temporary permits are issued for up to 3 years. Temporary permits are issued mainly for road construction projects, where water is used to suppress dust, to compact soils, and to start the growth of new vegetation.

Water rights can include the right to divert and/or store the appropriated water. A run-of-the-river water right provides for the diversion of streamflows and does not include storage of water for use during dry periods. These rights have no authorization to store water, only the right to take water from the stream. A run-of-the-river right may be limited by streamflow, pumping rate, or diversion location.

Water rights including provisions for storage of water allow a water right holder to impound streamflows for use at a later time. The storage provides water for use during dry periods, when water may not be available due to hydrologic conditions or because current flows are required to be passed to downstream senior water rights.

While most water rights are diverted and used within the river basin of origin, water rights that divert from one river basin to another basin require an interbasin transfer permit. Several types of transfers that receive special consideration include emergency transfers, transfers of water from a river basin for use in an adjoining coastal basin (such as from the Brazos River Basin to the San Jacinto-Brazos Coastal Basin), diversions of less than 3,000 acft/yr, and diversions within any city or county that has any portion in the basin of origin.

3.1.3 Water Rights in the Brazos River Basin

A total of 1,123 water rights exist in the Brazos River Basin, with a total authorized diversion of 2,664,000 acft/yr. It is important to note that a small percentage of the water rights make up a large percentage of the authorized diversion volume. In the Brazos River Basin, 39 water rights (3.4 percent) make up 2,372,000 acft/yr (89 percent) of the authorized diversion volume. The remaining 1,084 water rights primarily consist of small irrigation rights distributed throughout the river basin. Figure 3.1-1 shows a comparison of significant water rights in the Brazos River Basin by number of rights and diversion volume.

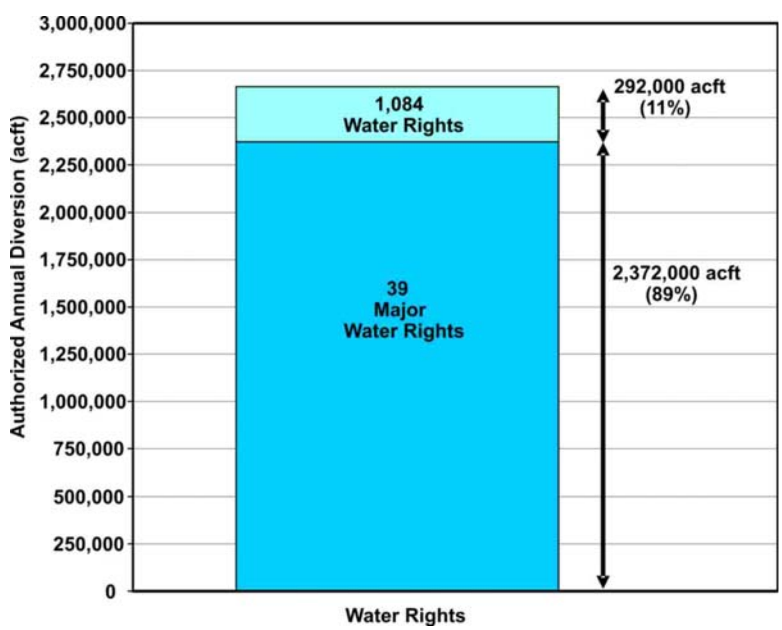

Figure 3.1-1. Comparison of Water Rights in the Brazos River Basin

Region G includes the majority of the water rights in the Brazos River Basin. A total of 992 water rights (88 percent) exist in Region G, making up 1,379,000 acft/yr (52 percent) of the total authorized diversion in the river basin. Region H, located downstream of Region G, has a total of only 39 water rights (4 percent) in the Brazos River Basin, but these include some very large rights and make up 1,168,000 acft/yr (44 percent) of the total authorized diversions. Other regions make up a small percentage of the remaining water rights and total authorized diversion, as shown in Figure 3.1-2. The authorized diversions in Region H generally consist of very large, senior priority, run-of-the-river water rights. In comparison, water rights in Region G are larger in number and diversion volume; however, the water rights are generally junior in priority to those downstream in Region H. Therefore, in times of drought, when streamflows are low, diversions of water from streams in Region G may be restricted for several of the water right

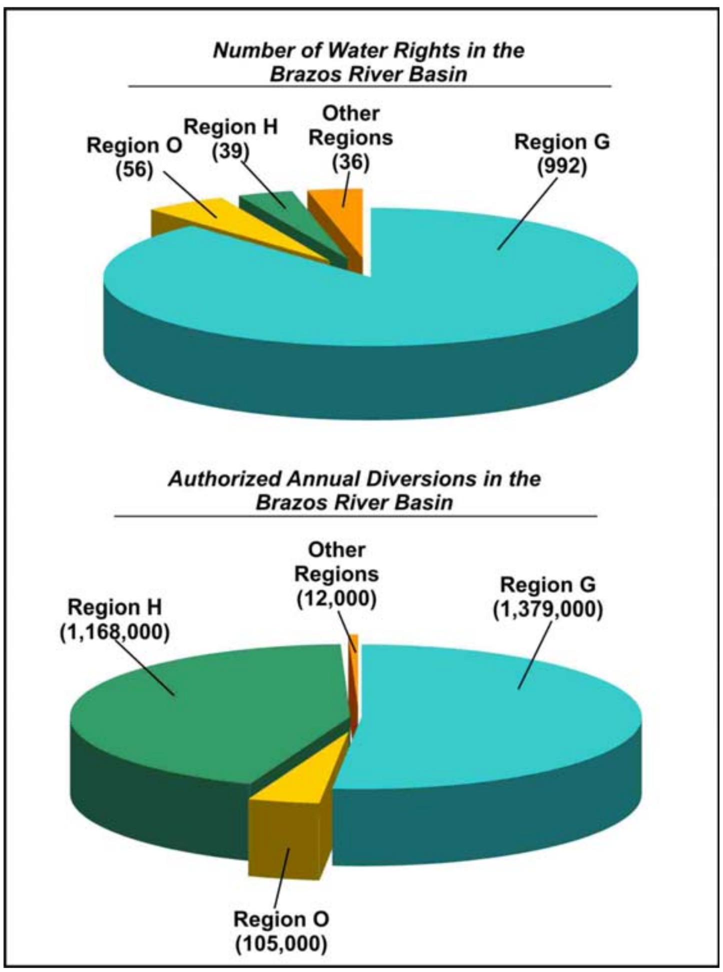

Figure 3.1-2. Comparison of Significant Water Rights in the Brazos River Basin by Number of Rights and Diversion Volume

holders. A comparison of the quantity of authorized diversions relative to the priority date of the water rights in Region G and Region H is presented in Figure 3.1-3. Major water rights are defined as having an authorized diversion of greater than 10,000 acft/yr or 5,000 acft of authorized storage. Figure 3.1-4 shows the location of major water rights in the Brazos River Basin, and a list of all water rights, summarized from the TCEQ water right database for all rights in Region G, is provided in Appendix G.

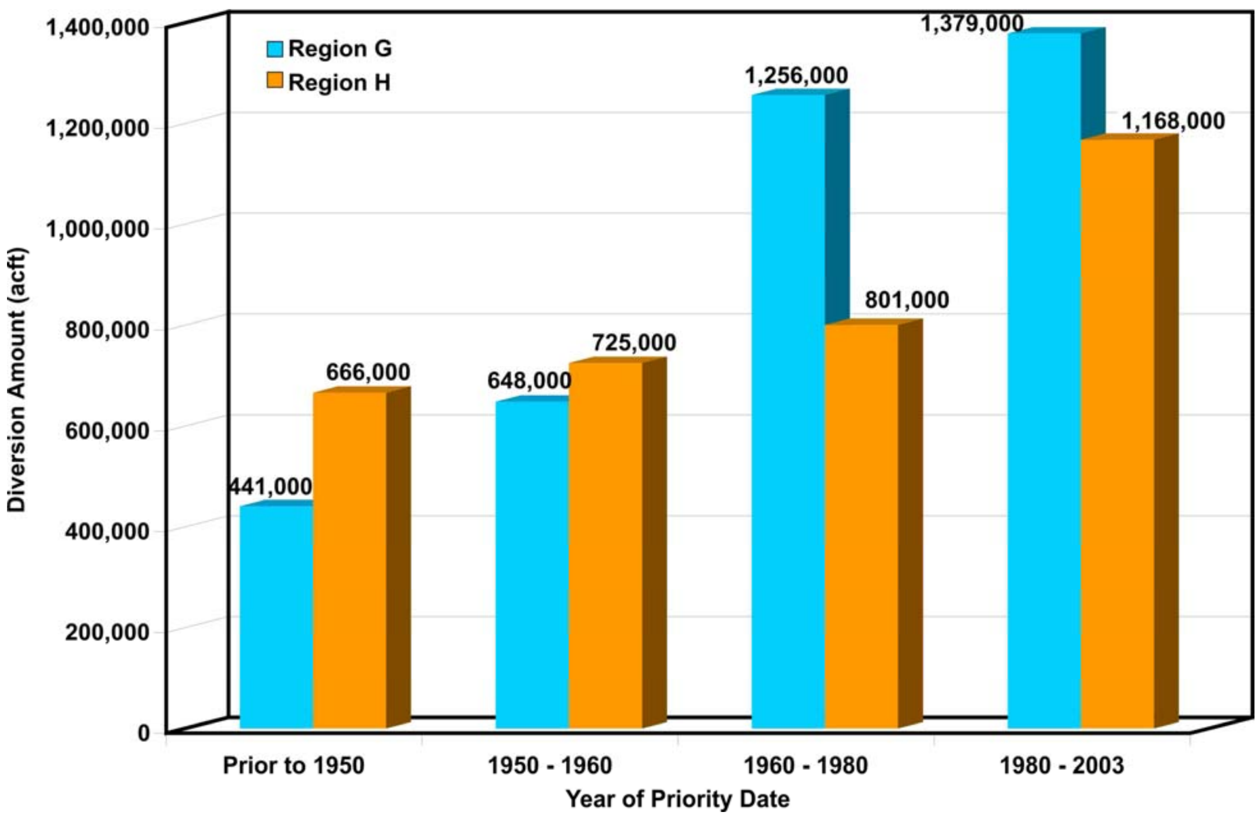

Figure 3.1-3. Comparison of Cumulative Diversion Volume and Priority Date for Region G and Region H

While Region H includes a large quantity of senior priority water rights, most of these water rights have very little storage associated with them and, therefore, may be described primarily as run-of-the-river water rights. The water rights in Region G are generally junior to those water rights in Region H; however, there is a substantial volume of reservoir storage associated with the water rights in Region G to provide a firm supply. The total authorized storage in the Brazos River Basin is approximately 4,057,000 acft, with 3,550,000 acft (88 percent) located in Region G. In Region H, the quantity of reservoir storage is 231,000 acft,

Water Right	Name	Diversion Amount (acft)	Storage Capacity (acft)	Priority Date
2315	City of Waco	39,100	104,100	01/10/1929
2315	City of Waco	19,100		04/16/1958
2315	City of Waco	900		02/21/1979
5094	City of Waco	20,770	87,962	09/12/1986
2936	U.S. Dept. of the Army	10,000	12,000	01/24/1953
2936	U.S. Dept. of the Army	2,000		08/23/1954
2938	City of Temple	15,804	500	10/30/1915
2938	City of Temple	20,000		01/11/1957
2939	Brazos Electric Cooperative	38,800		02/07/1949
3758	Aluminum Co. of America	18,000		12/12/1951
4031	Palo Pinto Co. MWD 1	16,000	44,100	07/03/1962
4031	Palo Pinto Co. MWD 1	2,500	24	09/08/1964
4097	Texas Utilities Electric Co.	23,180	151,500	04/25/1973
4139	City of Abilene		608	08/03/1949
4155	City of Lubbock	56,200	115,937	10/05/1981
4161	City of Abilene	30,690	73,960	03/25/1937
4213	West Central Texas MWD	52,800	317,750	05/28/1957
4213	West Central Texas MWD	3,200		08/14/1972
4340	City of Lubbock	22,910		03/07/1983
4342	Texas Utilities Electric Co.	12,000	37,800	08/21/1926
4342	Texas Utilities Electric Co.	15,000		09/16/1966
4345	Texas Utilities Electric Co.	10,000	8,500	03/06/1951
5155	Brazos River Authority	230,750	724,739	04/06/1938
5156	Brazos River Authority	61,562	155,000	02/13/1964
5157	Brazos River Authority	8,336	50,000	08/30/1982
5158	Brazos River Authority	7,943	52,400	10/25/1976
5159	Brazos River Authority	19,658	59,400	12/16/1963
5160	Brazos River Authority	100,157	457,600	12/16/1963
5161	Brazos River Authority	67,768	235,700	12/16/1963
5162	Brazos River Authority	13,610	37,100	02/12/1968
5163	Brazos River Authority	19,840	65,500	02/12/1968
5164	Brazos River Authority	48,000	160,110	12/16/1968
5164	Millsap Water Supply Corp.	90	215	12/11/1987
5165	Brazos River Authority	65,074	225,400	05/06/1974
5168	Gulf Coast Water Authority	99,932		01/15/1926
5168	Gulf Coast Water Authority		7,308	03/17/1947
5171	Gulf Coast Water Authority	75,000		02/01/1939
5171	Gulf Coast Water Authority	50,000		12/12/1950
5272	Aluminum Co. of America	14,000	15,650	12/12/1951
5272	City of Gilmer	750		12/14/1989
5287	Bistone Municipal WSD	2,952	9,600	04/15/1957
5298	Texas Utilities Electric Co.	30,319	30,319	07/01/1974
5320	Richmond Irrigation Co.	40,000		10/23/2026
5322	Chocolate Bayou Co.	155,000	864	02/08/1929
5325	Houston L&P Co - Parish	28,711	18,750	12/16/1955
5328	Dow Chemical Co.	85,000	21,973	02/28/1929
5328	Dow Chemical Co.	150,000	10,200	02/14/1942
5328	Dow Chemical Co.	7,500	600	04/03/1951

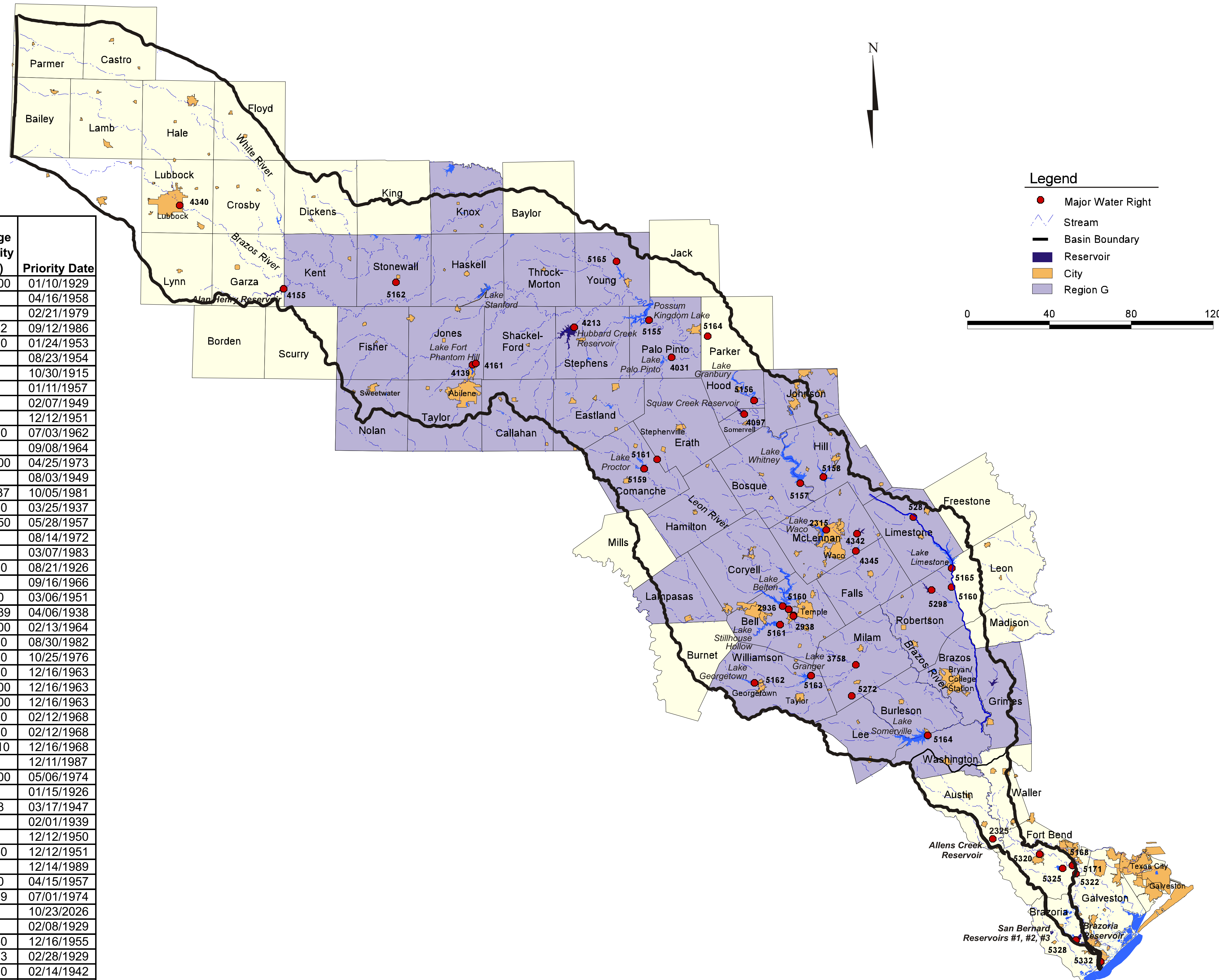

Figure 3.1-4. Major Water Rights and Reservoirs in the Brazos River Basin

or 5.7 percent of the total authorized storage volume in the river basin. The large quantity of reservoir storage in Region G provides for a firm supply of water during drought conditions, when streamflows are low and may be required to be passed through to downstream senior water rights in Region H. Figure 3.1-5 presents a comparison of the total authorized storage and annual diversion volume for Region G and Region H.

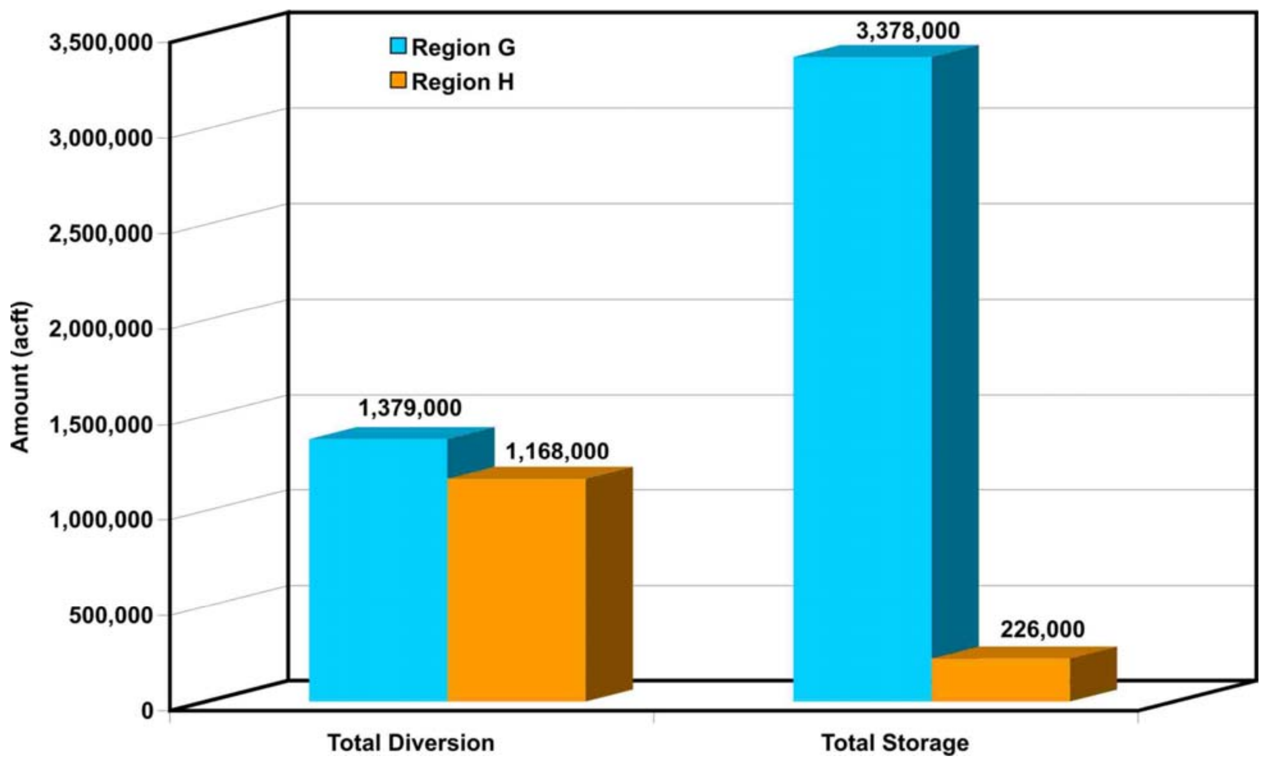

Figure 3.1-5. Comparison of Storage and Diversion Volume for Regions G and H

A total of 48 major reservoirs, with capacities greater than 5,000 acft, exist in the river basin. The U.S. Army Corps of Engineers (USCOE) owns several of these reservoirs, including Lake Georgetown, Lake Aquilla, Lake Granger, Lake Proctor, Lake Somerville, Lake Waco, Lake Belton, Lake Stillhouse Hollow, and Lake Whitney. These reservoirs were built for the primary purpose of flood control; however, they also included other benefits such as water supply and recreation. For purposes of water supply, the USCOE has contracted conservation storage in each reservoir to the BRA. The BRA owns the water right permit for each reservoir and manages the water supply conservation storage in each reservoir. Other major reservoirs in the basin that provide municipal, industrial, and irrigation water supply are owned by the BRA, City of Waco, City of Abilene, City of Mineral Wells, Palo Pinto County MWD No. 1, West Central Texas MWD, City of Cisco, City of Breckenridge, City of Sweetwater, City of Cleburne, and City of Stamford. A summary of major reservoirs in the Brazos River Basin is presented in Table 3.1-1 and the locations of the reservoirs are shown in Figure 3.1-4.

A number of interbasin transfer permits exist in the Brazos River Basin. These permits include both authorizations for diversions from the Brazos River Basin to adjacent river basins and from adjacent river basins to the Brazos River Basin. Most of the interbasin transfer permits are obviously located along the basin divide. Examples of interbasin transfers that authorize diversions from an adjacent river basin to the Brazos River Basin include: Lake Meredith (Canadian River Basin) to the Lubbock and Plainview areas in Lubbock and Hale County; Oak Creek Reservoir (Colorado River Basin) to the City of Sweetwater in Nolan County; and Lake Travis (Colorado River Basin) to the City of Cedar Park in Williamson County. Interbasin transfers authorized for diversion from the Brazos River Basin to other river basins include: Lake Mexia in Limestone County to part of the City of Mexia that lies in the Trinity River Basin; Teague City Lake in Freestone County to part of the City of Teague that lies in the Trinity River Basin; and Lake Granbury in Hood County to part of Johnson County that lies in the Trinity River Basin. A summary of interbasin transfers (excluding transfers authorized to adjacent coastal basins) associated with the Brazos River Basin is presented in Table 3.1-2.

3.1.4 Water Supply Contracts

Many entities within Region G obtain surface water through water supply contracts. These supplies are usually obtained from entities that own surface water rights, and the contracts specify the quantity of water each year to a buyer for an established unit price. The BRA is the largest provider of water supply contracts in Region G, and has contracted to sell 600,640 acft/yr from its system of reservoirs in the Brazos River Basin. The BRA contracts raw water to various entities for long-term supply as well as short-term supply for municipal, industrial, and irrigation uses. Other water right holders that contract large quantities of raw water supply to other entities include the West Central Texas MWD and the Palo Pinto County MWD No. 1. The West Central Texas MWD contracts raw water from Hubbard Creek Reservoir for municipal use to the Cities of Abilene, Albany, Anson, and Breckenridge. The City of Abilene contracts raw water

Table 3.1-1.
Major Reservoirs[1] of the Brazos River Basin

Reservoir	Water Right Owner	Authorized Storage (acft)	Authorized Diversion (acft)	Priority Date	County	Planning Region
Abilene	City of Abilene	11,868	1,675	1/23/18	Taylor	G
Alcoa Lake	Aluminum Co. of America	15,650	14,000	12/12/51	Milam	G
Alan Henry	Brazos River Authority	115,937	35,200	10/5/81	Garza	O
Allens Creek	Brazos River Authority City of Houston TWDB	145,553	99,650	9/1/99	Austin	H
Aquilla	Brazos River Authority	52,400	13,896	10/25/76	Hill	G
Belton	Brazos River Authority	457,600	100,257	12/16/63	Bell	G
Brazoria Reservoir–Off-Channel	Dow Chemical	21,700	0	4/7/52	Brazoria	H
Cisco	City of Cisco	45,000	1,971 56	4/16/20 9/5/78	Eastland	G
Daniel	City of Breckenridge	11,400	2,100	4/26/46	Stephens	G
Dansby Power Plant	City of Bryan	15,227	850	5/30/72	Brazos	G
Eagle Nest Lake	T L Smith Trust Et Al	18,000 11,315	4,000 1,800	1/15/48 9/9/93	Brazoria	H
Fort Phantom Hill	City of Abilene	73,960	30,690	3/25/37	Jones	G
Georgetown	Brazos River Authority	37,100	13,610	2/12/68	Williamson	G
Gibbons Creek Power	Texas Municipal Power	26,824 5,260	9,740	2/22/77 3/9/89	Grimes	G
Graham/Eddleman	City of Graham	4,503 39,000 8,883	5,000 15,000	11/21/27 11/15/54 9/16/57	Young	G
Granbury	Brazos River Authority	155,000	64,712	2/13/64	Hood	G
Granger	Brazos River Authority	65,500	19,840	2/12/68	Williamson	G
Harris Reservoir–Off-Channel	Dow Chemical	10,200	0	2/14/42	Brazoria	H
Hubbard Creek Lake	West Central Texas MWD	317,750	52,800 3,200	5/28/57 8/14/72	Stephens	G
Leon	Eastland Co WSD	28,000	1,265 2,438 2,598	5/17/31 3/21/52 3/25/86	Eastland	G
Limestone	Brazos River Authority	217,494 7,906	65,450	5/1/74 9/4/79	Robertson	G
Miller's Creek	North Central Texas MWA	30,696	5,000	10/1/58	Baylor	B
Palo Pinto	Palo Pinto Co. MWD 1	34,250 9,874	10,000 2,500 6,000	7/3/62 9/8/64 7/3/62	Palo Pinto	G
Pat Cleburne Reservoir	City of Cleburne	25,600	5,760 240	8/6/62 3/29/76	Johnson	G
Proctor	Brazos River Authority	59,400	19,658	12/16/63	Comanche	G
Smithers Lake	Houston L&P	18,750	28,711	12/16/55	Fort Bend	H

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Table 3.1-1 (concluded)

Reservoir	*Water Right Owner*	*Authorized Storage (acft)*	*Authorized Diversion (acft)*	*Priority Date*	*County*	*Planning Region*
Somerville	**Brazos River Authority**	**160,110**	**48,000**	**12/16/63**	**Washington**	**G**
Squaw Creek Reservoir	**Texas Utilities Electric Co.**	**151,500**	**23,180**	**4/25/73**	**Somervell**	**G**
Stamford	**City of Stamford**	**60,000**	**10,000**	**6/8/49**	**Haskell**	**G**
Stillhouse Hollow	**Brazos River Authority**	**235,700**	**67,768**	**12/16/63**	**Bell**	**G**
Sweetwater	**City of Sweetwater**	**10,000**	**3,740**	**10/17/27**	**Nolan**	**G**
Tradinghouse Steam	**Texas Utilities Electric Co.**	**37,800**	**12,000**	**8/21/26**	**McLennan**	**G**
			15,000	**9/16/66**		
Twin Oak Steam Electric	**Texas Utilities Electric Co.**	**30,319**	**13,200**	**7/1/74**	**Robertson**	**G**
Waco	**City of Waco**	**104,100**	**39,100**	**1/10/29**	**McLennan**	**G**
			19,100	**4/16/58**		
			900	**2/21/79**		
	City of Waco	**87,962**	**20,770**	**9/12/86**		
Whitney	**Brazos River Authority**	**50,000**	**18,336**	**8/30/82**	**Hill**	**G**
White River Reservoir	**White River MWD**	**33,160**	**6,000**	**9/22/58**	**Crosby**	**O**
		5,072		**11/21/60**		
		6,665		**8/16/71**		

[1] Major Reservoirs are defined as having a capacity of 5,000 acft or greater.

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Table 3.1-2.
Summary of Interbasin Transfers
Associated with the Brazos River Basin[1]

River Basin of Origin	Location of Use			Description	Authorized Diversion (acft/yr)	Priority Date
	River Basin	Planning Region	County			
Brazos	Trinity	G	Johnson	Lake Granbury to Johnson County	2,600	11/7/86
Brazos	Trinity	G	Limestone	Lake Mexia to part of Mexia	N/A	N/A
Brazos	Trinity	C	Freestone	Teague City Lake to part of Teague	N/A	N/A
Brazos	Colorado	G	Lampasas	Brazos River to City of Lampasas	180	6/23/14
Brazos	Trinity	C	Multiple	Lake Possum Kingdom to Trinity Basin	5,240	4/6/38
Canadian	Brazos	O	Lubbock	Lake Meredith to Lubbock Co. Area	151,200	1/30/56
Colorado	Brazos	G	Fisher	Lake J B Thomas to Fisher Co.	N/A	N/A
Colorado	Brazos	G	Nolan	Oak Creek Res. to Lk Trammel/Sweetwater	3,000	N/A
Colorado	Brazos	G	Callahan	Lake Clyde to Clyde	200	2/2/65
Colorado	Brazos	G	Taylor	Lake O H Ivie to Abilene	15,000	2/2/78
Colorado	Brazos	G	Williamson	Lake Austin to Williamson Co.	N/A	N/A
Colorado	Brazos	G	Williamson	Lake Travis to Cedar Park	16,500	N/A
Colorado	Brazos	G	Williamson	Lake Travis to Leander	6,400	N/A
Colorado	Brazos	F	Fisher	Snyder to City of Rotan	N/A	N/A
Red	Brazos	B	Archer	Small Lakes to Megargel	N/A	N/A
Red	Brazos	B	Archer	Lake Cooper & Olney to Olney	35	8/11/80
Red	Brazos	O	Floyd	Lake MacKenzie to Floydada & Lockney	N/A	N/A
Trinity	Brazos	C	Parker	Lake Weatherford to part of Weatherford	N/A	N/A

[1] Excludes transfers authorized to adjacent coastal basins.

from Fort Phantom Hill Reservoir to West Texas Utilities for industrial use as well as municipal supply to several other surrounding cities and water supply corporations. The Palo Pinto County MWD No. 1 contracts raw water from Lake Palo Pinto for industrial use to Brazos Electric Co-op as well as for municipal use for the City of Mineral Wells and several smaller water supply corporations. Table 3.1-3 provides a summary of all the contracts held by the identified Wholesale Water Providers within Region G. These contracts make up the bulk of water contracts in the region, however, there are numerous smaller entities which often contract between each other for emergency supplies or various other reasons which are not summarized here. The list also excludes WWPs located primarily outside Region G such as the Lower Colorado River Authority and the Colorado River Municipal Water District. These supplies are summarized in Table 3.5-1.

Table 3.1-3.
Water Supply Contracts Held by WWPs in Region G (all values in acft/yr)
(Note: Increasing contracts represent projected demands for "meets" contracts)

Wholesale Water Supplier	*Year*						
	2000	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
BRA (LAKE AQUILLA)							
Contracts							
Aquilla WSD	5,953	5,953	5,953	5,953	5,953	5,953	5,953
City of Cleburne	5,300	5,300	5,300	5,300	5,300	5,300	5,300
Lake Whitney Water Company	150	150	150	150	150	150	150
Total Contracts	11,403	11,403	11,403	11,403	11,403	11,403	11,403
BRA (LITTLE RIVER SYSTEM)							
Contracts							
439 WSC	1,409	1,409	1,409	1,409	1,409	1,409	1,409
ALCOA	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Bell County WCID #1	49,509	49,509	49,509	49,509	49,509	49,509	49,509
Bluebonnet WSC	8,301	8,301	8,301	8,301	8,301	8,301	8,301
Brushy Creek MUD	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Central Bosque WSC	100	100	100	100	100	100	100
Central Texas WSC	12,795	12,795	12,795	12,795	12,795	12,795	12,795
Chisholm Trail SUD	4,760	4,760	4,760	4,760	4,760	4,760	4,760
City of Belton	2,500	2,500	2,500	2,500	2,500	2,500	2,500
City of Gatesville	5,448	5,448	5,448	5,448	5,448	5,448	5,448
City of Georgetown	6,720	6,720	6,720	6,720	6,720	6,720	6,720
City of Georgetown	15,448	15,448	15,448	15,448	15,448	15,448	15,448
City of Harker Heights	3,150	3,150	3,150	3,150	3,150	3,150	3,150
City of Lampasas	3,500	3,500	3,500	3,500	3,500	3,500	3,500
City of McGregor	810	810	810	810	810	810	810
City of Round Rock	6,720	6,720	6,720	6,720	6,720	6,720	6,720
City of Round Rock	18,134	18,134	18,134	18,134	18,134	18,134	18,134
City of Taylor	8,525	8,525	8,525	8,525	8,525	8,525	8,525
City of Temple	27,953	27,953	27,953	27,953	27,953	27,953	27,953
Coryell City WSD	300	300	300	300	300	300	300
Country Harvest	8	8	8	8	8	8	8
High Gabriel WSC	310	310	310	310	310	310	310
Jarrell-Schwertner WSC	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Jerry Glaze	100	100	100	100	100	100	100
Jonah Water SUD	2,439	2,439	2,439	2,439	2,439	2,439	2,439
Kempner WSC	5,150	5,150	5,150	5,150	5,150	5,150	5,150
Lake Proctor Irrigation Authority	2,743	2,743	2,743	2,743	2,743	2,743	2,743
Lakeview Golf & Country Club	70	70	70	70	70	70	70
Multi-County WSC	450	450	450	450	450	450	450
North Leon River Irrigation Corporation	3,909	3,909	3,909	3,909	3,909	3,909	3,909
Okie Pecan Farm	48	48	48	48	48	48	48
Salado WSC	1,600	1,600	1,600	1,600	1,600	1,600	1,600
Sun City Georgetown	15	15	15	15	15	15	15

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Table 3.1-3 (continued)

Wholesale Water Supplier	***Year***						
	2000	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
The Grove WSC	460	460	460	460	460	460	460
Upper Leon River MWD	6,439	6,439	6,439	6,439	6,439	6,439	6,439
Wildflower County Club	200	200	200	200	200	200	200
Total Contracts	210,023	210,023	210,023	210,023	210,023	210,023	210,023
BRA (MAIN STEM)							
Contracts							
Acton MUD	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Acton MUD	3,000	3,000	3,000	3,000	3,000	3,000	3,000
AES Wolf Hollow	10,000	10,000	10,000	10,000	10,000	10,000	10,000
Basa Resources	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Bluegree Southwest One, LP	200	200	200	200	200	200	200
Brazos Electric Power Coop.	3,600	3,600	3,600	3,600	3,600	3,600	3,600
Carr-Thomas Ranch	50	50	50	50	50	50	50
Citation Oil & Gas Corp.	175	175	175	175	175	175	175
City of Abilene	50	50	50	50	50	50	50
City of Brenham	3,535	3,535	3,535	3,535	3,535	3,535	3,535
City of Cleburne	4,700	4,700	4,700	4,700	4,700	4,700	4,700
City of Graham	1,000	1,000	1,000	1,000	1,000	1,000	1,000
City of Granbury	6,179	6,179	6,179	6,179	6,179	6,179	6,179
City of Granbury	4,621	4,621	4,621	4,621	4,621	4,621	4,621
City of Keene	2,040	2,040	2,040	2,040	2,040	2,040	2,040
City of Lorena	1,000	1,000	1,000	1,000	1,000	1,000	1,000
City of Lubbock	961	961	961	961	961	961	961
City of Marlin	1,200	1,200	1,200	1,200	1,200	1,200	1,200
City of Rosebud	100	100	100	100	100	100	100
City of Stamford	1,820	1,820	1,820	1,820	1,820	1,820	1,820
City of Whitney	750	750	750	750	750	750	750
Decordova Bend States Owners	400	400	400	400	400	400	400
Double Diamond, Inc.	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Double Diamond, Inc.	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Dow Pipeline Company	16,000	16,000	16,000	16,000	16,000	16,000	16,000
Fred T. Owen Jr.	60	60	60	60	60	60	60
Granbury Recreational Association	50	50	50	50	50	50	50
Gulf Coast Water Authority	32,668	32,668	32,668	32,668	32,668	32,668	32,668
Hill Country Harbor Village	250	250	250	250	250	250	250
Horizon Turf Grass	150	150	150	150	150	150	150
Island Condominium Owners	20	20	20	20	20	20	20
Johnson County Fresh WSD #1	1,665	1,665	1,665	1,665	1,665	1,665	1,665
Johnson County Rural WSC	13,210	13,210	13,210	13,210	13,210	13,210	13,210
Lenmo Inc.	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Mirant Texan Management, Inc.	3,500	3,500	3,500	3,500	3,500	3,500	3,500
Monarch Utilities I, L.P.	600	600	600	600	600	600	600
North Ridge Corporation	235	235	235	235	235	235	235

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Table 3.1-3 (continued)

Wholesale Water Supplier	Year						
	2000	2010	2020	2030	2040	2050	2060
Patterson Petroleum, Inc.	120	120	120	120	120	120	120
Pecan Plantation Owners Association	500	500	500	500	500	500	500
Pecan Plantation Owners Association	250	250	250	250	250	250	250
Possum Kingdom WSC	410	410	410	410	410	410	410
Ranch Owner's Association	250	250	250	250	250	250	250
Reliant Energy	83,000	83,000	83,000	83,000	83,000	83,000	83,000
Rex R. Worrell	300	300	300	300	300	300	300
Robo Investments, Inc.	100	100	100	100	100	100	100
Shackleford WSC	353	353	353	353	353	353	353
SLC Water Supply	200	200	200	200	200	200	200
South Texas Water Company	5,625	5,625	5,625	5,625	5,625	5,625	5,625
Sportsmans World MUD	125	125	125	125	125	125	125
Stephens County RWSC	800	800	800	800	800	800	800
Sugar Tree, Inc.	400	400	400	400	400	400	400
Sugar Tree, Inc.	100	100	100	100	100	100	100
Texas A&M University	6,945	6,945	6,945	6,945	6,945	6,945	6,945
Texas Forest Service	0	0	0	0	0	0	0
Texas Genco	18,000	18,000	18,000	18,000	18,000	18,000	18,000
Texas Municipal Power Agency	3,600	3,600	3,600	3,600	3,600	3,600	3,600
TPWD	800	800	800	800	800	800	800
Turfgrass American, L.P.	1,300	1,300	1,300	1,300	1,300	1,300	1,300
TXU Electric	57,447	57,447	57,447	57,447	57,447	57,447	57,447
TXU Electric	40,000	40,000	40,000	40,000	40,000	40,000	40,000
TXU Electric	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Vulcan Construction Materials	1,800	1,800	1,800	1,800	1,800	1,800	1,800
Wellborn SUD	4,000	4,000	4,000	4,000	4,000	4,000	4,000
Total Contracts	379,214	379,214	379,214	379,214	379,214	379,214	379,214
AQUILLA WATER SUPPLY							
Contracts							
Brandon-Irene WSC	280	280	280	280	280	280	280
Chatt WSC (Hill C-O)	84	84	84	84	84	84	84
Files Valley WSC	1,008	1,008	1,008	1,008	1,008	1,008	1,008
Hill County WSC (Hill C-O)	336	336	336	336	336	336	336
Hillsboro	4,200	4,200	4,200	4,200	4,200	4,200	4,200
Menlow WSC (Hill C-O)	45	45	45	45	45	45	45
Total Contracts	5,953	5,953	5,953	5,953	5,953	5,953	5,953
BELL COUNTY WCID #1							
Contracts							
439 Water Supply Corp.	750	750	750	750	750	750	750
City of Belton	4,966	4,966	4,966	4,966	4,966	4,966	4,966
City of Copperas Cove	7,824	7,824	7,824	7,824	7,824	7,824	7,824

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Table 3.1-3 (continued)

Wholesale Water Supplier	***Year***						
	2000	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
City of Harker Heights	5,265	5,265	5,265	5,265	5,265	5,265	5,265
City of Killeen	29,964	29,964	29,964	29,964	29,964	29,964	29,964
City of Nolanville	740	740	740	740	740	740	740
Total Contracts	49,509	49,509	49,509	49,509	49,509	49,509	49,509
BLUEBONNET WSC							
Contracts							
Bruceville-Eddy	689	827	964	1,081	1,200	1,275	1,389
Elm Creek WSC	80	480	580	580	680	680	780
City of McGregor	948	933	923	913	902	894	899
Moffat WSC	351	402	430	457	468	477	488
City of Moody	199	202	203	203	204	206	212
Pendleton WSC	231	250	265	273	278	282	287
Spring Valley WSC (McLennan C-O)	177	250	298	331	336	331	331
Total Contracts	2,675	3,344	3,663	3,838	4,068	4,145	4,386
CENTRAL TEXAS WSC							
Contracts							
Armstrong WSC (Bell C-O)	92	92	92	92	92	92	92
City of Bartlett	0	180	180	180	180	180	180
Bell County WCID No. 5 (Bell C-O)	37	37	37	37	37	37	37
Bell-Milam-Falls WSC	446	446	446	446	446	446	446
Dog Ridge WSC	671	671	671	671	671	671	671
East Bell County WSC	341	341	341	341	341	341	341
City of Holland	258	258	258	258	258	258	258
Kempner WSC	3,500	5,500	5,500	5,500	5,500	5,500	5,500
Little Elm Valley WSC (Milam C-O)	147	147	147	147	147	147	147
City of Lott	184	184	184	184	184	184	184
City of Rodgers	368	368	368	368	368	368	368
City of Rosebud	500	500	500	500	500	500	500
Town of Buckholts-Water Dept. (Milam C-O)	174	174	174	174	174	174	174
Town of Oenaville and Belfalls (Bell C-O)	57	57	57	57	57	57	57
West Bell County WSC	921	921	921	921	921	921	921
Westphalia WSC (Falls C-O)	45	45	45	45	45	45	45
Total Contracts	7,741	9,921	9,921	9,921	9,921	9,921	9,921
UPPER LEON MWD							
Contracts							
City of Comanche	552	634	632	622	605	587	568
City of De Leon	286	280	280	274	265	256	248
City of Dublin	454	485	516	544	576	682	753
City of Gorman	143	137	134	127	120	113	108

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Table 3.1-3 (continued)

Wholesale Water Supplier	***Year***						
	2000	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
City of Hamilton	2,000	2,000	2,000	2,000	2,000	2,000	2,000
City of Stephenville	1,862	1,862	1,862	1,862	1,862	1,862	1,862
Total Contracts	5,297	5,398	5,424	5,429	5,428	5,500	5,539
EASTLAND CO WSD							
Contracts							
City of Eastland	1,791	1,791	1,791	1,791	1,791	1,791	1,791
City of Carbon	73	73	73	73	73	73	73
Westbound WSC	47	47	47	47	47	47	47
City of Ranger	710	710	710	710	710	710	710
Total Contracts	2,621	2,621	2,621	2,621	2,621	2,621	2,621
PALO PINTO CO MWD							
Contracts							
City of Mineral Wells	3,412	3,653	3,802	3,928	4,008	4,151	4,337
City of Palo Pinto	179	179	179	179	179	179	179
Santo WSC	331	331	331	331	331	331	331
Sturdivant-Progress WSC	17	17	17	17	17	17	17
North Rural WSC	368	368	368	368	368	368	368
Parker County WSC	294	294	294	294	294	294	294
Millsap WSC	184	184	184	184	184	184	184
City of Graford	92	92	92	92	92	92	92
Lake Palo Pinto Water Assoc.	100	100	100	100	100	100	100
Palo Pinto County SE	2,024	2,024	2,024	2,024	2,024	2,024	2,024
Total Contracts	7,001	7,242	7,391	7,517	7,597	7,740	7,926
WEST CENTRAL TEXAS MWD							
Contracts							
City of Abilene	20,361	20,361	20,361	20,361	20,361	20,361	20,361
City of Albany	2,197	2,197	2,197	2,197	2,197	2,197	2,197
City of Anson	2,409	2,409	2,409	2,409	2,409	2,409	2,409
City of Breckenridge	2,881	2,881	2,881	2,881	2,881	2,881	2,881
Total Contracts	27,848	27,848	27,848	27,848	27,848	27,848	27,848
NORTH CENTRAL TEXAS MWD							
Contracts							
City of Aspermont	93	93	93	93	93	93	93
City of Benjamin (Knox C-O)	8	8	8	8	8	8	8
City of Goree (Knox C-O)	63	63	63	63	63	63	63
City of Haskell	504	504	504	504	504	504	504
City of Knox City	267	267	267	267	267	267	267
City of Munday	281	281	281	281	281	281	281
City of O'Brien (Haskell C-O)	6	6	6	6	6	6	6

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Table 3.1-3 (continued)

Wholesale Water Supplier	Year						
	2000	2010	2020	2030	2040	2050	2060
City of Rochester (Haskell C-O)	13	13	13	13	13	13	13
City of Rule	30	30	30	30	30	30	30
Paint Creek WSC (Haskell C-O)	54	54	54	54	54	54	54
Total Contracts	1,319	1,319	1,319	1,319	1,319	1,319	1,319
ABILENE							
Contracts							
Blair Water Supply Corp. (Taylor C-O)	107	107	107	107	107	107	107
City of Baird	138	138	138	138	138	138	138
City of Clyde	307	307	307	307	307	307	307
City of Hamlin	307	307	307	307	307	307	307
City of Merkel	384	384	384	384	384	384	384
City of Stamford	537	537	537	537	537	537	537
City of Tye	138	138	138	138	138	138	138
Eula WSC (Callahan C-O)	61	61	61	61	61	61	61
Hamby Water Supply Corp. (Taylor C-O)	307	307	307	307	307	307	307
Hawley WSC	307	307	307	307	307	307	307
Potosi Water Supply Corp.	307	307	307	307	307	307	307
Steamboat Mountain WSC	460	460	460	460	460	460	460
Sun Water Supply Corp. (Taylor C-O)	307	307	307	307	307	307	307
View-Caps Water Supply Corp. (Taylor C-O)	368	368	368	368	368	368	368
Manufacturing (Taylor County)	789	972	1,081	1,177	1,270	1,349	1,462
Total Contracts	4,824	5,007	5,116	5,212	5,305	5,384	5,497
CEDAR PARK							
Contracts							
Indian Springs Subdiv. (Williamson C-O)	9	9	9	9	9	9	9
Williamson Co. Mud #3 (Williamson C-O)	722	722	722	722	722	722	722
Williamson-Travis Co. MUD #1	510	770	1,085	1,462	1,865	2,320	2,807
Blockhouse MUD	578	903	1,288	1,749	2,242	2,796	3,389
Total Contracts	1,819	2,404	3,104	3,942	4,838	5,847	6,927
ROUND ROCK							
Contracts							
Brushy Creek MUD	3,360	0	0	0	0	0	0
Fern Bluff MUD	745	1,339	2,049	2,882	3,805	4,810	5,888
William County MUD #9 (Williamson C-O)	190	230	257	269	278	282	288
Total Contracts	4,295	1,569	2,306	3,151	4,083	5,092	6,176

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Table 3.1-3 (concluded)

Wholesale Water Supplier	Year						
	2000	2010	2020	2030	2040	2050	2060
SWEETWATER							
Contracts							
Bitter Creek WSC	460	460	460	460	460	460	460
City of Blackwell (Nolan C-O)	168	168	168	168	168	168	168
City of Bronte (OoR)	504	504	504	504	504	504	504
City of Roby	350	350	350	350	350	350	350
City of Trent (Taylor C-O)	187	187	187	187	187	187	187
Fort Chadborne Ranch (Nolan C-O)	135	135	135	135	135	135	135
Manufacturing (Nolan)	550	550	550	550	550	550	550
West Texas Utilities (Nolan SE)	800	800	800	800	800	800	800
Total Contracts	3,154	3,154	3,154	3,154	3,154	3,154	3,154
WACO							
Contracts							
City of Bellmead	2,477	2,622	2,751	2,873	2,984	3,065	3,202
City of Northcrest (McLennan C-O)	208	202	191	183	180	179	178
City of Hewitt	1,838	2,029	2,237	2,395	2,571	2,684	2,877
City of Lacy-Lakeview	678	835	989	1,116	1,256	1,338	1,477
City of Woodway	2,974	2,944	2,925	2,903	2,882	2,867	2,874
City of Beverly Hills	412	414	416	416	414	416	424
Total Contracts	8,587	9,046	9,509	9,886	10,287	10,549	11,032

[1]Excludes WWPs located primarily in other regions.

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3.2 Determination of Surface Water Availability

3.2.1 Modified TCEQ Water Availability Model of the Brazos River Basin (Brazos G WAM)

Determination of water availability for existing water rights is based on a rather complex function of location, hydrologic conditions, diversion volume, reservoir storage, and priority date. Computer models that are capable of analyzing these complex inter-relationships are typically employed to determine water availability for water rights. Water availability estimates for the Brazos G Area were developed using a computer model for the Brazos River Basin. The Water Rights Analysis Package (WRAP) computer model was developed at Texas A&M University for use as a water resources management tool. The model can be used to evaluate the reliability of existing water rights and to determine unappropriated streamflow potentially available for new water right permits. WRAP simulates the management and use of streamflow and reservoirs over a historical period of record, adhering to the prior appropriation doctrine, which governs Texas' water right priority system.

The TCEQ maintains a Brazos River Basin water availability model (TCEQ WAM) that contains information on all water rights in the basin. The TCEQ WAM is the fundamental tool used to determine surface water availability throughout the Brazos Basin for water rights permitting. Embedded within this model are certain assumptions that the TCEQ specifies when analyzing water right reliabilities. These assumptions are not necessarily the most appropriate to apply to the regional water planning process. For example, the TCEQ WAM utilizes permitted storage capacities for all reservoirs, whereas, water supply planning should be based upon current and future sedimentation conditions in the reservoirs.

The BGRWPG has approved (and the TWDB has authorized) several assumptions to be incorporated into the TCEQ WAM for purposes of determining surface water availability. With these modifications, the TCEQ WAM with hereinafter be referred to as the "Brazos G WAM." These assumptions include the following items.

- Inclusion of a certain level of current and future return flows by entities located throughout the basin. These return flows were based on historical return flow information as well as projected future rates assuming an aggressive plan for future reuse. The return flow amounts were reviewed and acknowledged by each entity and by the BGRWPG before being included in the model. Table 3.2-1 lists the entities and the annual amount of return flows approved for use in the Brazos G WAM.
- The TCEQ WAM assumes all diversions from storage occur lakeside and does not take into account BRA contracts located throughout the basin. Therefore the Brazos G WAM was modified with all BRA contracts located and modeled at their actual diversion locations and able to receive releases from multiple reservoirs if applicable.
- The Brazos G WAM uses Year 2000 and Year 2060 elevation-area-capacity information for all reservoirs greater than 5,000 acft storage capacity.
- The Brazos G WAM also includes three subordination agreements as agreed to by the TWDB:
  - Possum Kingdom Reservoir is subordinated to Lake Alan Henry,
  - Possum Kingdom Reservoir is subordinated to the City of Stamford's California Creek pump-back operation into Lake Stamford, and
  - Lake Waco is subordinated to the City of Clifton's 1996 priority date water right.

Table 3.2-1.
Return Flows Included in the Brazos G WAM

Facility	Stream	2000 Returns (MGD)[1]	Confirmed Estimated 2060 Discharge (MGD)[2]
Acton MUD	Brazos River	0.09	1.20
Acton MUD	Brazos River	0.11	1.00
Bell County WCID	Nolan Creek	3.27	9.25
Bell County WCID	Nolan Creek	7.87	10.44
Block House MUD	Brushy Creek	0.22	0.00
BRA CRWTF	Brazos River	2.12	2.50
BRA SLRSS	Steep Bank Creek	3.69	3.60
BRA SWATS	Brazos River	0.28	2.00
BRA TBRSS	Nolan Creek	5.32	6.88
BRA/LCRA BCRWSS West	Brushy Creek	7.07	12.27
Brushy Creek MUD	Brushy Creek	0.21	0.00
City of Abilene	Deadman Creek	11.36	0.00
City of Brenham	Hog Branch	1.61	1.43
City of Bryan[3]	Trib to Carters Creek	4.46	4.84
City of Bryan[3]	Still Creek	1.66	2.28
City of Cedar Park	Unnamed Trib to Brushy Creek	1.51	5.00
City of College Station[3]	Carters Creek	5.45	6.80
City of Copperas Cove	Clear Creek	0.47	2.00
City of Copperas Cove	House Creek	1.42	2.00
City of Freeport	Brazos River	1.36	3.50
City of Gatesville-2	Leon River	1.21	2.10
City of Georgetown	San Gabriel River	1.67	3.25
City of Georgetown	Unnamed Trib to San Gabriel River	0.54	3.16
City of Graham	Salt Creek	0.97	0.95
City of Granbury	Brazos River	0.73	3.10
City of Harker Heights	Nolan Creek	1.15	1.87
City of Hempstead	Brazos River	0.23	0.95
City of Hillsboro	Hackberry Creek	0.90	3.20
City of Lake Jackson	Brazos River	2.50	2.50
City of Leander	Brushy Creek	0.48	15.00
City of Rosenberg	Brazos River	1.21	2.00
City of Rosenberg-1	Seabourne Creek	1.30	4.50
City of Stephenville	North Bosque River	1.17	1.46
City of Sugarland	Steep Bank Creek	3.88	3.50
City of Taylor	Mustang Creek	1.44	0.00
City of Temple	Unnamed Trib to Little Elm Ck	2.06	2.06
City of Waco WMRSS	Brazos River	21.92	0.00
City of West Columbia	Brazos River	1.02	0.76
Pecan Grove MUD	Unnamed Trib to the Brazos River	1.05	1.20
Texas A&M University	Brazos River	1.74	0.00
Texas A&M University	Unnamed Trib to White Creek	1.05	0.00
	Total:	**107.76**	**128.56**
	Total (acft/yr):	**120,691**	**143,987**

[1] 2000 return flow estimates derived from TCEQ WAM.

[2] Initial estimated assume 75% of Y2000 will continue to be discharged (assumed 25% reuse) and 50% of wastewater flows in excess of Y2000 levels will be discharged (50% reuse of any future effluent). Final estimates were refined after consultation with local dischargers.

[3] Bryan and College Station have filed applications pursuant to Tex. Water Code § 11.042, requesting authorization to reuse their current and future return flows derived from privately owned groundwater.

These assumptions were used throughout the regional planning process for runs that were used to determine surface water availability for existing rights, and also for runs that were used to determine the potential yield of new water management strategies.

The Brazos G WAM contains 77 primary control points that contain naturalized flow information, and 67 evaporation data sets used to calculate evaporation for the 650 reservoirs included in the model. The period of record for the TCEQ WAM is 1940-1997. This is also true for the Brazos G WAM, although Section 3.2.2 will discuss some updates made to more accurately reflect current drought conditions in the upper Brazos Basin. Water availability computations are performed at over 3,800 control points located throughout the river basin in the process of operating over 1,700 water right records. The Brazos G WAM contains water right data available from the TCEQ for all water rights in the Brazos Basin as of November 2002. Water right applications submitted or approved after this date are not reflected in the model. A summary of yield data for major reservoirs analyzed in the Brazos G WAM are discussed in Section 3.2.3.

3.2.2 Reliability of Surface Water Supplies and New Upper Basin Drought of Record

Hydrologic conditions are a primary factor that affect the reliability of a water right. Severe drought periods have been experienced in all areas of Region G in the Brazos River Basin. The drought of record for most areas of Region G occurred in the 1950s with other less severe drought periods occurring in the 1960s, 1970s, 1980s and even recently in the 1990s. In some parts of the upper Brazos Basin, the recent drought of the 1990s has continued past the turn of the century, and in many places streamflow data indicate that its severity is greater than that of the drought that occurred in the 1950s. For the past 6.5 years, streamflows in the area have averaged between 31 and 52 percent of flows occurring during the first 6.5 years of the previous drought of record, which occurred from 1943 through 1956. Figure 3.2-1 illustrates this with a comparison of cumulative gaged flows for the Clear Fork at Nugent gage during the drought of the 1950s and the current drought. During the current drought, several area reservoirs have experienced record drawdowns and there appears to be no end in sight to these severe drought conditions, despite some recovery since June of 2004. The City of Abilene, located in this upper portion of the Brazos Basin, initiated a study to quantify the current drought and its effect on the supplies of the region. The drought primarily affected the upper parts of the Brazos Basin, specifically those reservoirs upstream of Possum Kingdom Reservoir located in the Clear Fork of the Brazos watershed, and others in close proximity. A new tool was developed to analyze the current drought, given that the period of record of the existing Brazos G WAM only extends through 1997.

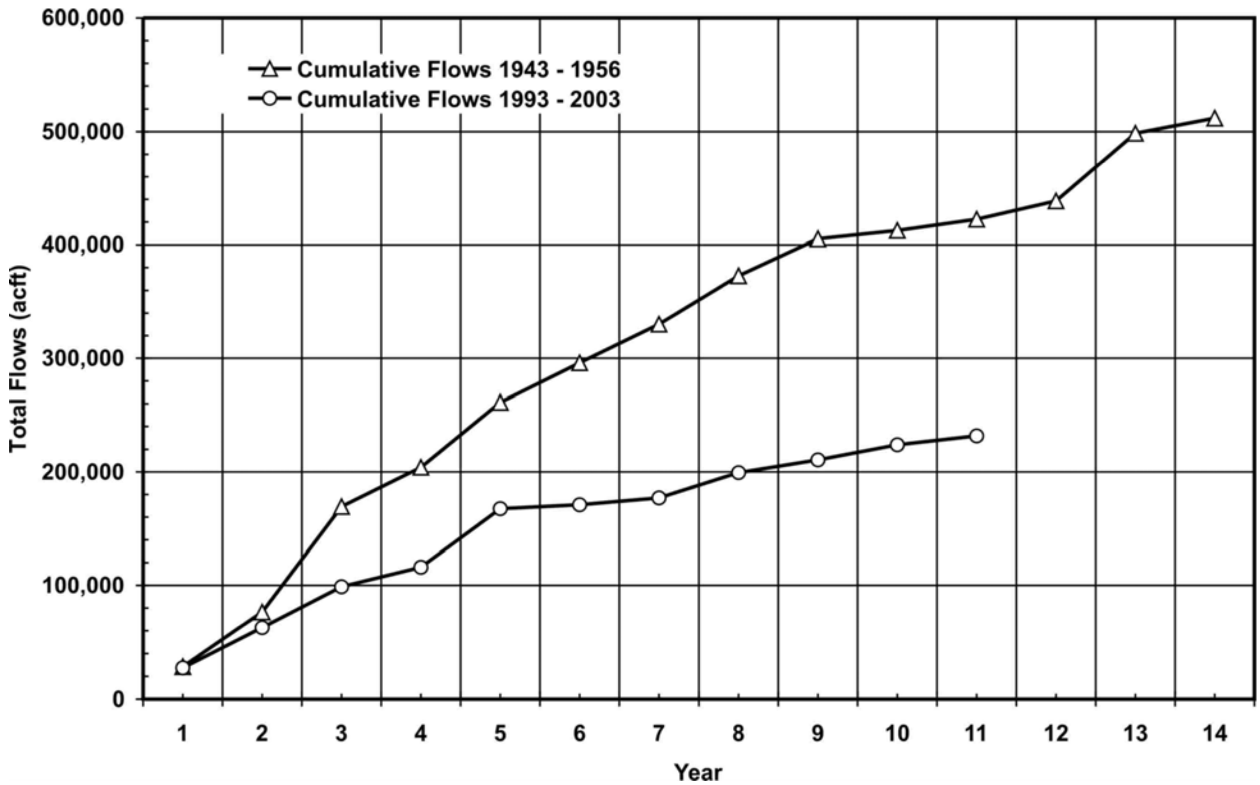

Figure 3.2-1. Cumulative Gaged Flows at Clear Fork of the Brazos near Nugent

Several possible studies and tools were evaluated to determine their effectiveness at quantifying the current drought. The selected tool was a modified version of the existing Brazos G WAM. The hydrology of the Brazos G WAM was extended through June of 2004 for the primary control points located within the drought-stricken area with the last control point in the model being the Brazos River at Palo Pinto. Naturalized flows were updated using the latest information for the 16 primary controls included in this segmented version of the Brazos G WAM, and 15 evaporation data sets were updated for inclusion into this model. All water rights and control points outside the updated drought study area were removed and not included in the analysis.

The modified Brazos G WAM was used to determine safe yields of reservoirs upstream of Possum Kingdom Reservoir (see Section 3.2.3), which should be considered as interim estimates. For those reservoirs for which the current drought through June 2004 is more than the 1950s drought, the current drought cycle has not ended in the upper basin and yields might be less than estimated using the modified Brazos G WAM.

3.2.3 Yield Analysis for Large Reservoirs

Water availability estimates for large reservoirs were evaluated using the Brazos G WAM. Year 2000 and 2060 yields were determined for all large reservoirs with greater than 5,000 acft of authorized storage and municipal supply reservoirs greater than 1,000 acft of authorized storage. Yields were limited to authorized diversions.

Firm yields were calculated for reservoirs located below and including Possum Kingdom Reservoir. The period of record for the firm yield analyses was 1940-1997.

Safe yields were calculated for Palo Pinto Reservoir and all reservoirs located above Possum Kingdom Reservoir. Safe yield is defined as the amount of water that can be diverted from a reservoir during a repeat of the worst drought of record while still maintaining a reserve capacity equal to a 1-year supply. Utilization of safe yield versus firm yield is a common practice in west Texas where droughts are frequent and severe, and water managers are acutely aware that a drought more severe than recent recorded history could occur. Safe yield provides additional assurance of supply in an area where water resource alternatives are limited. Modifications were made to the Brazos G WAM to more accurately simulate current drought conditions in the upper Brazos Basin by extending the period of record through June 2004 for parts of the upper basin (Section 3.2.2).

A summary of firm and safe yield estimates for large reservoirs is presented in Table 3.2-2.

3.2.4 Reliability of Run-of-the-River and Small Reservoir Water Rights

The results of the Brazos G WAM simulations include water availability estimates for each water right located in the Brazos Basin. Summaries of water available to run-of-the-river water rights (including rights with small reservoirs) are presented in Appendix G. If the supply for a water right was determined by a firm or safe yield analysis then this number is shown in the appendix. Water availability for other rights is expressed in terms of the minimum annual

Table 3.2-2.
Yields for Large Reservoirs in the Brazos G Area (acft/yr)

Reservoir	Year 2000 Yield	Year 2060 Yield	Firm or Safe Yield	1997 or 2004 Hydrology
Abilene	1,200	525	Safe	2004
ALCOA[1]	7,800	7,700	Firm	1997
Anson	120	120	Firm	1997
Anson North	65	194	Safe	2004
Aquilla	13,896	5,142	Firm	1997
Baird	385	385	Firm	1997
Belton	98,534	97,217	Firm	1997
Cisco	1,340	1,340	Safe	2004
Daniel	180	150	Safe	2004
Dansby Power Plant	85	85	Firm	1997
Lake Eastland (C3465)	520	520	Firm	1997
Fort Phantom Hill	7,430	6,940	Safe	2004
Georgetown	12,025	12,003	Firm	1997
Gibbons Creek[1]	6,310	6,310	Firm	1997
City of Gordon (C4355)	5	5	Firm	1997
Graham/Eddleman	4,550	3,650	Safe	2004
Granbury	64,712	63,212	Firm	1997
Granger	19,840	9,219	Firm	1997
Hubbard Creek	17,440	16,750	Safe	2004
Kirby	500	320	Safe	2004
Lake Creek Steam-Electric	10,000	9,945	Firm	1997
Lake Davis	100	0	Safe	2004
Leon	5,960	5,870	Firm	1997
Limestone	65,074	55,744	Firm	1997
City of Marlin Reservoirs (C4355)	2650	2650	Firm	1997
Mart	No Yield	No Yield	Firm	1997
McCarty Lake	100	370	Safe	2004
Mexia	1,180	144	Firm	1997
Miller's Creek	700	0	Safe	2004
Mineral Wells	2,520	2,430	Firm	1997
Palo Pinto	8,500	6,660	Safe	1997
Pat Cleburne	5,275	4,837	Firm	1997
Possum Kingdom	230,750	230,750	Firm	1997
Post Dam (North Fork)	5,500	5,250	Firm	1997

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Table 3.2-2 (concluded)

Reservoir	Year 2000 Yield	Year 2060 Yield	Firm or Safe Yield	1997 or 2004 Hydrology
Proctor	19,658	13,492	Firm	May 2001[2]
Robinson	2510	2510	Firm	1997
Somervell	850	850	Firm	1997
Somerville	43,370	42,043	Firm	1997
Squaw Creek	8,830	8,710	Firm	1997
Stamford	5,890	5,300	Safe	2004
Stillhouse Hollow	67,768	67,768	Firm	1997
Sweetwater	1,035	980	Safe	2004
Trammel	717	717	Firm	1997
Throckmorton	325	325	Firm	1997
Tradinghouse	4,120	4,120	Firm	1997
Twin Oaks	2,750	2,600	Firm	1997
Waco	79,869	79,869	Firm	1997
White River Reservoir	2,915	8	Firm	1997
Whitney	18,336	18,336	Firm	1997

[1] Yields include BRA contracts and operational constrains limiting reservoir drawdown.

[2] Lake Proctor yield determined by study conducted for BRA using hydrology through May 2001.

supply, which is defined as the water available during the most severe drought year over the 58-year simulation period of 1940 to 1997. Water right reliabilities were calculated for the year 2000 and 2060 conditions. The minimum annual supply values for the water rights are used to determine the supplies available by use and county for comparison with demands as described in Section 4A.1.

Minimum annual supplies for individual irrigation rights were calculated and are included as part of the results presented in Appendix G. For irrigation water rights, another definition for supply is used by the BGRWPG commonly referred to as the 75/75 convention. The 75/75 convention defines a reliable irrigation supply as that quantity of which at least 75% can be diverted at least 75% of the time. The 75/75 estimates were developed for irrigation water rights grouped by county for those in the Brazos River Basin located within Region G. The results of the 75/75 irrigation water availability analysis for each county are presented Table 3.2-3. This analysis was completed for the year 2000 and 2060 conditions; however, only the 2060 results are shown because most of the run-of-the-river rights are only marginally affected by the different scenarios and the values do not vary significantly when all rights in a county are aggregated.

Table 3.2-3.
Summary of Irrigation Rights by County
75/75 Reliability Analysis
(Year 2060 Conditions)

County	75/75 Supply Reliability (acft/yr)
Brazos	7,382
Bell	5,805
Bosque	6,966
Burleson	4,177
Callahan	42
Comanche	20,582
Coryell	1,739
Eastland	2,441
Erath	5,344
Falls	5,101
Fisher	743
Grimes	1,082
Hamilton	3,426
Haskell	827
Hill	1,040
Hood	13,296
Johnson	811
Jones	2,366
Kent	307
Knox	2,930
Lampasas	1,255
Lee	128
Limestone	19
McLennan	8,379
Milam	10,822
Nolan	120
Palo Pinto	6,961
Robertson	4,669
Shackleford	82
Somervell	1,378
Stephens	796
Stonewall	11
Taylor	223
Throckmorton	12
Washington	4,696
Williamson	1,027
Young	891
Total	127,874

3.2.5 Unappropriated Flows in the Region

The Brazos G WAM calculates unappropriated flow each month for the 1940 – 1997 period at each modeled location in the basin. Unappropriated flow is the flow that could potentially be made available to a new water right permit. This unappropriated flow is computed assuming no additional instream flow restrictions and full use of all existing water rights. The quantity of unappropriated flow varies throughout the river basin depending on location. Summaries of unappropriated flows from the Brazos G WAM were developed at the following locations:

- Brazos River at South Bend (BRSB23),
- Brazos River near Glen Rose (BRGR30),
- Brazos River near Aquilla (BRAQ33),
- Bosque River near Waco (BOWA40),
- Little River at Cameron (LRCA59),
- Brazos River near Bryan (BRBR59),
- Brazos River near Hempstead (BRHE68), and
- Brazos River at Richmond (BRRI70).

These locations effectively summarize flow conditions throughout the river basin and are located at current or discontinued USGS streamflow gaging stations. Table 3.2-4 summarizes the monthly and annual unappropriated flows at these selected locations. Figures 3.2-2 through 3.2-9 illustrate the annual time series of unappropriated flows at each location. As shown in these figures, unappropriated flow is not available at the South Bend gage location for most years, especially during the drought years. Conversely, unappropriated flow is potentially available in most years at Richmond in the lower basin, and often in large quantities. Unappropriated flow is not available at Richmond during the severe drought year of 1951, which is the lowest flow year during the 1940 to 1997 period. As Table 3.2-4 and Figures 3.2-2 through 3.2-9 show, location further downstream on major streams tend to have more unappropriated flow than those upstream with less contributing drainage area. These data suggest that any new potential water rights requiring a firm supply would need to be permitted with storage. In order to provide a firm supply the right would have to operate to fill the reservoir and meet diversions in wet times, while relying on stored water to meet diversions during drought times.

Table 3.2-4.
Summary of Unappropriated Flow
at Selected Brazos G WAM Locations

Control Point	Unappropriated Flow Estimates							
	Monthly Unappropriated Flows (acft)				Annual Unappropriated Flows (acft)			
	Maximum	Minimum	Mean	Median	Maximum	Minimum	Mean	Median
BRSB23	1,219,081	0	22,037	0	2,756,889	0	264,443	89,111
BRGR30	2,507,807	0	41,806	0	3,397,776	0	501,672	283,983
BRAQ33	2,737,974	0	53,280	0	2,737,974	0	639,363	401,129
BOWA40	524,951	0	19,937	0	946,025	0	239,242	188,413
LRCA58	1,401,725	0	74,984	0	3,880,936	0	899,805	731,643
BRBR59	4,314,330	0	189,603	0	9,848,053	0	2,275,235	1,945,178
BRHE68	4,986,393	0	230,754	493	11,839,932	0	2,769,046	2,450,151
BRRI70	5,561,864	0	317,671	63,122	13,652,968	0	3,812,047	3,511,584

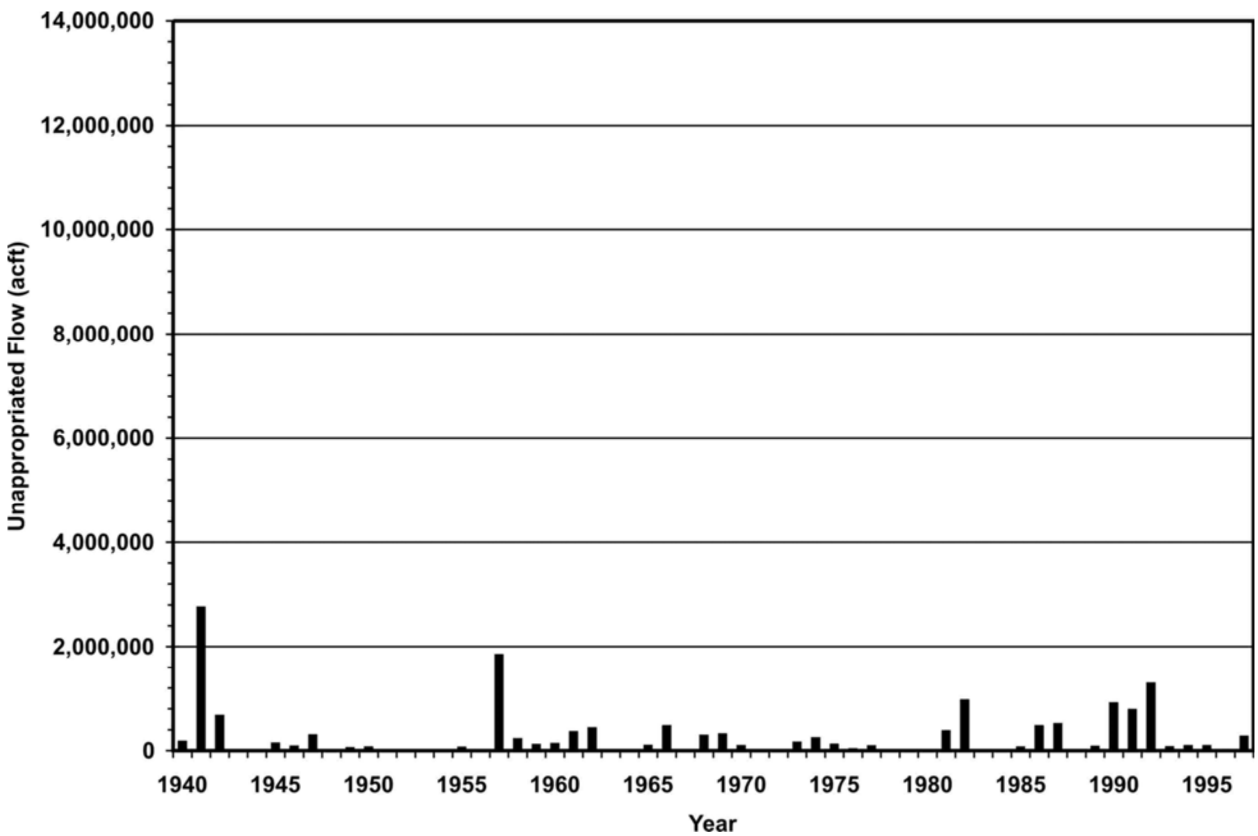

Figure 3.2-2. Estimated Annual Unappropriated Flow at Brazos River at South Bend

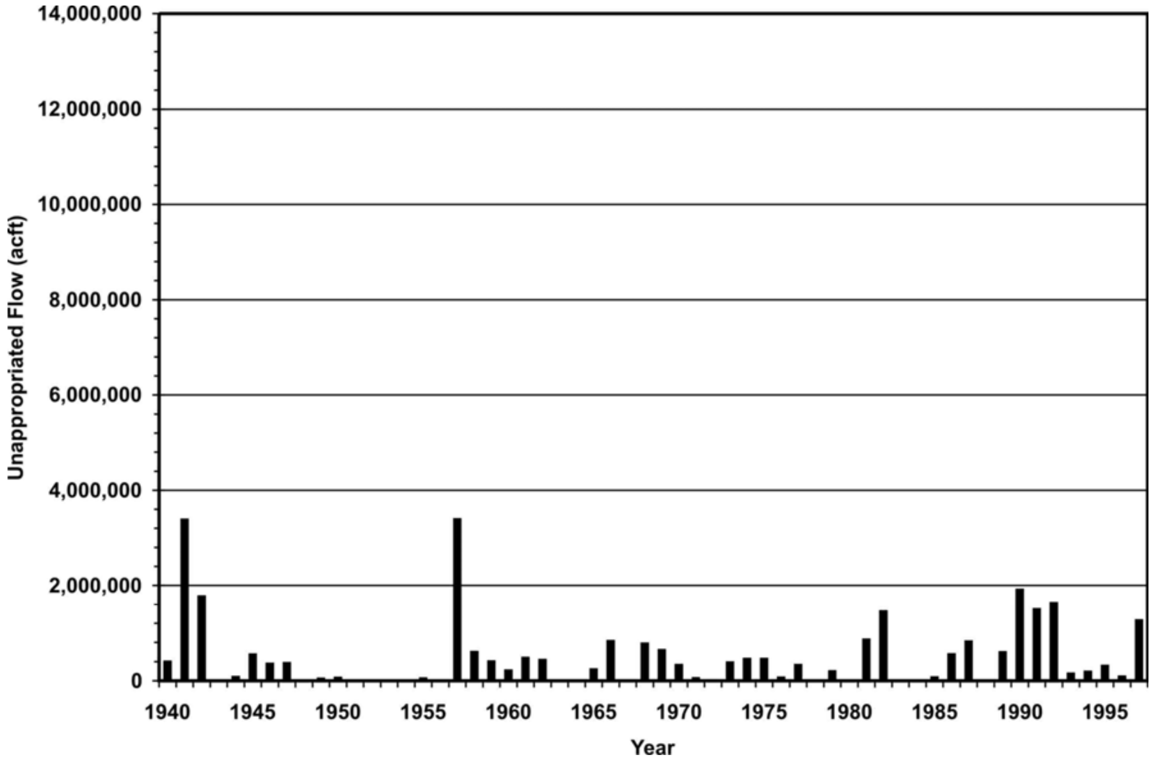

Figure 3.2-3. Estimated Annual Unappropriated Flow at Brazos River near Glen Rose

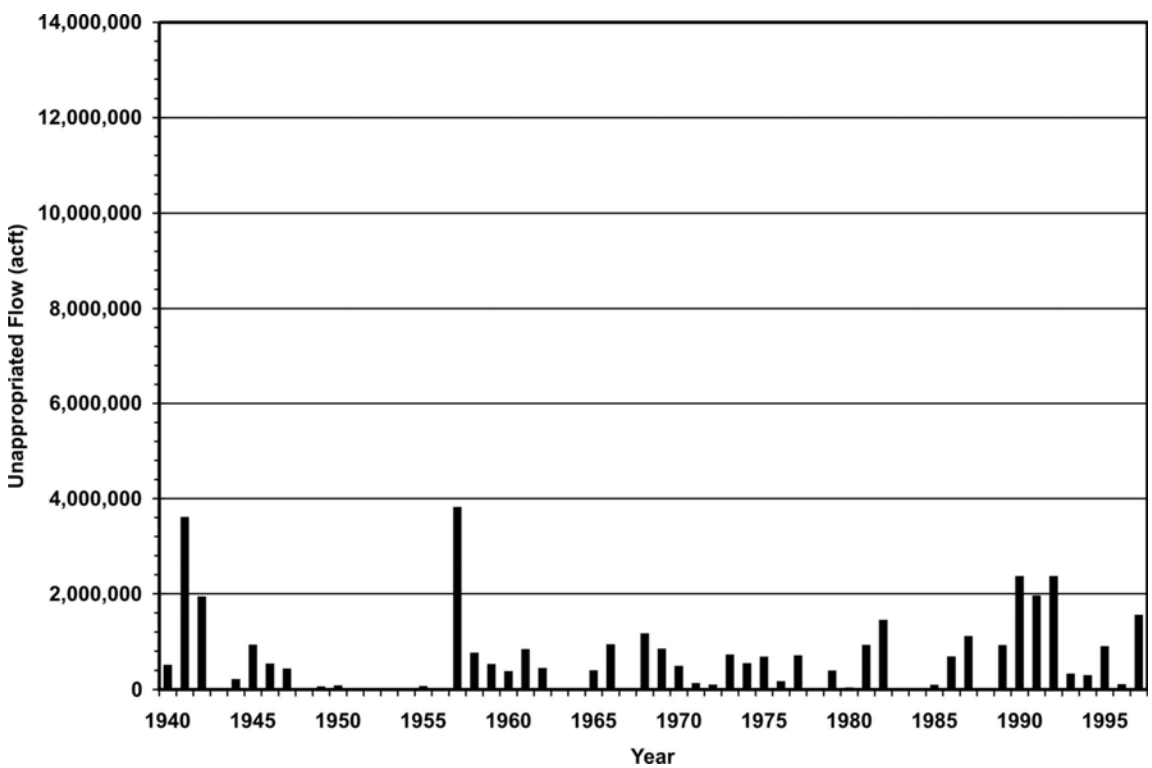

Figure 3.2-4. Estimated Annual Unappropriated Flow at Brazos River near Aquilla

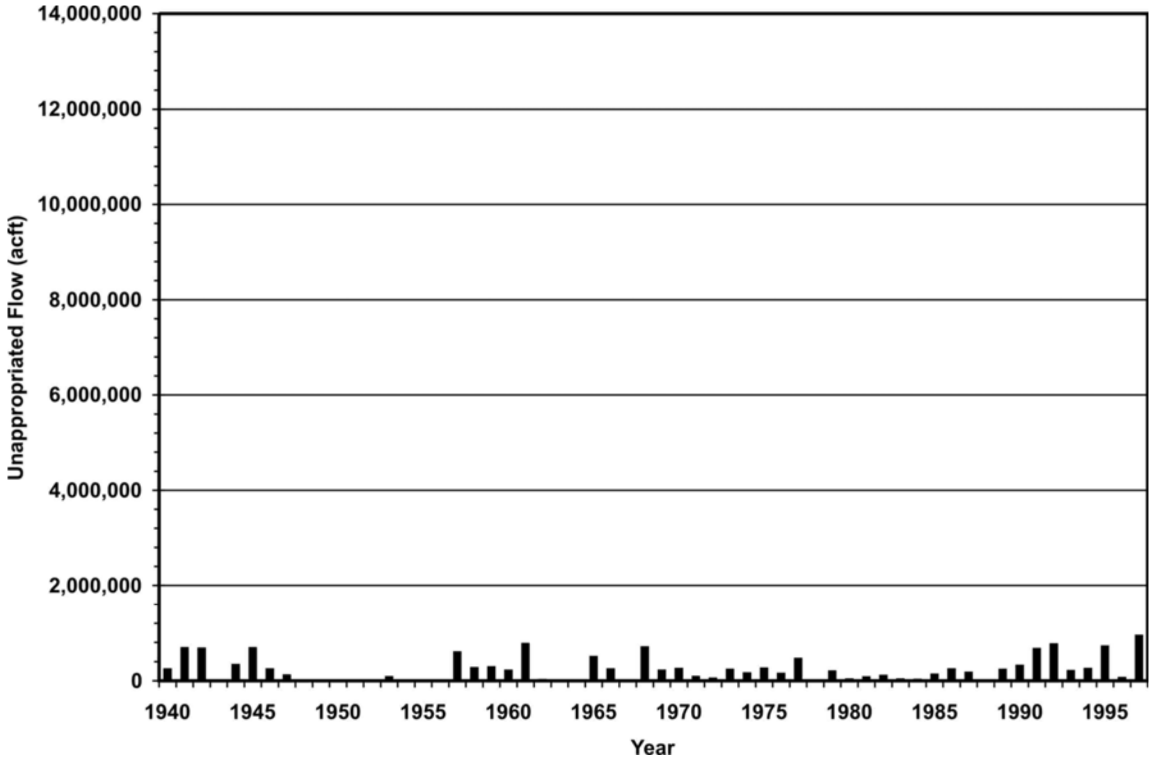

Figure 3.2-5. Estimated Annual Unappropriated Flow at Bosque River near Waco

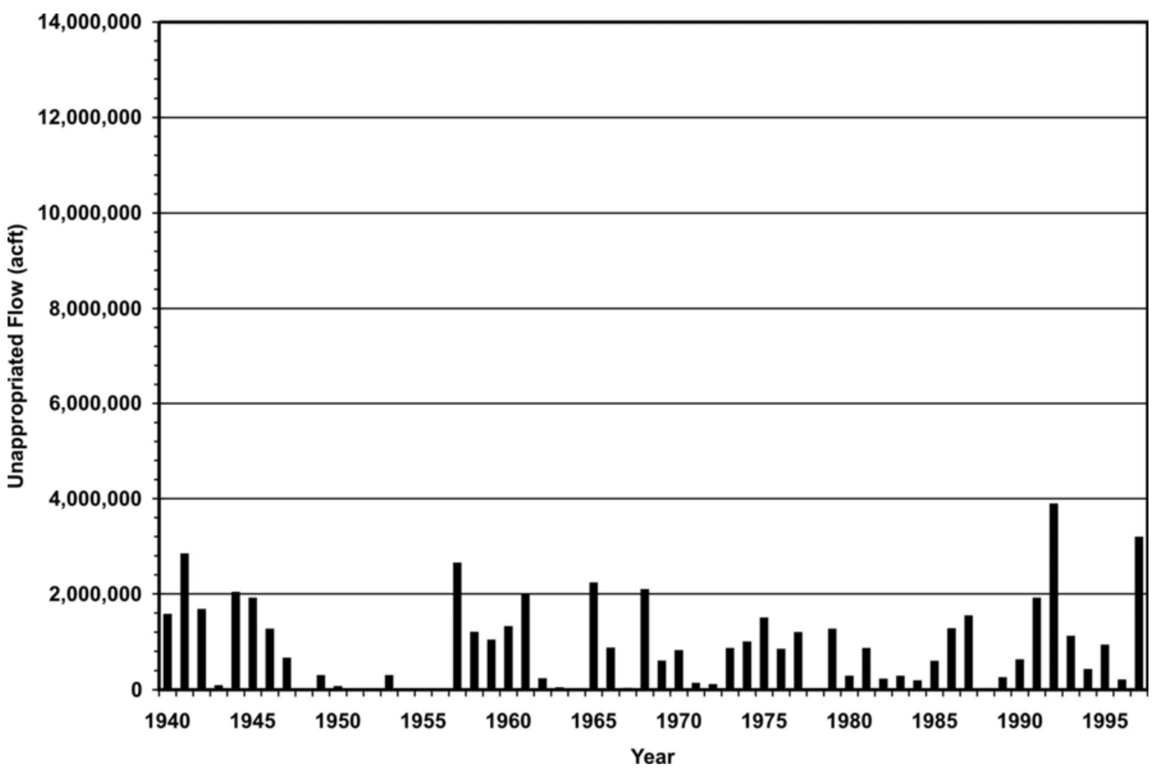

Figure 3.2-6. Estimated Annual Unappropriated Flow at Little River at Cameron

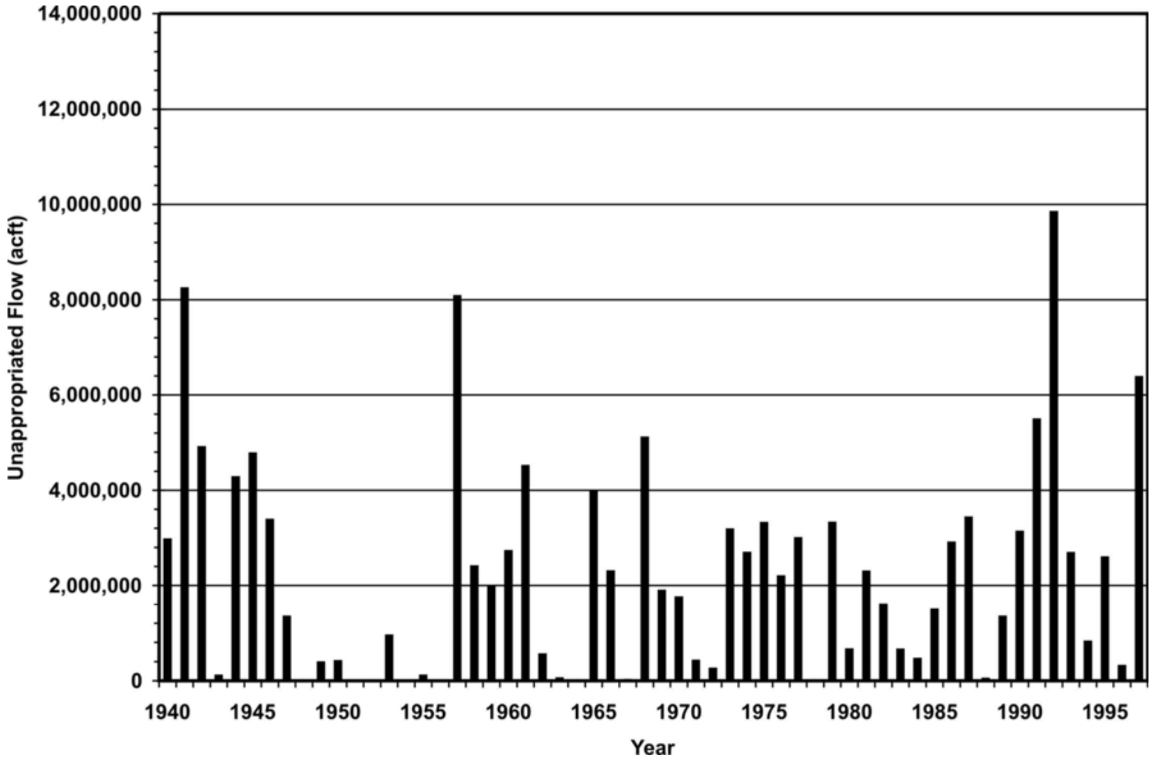

Figure 3.2-7. Estimated Annual Unappropriated Flow at Brazos River near Bryan

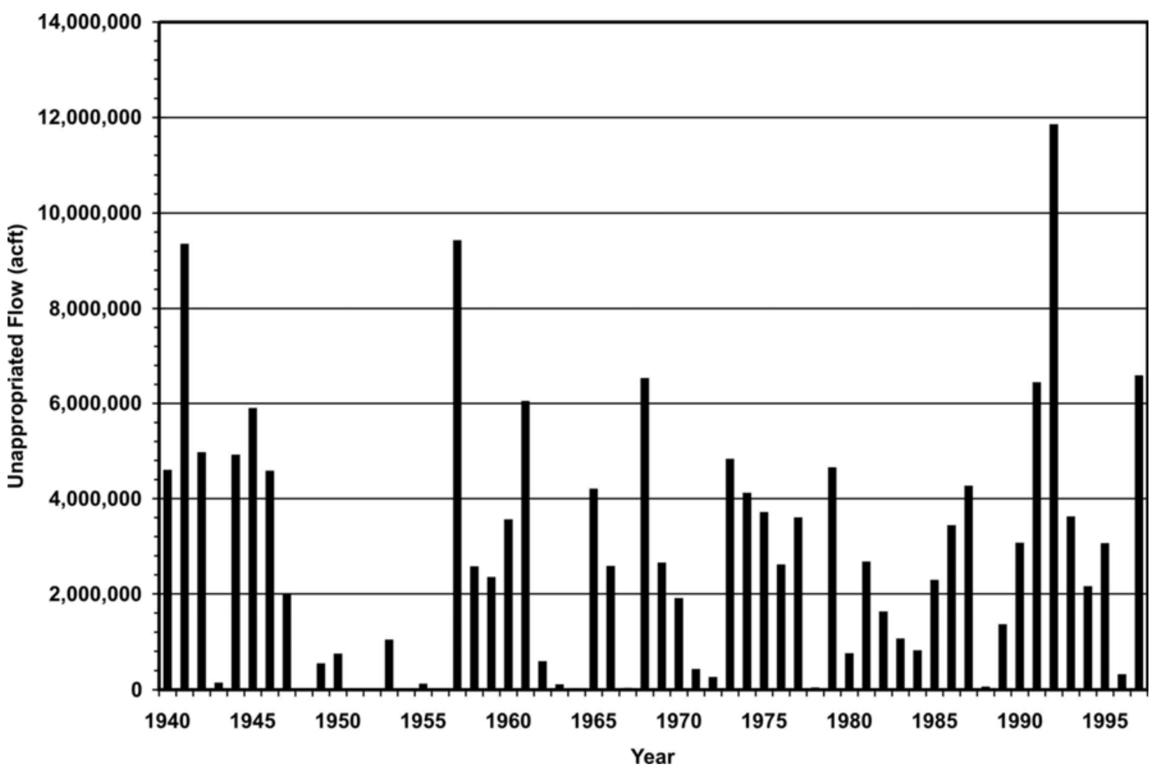

Figure 3.2-8. Estimated Annual Unappropriated Flow at Brazos River near Hempstead

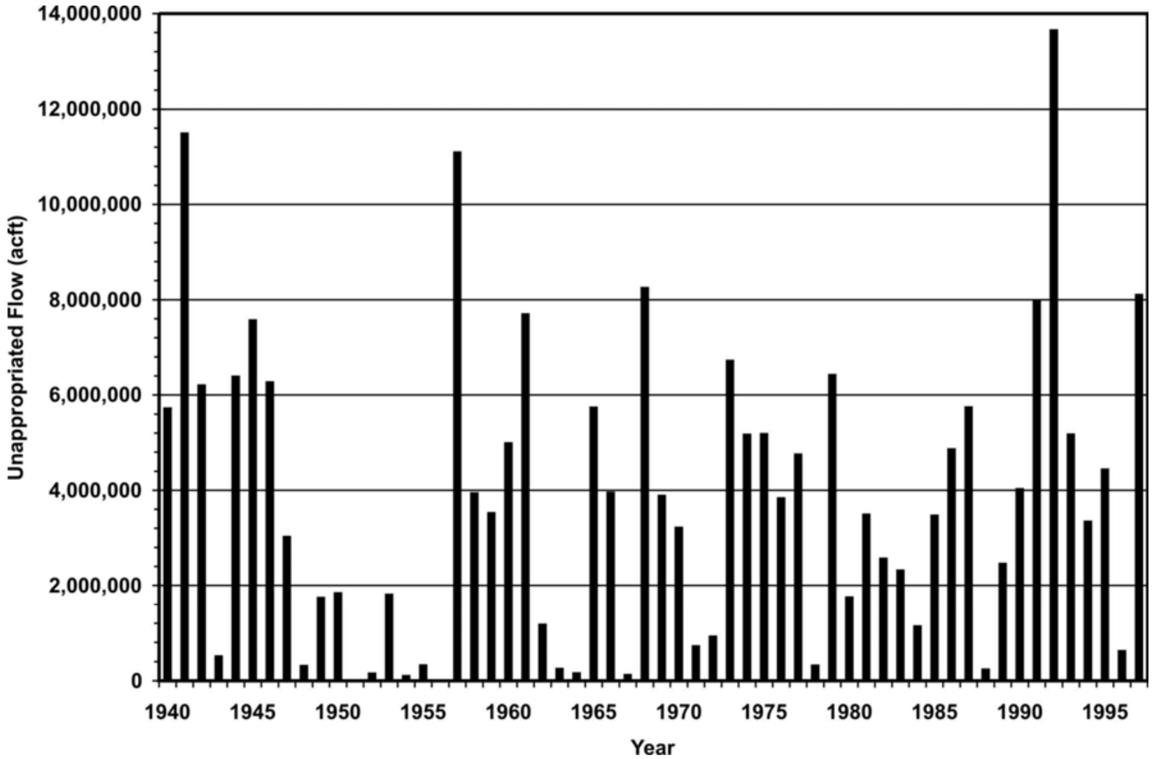

Figure 3.2-9. Estimated Annual Unappropriated Flow at Brazos River at Richmond

3.3 Water Quality Considerations Affecting Supply

The Brazos G WAM model addresses the quantity of water available to existing water rights. However, water quality issues for some sources of water for existing water rights and contracts may limit the availability of water for certain beneficial uses. Water quality that does not meet criteria for designated uses such as public water supply, contact recreation, and aquatic life support is very important to water supply considerations.

3.3.1 Point and Non-Point Source Pollution Water Quality

A number of stream segments and lakes in the Brazos G Regional Water Planning Area do not meet water quality standards due to point and/or non point source pollution. The TCEQ and USEPA (40 CFR 130.7) have the responsibility to identify water bodies that do not meet, or are not expected to meet, applicable water quality standards for designated uses.[1] These stream segments and lakes are identified in Section 303(d) list as impaired or threatened water bodies.[2] The summary of these segments is contained in Table 3.3-1.[3] The TCEQ has the responsibility to identify and prioritize water bodies that may require a Total Maximum Daily Load (TMDL) allocation to address the cause and source of a water quality impairment. TMDL studies of bacteria are currently underway for the Leon River below Lake Proctor (segment 1221). Goose Branch in Erath County (and associated tributary) has been identified with a low priority for a TMDL study.

These water quality issues are beyond the scope of regional water planning activities. The Brazos G Regional Water Planning Group encourages TCEQ and USEPA to take responsibility and aggressively pursue their obligation to restore water quality to meet intended uses.

[1] Texas Commission on Environmental Quality, *TMDL Guidance Document Outline*. http://www.tnrcc.state.tx.us
[2] Texas Commission on Environmental Quality, *State of Texas 1999 Clean Water Act Section 303(d) List and Schedule for Development of Total Maximum Daily Loads*. SFR-58/99, April 1, 1999.
[3] Texas Commission on Environmental Quality, *DRAFT Texas 2004 Section 303(d) List (May 13, 2005).* http://www.tnrcc.state.tx.us/water/quality/04_twqi303d/04_303d/04_303d.pdf.

Table 3.3-1.
DRAFT 2004 Texas 303(d) List (May 13, 2005)
Brazos G Regional Water Planning Area

Segment Number	Segment Name	Category	Rank	Source	Parameter of Concern
1209	Navasota River Below Lake Limestone	5c	D	Nonpoint	Bacteria
1209A	Country Club Lake (Brazos County)	5c	D	Point	Chronic toxicity in sediment to aquatic organisms; metals in sediment
1209B	Fin Feather Lake (Brazos County)	5c	D	Point	Chronic toxicity in sediment to aquatic organisms; arsenic, copper and lead in sediment
1209C	Carters Creek (Brazos County)	5c	D	Point and Nonpoint	Bacteria
1209G	Cedar Creek (Robertson County)	5c	D	Nonpoint	Bacteria
1209I	Gibbons Creek (Grimes County)	5c	D	Nonpoint	Depressed dissolved oxygen; bacteria
1209K	Steele Creek (Limestone County)	5c	D	Nonpoint	Bacteria
1210	Lake Mexia	5b	S	Nonpoint	Depressed dissolved oxygen
1210A	Navasota River above Lake Mexia	5c	D	Nonpoint	Bacteria
1211A	Davidson Creek (Burleson County)	5c	D	Nonpoint	Bacteria
1212	Lake Somerville	5c	D	Nonpoint	Low and high pH
1212B	East Yegua Creek (Lee/Milam Counties)	5c	D	Nonpoint	Bacteria
1217	Lampasas River above Stillhouse Hollow Lake	5c	D	Nonpoint	Bacteria
1218	Nolan Creek South Nolan Creek	5c	D	Nonpoint	Bacteria
1221	Leon River below Proctor Lake	5a	U	Nonpoint	Bacteria
1221A	Resley Creek (Comanche County)	5c	D	Nonpoint	Bacteria
1222	Proctor Lake	5c	D	Point and Nonpoint	Depressed dissolved oxygen
1222A	Duncan Creek (Comanche County)	5c	D	Nonpoint	Bacteria
1226B	Green Creek (Erath County)	5c	D	Nonpoint	Bacteria
1226E	Indian Creek (Erath County	5c	D	Nonpoint	Bacteria
1226F	Sims Creek (Erath County	5c	D	Nonpoint	Bacteria
1227	Nolan River	5b 5c	S D	Nonpoint Point and Nonpoint	Sulfate Bacteria
1238	Salt Fork Brazos River	5b	S	Nonpoint	Total dissolved solids; chloride
1240	White River Lake	5b	S	Nonpoint	Chloride
1241A	North Fork Double Mountain Fork Brazos River	5c	D	Point and Nonpoint	Bacteria
1242	Brazos River above Navasota River	5c	D	Nonpoint	Bacteria
1242D	Thompson Creek	5c	D	Point and Nonpoint	Bacteria
1242I	Campbells Creek	5c	D	Point and Nonpoint	Bacteria
1242K	Mud Creek (Robertson County)	5c	D	Point and Nonpoint	Bacteria
1242L	Pin Oak Creek (Robertson County)	5c	D	Point and Nonpoint	Bacteria
1242M	Spring Creek (Robertson County)	5c	D	Nonpoint	Bacteria
1242N	Tehuacana Creek (Hill County)	5c	D	Point and Nonpoint	Bacteria
1242P	Big Creek (Falls County)	5c	D	Point and Nonpoint	Bacteria
1243	Salado Creek	5c	D	Nonpoint	Depressed dissolved oxygen

Table 3.3-1.
DRAFT 2004 Texas 303(d) List (May 13, 2005)
Brazos G Regional Water Planning Area (concluded)

Segment Number	Segment Name	Category	Rank	Source	Parameter of Concern
1245	Upper Oyster Creek	5a 5c	U D	Nonpoint Point and Nonpoint	Bacteria; Depressed dissolved oxygen
1246E	Wasp Creek (McLennan/Coryell Counties)	5c	D	Nonpoint	Bacteria
1247A	Willis Creek (Williamson County)	5c	D	Nonpoint	Bacteria
1248	San Gabriel/ North Fork San Gabriel River	5c	D	Nonpoint	Total dissolved solids
1248C	Mankins Branch (Williamson county)	5c	D	Nonpoint	Bacteria
1254	Aquilla Reservoir	5c	D	Nonpoint	Depressed dissolved oxygen
1255	Upper North Bosque River	5c	D	Nonpoint	Bacteria
1255A	Goose Branch (Erath County)	5a	L	Nonpoint	Bacteria
1255B	North Fork Upper North Bosque River (Erath County)	5c	D	Nonpoint	Bacteria
1255C	Scarborough Creek (Erath County)	5c	D	Nonpoint	Bacteria
1255D	South Fork North Bosque River (Erath County)	5c	D	Nonpoint	Bacteria
1255E	Unnamed tributary of Goose Branch (Erath County)	5a	L	Nonpoint	Bacteria
1255F	Unnamed tributary of Scarborough Creek (Erath County)	5c	D	Nonpoint	Bacteria
1255G	Woodhollow Branch (Erath County)	5c	D	Nonpoint	Bacteria

Explanation of Column Headings:

Segment Number: This is the classified segment number to a water body or a portion of a water body in the Texas Surface Water Quality Standards. A letter designation following the segment number indicates an unclassified water body that is located within the watershed of the classified segment whose number is shown before the letter.

Segment Name: The name of the water body.

Category: Category 5- The water body does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants.

5a- A TMDL is underway, scheduled, or will be scheduled.

5b- A review of the water quality standards will be conducted before a TMDL is scheduled.

5c- Additional data and information will be collected before a TMDL is scheduled.

Rank: For Category 5a, a rank of High (H), Medium (M), or Low (L) is given for the urgency to initiate a TMDL.

For water bodies in Category 5b, a ranking of “S” has been assigned to indicate that a standards review will be conducted before a TMDL is scheduled.

For water bodies in Category 5c, a ranking of “D” has been assigned to indicate that additional data and information will be collected before a TMDL is scheduled.

Parameters of Concern: Those pollutants or water quality conditions for which screening procedures indicate an existing impairment, or a threat of within the next two years.

3.3.2 Comparison of Supplies with Water Quality Standards

The Salt Fork of the Brazos River watershed is the primary source of natural salt in the Brazos Basin, and although it contributes only 14 to 18 percent of the total flow of the Brazos River, it contributes 45 to 55 percent of total dissolved minerals and 75 to 85 percent of dissolved salt.[4] As a result of this high mineral content in these Brazos River headwater tributaries, the principal water quality issue in the Brazos River Basin is generally associated with total dissolved solids (TDS), chloride (Cl), and sulfate ($-SO^4$) concentrations on the main stem of the Brazos River. Water sources with TDS, Cl, and $-SO^4$ concentrations exceeding TCEQ Drinking Water Standards of 1,000 mg/l, 300 mg/l, and 300 mg/l respectively, are generally considered as low quality and may require higher cost advanced treatment methods for use as a municipal or industrial supply.

The Brazos River above Possum Kingdom Lake (from Stonewall County through Knox, Baylor, and Young Counties) is not impaired according to TCEQ standards; however monitoring data indicates increasing levels of TDS, chloride, and sulfate.[4] On the main stem of the Brazos River, the Draft 2004 Texas Water Quality Inventory includes a list of water bodies in Brazos G with water quality concerns. A summary of water bodies in Brazos G that have high TDS, chloride, and/or sulfate concentrations that may affect regional surface water supplies are summarized in Table 3-3.2. The largest impacts in terms of quantity of supply are associated with Possum Kingdom Lake, Lake Granbury, and Lake Whitney. These reservoirs have a combined 2060 firm yield of 312,298 acft/yr. Other surface water supplies with water quality concerns include Lake Stamford, Lake Sweetwater, and the Brazos River above the Navasota River. While not listed by TCEQ for impairments, Lake Georgetown and Granger Lake water quality exhibit increasing trends in chloride, sulfate, and/or TDS.[4] Advanced treatment is being utilized by some of the water right and contract holders that divert water directly from these reservoirs in order to meet drinking water standards. Other contract holders divert stored water released from these reservoirs at locations farther downstream, at which point the water quality is improved as it blends with downstream tributary streamflow.

[4] Brazos River Authority, "Basin Highlights Report, 2005 Annual Water Quality Report."

Table 3.3-2.
Water Bodies with Concerns for Meeting Public Water Quality Standards in the Brazos G Area

Water Body No.	Water Body Name	Public Water Supply Concern(s)				Texas Water Quality Standard		
		TDS	Chloride	Sulfate	Increased costs for demineralization	TDS (mg/l)	Chloride (mg/l)	Sulfate (mg/L)
1203	Lake Whitney		✓			1,500	670	320
1205	Lake Granbury	✓	✓		✓	2,500	1,000	600
1207	Possum Kingdom Lake	✓	✓	✓	✓	3,500	1,200	500
1235	Lake Stamford	✓	✓	✓		2,100	580	400
1237	Lake Sweetwater			✓		730	250	225
1242	Brazos River above Navasota River				✓	1,000	350	200

3.3.3 Special Water Quality Studies and Activities in the Brazos River Basin

There are several special water quality studies that are on-going in the Brazos River Basin as described in the Brazos River Authority's 2005 Basin Highlights Report. A brief summary of these projects is described below.

3.3.3.1 Natural Salt Pollution Control

High concentrations of salt enter the Brazos River Basin from the semi-arid Upper Brazos Basin Region, consisting of salt and gypsum encrusted hills and canyon-like valleys. Major tributaries include the Salt and Double Mountain Forks of the Brazos River. Representatives from Stonewall, Kent, and Garza Counties have formed a Salt Fork Water Quality Corporation (SFWQC) to evaluate brine control to reduce chloride concentrations in the Brazos River. Preliminary studies have shown that pumping brine water using shallow recovery wells in Stonewall and Kent could reduce chloride concentration by an estimated 55 to 65 percent above Possum Kingdom Lake. The planning stage of the project is on-going and includes an environmental site assessment; geophysical studies on Salt Croton Creek, Croton Creek, and Short Croton Creek; pipeline routing options; and financial analysis.

3.3.3.2 Lake Granbury Escherichia coli Study

In May 2002, a study of Escherichia coli for Lake Granbury commenced and included 53 monitoring locations. The objective of the program was to assess potential impacts of on-site sewage facilities. By 2004, several areas were identified where on-site systems were failing or improperly maintained. In August 2004, the monitoring program was revised and twelve sites were eliminated from future sampling.

3.3.3.3 Mining and Rock Quarry Operations

In October 2003, the TCEQ conducted an investigation of rock mining operations and determined that two operations in the Brazos River below Possum Kingdom Lake (Segment 1206) were noncompliant in controlling stormwater runoff. A target monitoring program was established to assess impacts of these operations on water quality.

3.3.3.4 Compost Effectiveness Monitoring

In September 2000, the Texas Soil and Water Conservation Board initiated the Dairy Manure Export Support (DMES) project to remove a large portion of dairy waste from the North Bosque Watershed. From 2000 through 2003, nearly 64 percent of dairy manure produced was hauled to composting facilities. A monitoring program of seven sites was established and has demonstrated statistically significant water quality improvement with declines in phosphorous levels. A pilot project to use a digester pond to convert manure slurry to methane gas for electricity is expected to open in the summer of 2005 near Hico, Texas in Hamilton County.

3.3.3.5 Bacterial Source Tracking

Several agencies are compiling a reference library to profile bacterial sources for Lake Waco and Lake Belton, as well as source waters for those reservoirs. Final development and classification of the reference library is expected to be completed in 2005.

3.3.3.6 North Bosque River Watershed Activity Coordination Project

The Brazos River Authority, Texas State Soil and Water Conservation Board, and EPA are engaged in an effort to identify pollution prevention projects for the North Bosque River watershed. Funding for this project runs through March 2006.

3.3.3.7 North Bosque River- PL566 Reservoir Evaluation

In October 2004, the Brazos River Authority funded a test pilot program to use alum to "fix" phosphorous in a flood control reservoir north of Stephenville. The process binds orthophosphate phosphorous to alum in an insoluble form. The treatment system is expected in summer 2005.

3.3.3.8 Brazos Navasota Watershed Management Project

The Brazos Navasota Watershed Management Project, funded by the EPA and managed by the Brazos River Authority, is a multiple-phase approach to water quality management which includes creation of a stakeholder group, development of a water quality database, water quality monitoring, evaluation of poultry production practices, and recommendations of specific management techniques to protect water quality.

3.3.3.9 Nutrient Special Study in Brazos/ Navasota Watersheds

This special study is designed to determine if a relationship exists between support of aquatic life and nutrient-related water quality parameters. The study area includes Carters Creek, Cedar Creek, Cottonwood Creek, and Thompson Creek. These creeks were selected based on historical data showing high nitrogen and phosphorus concentrations. Study results will be submitted to the EPA in August 2005.

3.3.3.10 Dissolved Oxygen Special Study in Brazos/ Navasota Watersheds

The Watershed Task Force has initiated a study of Gibbons Creek to evaluate dissolved oxygen concentrations. The study includes 24-hour dissolved oxygen monitoring, biological assessment, and streamflow data collection on Gibbons Creek. A summary of results will be included in the Brazos/Navasota Watershed Management Plan.

3.4 Groundwater Availability

Fifteen aquifers underlie parts of the Brazos G Area, including six of the major and nine of the minor aquifers in Texas.[5] As presented earlier, Figures 1-9 and 1-10 show locations of the major and minor aquifers. A description of each aquifer, including groundwater availability, is presented in Appendix B. Table 3.4-1 summarizes groundwater availability by aquifer and by area. Table 3.4-2 is a compilation of groundwater availability and estimated supply by county. The availability estimates do not include saline water (greater than 1,000 milligrams per liter of total dissolved solids) and assumes a uniform distribution of withdrawals.

Table 3.4-1.
Groundwater Availability from BGRWPA Aquifers

Aquifer	*2060 Availability (acft/yr)*	*Typical Range in Well Yields (gpm)*
Western Area		
Seymour	67,055	100 to 1,000
Dockum	3,700	100 to 400
Blaine	1,333	less than 25
Edwards-Trinity (Plateau)	1,500	5 to 300
Subtotal:	73,588	
Central Area		
Trinity	77,563	50 to 500
Edwards-BFZ (Northern Segment)	12,500	200 to 2,000
Woodbine	2,432	50 to 150
Marble Falls	4,183	less than 100
Ellenburger-San Saba	551	
Hickory	ND	ND
Subtotal:	97,229	
Southeastern Area		
Brazos River Alluvium	66,700	250 to 500
Carrizo-Wilcox	251,000	100 to 3,000
Queen City	3,459	200 to 500
Sparta	10,333	200 to 600
Gulf Coast	28,296	300 to 800
Subtotal:	359,788	
Other and Undifferentiated	2,915	—
Total:	533,520	

BFZ – Balcones Fault Zone.
ND indicates not determined.

[5] Texas Water Development Board, *Water for Texas*, 1997.

Table 3.4-2.
Groundwater Availability and Supply from BGRWPA Counties and Aquifers

County	Aquifer	Availability (acft/yr)	2010 Supply (acft/yr)	2060 Supply (acft/yr)
Bell	Edwards-BFZ (Northern Segment)	2,500	1,200	1,200
	Trinity	2,169	1,383	1,353
	Subtotal:	4,669	2,583	2,553
Bosque	Brazos River Alluvium	2,500	671	598
	Trinity	1,718	1,718	1,718
	Subtotal:	4,218	2,389	2,316
Brazos	Brazos River Alluvium	12,500	2,074	1,620
	Carrizo-Wilcox	53,000	37,282	37,282
	Gulf Coast	1,177	0	0
	Queen City	645	285	285
	Sparta	2,107	2,103	2,107
	Subtotal:	69,429	41,744	41,294
Burleson	Brazos River Alluvium	9,400	8,583	6,914
	Carrizo-Wilcox	44,000	2,873	2,873
	Queen City	672	612	612
	Sparta	1,666	1,301	1,300
	Subtotal:	55,738	13,369	11,699
Callahan	Trinity	3,787	1,971	1,919
	Subtotal:	3,787	1,971	1,919
Comanche	Trinity	21,976	20,772	19,775
	Subtotal:	21,976	20,772	19,775
Coryell	Trinity	1,791	484	494
	Subtotal:	1,791	484	494
Eastland	Trinity	4,853	4,853	4,853
	Subtotal:	4,853	4,853	4,853
Erath	Trinity	20,165	14,820	14,284
	Subtotal:	20,165	14,820	14,284
Falls	Brazos River Alluvium	15,600	1,230	1,041
	Carrizo-Wilcox	1,000	0	0
	Trinity	161	161	161
	Subtotal:	16,761	1,391	1,202
Fisher	Dockum	100	100	100
	Seymour	7,000	2,809	2,463
	Subtotal:	7,100	2,909	2,563

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Table 3.4-2 (continued)

County	Aquifer	Availability (acft/yr)	2010 Supply (acft/yr)	2060 Supply (acft/yr)
Grimes	Brazos River Alluvium	1,700	0	0
	Carrizo-Wilcox	5,000	171	172
	Gulf Coast	14,083	4,614	4,620
	Queen City	462	0	0
	Sparta	2,044	379	379
	Subtotal:	23,289	5,164	5,171
Hamilton	Trinity	2,146	1,142	1,118
	Subtotal:	2,146	1,142	1,118
Haskell	Seymour	20,055	20,000	20,000
	Subtotal:	20,055	20,000	20,000
Hill	Trinity	2,383	2,081	2,081
	Woodbine	1,433	458	447
	Subtotal:	3,816	2,539	2,528
Hood	Trinity	6,163	5,909	5,909
	Subtotal:	6,163	5,909	5,909
Johnson	Trinity	2,053	2,053	2,053
	Woodbine	866	553	553
	Subtotal:	2,919	2,606	2,606
Jones	Seymour	8,000	4,245	3,703
	Subtotal:	8,000	4,245	3,703
Kent	Dockum	100	0	0
	Seymour	5,700	1,263	1,130
	Subtotal:	5,800	1,263	1,130
Knox	Blaine	1,333	0	0
	Seymour	24,000	23,910	23,910
	Subtotal:	25,333	23,910	23,910
Lampasas	Ellenburger-San Saba	551	0	0
	Marble Falls	4,183	33	27
	Trinity	2,145	906	889
	Subtotal:	6,879	939	916
Lee	Carrizo-Wilcox	45,000	9,138	3,616
	Queen City	1,240	924	892
	Sparta	3,900	150	150
	Subtotal:	50,140	10,212	4,658
Limestone	Carrizo-Wilcox	20,000	13,604	13,627
	Trinity	66	0	0
	Woodbine	33	0	0
	Subtotal:	20,099	13,604	13,627

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Table 3.4-2 (concluded)

County	Aquifer	Availability (acft/yr)	2010 Supply (acft/yr)	2060 Supply (acft/yr)
McLennan	Brazos River Alluvium	15,600	2,359	2,300
	Trinity	1,718	1,718	1,718
	Woodbine	100	11	11
	Subtotal:	17,418	4,088	4,029
Milam	Carrizo-Wilcox	45,000	17,239	14,719
	Trinity	321	0	0
	Subtotal:	45,321	17,239	14,719
Nolan	Dockum	3,500	3,500	3,500
	Edwards-Trinity (Plateau)	1,000	836	836
	Subtotal:	4,500	4,336	4,336
Palo Pinto	Trinity	286	49	48
	Subtotal:	286	49	48
Robertson	Brazos River Alluvium	6,300	5,150	38
	Carrizo-Wilcox	38,000	28,037	21,490
	Queen City	440	0	0
	Sparta	616	0	0
	Subtotal:	45,356	33,187	21,528
Shackelford		0	0	0
	Subtotal:	0	0	0
Somervell	Trinity	1,233	1,233	1,233
	Subtotal:	1,233	1,233	1,233
Stephens	Other Aquifer	705	705	705
	Subtotal:	705	705	705
Stonewall	Seymour	2,300	465	419
	Subtotal:	2,300	465	419
Taylor	Edwards-Trinity (Plateau)	500	28	25
	Trinity	679	424	476
	Subtotal:	1,179	452	501
Throckmorton	Other Aquifer	364	89	101
	Subtotal:	364	89	101
Washington	Brazos River Alluvium	3,100	0	0
	Gulf Coast	13,036	4,957	4,998
	Subtotal:	16,136	4,957	4,998
Williamson	Edwards-BFZ (Northern Segment)	10,000	10,000	10,000
	Trinity	1,750	1,750	1,750
	Other Aquifer	665	665	665
	Subtotal:	12,415	12,415	12,415
Young	Other Aquifer	1,181	541	602
	Subtotal:	1,181	541	602
Total:		533,520	278,591	253,878

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3.4.1 Method of Analysis

The adopted process for estimating groundwater availability for the 2006 Brazos G Regional Water Plan consisted of appointing a Groundwater Work Group (GWG) to work with groundwater specialists and to provide recommendations to the BGRWPG. Under guidance and direction of the GWG, the groundwater specialists conducted several technical analyses and presented the findings at GWG meetings. After considerable discussion in public meetings, the GWG formulated recommendations and submitted them to the BGRWPG.

The process began on June 25, 2003, with a description of the aquifers in Brazos G and the methods that have been used in the past to estimate groundwater availability. At an October 14, 2003 meeting of the GWG, the groundwater specialist provided the results of the 2001 Brazos G groundwater availability estimates by aquifer and by county and recommendations for 2006 Brazos G estimates along with a discussion on applying TWDB's Groundwater Availability Models (GAMs), where available. At this meeting, the previous estimates were recommended by the GWG and were subsequently adopted by the BGRWPG for the Blaine, Brazos River Alluvium, Ellenburger-San Saba, Gulf Coast, Marble Falls, Queen City, Sparta, Trinity, and Woodbine Aquifers.

At an October 24, 2003 meeting which was focused on the Carrizo-Wilcox Aquifer, results of three simulations of the Central Carrizo-Wilcox GAM were presented and discussed. These simulations were at 75, 100, and 125 percent of the 2001 Brazos G availability estimates for the Carrizo-Wilcox. At the December 12, 2003 meeting of the BGRWPG and on the basis of guidance of the GWG, the groundwater specialists presented an analysis and recommendations of groundwater availability for the Seymour, Dockum, Edwards-Trinity (Plateau), Edwards-BFZ (Northern Segment), and Carrizo-Wilcox Aquifers. The BGRWPG adopted groundwater availability estimates for all these aquifers except the Carrizo-Wilcox.

At a February 11, 2004 BGRWPG meeting, results of simulations requested by the BGRWPG with pumping at 33, 80, and 100 percent of the previously recommended availability estimates were presented. Following considerable discussion, the recommended availability estimates were adopted by the BGRWPG. In a GWG meeting on February 15, 2005 and a BGRWPG meeting on February 22, 2005, the groundwater availability estimates for Lee County were reconsidered at the request of the Lost Pines Groundwater Conservation District. After considerable debate, the BGRWPG let stand the previously adopted estimates for Lee County.

In the overall development of groundwater availability estimates for the 2006 Brazos G Regional Water Plan, five approaches were used. The approaches are briefly described in Table 3.4-3 along with the applicable aquifers.

Table 3.4-3.
Summary of Methods Used to Estimate Groundwater Availability

Method of Analysis	*Description of Method*	*Aquifers*
Application of TWDB's Groundwater Availability Model (GAM)	Several GAM simulations with various pumping levels were performed to calculate regional and local groundwater drawdowns[1]. The estimated groundwater availability is equal to the greatest pumping rate that produced acceptable drawdowns.	Carrizo-Wilcox
Historical Performance	Historical data on groundwater levels, pumpage, and precipitation were studied to evaluate the past performance of the aquifer. This performance was used to estimate the potential level of groundwater development.	Dockum, Edwards-Trinity (Plateau), and Seymour
Application of TWDB's Groundwater Availability Model (GAM) and Historical Performance	Combining the two above methods	Edwards-BFZ (Northern Segment)
TWDB	Estimates developed using various methods for 1997 State Water Plan.	Blaine, Brazos River Alluvium, Ellenburger-San Saba Gulf Coast, Marble Falls, Queen City, Sparta, and Woodbine
2001 Brazos G	Estimates developed using various methods for 1997 State Water Plan with revisions to selected counties on the basis of aquifer performance.	Trinity

[1] Aquifer drawdown information is shown in Appendix B.

A description of each of the aquifers is provided in Appendix B. For the aquifers with updates from the Brazos G 2001 Regional Water Plan (i.e., Carrizo-Wilcox, Dockum, Edwards-Trinity (Plateau), Edwards-BFZ (Northern Segment), and Seymour), documentation on the analysis is also provided.

The distribution of groundwater availability is summarized by dividing the BGRWPA into three areas. As tabulated in Table 3.4-1 and shown in Figure 3.4-1, the groundwater in Region G is not uniformly distributed, with about 14 percent occurring in the western area, about 18 percent in the central area, and about 68 percent in the eastern area.

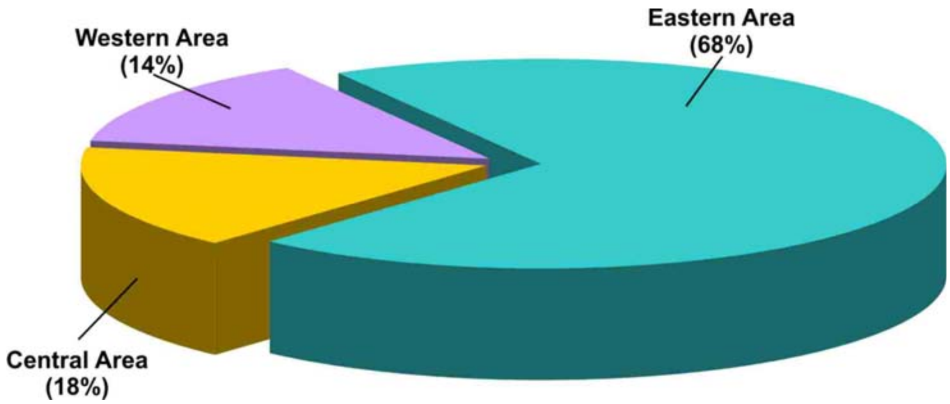

Figure 3.4-1. Distribution of Groundwater by Area — 533,520 acft/yr

3.4.2 Western Area

Only part of the western area is underlain by a major or minor aquifer, as shown in Figures 1-9 and 1-10. Together, the four aquifers—Blain, Dockum, Edwards-Trinity (Plateau), and Seymour—can supply up to 73,588 acft/yr. Of the four aquifers, the Seymour Aquifer has nearly 91 percent of the supplies and is scattered in six counties (Figure 3.4-2); however, about two-thirds of the supply is in Knox and Haskell Counties. The Dockum Aquifer exists only on the western fringe and can contribute about 5 percent of the groundwater supply in the area. Undifferentiated aquifers underlie some of the area, including all of Shackelford, Stephens, Throckmorton, and Young Counties. At best, the undifferentiated aquifers can provide only meager supplies for livestock and domestic uses.

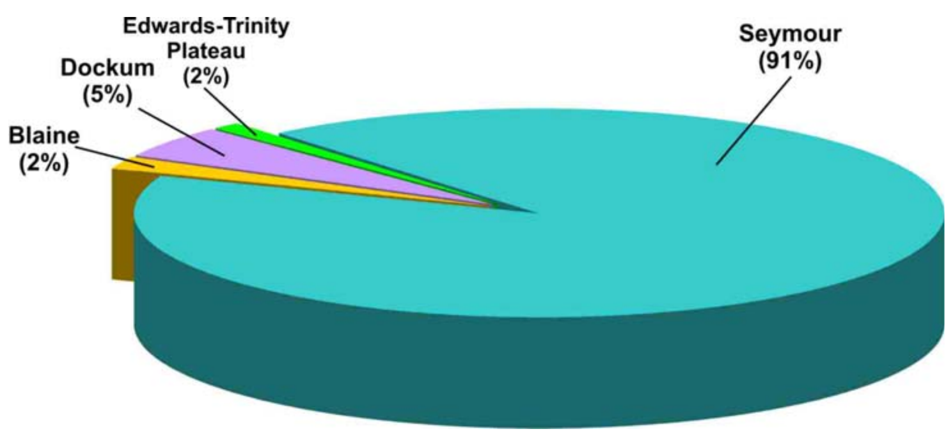

Figure 3.4-2. Groundwater Availability in the Western Area — 73,588 acft/yr

3.4.3 Central Area

Major or minor aquifers exist in the southeastern two-thirds of the central area, as shown in Figures 1-9 and 1-10. Together, the five aquifers (Edwards-BFZ (Northern Segment), Ellenburger-San Saba, Marble Falls, Trinity, and Woodbine) can provide up to 97,229 acft/yr. Of the five aquifers, the Trinity Aquifer is most extensive and has about 80 percent of the supplies (Figure 3.4-3). Although the Trinity Aquifer as a whole can provide 77,563 acft/yr, local areas have been severely over-drafted and cannot yield substantial supplies in the current planning period. The Edwards-BFZ (Northern Segment) only exists in parts of Bell and Williamson Counties and has about 13 percent of the area's groundwater supply.

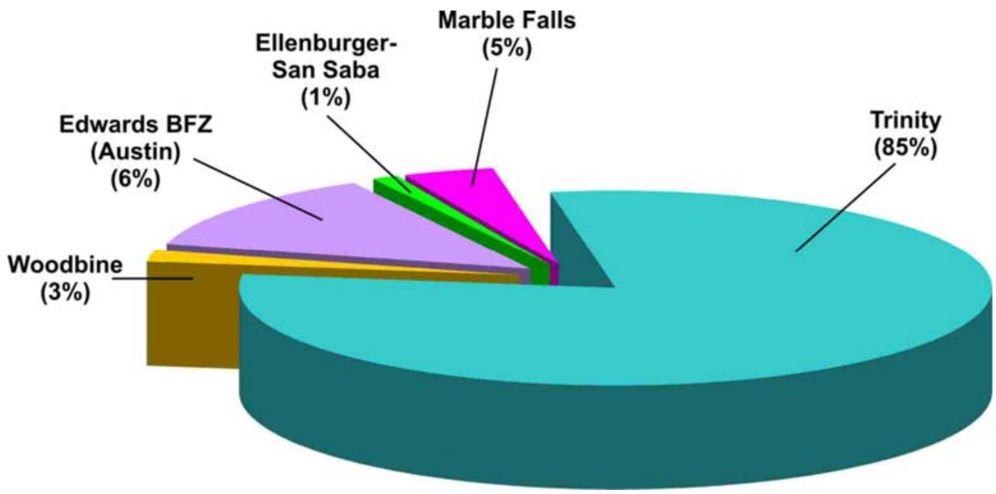

Figure 3.4-3. Groundwater Availability in the Central Area — 97,229 acft/yr

3.4.4 Eastern Area

Major or minor aquifers exist throughout the eastern area except in the western fringe, as shown in Figures 1-9 and 1-10. Together, the five aquifers (Brazos River Alluvium, Carrizo-Wilcox, Gulf Coast, Queen City, and Sparta) can provide up to 359,788 acft/yr. Of the five aquifers, the Carrizo-Wilcox Aquifer is most extensive and has about 70 percent of the supplies (Figure 3.4-4). The Brazos River Alluvium has about 18 percent of the supplies.

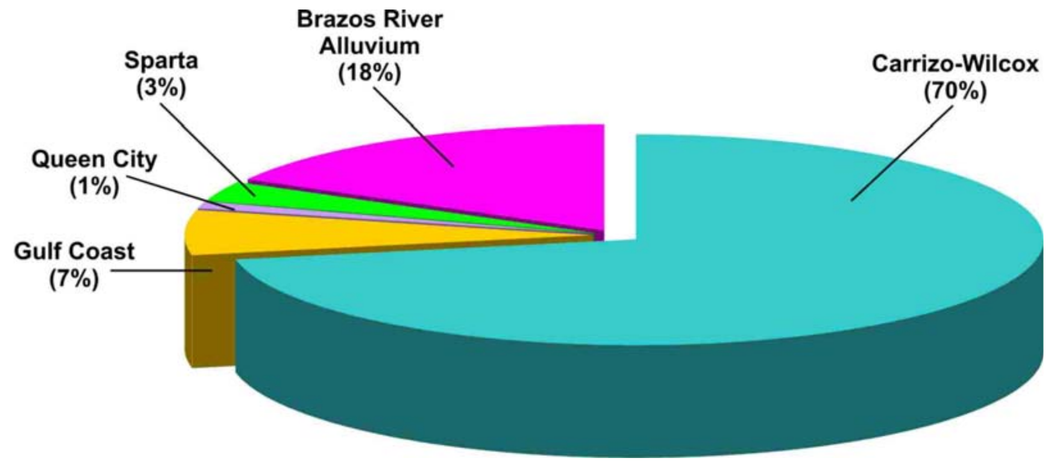

Figure 3.4-4. Groundwater Availability in the Eastern Area — 359,788 acft/yr

3.4.5 Data and Information Needs

To make major improvements in the accuracy and reliability of existing groundwater availability estimates, the following data, analyses, and tools are suggested.

- Water levels measurements:
  - Frequency (daily or monthly): At a relatively few and key locations, water level data for long periods of time provide documentation on trends and a means of determining if the availability estimates can or should be modified.
  - Coverage: Infrequent (annual) water level measurements made at many locations over a relatively short period of time provides a key data element in constructing water level maps that can show the regional flow patterns and extent of influence from pumping centers.
- Recharge:
  - Outcrop areas: Estimates (actually assumptions at this time) can be greatly improved by establishing a data collection network of precipitation gages and shallow water level monitoring wells in the outcrop areas.
  - Streams: Estimates can be made by conducting streamflow gain-loss studies and the establishment of monitoring networks to measure stage and discharge of streams and water levels in nearby shallow wells.
  - Cross-formational flow: These estimates would be made with existing hydrogeologic information, development of models and a rather dense network of water level monitoring wells.
- Discharge:
  - Wells: The existing estimates of pumpage are believed to be rather inaccurate. In the calculation of availability, withdrawals are a very strong control in aquifer conditions and directly influence the results.

- Streams, evapotranspiration, and wetlands areas: Estimates can be improved with rather dense networks of water level monitoring wells and flow-net analyses.
- Modeling: The best method to develop a water budget for an aquifer and the calculation of groundwater availability is the development of a groundwater flow model. Once the model has been tested, it is very useful in testing various groundwater development scenarios. The TWDB has completed GAMs for eight of the nine major aquifers and four of the 20 minor aquifers in Texas. Continued development and refinement of these models will greatly aid future estimates of groundwater availability.
- Water Quality: Networks of wells and periodic sampling are needed in areas where the water is vulnerable to contamination. This is most important in outcrop areas where there is considerable activity and development.

3.4.6 Comparison of Groundwater Availability Estimates to Groundwater Conservation District Estimates

One of the requirements in State statues for the groundwater conservation districts is developing a groundwater management plan that includes an estimate of groundwater availability. Likewise, the regional planning requires estimating groundwater availability to determine the total water supplies within a county and in the planning region. A compilation of these two sources of groundwater availability estimates is provided in Table 3.4-4.

Table 3.4-4 shows the Lee County groundwater availability estimates by Lost Pines GCD and BGRWPG to be nearly the same. However, the district originally estimated the Lee County groundwater availability from the Carrizo-Wilcox to be equal to recharge in Lee County, as determined by the Central Carrizo-Wilcox GAM, which is 7,500 acft/yr. This availability estimate was changed by the district to 46,458 acft/yr for the appearance of eliminating the apparent conflict with the 2001 Brazos G Regional Water Plan in order to obtain a determination of administrative completeness from the TWDB. This change was made under protest to the TWDB and to the BGRWPG.

One of the notable differences in groundwater availability estimates is in Lampasas County where the district's estimate is nearly three times greater than the Brazos G estimate. The district and Brazos G reference TWDB estimates that were prepared at different times and by different methods.

**Table 3.4-4.
Comparison of Groundwater Availability Estimates by
Groundwater Conservation Districts and Brazos G Regional Water Planning Group**

Groundwater Conservation District (GCD)	Counties in Brazos G	Aquifer(s)	Groundwater Availability Estimates (acft/yr)	
			GCD	Brazos G
Western Area				
Clear Fork	Fisher	Dockum	N/A	100
		Seymour	N/A	7,000
		Total		7,100
Salt Fork	Kent	Dockum	N/A	100
		Seymour	N/A	5,700
		Total	4,964	5,800
Wes-Tex	Nolan		N/A	4,500
Rolling Plains	Knox and Haskell	Blaine	1,333	1,333
		Seymour	47,000	44,000
		Total	48,333	45,333
Central Area				
Clearwater	Bell	Edwards-BFZ (Northern Segment)	1,315	2,500
		Trinity	3,318	2,169
		Total	4,673	4,669
Middle Trinity	Erath and Comanche	Edwards-Trinity	42,141	42,141
Saratoga	Lampasas	Ellenburger-San Saba	N/A	551
		Marble Falls	N/A	4,183
		Trinity	N/A	2,145
		Total	18,150	6,879
Eastern Area				
Post Oak Savannah	Milam and Burleson	Brazos River Alluvium	9,400	9,400
		Carrizo-Wilcox	92,916	90,000
		Queen City	672	672
		Sparta	1,666	1,666
		Trinity	321	321
		Total	111,854	100,559
Brazos Valley	Brazos and Robertson	Brazos River Alluvium	25,500	18,800
		Carrizo-Wilcox	92,900	90,000
		Gulf Coast	1,177	1,177
		Queen City	1,085	1,085
		Sparta	4,146	2,723
		Total	124,808	113,785
Lost Pines	Lee	Carrizo-Wilcox	46,458[1]	45,000
		Queen City	N/A	1,240
		Sparta	N/A	3,900
		Total	N/A	50,140
Bluebonnet	Grimes	Brazos River Alluvium	1,700	1,700
		Carrizo-Wilcox	6,789	5,000
		Gulf Coast	14,083	14,083
		Queen City	462	462
		Sparta	2,044	2,044
		Total	25,078	23,289

[1] The Lost Pines GCD originally estimated the Lee County groundwater availability from the Carrizo-Wilcox to be equal to recharge in Lee County, as determined by the Central Carrizo-Wilcox GAM, which is 7,500 acft/yr. This availability estimate was changed by the district to 46,458 acft/yr for the appearance of eliminating the apparent conflict with the 2001 Brazos G Regional Water Plan in order to obtain a determination of administrative completeness from the TWDB. This change was made under protest to the TWDB and to the BGRWPG.

3.5 Supplies from Other Regions

A limited number of entities within the Brazos G Area obtain water from sources located outside of the region. These other sources are Benbrook Reservoir, Navarro Mills Reservoir, the Colorado River MWD System, Lake Livingston (Trinity River Authority), and the Highland Lakes System (LCRA). Table 3.5-1 summarizes the current supplies from other regions to the Brazos G Area.

Table 3.5-1.
Water Supplies from Other Regions

Receiving Entity	*Source*	*Source Region*	*Amount Supplied (acft/yr)*
Burleson	Lake Benbrook	C	2,330
Mansfield	Lake Benbrook	C	Meets
Hill County – Other	Navarro Mills Reservoir	C	353
Abilene	Colorado River MWD System	F	6,720
Hubbard	Navarro Mills Reservoir	C	Meets
Grimes County SE	Lake Livingston (TRA)	H	6,721
Cedar Park	Highland Lakes System	K	18,000
Leander	Highland Lakes System	K	6,400
Lometa	Highland Lakes System	K	Meets
Blockhouse MUD	Highland Lakes System	K	Included in Cedar Park
Wells Branch MUD	Highland Lakes System	K	Meets
Williamson-Travis County MUD #1	Highland Lakes System	K	Included in Cedar Park

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Section 4
Identification, Evaluation, and Selection of Water Management Strategies Based on Needs

Section 4A
Comparison of Water Demands with Water Supplies to Determine Needs [31 TAC §357.7(a)(5-7)]

4A.1 Introduction

In this section, the demand projections from Section 2 and the supply projections from Section 3, are brought together to estimate projected water needs in the region through year 2060.

As a recap, Section 2 presents demand projections for six types of use: municipal, manufacturing, steam-electric, mining, irrigation, and livestock. The projections are for dry-year demands. Section 3 presents estimates of surface water and groundwater availability.

4A.1.1 Methods to Estimate Available Water Supplies in the Region

4A.1.1.1 Surface Water Supplies

Surface water in the region available to meet projected demands consists of firm yield of reservoirs, dependable supply of run-of-river water rights through drought of record conditions, and local on-farm sources. Contracts and/or rights to reservoirs, and run-of-river rights were allocated as supplies to their stated type of use: municipal, industrial (manufacturing, steam-electric, and mining), and irrigation. Additionally, municipal supply was further allocated among cities and other municipal water supply entities. This was done by obtaining water seller information (i.e., which contract/right holders – a wholesaler – are reselling water to other water supply entities) and water purchase contract limits between buyers and sellers. This information was obtained from TWDB files and follow-up queries to water supply entities. All water supply contracts were assumed to be renewed at their existing levels unless input was given to the contrary by local entities.

Water associated with a wholesaler that is not resold remains as an available supply to the wholesaler in the supply tables. In the case where a wholesaler's supply is deficient to meet its own demands and contractual commitments, it was assumed that contracts would not be met as well. In these cases, the supply available from each customer's contract was prorated down according the contract amount.

It was assumed that all livestock demands would be met from local water sources (e.g., shallow groundwater, stock ponds).

In certain instances the entity's available water supply is constrained by lack of infrastructure. For example, an entity may hold a contract to divert water from a reservoir; however, the required pipeline has not been built. In this instance, the contract amount would not be included in the entity's available water supply.

In some instances, specific operational, contractual, or legal constraints required modifications to the general surface water allocation procedure. For example, provision in the current contract between the City of Abilene and the West Central Texas Municipal Water District for supplies to the City from Hubbard Creek Reservoir preclude the City from receiving its normal pro-rata share of the reservoir's safe yield during times when the reservoir is significantly drawn down. However, the other member cities of the district (Anson, Albany, and Breckenridge) do not have similar provisions in their contracts with the district.

4A.1.1.2 Groundwater Allocation

Total groundwater availability in the region was determined based on the specific methods identified for each aquifer as discussed in Section 3.4. Total groundwater availability is shown for each county, by aquifer, in Table 3-14. For each county, total available groundwater was allocated among the six user groups—municipal, manufacturing, steam-electric, mining, irrigation, and livestock—in the following manner:

- Municipal supplies from each aquifer were estimated as follows:
    a. For cities using groundwater sources, supply is based upon well capacities. For cases in which the total demand on that portion (i.e., county and river basin) of the aquifer exceeds the total availability, supply is prorated downward for every entity using that particular source.
    b. For rural areas, it is assumed that the rural household (municipal type) demand would be met from aquifers underlying that river basin portion of the county. The rural supply is generally calculated as 125 percent of the year 2000 use from each particular aquifer. For cases in which the total demand on that portion (i.e., county and river basin) of the aquifer exceeds the total availability, supply is prorated downward for every entity using that particular source.
- Industrial supply from groundwater sources is associated with aquifers underlying the river basin portion of the county. The industrial supply is generally calculated as 130 percent of the year 2000 use from each particular aquifer. For cases in which the total demand on that portion (i.e., county and river basin) of the aquifer exceeds the

total availability, supply is prorated downwards for every entity using that particular source.

- Steam-electric supply from groundwater sources is associated with aquifers underlying the river basin portion of the county. The steam-electric supply is generally calculated as 130 percent of the year 2000 use from each particular aquifer. For cases in which the total demand on that portion (i.e., county and river basin) of the aquifer exceeds the total availability, supply is prorated downward for every entity using that particular source.
- Irrigation supply from groundwater sources is associated with aquifers underlying the river basin portion of the county. The irrigation supply is calculated as being equal to the projected demand in each decade. For cases in which the total demand on that portion (i.e., county and river basin) of the aquifer exceeds the total availability, supply is prorated downward for every entity using that particular source.
- Mining supply from groundwater sources is associated with aquifers underlying the river basin portion of the county. The mining supply is calculated as being equal to the projected demand in each decade. For cases in which the total demand on that portion (i.e., county and river basin) of the aquifer exceeds the total availability, supply is prorated downward for every entity using that particular source.

In some specific instances, these general procedures were modified to more accurately reflect the interactions between water demands, supplies, and needs. The demands and supplies for College Station as a WUG include Texas A&M University, by TWDB definition. However, Texas A&M utilizes its own supply source separate from the City. Recent improvements to the university's supply wells and effective water conservation efforts have increased supply surpluses to meet the university's demands. This surplus should not be considered as excess supply available to the City because the two utilities are interconnected only for emergency purposes. For College Station as a WUG, the supply from Texas A&M University wells was set equal to the university's projected demands (supplied by Texas A&M), in order to more accurately define needs for College Station.

4A.2 Water Needs Projections for Water User Groups

If projected demands exceed projected supplies for a water user group, the difference or shortage, is identified as a water need for that water user group. This section contains a summary of the water needs (shortages) for each Water User Group (WUG) located in the Brazos G Area. Tables in Appendix C provide a detailed analysis of water needs for each water user group by county as well as a summary for the region as a whole. The following sections summarize the data presented in Appendix C.

4A.2.1 Projected Municipal Shortages

Water shortages are projected for 92 municipal WUGs, which are listed in Table 4A-1, along with the projected year 2030 and 2060 shortages, and the approximate decade that shortages are expected to begin. Thirty of the 37 counties in the Brazos G Area are projected to have at least one municipal WUG shortage. The County-Other category includes water supply corporations, water districts, privately owned utilities, and small towns that generally supplied less than 280 acft of water in the year 2000. The County-Other category is projected to be water short in 15 counties: Bosque, Coryell, Eastland, Falls, Hood, Johnson, Kent, Knox, Lampasas, McLennan, Nolan, Palo Pinto, Somervell, Stephens, and Williamson.

4A.2.2 Projected Manufacturing Shortages

Table 4A-2 lists the counties projected to have shortages in the Manufacturing Use category, projected year 2030 and 2060 shortages, and the approximate decade shortages are projected to begin. Eighteen of the 37 counties in the Brazos G area are projected to have manufacturing shortages, with the largest shortages occurring in Johnson, Williamson, Bell, and Bosque Counties.

4A.2.3 Projected Steam-Electric Shortages

Table 4A-3 lists the nine counties projected to have shortages in the Steam-Electric Use category, projected year 2030 and 2060 shortages, and the approximate decade shortages are projected begin.

Table 4A-1.
Municipal WUGs with Projected Water Shortages

County	Shortages Begin	Projected Shortages (acft/yr) Year 2030	Projected Shortages (acft/yr) Year 2060
Bell County			
Bartlett (P)	2010	(85)	(99)
Bell-Milam-Falls (P)	2020	(39)	(76)
Dog Ridge WSC	2010	(205)	(311)
Elm Creek WSC (P)	2010	(181)	(206)
Jarrell-Schwertner WSC (P)	2060	0	(1)
Killeen	2050	0	(2,157)
Little River Academy	2010	(20)	(29)
Morgans Point Resort	2010	(202)	(255)
Bosque County			
Childress Creek WSC	2010	(193)	(206)
Cross Country WSC (P)	2010	(29)	(32)
Meridian	2010	(68)	(69)
Valley Mills	2010	(103)	(102)
Walnut Springs	2010	(60)	(59)
County-Other	2010	(842)	(919)
Brazos County			
Bryan	2050	0	(1,341)
College Station	2020	(5,603)	(11,166)
Wickson Creek SUD (P)	2020	(474)	(1,074)
Burleson County			
Southwest Milam WSC (P)	2010	(21)	(34)
Callahan County			
Coleman County WSC (P)	2010	(44)	(26)
Potosi WSC (P)	2010	(1)	(0)
Comanche County			
None			
Coryell County			
Elm Creek WSC (P)	2010	(69)	(96)
Gatesville	2040	0	(1,232)
County-Other	2010	(2,103)	(2,776)
Eastland County			
Rising Star	2010	(10)	0
County-Other	2010	(205)	(99)
Erath County			
None			

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Table 4A-1 (continued)

County	Shortages Begin	Projected Shortages (acft/yr)	
		Year 2030	Year 2060
Falls County			
Bell-Milam-Falls WSC (P)	2010	(115)	(241)
Elm Creek WSC (P)	2010	(7)	(11)
West Brazos WSC (P)	2010	(250)	(351)
County-Other	2010	(111)	0
Fisher County			
Rotan[1]	2010	(1)	(33)
Grimes County			
Wickson Creek SUD (P)	2010	(665)	(1,017)
Hamilton County			
None			
Haskell County			
Haskell	2010	(383)	(472)
Rule	2010	0	0
Hill County			
Brandon-Irene WSC	2050	0	(92)
Hillsboro	2060	0	(20)
Parker WSC (P)	2010	(46)	(58)
White Bluff Community WS	2010	(341)	(663)
Woodrow-Osceola WSC	2010	(120)	(154)
Hood County			
Oak Trail Shores Sub.	2010	(114)	(101)
County-Other	2010	(1,195)	(3,543)
Johnson County			
Alvarado	2010	(473)	(647)
Bethany WSC	2010	(344)	(515)
Bethesda WSC	2010	(3,722)	(6,703)
Burleson	2010	(1,910)	(3,996)
Cleburne	2050	0	(2,853)
Godley	2010	(224)	(403)
Grand View	2060	0	(1)
Johnson County FWSD #1	2040	0	(609)
Johnson County Rural WSC	2030	(2,482)	(13,259)
Joshua	2010	(782)	(1,163)
Mountain Peak WSC	2010	(421)	(888)
Parker WSC (P)	2010	(354)	(617)
Rio Vista	2010	(69)	(106)
County-Other	2010	(2,516)	(2,977)

[1]These apparent needs are negated with a Water Management Strategy in Region F involving subordination of downstream senior water rights in the Colorado River Basin. No strategy is, therefore, identified in the Fisher County plan for Rotan (Section 4C.11), but it is identified in the TWDB DB07 database.

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Table 4A-1 (continued)

County	Shortages Begin	Projected Shortages (acft/yr)	
		Year 2030	Year 2060
Jones County			
Abilene (P)	2010	(589)	(507)
Kent County			
County-Other	2010	(16)	(3)
Knox County			
Knox City	2010	(153)	(216)
Munday	2010	(185)	(250)
County-Other	2010	(26)	(22)
Lampasas County			
County-Other	2010	(703)	(845)
Lee County			
Aqua WSC (P)	2020	(83)	(176)
Giddings	2030	(91)	(354)
Lee County WSC	2010	(515)	(726)
Southwest Milam WSC (P)	2020	(10)	(23)
Limestone County			
Groesbeck	2060	0	(87)
McLennan County			
Chalk Bluff WSC	2010	(550)	(749)
Crawford	2010	(60)	(65)
Cross County WSC (P)	2010	(492)	(612)
Elm Creek WSC (P)	2010	(222)	(318)
Gholson	2010	(175)	(222)
Hallsburg	2010	(148)	(172)
Mart	2010	(342)	(390)
North Bosque WSC	2010	(479)	(679)
Riesel	2010	(112)	(129)
West	2010	(411)	(442)
West Brazos WSC (P)	2010	(180)	(229)
Western Hills WS	2010	(489)	(663)
County-Other	2010	(6,067)	(6,786)
Milam County			
Bell-Milam-Falls WSC (P)	2010	(74)	(105)
Southwest Milam WSC (P)	2040	0	(77)
Nolan County			
Roscoe	2010	(42)	(17)
Sweetwater	2010	(2,026)	(1,693)
County-Other	2010	(27)	(4)
Palo Pinto County			
Strawn	2020	(7)	(23)
County-Other	2010	(203)	(637)
Robertson County			
Wickson Creek SUD (P)	2010	(21)	(25)

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Table 4A-1 (concluded)

County	Shortages Begin	Projected Shortages (acft/yr)	
		Year 2030	Year 2060
Shackelford County			
None			
Somervell County			
County-Other	2010	(231)	(260)
Stephens County			
County-Other	2010	(216)	(193)
Stonewall County			
Aspermont	2010	0	0
Taylor County			
Abilene (P)	2010	(13,482)	(12,466)
Coleman County WSC (P)	2010	(20)	(18)
Merkel	2010	(85)	(52)
Potosi WSC (P)	2010	(119)	(84)
Tye	2010	(43)	(29)
Throckmorton County			
None			
Washington County			
None			
Williamson County			
Aqua WSC (P)	2010	(30)	(88)
Bartlett (P)	2010	(61)	(90)
Bell-Milam-Falls WSC (P)	2010	(33)	(92)
Cedar Park	2030	(6,650)	(26,819)
Chisholm Trail SUD	2030	(1,021)	(7,927)
Florence	2020	(63)	(232)
Georgetown	2060	0	(3,429)
Hutto	2010	(407)	(780)
Jarrell-Schwertner WSC (P)	2020	(374)	(1,415)
Jonah Water SUD	2040	0	(1,531)
Leander	2060	0	(232)
Liberty Hill	2010	(788)	(1,722)
Round Rock	2020	(10,566)	(42,548)
Southwest Milam WSC (P)	2010	(161)	(418)
Thrall	2010	(144)	(239)
Weir	2010	(277)	(557)
County-Other	2040	0	(3,125)
Young County			
None			
Number of utility-specific WUGs on list: 74	Number of County-Others: 15		Total: 89
(P) Indicates WUG is in multiple counties.			

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Table 4A-2.
Counties with Projected Water Shortages
for Manufacturing Use

County	***Shortages Begin***	***Projected Shortages (acft/yr)***	
		Year 2030	***Year 2060***
Bell County	2010	(1,163)	(1,446)
Bosque County	2010	(921)	(1,300)
Brazos County	2020	(96)	(232)
Burleson County	2040	0	(98)
Erath County	2020	(16)	(40)
Fisher County	2010	(155)	(236)
Grimes County	2010	(80)	(189)
Hill County	2020	(21)	(53)
Hood County	2010	(8)	(15)
Johnson County	2010	(2,546)	(3,639)
Lampasas County	2010	(135)	(169)
Limestone County	2010	(44)	(69)
McLennan County	2010	(1,089)	(1,508)
Nolan County	2040	0	(239)
Robertson County	2020	(31)	(77)
Somervell County	2010	(4)	(7)
Washington County	2020	(70)	(199)
Williamson County	2010	(1,583)	(2,328)

Table 4A-3.
Counties with Projected Water Shortages for Steam-Electric Use

County	Shortages Begin	Projected Shortages (acft/yr)	
		Year 2030	Year 2060
Bosque County	2010	(3,497)	(8,223)
Grimes County	2030	(727)	(9,715)
Johnson County	2010	(1,200)	(1,200)
Limestone County	2040	0	(15,814)
McLennan	2010	(21,628)	(34,016)
Milam County	2010	(4,700)	(8,200)
Nolan County	2010	(1,377)	(2,817)
Palo Pinto County	2040	0	(1,658)
Robertson County	2040	0	(8,284)

4A.2.4 Projected Mining Shortages

Table 4A-4 lists the 10 counties projected to have shortages in the Mining Use category, projected year 2030 and 2060 shortages, and the approximate decade shortages are projected to begin. Significant shortages are projected for Stephens and Williamson Counties. Mining water use in Williamson County is primarily associated with dewatering for quarry operations.

4A.2.5 Projected Irrigation Shortages

Table 4A-5 lists the seven counties projected to have shortages in the Irrigation Use category, projected year 2030 and 2060 shortages, and the approximate decade shortages are projected to begin.

4A.2.6 Projected Livestock Shortages

There are no livestock shortages. As explained in Section 3, livestock demands were assumed to be met from stock tanks and locally-occurring groundwater

Table 4A-4.
Counties with Projected Water Shortages for Mining Use

County	Shortages Begin	Projected Shortages (acft/yr)	
		Year 2030	Year 2060
Haskell County	2010	(52)	(47)
Hood County	2010	(25)	(24)
Johnson County	2010	(285)	(315)
Knox County	2010	(3)	(3)
Lampasas County	2010	(24)	(23)
Nolan County	2010	(199)	(197)
Somervell County	2010	(94)	(85)
Stephens County	2010	(5,884)	(6,662)
Taylor County	2010	(5)	(4)
Williamson County	2010	(1,576)	(1,882)

Table 4A-5.
Counties with Projected Water Shortages for Irrigation Use

County	Shortages Begin	Projected Shortages (acft/yr)	
		Year 2030	Year 2060
Burleson County	2010	(3,993)	(2,991)
Eastland County	2010	(9,224)	(9,257)
Haskell County	2010	(25,936)	(21,950)
Knox County	2010	(13,317)	(10,460)
Nolan County	2010	(2,914)	(2,566)
Shackelford County	2010	(99)	(81)
Throckmorton County	2010	(3,988)	(3,988)

4A.3 Water Needs for Wholesale Water Providers

The TWDB's definition of a Wholesale Water Provider (WWP) is:

"A WWP is any person or entity, including river authorities and irrigation districts, that has contracts to sell more than 1,000 acft of water wholesale in any one year during the five years immediately preceding the adoption of the last Regional Water Plan. The Planning Groups shall include as wholesale water providers other persons and entities that enter or that the Planning Group expects or recommends to enter contracts to sell more than 1,000 acft of wholesale water during the period covered by the plan."

Under this definition, the list of WWPs for the Brazos G Region is as follows:

- Brazos River Authority
- Aquilla Water Supply District
- Bell County WCID No. 1
- Bluebonnet WSC
- Central Texas WSC
- Upper Leon Municipal Water District
- Eastland County Water Supply District
- Palo Pinto County Municipal Water District
- West Central Texas Municipal Water District
- North Central Texas Municipal Water District
- City of Abilene
- City of Cedar Park
- City of Round Rock
- City of Sweetwater
- City of Waco

In addition, to these WWPs, there are other WWPs that provide water to the Brazos G Region. These include the Lower Colorado River Authority (Region K), Colorado Municipal Water District (Region F), and the Trinity River Authority (Region C). Water supply plans will be developed for these entities by the regional water planning groups in the planning regions in which they are primarily located.

4A.3.1 Wholesale Water Provider Summary Tables

Summaries for each WWP, including a brief description, contracts for water sales, and supplies are provided in Tables 4A-6 through 4A-20. Projected demands are total contracts or projected demands of customer entities, whichever is greater, plus demands to be met from water management strategies recommended for that WWP.

Table 4A-6.
Wholesale Water Provider Summary
Brazos River Authority

Name: Brazos River Authority

Description: The largest provider of water in the Brazos G Region is the Brazos River Authority (BRA). The BRA also operates water and wastewater treatment systems, has programs to assess and protect water quality, does water supply planning and supports water conservation efforts in the Brazos River Basin. BRA provides water from three wholly owned and operated reservoirs in the region: Lake Granbury, Possum Kingdom Lake, and Lake Limestone. BRA also contracts for conservation storage space in the nine U.S. Army Corps of Engineers reservoirs in the region: Lakes Waco, Proctor, Belton, Stillhouse Hollow, Georgetown, Granger, Somerville, Whitney, and Aquilla. The total permitted capacity of these twelve reservoirs in the BRA system is approximately 2.3 million acft. BRA holds rights for diversion in the region totaling more than 660,000 acft, and contracts to supply water to municipal, industrial and agricultural water customers in the BGRWPA and other regions. BRA's largest municipal customers in 2000 included Bell County Water Control and Improvement District No. 1, the City of Round Rock, and the Central Texas Water Supply Corporation. For planning purposes, the overall BRA system has been divided into three separate systems: the Lake Aquilla system consisting of Lake Aquilla and its associated contracts; the Little River System consisting of Lake Proctor, Lake Belton, Stillhouse Hollow Reservoir, Lake Georgetown, and Lake Granger; and the Main Stem/Lower Basin System consisting of Possum Kingdom Reservoir, Lake Granbury, Lake Whitney, Lake Somerville, and Lake Limestone. The demands shown below include the projected demands for water from the proposed BRA System Operation appropriation.

Projected Demands:

Major Long-Term Water Contracts/ Future Sales *(as of June 2005)*	***Year (acft/yr)***					
	2010	***2020***	***2030***	***2040***	***2050***	***2060***
Lake Aquilla System[1, 2]	11,403	11,403	11,403	11,403	11,403	11,403
Little River System[2]	212,323	212,323	212,323	212,573	239,923	243,389
Main Stem/Lower Basin System (Brazos G)[2]	470,058	477,447	478,959	514,682	516,845	523,520
Main Stem/Lower Basin System (Region H)[3]	301,258	301,258	326,481	326,481	369,806	375,406
Projected Total Demand	995,042	1,002,431	1,029,166	1,065,139	1,137,977	1,153,718

1 Demands for Lake Aquilla System in excess of current contracts are assumed to be met from Main Stem/Lower Basin System.

2 Demands include 460,586 acft/yr of current contracts (combined 3 systems) in Brazos G, 2,761 acft/yr of current contracts in Region O and Region C, and future demands to be met by the BRA in Brazos G and Region C. Future demands will be met from uncontracted BRA supply, BRA System Operations, and Lake Granger Augmentation. See Section 4C for details concerning individual WUG and WWP plans. Demands do not include BRA/LCRA Alliance supply. See Table 4A-21 for summary of supplies assumed available to Region C and Region O.

3 Demands include 138,913 acft/yr of current contracts and future demands to be met by the BRA in Region H. Future demands in Region H are to be met from uncontracted BRA supply, BRA System Operations, Allens Creek Reservoir, Little River Off-Channel Reservoir, and Freeport Desalination. See Table 4A-21 for summary of supplies assumed available to Region H.

Supplies (reservoir firm yield):

Source	***Year (acft/yr)***					
	2010	***2020***	***2030***	***2040***	***2050***	***2060***
Lake Aquilla System	12,437	10,978	9,519	8,060	6,601	5,142
Little River System	211,856	209,425	206,994	204,561	202,130	199,699
Main Stem/Lower Basin System	414,491	412,465	410,439	408,412	406,386	404,360
Total Supply	638,784	632,868	626,952	621,033	615,117	609,201

Projected Balances:

	Year (acft/yr)					
	2010	***2020***	***2030***	***2040***	***2050***	***2060***
Lake Aquilla System	1,034	(425)	(1,884)	(3,343)	(4,802)	(6,261)
Little River System	(467)	(2,898)	(5,329)	(8,012)	(37,793)	(43,690)
Main Stem/Lower Basin System	(356,825)	(366,240)	(395,001)	(432,751)	(480,265)	(494,566)
Total Balance/(Shortage)[1]	(356,258)	(369,563)	(402,214)	(444,106)	(522,860)	(544,517)

Table 4A-7. Wholesale Water Provider Summary Aquilla Water Supply District

Name: **Aquilla Water Supply District**

Description: Aquilla Water Supply District is located in Hill County, and obtains raw water from Lake Aquilla through a contract with the BRA. The district supplies treated water to six wholesale customers. The City of Hillsboro is the district's largest customer, and purchased 3,889 acft in 2000. Total sales for Aquilla Water Supply District in 2000 were 4,844 acft.

Projected Demands:

	Year (acft/yr)					
Major Water Contract Holders	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Brandon-Irene WSC	280	280	280	280	280	280
Chatt WSC	84	84	84	84	84	84
Files Valley WSC	1,008	1,008	1,008	1,008	1,008	1,008
Hill Country WSC	336	336	336	336	336	336
Hillsboro	4,200	4,200	4,200	4,200	4,200	4,200
Menlow WSC	45	45	45	45	45	45
Total Demand	5,953	5,953	5,953	5,953	5,953	5,953

Supply:

	Year (acft/yr)					
Source	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Lake Aquilla (BRA Contract)	5,433	4,912	4,392	3,871	3,351	2,830

Projected Balance:

	Year (acft/yr)					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Balance/(Shortage)	(520)	(1,041)	(1,561)	(2,082)	(2,602)	(3,123)

Table 4A-8.
Wholesale Water Provider Summary
Bell County WCID No. 1

Name: **Bell County Water Control and Improvement District No.1**

Description: Bell County Water Control and Improvement District (WCID) No. 1 obtains and treats water for its customers from Lake Belton through a contract with the Brazos River Authority for 49,509 acft/yr. Bell County WCID No. 1 also diverts and treats water for Fort Hood using the Department of the Army's water right in Lake Belton, which, for planning purposes, is not listed as a supply for Bell County WCID No. 1.

Projected Demands:

Major Water Contract Holders	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
City of Belton	4,966	4,966	4,966	4,966	4,966	4,966
City of Copperas Cove	7,824	7,824	7,824	7,824	7,824	7,824
City of Harker Heights	5,265	5,265	5,265	5,265	5,265	5,265
City of Killeen	29,964	29,964	29,964	29,964	30,064	32,464
City of Nolanville (Bell Co. WCID No. 3)	740	740	740	740	740	740
439 Water Supply Corp	750	750	750	750	750	750
Total Demand	49,509	49,509	49,509	49,509	49,609	52,009

Supply:

Source	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Lake Belton (BRA Contract)	49,417	49,325	49,234	49,142	49,050	48,958

Projected Balance:

	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Balance/(Shortage)	(92)	(184)	(275)	(367)	(559)	(3,051)

Table 4A-9. Wholesale Water Provider Summary Bluebonnet Water Supply Corporation

Name: **Bluebonnet Water Supply Corporation**

Description: The Bluebonnet Water Supply Corporation (WSC) is located in Bell County. The WSC obtains raw water from Lake Belton, and sells treated water to nine entities in the BGRWPA. The largest customer is the City of McGregor, which purchased 943 acft in 2000. Wholesale sales in year 2000 totaled 2,848 acft.

Projected Demands:

	Year (acft/yr)					
Major Water Contract Holders	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
City of Bruceville-Eddy	827	964	1,081	1,200	1,275	1,389
Elm Creek WSC	480	580	580	680	680	780
City of McGregor	933	923	913	902	894	899
Moffat WSC	402	430	457	468	477	488
City of Moody	202	203	203	204	206	212
Pendleton WSC	250	265	273	278	282	287
Spring Valley WSC	250	298	331	336	331	331
Total Demand	3,344	3,663	3,838	4,068	4,145	4,386

Supply:

	Year (acft/yr)					
Source	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
Lake Belton (BRA Contract)	8,286	8,270	8,255	8,240	8,224	8,209

Projected Balance:

	Year (acft/yr)					
	2010	***2020***	***2030***	***2040***	***2050***	***2060***
Balance/(Shortage)	4,942	4,607	4,417	4,172	4,079	3,823

Table 4A-10.
Wholesale Water Provider Summary
Central Texas Water Supply Corporation

Name: **Central Texas Water Supply Corporation**

Description: The Central Texas Water Supply Corporation (WSC) provides water to a number of water supply corporations and cities in Bell, Williamson, and Lampasas Counties. The Central Texas WSC obtains water under contract with the Brazos River Authority from Lake Stillhouse Hollow.

Projected Demands:

Major Water Contract Holders	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Armstrong WSC	92	92	92	92	92	92
City of Bartlett	180	180	180	180	180	180
Bell County WCID No. 5	37	37	37	37	37	37
Bell-Milam-Falls WSC	546	646	746	846	946	1,046
Coryell County-Other	200	600	1,000	1,200	1,400	1,600
Dog Ridge WSC	771	871	971	971	971	1,071
East Bell County WSC	341	341	341	341	341	341
City of Holland	258	258	258	258	258	258
Kempner WSC	3,500	5,500	5,500	5,500	5,500	5,500
Little Elm Valley WSC	147	147	147	147	147	147
City of Lott	184	184	184	184	184	184
City of Rodgers	368	368	368	368	368	368
City of Rosebud	500	500	500	500	500	500
Salado WSC	0	100	250	300	350	400
Town of Buckholts-Water Dept.	174	174	174	174	174	174
Town of Oenaville and Belfalls	57	57	57	57	57	57
West Bell County WSC	921	921	921	921	921	921
Westphalia WSC	45	45	45	45	45	45
Total Demand	10,321	11,021	11,771	12,121	12,471	12,921

Supply:

Source	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Lake Stillhouse Hollow (BRA Contract)	12,772	12,748	12,725	12,702	12,678	12,655

Projected Balance:

	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Balance/(Shortage)	2,451	1,727	954	581	207	(266)

Table 4A-11.
Wholesale Water Provider Summary
Upper Leon Municipal Water District

Name: **Upper Leon Municipal Water District**

Description: The Upper Leon Municipal Water District obtains water from Lake Proctor through contracts with the BRA. The MWD provides treated water to the Cities of Comanche, De Leon, Dublin, Gorman, and Hamilton. The MWD also has a contract to sell water to Stephenville, but the infrastructure is not complete. Total 2000 sales were 2,445 acft.

Projected Demands:

	Year (acft/yr)					
Major Water Contract Holders	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
City of Comanche	634	632	622	605	587	568
City of De Leon	280	280	274	265	256	248
City of Dublin	485	516	544	576	682	753
City of Gorman	137	134	127	120	113	108
City of Hamilton	2,000	2,000	2,000	2,000	2,000	2,000
City of Stephenville	1,862	1,862	1,862	1,862	1,862	1,862
Total Demand	5,398	5,424	5,429	5,428	5,500	5,539

Supply:

	Year (acft/yr)					
Source	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Lake Proctor (BRA Contract)	6,427	6,415	6,404	6,392	6,380	6,368

Projected Balance:

	Year (acft/yr)					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Balance/(Shortage)	1,029	991	975	964	880	829

Table 4A-12.
Wholesale Water Provider Summary
Eastland County Water Supply District

Name: **Eastland County Water Supply District**

Description: The Eastland County Water Supply District owns and operates Lake Leon and has a water right to divert 5,800 acft for municipal and industrial purposes and 500 acft for irrigation. The district currently provides treated water to entities in Eastland County through the Cities of Eastland and Ranger. Total water sales in 2000 were 1,762 acft.

Projected Demands:

	Year (acft/yr)					
Major Water Contract Holders	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
City of Eastland	1,791	1,791	1,791	1,791	1,791	1,791
City of Carbon	73	73	73	73	73	73
Eastland County-Other	300	300	300	300	300	300
Westbound WSC	47	47	47	47	47	47
City of Ranger	710	710	710	710	710	710
Total Demand	2,291	2,291	2,291	2,291	2,291	2,291

Supplies:

	Year (acft/yr)					
Source	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
Run-of-the-River Right	450	450	450	450	450	450
Lake Leon	5,451	5,451	5,451	5,451	5,451	5,451
Total Supply	5,901	5,901	5,901	5,901	5,901	5,901

Projected Balance:

	Year (acft/yr)					
	2010	***2020***	***2030***	***2040***	***2050***	***2060***
Balance/(Shortage)	2,980	2,980	2,980	2,980	2,980	2,980

Table 4A-13.
Wholesale Water Provider Summary
Palo Pinto County Municipal Water District

Name: **Palo Pinto County Municipal Water District**

Description: Palo Pinto Municipal Water District owns and operates Lake Palo Pinto, which is used to supply water to entities in Palo Pinto and Parker Counties. The district has rights to 18,500 acft a year for municipal and steam electric power uses. Treated water is supplied to the City of Mineral Wells (and its customers) and Lake Palo Pinto Water Association. Wholesale municipal sales totaled 4,616 acft in 2000 and steam electric power sales were 1,378 acft.

Projected Demands:

Major Water Contract Holders	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
City of Mineral Wells[1]	3,653	3,802	3,928	4,008	4,151	4,337
City of Graford	92	92	92	92	92	92
Palo Pinto County Steam-Electric	2,024	2,024	2,024	2,024	2,024	2,024
Palo Pinto County-Other	994	994	994	994	994	994
Parker County-Other (Region C)	759	759	759	759	759	759
Parker County Manufacturing (Region C)	275	275	275	275	275	275
Total Demand	7,797	7,946	8,072	8,152	8,295	8,481

[1] Includes supply to portion of Mineral Wells located in Region C.

Supply:

Source	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Lake Palo Pinto	8,193	7,887	7,580	7,273	6,967	6,660

Projected Balance:

	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Balance/(Shortage)	396	(59)	(492)	(879)	(1,328)	(1,821)

Table 4A-14.
Wholesale Water Provider Summary
West Central Texas Municipal Water District

Name: **West Central Texas Municipal Water District**

Description: The West Central Texas Municipal Water District (MWD) holds water rights in Hubbard Creek Reservoir that authorize it to divert up to 56,000 acft of water per year from the reservoir for municipal, industrial, irrigation, mining, domestic, and livestock use. The District provides raw water to its member cities of Abilene, Albany, Anson, and Breckenridge. The District holds a long-term contract with the Colorado River Municipal Water District (CRMWD) for 16 percent of the yield in O.H. Ivie Reservoir (~15,000 acft) and a supporting contract with the City of Abilene to provide this water to the city.

Projected Demands:

	Year (acft/yr)					
Major Water Contract Holders	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
City of Abilene	20,361	20,361	20,361	20,361	20,361	20,361
City of Albany	2,197	2,197	2,197	2,197	2,197	2,197
City of Anson	2,409	2,409	2,409	2,409	2,409	2,409
City of Breckenridge	2,881	2,881	2,881	2,881	2,881	2,881
Total Demand	27,848	27,848	27,848	27,848	27,848	27,848

Supply:

	Year (acft/yr)					
Source	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Hubbard Creek Reservoir	17,325	17,210	17,095	16,980	16,865	16,750

Projected Balance:

	Year (acft/yr)					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Balance/(Shortage)	(10,523)	(10,638)	(10,753)	(10,868)	(10,983)	(11,098)

Table 4A-15.
Wholesale Water Provider Summary
North Central Texas Municipal Water District

Name: **North Central Texas Municipal Water District**

Description: North Central Texas Municipal Water District supplies treated water to entities in Knox, Haskell and Stonewall Counties. The district has water rights to divert 5,000 acft from Millers Creek Reservoir for municipal, industrial, and mining purposes. Wholesale water sales totaled 1,410 acft in 2000.

Projected Demands:

	Year (acft/yr)					
Major Water Contract Holders	2010	2020	2030	2040	2050	2060
City of Aspermont	93	93	93	93	93	93
City of Benjamin	8	8	8	8	8	8
City of Goree	63	63	63	63	63	63
City of Haskell	504	504	504	504	504	504
City of Knox City	267	267	267	267	267	267
City of Munday	281	281	281	281	281	281
City of O'Brian	6	6	6	6	6	6
City of Rochester	13	13	13	13	13	13
City of Rule	30	30	30	30	30	30
Paint Creek WSC	54	54	54	54	54	54
Total Demand	1,319	1,319	1,319	1,319	1,319	1,319

Supply:

	Year (acft/yr)					
Source	2010	2020	2030	2040	2050	2060
Millers Creek Reservoir	583	467	350	233	117	0

Projected Balance:

	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Balance/(Shortage)	(739)	(852)	(969)	(1,086)	(1,202)	(1,319)

Table 4A-16.
Wholesale Water Provider Summary
City of Abilene

Name/Location: **City of Abilene**

Description: The City of Abilene relies on Lakes Fort Phantom Hill, Kirby, and Abilene and water from West Central Texas MWD to meet its needs. The City also has a contract with West Central Texas MWD for ~15,000 acft from O.H Ivie Reservoir, owned by the Colorado River Municipal Water District. The City provides treated water to several entities in the area.

Projected Demands:

Major Water Contract Holders	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
City of Abilene	22,891	23,485	23,507	23,181	22,588	21,879
Blair WSC	107	107	107	107	107	107
City of Baird	138	138	138	138	138	138
City of Clyde	307	307	307	307	307	307
City of Hamlin	307	307	307	307	307	307
City of Merkel	384	384	384	384	384	384
City of Stamford	537	537	537	537	537	537
City of Tye	138	138	138	138	138	138
Eula WSC	61	61	61	61	61	61
Hamby WSC	307	307	307	307	307	307
Hawley WSC	307	307	307	307	307	307
Potosi WSC	307	307	307	307	307	307
Steamboat Mountain WSC	460	460	460	460	460	460
Sun WSC	307	307	307	307	307	307
View Caps WSC	368	368	368	368	368	368
Taylor County Manufacturing	972	1,081	1,177	1,270	1,349	1,462
Total Demand	27,898	28,601	28,719	28,486	27,972	27,376

Supplies:

Source	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Lake Abilene[1]	0	0	0	0	0	0
Fort Phantom Hill	4,848	4,767	4,685	4,603	4,522	4,440
Lake Kirby[2]	0	0	0	0	0	0
Lake O.H. Ivie (Colorado River MWD)[3]	6,720	6,720	6,720	6,720	6,720	6,720
West Central Texas MWD	3,243	3,243	3,243	3,243	3,243	3,243
Total Supply	14,811	14,730	14,648	14,566	14,485	14,403

[1] Lake Abilene is not considered a dependable supply by the City and is currently not used. The reservoir went dry during the recent and ongoing drought with zero demand on the reservoir.

[2] Lake Kirby is used primarily to store reuse water for the City's reuse customers. Reuse demands are not included in the water demand projections for the City.

[3] Current treatment capacity (desalination) is approximately 6 MGD (6,720 acft/yr).

Projected Balance:

	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Balance/(Shortage)	(13,087)	(13,871)	(14,071)	(13,920)	(13,487)	(12,973)

Table 4A-17.
Wholesale Water Provider Summary
City of Cedar Park

Name: **City of Cedar Park**

Description: The City of Cedar Park is located in Williamson County and provides wholesale water to entities in Williamson and Travis Counties. In 2000, the City purchased all of its raw water from the LCRA Highland Lakes System (Region K). The City sold 2,378 acft to its wholesale customers and provided 6,000 acft of water to retail customers. The City's largest wholesale customer in 2000 was the City of Leander.

Projected Demands:

	Year (acft/yr)					
Major Water Contract Holders	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
City of Cedar Park	10,744	14,886	20,708	25,883	31,068	37,892
Indian Springs Subdivision.	9	9	9	9	9	9
Williamson County MUD #3	722	722	722	722	722	722
Williamson-Travis Co. MUD #1	770	1,085	1,462	1,865	2,320	2,807
Blockhouse MUD	903	1,288	1,749	2,242	2,796	3,389
Total Demand	13,148	17,990	24,650	30,721	36,915	44,819

Supply:

	Year (acft/yr)					
Source	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Highland Lakes System (LCRA)	18,000	18,000	18,000	18,000	18,000	18,000

Projected Balance:

	Year (acft/yr)					
	2010	*2020*	*2030*	*2040*	*2050*	*2060*
Balance/(Shortage)	4,852	10	(6,650)	(12,721)	(18,915)	(26,819)

Table 4A-18.
Wholesale Water Provider Summary
City of Round Rock

Name: **City of Round Rock**

Description: The City of Round Rock obtains raw water from the Edwards-BFZ (Northern Segment) Aquifer and purchases additional water from BRA through Lake Georgetown. The City sells wholesale water to local providers in Williamson County. Its largest customer, Brushy Creek MUD, bought 1,999 acft in 2000. In addition to the 3,090 acft of wholesale water sales in 2000, the City provided approximately 14,000 acft of treated water to retail and manufacturing customers. The City of Round Rock has contracted to purchase 18,134 acft/yr from the BRA at Stillhouse Hollow Reservoir in Bell County. The pipeline that delivers this water to Lake Georgetown was completed in late 2004.

Projected Demands:

	Year (acft/yr)					
Major Water Contract Holders	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
City of Round Rock	19,239	25,937	33,896	42,617	52,298	62,680
Fern Bluff MUD	1,339	2,049	2,882	3,805	4,810	5,888
Williamson County MUD #9	230	257	269	278	282	288
Total Demand	20,808	28,243	37,047	46,700	57,390	68,856

Supplies:

	Year (acft/yr)					
Source	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Stillhouse Hollow Reservoir (BRA Contract)	18,101	18,067	18,034	18,000	17,967	17,933
Lake Georgetown (BRA Contract)	6,708	6,695	6,683	6,671	6,658	6,646
Edwards-BFZ (Northern Segment) Aquifer	1,799	1,778	1,765	1,751	1,738	1,729
Total Supply	26,607	26,540	26,482	26,422	26,363	26,308

Projected Balance:

	Year (acft/yr)					
	2010	*2020*	*2030*	*2040*	*2050*	*2060*
Balance/(Shortage)	5,799	(1,703)	(10,565)	(20,278)	(31,027)	(42,548)

Table 4A-19.
Wholesale Water Provider Summary
City of Sweetwater

Name: **City of Sweetwater**

Description: The City of Sweetwater owns and operates two reservoirs in the BGRWPA, Lake Sweetwater and Lake Trammel, and a groundwater well field in the Dockum Aquifer. The City also owns and operates the Oak Creek Reservoir in Coke County (Region F) in the Colorado River Basin. The City of Sweetwater provides wholesale water to entities in Nolan and Fisher Counties, and the City of Bronte in Region F. The City also has a contract with American Electric Power (AEP) for cooling water from Oak Creek Reservoir. In 2000, Sweetwater sold approximately 750 acft of wholesale water to its municipal customers and 370 acft for steam electric power. At this time, the AEP power plant on Oak Creek Reservoir is not operating due to the low lake levels from the on-going drought in the region.

Projected Demands:

Major Water Contract Holders	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
City of Sweetwater	3,013	3,072	3,081	3,029	2,900	2,763
Bitter Creek WSC	460	460	460	460	460	460
City of Blackwell	168	168	168	168	168	168
City of Bronte	504	504	504	504	504	504
City of Roby	350	350	350	350	350	350
City of Trent	187	187	187	187	187	187
Fort Chadborne Ranch	135	135	135	135	135	135
Nolan County Manufacturing	550	550	550	550	550	550
Fisher County Manufacturing	92	125	155	184	210	236
American Electric Power (AEP)	800	800	800	800	800	800
Total Demand	6,259	6,351	6,390	6,367	6,264	6,153

Supplies:

Source	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Run-of-the-River Right	717	717	717	717	717	717
Lake Sweetwater	1,026	1,017	1,008	998	989	980
Dockum Aquifer	1,044	1,049	1,054	1,060	1,065	1,070
Total Supply	2,787	2,783	2,779	2,775	2,771	2,767

Projected Balance:

	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Balance/(Shortage)	(3,472)	(3,568)	(3,611)	(3,592)	(3,493)	(3,386)

Table 4A-20.
Wholesale Water Provider Summary
City of Waco

Name: **City of Waco**

Description: In year 2000 the City of Waco obtained raw water from Lake Waco, a small amount of groundwater from the Trinity Aquifer (not considered here) and purchased water from Bluebonnet WSC (not considered here). In 2003, the City, in cooperation with the BRA and the U.S. Army Corps of Engineers, implemented a project to raise the water level in Lake Waco to provide for additional supply. With this additional supply, the City has the right to divert 78,970 acft/yr for municipal and industrial purposes, and 900 acft/yr for irrigation uses. In 2000, the City provided 1,278 acft of treated wholesale water to the City of Hewitt, City of Woodway, and Bosqueville Green Acres WSC. Total water used by Waco in 2000 was over 30,000 acft, including wholesale sales. Irrigation supply from the City's rights is included in McLennan County Irrigation. Projected demands include current contracts and expected revised/new contract amounts, as provided by the City of Waco.

Projected Demands:

Current and Projected Contract Holders	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
City of Waco	24,876	26,453	27,781	29,159	30,033	31,304
City of Bellmead	2,622	2,751	2,873	2,984	3,065	3,202
City of Northcrest	202	191	183	180	179	178
City of Hewitt	1,467	3,294	6,106	6,198	6,293	6,389
City of Lacy-Lakeview	993	1,117	2,070	2,101	2,134	2,166
City of Woodway	2,944	2,925	2,903	2,882	2,867	2,874
City of Beverly Hills	414	416	416	414	416	424
West Brazos WSC	400	400	450	500	550	600
Chalk Bluff WSC	1,160	1,766	2,846	2,881	2,918	2,955
City of Crawford	65	65	65	65	65	70
Cross County WSC	450	500	550	600	650	700
City of Gholson	956	1,462	2,539	2,574	2,611	2,647
City of Hallsburg	150	150	150	160	170	180
City of Mart	350	350	350	400	400	400
North Bosque WSC	350	450	500	600	650	700
City of Riesel	150	150	150	150	150	150
City of West	1,206	1,712	2,789	2,824	2,861	2,897
Western Hills WS	400	500	550	600	650	700
McLennan County-Other	7,840	10,411	14,321	14,445	14,572	14,700
McLennan County Steam-Electric	7,000	3,000	6,000	9,000	14,000	19,000
McLennan County Manufacturing	2,503	2,888	3,249	3,618	3,948	4,275
Total Demand	56,498	60,951	76,841	82,335	89,182	96,511

Supplies:

Source	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Lake Waco (Municipal & Industrial)	78,970	78,970	78,970	78,970	78,970	78,970
Lake Brazos	5,600	5,600	5,600	5,600	5,600	5,600
Total Supplies	84,570	84,570	84,570	84,570	84,570	84,570

Projected Balance:

	Year (acft/yr)					
	2010	2020	2030	2040	2050	2060
Balance/(Shortage)	28,072	23,619	7,729	2,235	(4,612)	(11,941)

4A.4 Water Supplied to Meet Demands Not in Region G

Water contracts existing at each water source in the Brazos G Area that are currently or projected to provide water to another region were identified. The three BRA systems have been grouped into a single summary table (Table 4A-21). In addition to the BRA, the Palo Pinto County MWD No. 1 has been identified as supplying water out of the Brazos G Area into Region C (Table 4A-22).

4A.5 Social and Economic Impacts of Not Meeting Projected Water Needs

Section 357.7(4) of the rules for implementing Senate Bill 1 requires that the social and economic impacts of not meeting regional water supply needs be evaluated by regional water planning groups. TWDB has provided technical assistance by conducting the required analysis for the Brazos G Regional Water Planning Area using a methodology similar to that used for other regions.

The purpose of this element of Senate Bill 1 planning is to provide an estimate of the social and economic importance of meeting projected water needs or, conversely, to provide estimates of potential costs of not meeting the projected needs of each water user group. The social and economic effects of not meeting a projected water need can be viewed as the potential benefit to be gained from implementing a strategy to meet the particular need. The summation of all the impacts gives a view of the ultimate magnitude of the economic impacts of not meeting all of the projected needs.

The information provided by the TWDB is summarized in a report included in Appendix I.

Table 4A-21.
Supplies from BRA Available to Brazos G and Other Regions
(Existing Supplies and Recommended Water Management Strategies)

The following table summarizes supply and demand of the Brazos River Authority's reservoirs. This summary is used to coordinate water supply from Brazos G used in Region H, Region C, and Region O.

Owner: Brazos River Authority

BRA Reservoirs	*2000 (acft/yr)*	*2030 (acft/yr)*	*2060 (acft/yr)*
Permitted Diversion (Constructed Facilities)	661,901	661,901	661,901
Existing Reservoir Firm Yield (Stand-alone)	644,700	626,952	609,201
Long-Term Contract Holders/ Water Management Strategies		***Contract Amounts***	
In Region G			
Long-term Contracts	460,586	460,586	460,586
Uncontracted Current BRA Supply[1]	31,955	31,955	31,955
BRA System Operations[1]	–	62,196	62,196
In Region H			
Long-term Contracts	138,913	138,913	138,913
Uncontracted Current BRA Supply[1]	29,000	29,000	29,000
BRA System Operations[1]	–	120,000	120,000
Allens Creek Reservoir[2]	–	29,895	29,895
Little River Off-Channel Reservoir[3]	–	40,000	40,000
Freeport Desalination	–	28,000	28,000
In Region O			
City of Lubbock[4]	961	961	961
In Region C[5]			
Parker County Steam Electric	0	4,000	4,000
Vulcan Materials Co.	2,000	2,000	2,000
Total Water Supply Available from BRA System			
Region G	492,541	554,737	554,737
Region H	167,913	385,808	385,808
Region O	961	961	961
Region C	2,000	6,000	6,000
Grand Total	**663,415**	**947,506**	**947,506**

1 Supplies from current BRA supplies and BRA System Operation as coordinated between Regions G and H. BRA System Operations would develop a maximum supply of 995,946 acft/yr when diverted in the lower basin, including 99,650 acft/yr from Allens Creek Reservoir, but excluding the Little River Off-Channel Reservoir (Vol. II, Table 4B.4-1). Allocation of system supply to upstream locations reduces overall BRA supply from the BRA reservoir system to approximately 945,061 acft/yr.

2 Supply from water management strategy in Region H allocated to BRA (30% of 99,650 acft/yr). Region H has allocated 97,410 acft/yr of the supply from the strategy.

3 The Little River Off-Channel Reservoir is a recommended water management strategy in Region H. Operated as part of the BRA System, it would supply an additional 40,000 acft/yr to Region H (Vol. II, Table 4B.4-14). Region H has allocated 32,125 acft/yr of that supply.

4 Upstream supply contract to compensate BRA for loss of yield in Possum Kingdom Reservoir caused by Lake Alan Henry.

5 Some supplies to Region C are accounted for in BRA contracts with Aquilla Water Supply District.

Table 4A-22.
Lake Palo Pinto Supplies to Other Regions

Owner: Palo Pinto County MWD No. 1

Lake Palo Pinto	***2000 (acft/yr)***	***2030 (acft/yr)***	***2060 (acft/yr)***
Permitted Diversion	18,500	18,500	18,500
Safe Yield	8,500	7,580	6,660
Major Long-term Contract Holders	***Contract Amounts***		
In Region G			
City of Mineral Wells[1]	3,412	3,928	4,337
Palo Pinto County-Other	994	994	994
City of Graford	92	92	92
Brazos Electric Coop. (Palo Pinto Steam Electric)	2,024	2,024	2,024
In Region C			
Parker County Other (through Mineral Wells)	759	759	759
Parker County Manufacturing (through Mineral Wells)	275	275	275
Total Surface Water Supply from Palo Pinto County MWD No. 1			
Region G	6,522	7,038	7,447
Region C	1,034	1,034	1,034
Grand Total	**7,556**	**8,072**	**8,481**

[1] Includes supply to portion of Mineral Wells located in Region C.

Section 4B
Identification, Evaluation, and Selection of Water Management Strategies [31 TAC §357.7(a)(5-7)]

4B.1 Water Management Strategies

Title 31 TAC 357.7(a)(7) requires that the regional water planning group evaluate all water management strategies determined to be potentially feasible. The guidelines list multiple types of strategies and numerous subtypes, including water conservation; drought management measures; reuse of wastewater; expanded use of existing facilities, including systems optimizations, conjunctive use, reallocation of storage to new uses, etc.; interbasin transfers; new supply development; and others. At the beginning of the 2006 planning cycle, the Brazos G Regional Water Planning Group (BGRWPG) identified approximately 25 water management strategies to be potentially feasible. Some of these were evaluated for the previous 2001 Brazos G Regional Water Plan. Several strategies were re-evaluated due to changed conditions such as new hydrologic information or requests for further information.

Potential water supply strategies evaluated during preparation of the 2006 Brazos G Regional Water Plan are listed in Table 4B.1-1. Within some of the 15 types of water management strategies listed in Table 4B.1-1 there are a number of sub-options. For instance, in the section on New Reservoirs (Section 4B.14), seven potential reservoir sites are evaluated.

Them remainder of this section describes methods and procedures utilized to evaluate water management strategies considered for inclusion in the water plan for the Brazos G Area.

4B.1.1 Evaluation of Strategies

The following chapters contain an evaluation of each of the potential water management strategies. Each section is typically divided into five subsections: (1) Description of Option; (2) Available Yield; (3) Environmental Issues; (4) Engineering and Costing; and (5) Implementation Issues. Information in these sections was presented to the BGRWPG at regularly scheduled public meetings and was used in evaluating strategies to meet water needs in the region.

Table 4B.1-1.
Water Management Strategies Evaluated
for the 2006 Brazos G Regional Water Plan

Section No. (Located in Volume II)	***Title***
4B.2	Water Conservation
4B.3	Wastewater Reuse
4B.4	System Operation of Brazos River Authority Reservoirs
4B.5	Groundwater/Surface Water Conjunctive Use (Lake Granger Augmentation)
4B.6	Desalination
4B.7	Millers Creek Reservoir Augmentation
4B.8	Aquifer Storage and Recovery
4B.9	Brush Control and Range Management
4B.10	Weather Modification
4B.11	Interregional Water Management
4B.12	New Reservoirs
4B.13	Off-Channel Reservoirs
4B.14	Interconnection of Regional and Community Systems
4B.15	Carrizo-Wilcox Aquifer Development
4B.16	Voluntary Redistribution

4B.1.2 Plan Development Criteria

It is the goal of the BGRWPG to develop a plan to meet projected water needs within the region. The BGRWPG has adopted a set of Plan Development Criteria that was used to evaluate whether a given strategy should be used to meet a projected shortage and ultimately be included in the Brazos G Regional Water Plan. The proposed strategies were developed by evaluating the water management strategies using the BGRWPG criteria and then matching strategies to meet projected shortages. This section discusses the evaluation criteria adopted by the planning group during plan development, and criteria to be met in formulation of the plan. The adopted plan elements will meet these criteria:

- Water Supply – Water supply must be evaluated with respect to quantity, reliability, and cost. The criteria for quantity are that the plan must be sufficient to meet all projected needs in the planning period. The criteria for reliability is that it meet municipal and industrial needs 100 percent of the time, and 75 percent of agricultural needs 75 percent of the time. The criteria for cost are that the projected cost be reasonable to meet the projected needs.

- Environmental Issues – Environmental considerations must be examined with respect to environmental water needs, wildlife habitat, cultural resources, and bays and estuaries. The criteria for environmental water flows and wildlife habitat are that stream conditions must meet permit requirements for diversions that currently have permits. For projects that require permit acquisition the project will provide adequate environmental instream flows for aquatic habitat. Projects should be sited to avoid known cultural resources, if possible. Flows to bays and estuaries should meet expected permit conditions. (It should be noted that the Brazos River does not have a well-defined estuary or bay system, so bay and estuary inflow requirements are expected to be low).
- Impacts on Other State Water Resources – The criteria recommends a follow-up study by the BGRWPG if any significant impacts are anticipated on other state water resources.
- Threats to Agriculture and Natural Resources – The criteria requires that the planning group identify any potential impact, compare the impact to the proposed benefit of the plan, and make recommendations.
- Equitable Comparison of Feasible Strategies – This is achieved by the equal application of criteria across different water development plans.
- Interbasin Transfers – The planning group may consider interbasin transfers as a supply option. The criteria require that the participating entities recognize and follow Texas Water Code requirements for expected permitting requirements.
- Impacts from Voluntary Redistribution – The criteria require that any potential third party social or economic impacts from voluntary redistribution of water rights be identified and described.
- Other Criteria – Texas Water Development Board (TWDB) allows the BGRWPG to adopt other criteria. The BGRWPG has not adopted any further criteria.

The following sections discuss the methods and procedures used to develop the information needed to evaluate the strategies and compare them to the criteria.

4B.1.3 Engineering

A procedure was developed to maintain equal and consistent consideration of various design and cost variables across differing management options. These were planning level estimates only, and did not reflect detailed site-specific design work, nor any extensive optimization and selection of design variables. These procedures standardized the consideration of the following design and costing issues as closely as possible, given the varying scope and magnitude of differing projects. For each option, major cost components were determined at the outset. Estimates of volume of water and rate of delivery needed were developed from the supply-demand comparisons presented in Section 3, if directly applicable. Volumes necessary to meet shortages were estimated, and both average annual and peak rates of projected delivery were calculated. Average annual rates were adjusted to reflect pump station downtime due to maintenance activities. Transmission and treatment facilities were generally sized based on peak rates of delivery. Water source and delivery locations were determined, considering source and destination elevations, surrounding land use, and other geographic considerations. Further details on engineering factors considered are presented in the discussions of the various water management strategies presented in Volume II, Sections 4B.2 through 4B.16.

4B.1.4 Cost Estimates

The cost estimates of this study are expressed in three major categories: (1) construction costs or capital (structural) costs, (2) other (non-structural) project costs, and (3) annual costs. Construction costs are the direct costs incurred in constructing facilities, such as those for materials, labor, and equipment. "Other" project costs include expenses not directly associated with construction activities of the project, such as costs for engineering, legal counsel, land acquisition, contingencies, environmental studies and mitigation, and interest during construction. Capital costs and other project costs comprise the total project cost. Operation and maintenance, energy costs, purchase of wholesale water and debt service payments are examples of annual costs. Major components that may be part of a preliminary cost estimate are listed in Table 4B.1-2. All costs represent second quarter 2002 prices.

Table 4B.1-2.
Major Project Cost Categories

<table>
<tr><th>Capital Costs
(Structural Costs)</th><th>Other Project Costs
(Non-Structural Costs)</th></tr>
<tr><td rowspan="3">1. Pump Stations
2. Pipelines
3. Water Treatment Plants
a. Conventional
b. Desalination
4. Water Storage Tanks
5. Off-Channel Reservoirs
6. Well Fields
a. Injection
b. Recovery
c. ASR Wells
7. Dams and Reservoirs
8. Relocations
9. Other Items</td><td>1. Engineering (Design, Bidding and Construction Phase Services, Geotechnical, Legal, Financing, and Contingencies)
2. Land and Easements
3. Environmental - Studies and Mitigation
4. Interest During Construction</td></tr>
<tr><td>Annual Project Costs</td></tr>
<tr><td>1. Debt Service
2. Operation and Maintenance (excluding pumping energy)
3. Pumping Energy Costs
4. Purchase Water Cost (if applicable)</td></tr>
</table>

To estimate capital costs, tables of unit costs for each major component in the capital costs were developed through an internal review of bid documents and project cost audits of projects that HDR and Freese & Nichols (subconsultant) have implemented in the past. The cost tables report all-inclusive costs to construct, including the construction, infrastructure and control equipment, and all other materials, labor, and installation costs. Unit costs were developed for pump stations, intake structures, pipelines, wells, reservoir structures, channel dams and any other structural component called for in a water supply option.

As previously mentioned, "other" (non-structural) project costs are costs incurred in a project that are not directly associated with construction activities. These include costs for engineering, legal counsel, financing, contingencies, land, easements, surveying and legal fees for land acquisition, environmental and archaeology studies, permitting, mitigation, and interest during construction. These costs are added to the capital costs to obtain the total project cost. A standard percentage applied to the capital costs is used to calculate a combined cost that includes engineering, financial, legal services, and contingencies.

Annual costs are those that the project owner can expect to incur if the project is implemented. These costs include repayment of borrowed funds (debt service), operation and maintenance costs of the project facilities, pumping power costs, and water purchase costs, when applicable.

Debt service is the estimated annual payment that can be expected for repayment of borrowed funds based on the total project cost, an assumed finance rate, and the finance period in years. As specified in TWDB Exhibit B, Section 4.2.9, debt service for all projects was calculated assuming an annual interest rate of 6 percent and a repayment period of 40 years for large reservoir projects and 30 years for all other projects.

Operation and maintenance costs for dams, pump stations, pipelines, and well fields (excluding pumping power costs) include labor and materials required to operate the facilities and provide for regular repair and/or replacement of equipment. In accordance with TWDB guidelines, unless specific project data are available, operation and maintenance costs are calculated at 1 percent of the total estimated construction costs for pipelines, at 1.5 percent of the total estimated construction costs for dams and reservoirs, and at 2.5 percent for intake and pump stations. Water treatment plant operation and maintenance costs were based on treatment level and plant capacity. The operation and maintenance costs include labor, materials, replacement of equipment, process energy, building energy, chemicals, and pumping energy.

In accordance with TWDB guidelines, power costs are calculated on an annual basis using the appropriate calculated power load and a power rate of $0.06 per kWh. The amount of energy consumed is based upon the pumping horsepower required.

The raw water purchase cost, if applicable, is included if the water supply option involves purchase of raw or treated water from an entity. This cost varies by source.

A cost estimate summary for each individual option is presented with total capital costs, total project costs, and total annual costs. The level of detail is dependent upon the characteristics of each option. Additionally, the cost per unit of water involved in the option is reported as costs per acft and cost per 1,000 gallons of water developed. The individual option cost tables specify the point within the region at which the cost applies (e.g., raw water at the lake, treated water at the municipal and industrial demand center, or elsewhere as appropriate).

Numerous recommended water management strategies are included in plans for individual water user groups that are not specifically analyzed as separate water management strategies in Volume II. These generally involve small interconnections between two neighboring systems or purchases of additional supplies from a wholesale water provider or adjacent water user group. In these cases, the basis for the cost estimate is described briefly in the individual water user group plan.

4B.1.5 Methods Used to Investigate Environmental Effects of Proposed Regional Water Management Strategies

The Regional Water Planning Guidelines (31 TAC 357.7) require that each regional water management strategy includes an evaluation of environmental factors, specifically effects on environmental water needs, wildlife habitat, cultural resources, agricultural resources, upstream development on bays, estuaries, and arms of the Gulf of Mexico. These factors were evaluated for each of the proposed water management strategies according to the level of description and engineering design information provided. Details regarding the methodology to investigate environmental water needs, instream flow needs, impact on bays and estuaries, and fish and wildlife habitat are generally included in the analysis of each strategy.

4B.1.6 Agricultural Water Management Strategies

New firm water supplies cannot be developed for irrigated agriculture, because the cost of development far exceeds the value of the water in irrigated production. The assumption is made that the available groundwater resources are already fully exploited. Cloud seeding and brush control for water yield are the only potential new supplies of water for irrigated agriculture, but a firm yield cannot be assigned to these practices. Without any firm supply of water, agricultural producers will have to reduce the irrigation and confined livestock demands through a variety of conservation and other management practices. Conservation practices were evaluated, specifically related to irrigation conservation and the savings of water that can be expected. The evaluation is presented in Volume II, Section 4B.2.2.

4B.1.7 Water Conservation and Drought Preparation

Water conservation recommendations are included in the plans for individual Water User Groups. Water conservation as a water management strategy for individual municipal water user groups was evaluated as per the description in Volume II, Section 4B.2.1. Costs and savings to be expected from various Best Management Practices (BMPs) are described, and recommended target reductions in per capita water use (gpcd) are presented. For irrigation conservation, specific costs, expected savings and conservation target recommended by the Brazos G RWPG are described in Volume II, Section 4B.2.2. For conservation for other types of use (manufacturing, steam electric, mining, livestock) the Brazos G RWPG has recommended a target goal of seven percent reduction in overall water demands for entities with projected shortages, and has presented a list of recommended BMPs in Volume II, Section 4B.2.3. Little guidance exists for estimating water savings and costs for BMPs for non-municipal and non-irrigation uses, as water use under each of these categories is facility-specific.

While water conservation is a viable water management strategy that makes more efficient use of available supplies to meet projected water needs, drought management recommendations have not been made by the Brazos G RWPG as a water management strategy for specific WUG needs. The regional water plan is developed to meet projected water demands during a drought. The purpose of the planning is to ensure that sufficient supplies are available to meet future water demands. Reducing water demands during a drought as a defined water management strategy does not ensure that sufficient supplies will be available to meet the projected water demands; but simply eliminates the demands. While the Brazos G RWPG encourages entities in the Brazos G Area to promote demand management during a drought, it should not be identified as a "new source" of supply. Recommending demand reductions as a water management strategy is antithetical to the concept of planning to meet projected water demands. It does not make more efficient use of existing supplies as does conservation, but instead effectively turns the tap off when the water is needed most. It is planning to not meet future water demands. When considering the costs of demand reduction during drought, the costs for drought management could be considered as the economic costs of not meeting the projected water demands, as summarized in Appendix I.

4B.1.8 Funding and Permitting by State Agencies of Projects Not in the Regional Water Plan

Senate Bill 1 requires water supply projects to be consistent with approved regional water plans to be eligible for TWDB funding and to obtain TCEQ permits. Texas Water Code[1] provides that the TCEQ shall grant an application to appropriate surface water, including amendments to existing permits, only if the proposed action addresses a water supply need in a manner that is consistent with an approved regional water plan. TCEQ may waive this requirement if conditions warrant.

For TWDB funding, the Texas Water Code[2] states that the TWDB may provide financial assistance to a water supply project only after TWDB determines that the needs to be met by the project will be addressed in a manner that is consistent with the appropriate regional water plan. The TWDB may waive this provision if conditions warrant.

The Brazos G Regional Water Planning Group has considered the variety of actions and permit applications that may come before the TCEQ and the TWDB and does not want to unduly constrain projects or applications for small amounts of water that may not be specifically included in the adopted regional water plan. "Small amounts of water" is defined as involving no more than 1,000 acft/yr, regardless of whether the action is for a temporary or long term action. The Brazos G RWPG provides direction to TCEQ and TWDB regarding appropriations, permit amendments, and projects involving small amounts of water that will not have a

[1] Texas Water Code, Section 11.134
[2] Texas Water Code, Section 16.053(j)

significant impact on the region's water supply as follows: such projects are consistent with the regional water plan, even though not specifically recommended in the plan.

The Brazos G RWPG also provides direction to the TWDB regarding financial assistance for repair and replacement of existing facilities, or to develop small amounts of water (less than 1,000 acft/yr). Water supply projects not involving the development of or connection to a new water source, or involving development of a new supply less than 1,000 acft/yr, are consistent with the regional water plan, even though not specifically mentioned in the adopted plan.

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Section 4C
Water Supply Plans

The following sections present water supply plans to meet needs (shortages) for Water User Groups and Wholesale Water Providers in the Brazos G Regional Water Planning Area. Detailed explanations of major water management strategies are presented in Volume II, Section 4B. In the following sections:

- Capital costs represent second quarter 2002 prices.
- Unit and annual costs requiring new infrastructure (wells, reservoirs, etc.) are generally shown at full build-out and use of the facilities in the first year of implementation. This will often understate the unit costs ($/acft) in the early years of a project. However, detailed cost estimates for phasing of projects from decade to decade are beyond the scope of this regional planning study.
- Unit costs for projects utilizing existing infrastructure (purchase of additional water, etc.) are generally held constant, with annual costs adjusted according to level of projected use.
- Unit costs for raw or treated water for interconnections between systems are assumed, with actual costs expected to be negotiated between entities.
- As explained in Volume II, Section 4B.2 Water Conservation, municipal conservation assumes a reduction in per capita water use of 21 gpcd beginning in year 2020 for municipal WUGs with needs and per capita water use exceeding a target of 140 gpcd. Municipalities are encouraged to utilize any BMPs to achieve the conservation goals, not just those used to develop costs. Non-municipal WUGs with needs are recommended by the Brazos G RWPG to reduce total water demand 3 percent by 2010, 5 percent by 2020, and 7 percent from 2030 to 2060 by using Best Management Practices (BMPs). Average costs for irrigation conservation BMPs were derived from the information in Volume II, Section 4B.2.2, but costs for other non-municipal conservation BMPs were not developed due to lack of available data and guidance. Several counties project large irrigation shortages which cannot be met through the recommended conservation targets. These irrigation shortages are typically too large to be met economically through new water supplies and remain as unmet needs in the plan.

- Each municipal water user group is identified with the county in which it is primarily located and the needs (shortages) are reported for all of the counties in which the WUG is located.

4C.1 Bell County Water Supply Plan

Table 4C.1-1 lists each water user group in Bell County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.1-1.
Bell County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
439 WSC	1,149	1,014	Projected surplus
Bell-Milam-Falls WSC	(261)	(514)	Projected shortage – see plan below
City of Belton	3,883	3,464	Projected surplus
Dog Ridge WSC	(205)	(311)	Projected shortage – see plan below
East Bell County WSC	133	92	Projected surplus
Elm Creek WSC	(479)	(631)	Projected shortage – see plan below
Fort Hood (CDP)	3,653	3,842	Projected surplus
City of Harker Heights	2,907	1,904	Projected surplus
City of Holland	141	147	Projected surplus
City of Killeen	3,961	(2,157)	Projected shortage – see plan below
City of Little River-Academy	(20)	(29)	Projected shortage – see plan below
Moffat WSC	145	145	Projected surplus
City of Morgan's Point Resort	(202)	(255)	Projected shortage – see plan below
City of Nolanville	410	398	Projected surplus
Pendleton WSC	0	0	No projected needs
City of Rogers	180	187	Projected surplus
Salado WSC	1,330	1,146	Projected surplus
City of Temple	12,221	6,624	Projected surplus
City of Troy	45	53	Projected surplus
West Bell County WSC	298	322	Projected surplus
County-Other	406	407	Projected surplus
Manufacturing	(1,163)	(1,446)	Projected shortage – see plan below
Steam-Electric	4,466	1,660	Projected surplus
Mining	2	2	Projected surplus
Irrigation	4,363	4,457	Projected surplus
Livestock	0	0	No projected needs

[1] From Tables C-1 and C-2, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.1.1 439 WSC

439 WSC has a contract to purchase water from the Brazos River Authority from Lake Belton. 439 WSC contracts with Bell County WCID No. 1 to divert, treat, and deliver water from Lake Belton to the WSC. No shortages are projected for 439 WSC and no changes in water supply are recommended.

4C.1.2 Bell-Milam-Falls WSC

4C.1.2.1 Description of Supply

- Source: Surface Water – Contract with Central Texas WSC from Stillhouse Hollow Reservoir. Groundwater – Trinity Aquifer
- Estimated Reliable Supply: 817 acft/yr
- System Description: Bell-Milam-Falls WSC purchases treated water from Central Texas WSC. The WSC also has wells that are used to supplement the purchased water.

4C.1.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Bell-Milam-Falls WSC:

- Increase contract with Central Texas WSC by 100 acft/yr by 2010, increasing by 600 acft/yr by 2060.
- Conservation was also considered; however, the WSC's current per capita use rate is below the selected target rate of 140 gpcd.

4C.1.2.3 Costs

Costs of the Recommended Plan for Bell-Milam-Falls WSC.

a. Increase contract with Central Texas WSC:
    - Cost Source: estimated wholesale treated water rate
    - Date to be Implemented: By year 2010
    - Annual Cost: $410,400 in 2060

    The annual cost was calculated by multiplying the Bell-Milam-Falls WSC projected supply from this strategy by an estimated wholesale water rate of $684/acft.

Table 4C.1-2.
Recommended Plan Costs by Decade for Bell-Milam-Falls WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(1)	(137)	(261)	(360)	(431)	(514)
Increase Contract with CTWSC						
Supply From Plan Element (acft/yr)	100	200	300	400	500	600
Annual Cost ($/yr)	$68,400	$136,800	$205,200	$273,600	$342,000	$410,400
Unit Cost ($/acft)	$684	$684	$684	$684	$684	$684

4C.1.3 City of Belton

The City of Belton has a contract to purchase water from the Brazos River Authority from Lake Belton. Belton contracts with Bell County WCID No. 1 to divert, treat, and deliver water from Lake Belton to the City. No shortages are projected for the City of Belton and no changes in water supply are recommended.

4C.1.4 Dog Ridge WSC

4C.1.4.1 Description of Supply

- Source: Surface Water – Contract with Central Texas WSC from Stillhouse Hollow Reservoir.
- Estimated Reliable Supply: 671 acft/yr
- System Description: Dog Ridge WSC purchases treated water from Central Texas WSC.

4C.1.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Dog Ridge WSC:

- Increase contract with Central Texas WSC by 100 acft/yr by 2010, increasing by 400 acft/yr by 2060.
- Conservation was also considered; however, the WSC's current per capita use rate is below the selected target rate of 140 gpcd.

4C.1.4.3 Costs

Costs of the Recommended Plan for Dog Ridge WSC:

a. Increase contract with Central Texas WSC:
- Cost Source: estimated wholesale treated water rate
- Date to be Implemented: By year 2010
- Annual Cost: $273,600 in 2060

The annual cost was calculated by multiplying the Dog Ridge WSC projected supply from this strategy by an estimated wholesale water rate of $684/acft.

Table 4C.1-3.
Recommended Plan Costs by Decade for Dog Ridge WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(44)	(128)	(205)	(255)	(284)	(311)
Increase Contract with CTWSC						
Supply From Plan Element (acft/yr)	100	200	300	300	300	400
Annual Cost ($/yr)	$68,400	$136,800	$205,200	$205,200	$205,200	$273,600
Unit Cost ($/acft)	$684	$684	$684	$684	$684	$684

4C.1.5 East Bell County WSC

East Bell County WSC has a contract to purchase water from the Central Texas WSC from Stillhouse Hollow Reservoir. East Bell County WSC also has wells in the Trinity Aquifer. No shortages are projected for East Bell County WSC and no changes in water supply are recommended.

4C.1.6 Elm Creek WSC

4C.1.6.1 Description of Supply

- Source: Surface Water – Contract with Bluebonnet WSC from Lake Belton.
- Estimated Reliable Supply: 92 acft/yr
- System Description: Elm Creek WSC purchases treated water from Bluebonnet WSC and has wells located in the Trinity Aquifer.

4C.1.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Elm Creek WSC:

- Increase contract with Bluebonnet WSC by 400 acft/yr by 2010, increasing to 700 acft/yr by 2060.
- Conservation was also considered; however, the WSC's current per capita use rate is below the selected target rate of 140 gpcd.

4C.1.6.3 Costs

Costs of the Recommended Plan for Elm Creek WSC.

a. Increase contract with Bluebonnet WSC:
   - Cost Source: estimated wholesale treated water rate
   - Date to be Implemented: By year 2010
   - Annual Cost: $513,100 in 2060

   The annual cost was calculated by multiplying the Dog Ridge WSC projected supply from this strategy by an estimated wholesale water rate of $733/acft.

Table 4C.1-4.
Recommended Plan Costs by Decade for Elm Creek WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(328)	(410)	(479)	(540)	(579)	(631)
Increase Contract with CTWSC						
Supply From Plan Element (acft/yr)	400	500	500	600	600	700
Annual Cost ($/yr)	$293,200	$366,500	$366,500	$439,800	$439,800	$513,100
Unit Cost ($/acft)	$733	$733	$733	$733	$733	$733

4C.1.7 Fort Hood (CDP)

The U.S. Department of the Army (Fort Hood) has a water right to store and divert 12,000 acft in Lake Belton. No shortages are projected for Fort Hood and no changes in water supply are recommended.

4C.1.8 City of Harker Heights

The City of Harker Heights has a contract to purchase water from the Brazos River Authority from Lake Stillhouse Hollow. Harker Heights contracts with Bell County WCID No. 1

to divert, treat, and deliver water from Lake Belton to the City. No shortages are projected for the City of Harker Heights and no changes in water supply are recommended.

4C.1.9 City of Holland

The City of Holland has a contract to purchase water from the Central Texas WSC from Stillhouse Hollow Reservoir. No shortages are projected for the City of Holland and no changes in water supply are recommended.

4C.1.10 City of Killeen

4C.1.10.1 Description of Supply

- Surface Water purchased from Bell County WCID No 1.
- Estimated Reliable Supply: 29,632 acft/yr in 2060
- System Description: The City purchases water from Bell County WCID #1.

4C.1.10.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Killeen:

- Conservation.
- Increase contract with Bell County WCID No. 1. Killeen would meet the projected shortage by buying an additional 2,500 acft/yr from Bell County WCID No. 1 by 2060.

4C.1.10.3 Costs

Costs of the recommended plan for the City of Killeen to meet the projected shortages are:

a. Conservation
   - Date to be Implemented: before 2010 – use rate exceeds 140 gpcd in 2010
   - Annual Cost: maximum of $698,820 in 2020

b. Increase contract with Bell County WCID #1:
   - Cost Source: estimated wholesale treated water rate
   - Date to be Implemented: By year 2060
   - Annual Cost: $356,783 in 2060

   The annual cost was calculated by multiplying the City of Killeen projected supply from this strategy by an estimated wholesale water rate of $143/acft.

Table 4C.1-5.
Recommended Plan Costs by Decade for the City of Killeen

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	11,878	6,347	3,961	1,916	(48)	(2,157)
Conservation						
Supply From Plan Element (acft/yr)	820	1,839	1,752	1,439	875	381
Annual Cost ($/yr)	$311,600	$698,820	$665,760	$546,820	$332,500	$144,780
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Increase Contract with Bell County WCID #1						
Supply From Plan Element (acft/yr)	—	—	—	—	—	2,500
Annual Cost ($/yr)						$357,500
Unit Cost ($/acft)						$143

4C.1.11 City of Little River-Academy

4C.1.11.1 Description of Supply

- Source: Groundwater – Trinity Aquifer. Surface Water purchased from the City of Temple
- Estimated Reliable Supply: 272 acft/yr
- System Description: Surface water supply supplements groundwater supply. The City of Temple supplies treated surface water to Little River-Academy by transmission pipeline.

4C.1.11.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Little River-Academy:

- Voluntary Redistribution from City of Temple. Little River-Academy would meet the projected shortage by buying an additional 50 acft/yr from the City of Temple. The existing facilities have adequate capacity to deliver the additional water.
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.1.11.3 Costs

Costs of the recommended plan for the City of Little River-Academy to meet the projected shortages are:

a. Voluntary Redistribution from City of Temple:
   - Cost Source: estimated wholesale treated water rate
   - Date to be Implemented: By year 2010
   - Annual Cost: $43,850 in 2060

   The annual cost was calculated by multiplying the City of Little River Academy projected supply from this strategy by an estimated wholesale water rate of $877/acft.

Table 4C.1-6. Recommended Plan Costs by Decade for the City of Little River-Academy

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(3)	(13)	(20)	(22)	(25)	(29)
Voluntary Redistribution (City of Temple)						
Supply From Plan Element (acft/yr)	50	50	50	50	50	50
Annual Cost ($/yr)	$43,850	$43,850	$43,850	$43,850	$43,850	$43,850
Unit Cost ($/acft)	$877	$877	$877	$877	$877	$877

4C.1.12 Moffat WSC

Moffat WSC has a contract to purchase water from Bluebonnet WSC from Lake Belton, as well as supplemental wells in the Trinity Aquifer. No shortages are projected for Moffat WSC and no changes in water supply are recommended.

4C.1.13 City of Morgan's Point Resort

4C.1.13.1 Description of Supply

- Source: Surface Water from City of Temple
- Estimated Reliable Supply: 291 acft/yr
- System Description: The City of Morgan's Point Resort has a contract with the City of Temple to purchase treated surface water. The City of Temple serves Morgan's Point Resort through a transmission pipeline.

4C.1.13.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Morgan's Point Resort:

- Voluntary Redistribution from City of Temple. Morgan's Point Resort would meet its shortage through purchase of an additional 300 acft/yr from the City of Temple.

- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.1.13.3 Costs

Costs of the recommended plan for the City of Morgan's Point Resort to meet the projected shortages are:

a. Voluntary Redistribution from City of Temple:
   - Cost Source: estimated wholesale treated water rate
   - Date to be Implemented: By year 2010
   - Annual Cost: $263,100 in 2060

   The annual cost was calculated by multiplying the City of Morgan's Point Resort projected supply from this strategy by an estimated wholesale water rate of $877/acft.

Table 4C.1-7.
Recommended Plan Costs by Decade for the City of Morgan's Point Resort

Plan Element	2010	2020	2030	2040	2050	2060
Projected Shortage (acft/yr)	(123)	(164)	(202)	(227)	(241)	(255)
Voluntary Redistribution (City of Temple)						
Supply From Plan Element (acft/yr)	300	300	300	300	300	300
Annual Cost ($/yr)	$263,100	$263,100	$263,100	$263,100	$263,100	$263,100
Unit Cost ($/acft)	$877	$877	$877	$877	$877	$877

4C.1.14 City of Nolanville

The City of Nolanville contracts with Bell County WCID No. 1 to divert, treat, and deliver water from Lake Belton to the City. No shortages are projected for Nolanville and no changes in water supply are recommended.

4C.1.15 Pendleton WSC

Pendleton WSC contracts with Bluebonnet WSC to divert, treat, and deliver water from Lake Belton to the WSC. No shortages are projected for Pendleton WSC and no changes in water supply are recommended.

4C.1.16 City of Rogers

The City of Rogers purchases treated surface water from Central Texas WSC. No shortages are projected for the City of Rogers and no changes in water supply are recommended.

4C.1.17 Salado WSC

Salado WSC currently obtains water from the Edwards Aquifer and from a contract with the BRA. There are no projected shortages for Salado WSC; however, Salado WSC is currently pursuing a contract with Central Texas WSC to further augment their existing water supply.

4C.1.18 City of Temple

The City of Temple obtains raw water primarily from the Leon River, to which it holds a run-of-river permit. This permit from the TCEQ gives the City the right to divert water from the river but not to store it. The City also has contracted for stored water from BRA in Lake Belton. No shortages are projected for the City of Temple and no changes in water supply are recommended.

4C.1.19 City of Troy

The City of Troy obtains its water from a contract with the City of Temple and wells located in the Trinity Aquifer. No shortages are projected for the City of Troy and no changes in water supply are recommended.

4C.1.20 West Bell County WSC

West Bell County WSC obtains its water through a contract with the Central Texas WSC. No shortages are projected for West Bell County WSC and no changes in water supply are recommended.

4C.1.21 County-Other

No shortages are projected for County-Other entities and no changes in water supply are recommended. The Oenaville & Belfalls WSC is included in the County-Other category and has informed the Brazos G RWPG that due to recent growth, it expects to be large enough to be included as a Water User Group in the next planning cycle. The WSC obtains supply through a contract with the Central Texas WSC (57 acft/yr) and has applied to the Clearwater Underground Water Conservation District for a Historical and Existing Use Permit for 16.2 acft/yr from the Trinity Aquifer.

4C.1.22 Manufacturing

4C.1.22.1 Description of Supply

- Source: Groundwater from the Trinity Aquifer
- Estimated Reliable Supply: 17 acft/yr

4C.1.22.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage for Manufacturing in Bell County:

- Conservation; and
- Voluntary Redistribution from City of Temple. Manufacturing would meet its shortage through purchase of an additional 1,500 acft/yr from the City of Temple.

4C.1.22.3 Costs

Costs of the recommended plan for Bell County Manufacturing to meet the projected shortages are:

a. Conservation:
   - Date to be Implemented: By year 2010
   - Annual Cost: Not determined

b. Voluntary Redistribution from City of Temple:
   - Cost Source: estimated wholesale treated water rate
   - Date to be Implemented: By year 2010
   - Annual Cost: $1,315,500 in 2060

   The annual cost was calculated by multiplying the Manufacturing projected supply from this strategy by an estimated wholesale water rate of $877/acft.

Table 4C.1-8.
Recommended Plan Costs by Decade for Bell County Manufacturing

Plan Element	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
Projected Shortage (acft/yr)	(963)	(1,068)	(1,163)	(1,256)	(1,338)	(1,446)
Conservation						
Supply From Plan Element (acft/yr)	29	54	83	89	95	102
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Voluntary Redistribution (City of Temple)						
Supply From Plan Element (acft/yr)	1,500	1,500	1,500	1,500	1,500	1,500
Annual Cost ($/yr)	$1,315,500	$1,315,500	$1,315,500	$1,315,500	$1,315,500	$1,315,500
Unit Cost ($/acft)	$877	$877	$877	$877	$877	$877

4C.1.23 Steam-Electric

No shortages are projected for Bell County Steam-Electric and no changes in water supply are recommended.

4C.1.24 Mining

No shortages are projected for Bell County Mining and no changes in water supply are recommended.

4C.1.25 Irrigation

No shortages are projected for Bell County Irrigation and no changes in water supply are recommended.

4C.1.26 Livestock

No shortages are projected for Bell County Livestock and no changes in water supply are recommended.

4C.2 Bosque County Water Supply Plan

Table 4C.2-1 lists each water user group in Bosque County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.2-1.
Bosque County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2030 (acft/yr)	2060 (acft/yr)	
Childress Creek WSC	(193)	(206)	Projected shortage – see plan below
City of Clifton	588	570	Projected surplus; possible regional provider, see text below
City of Meridian	(68)	(69)	Projected shortage – see plan below
City of Valley Mills	(103)	(102)	Projected shortage – see plan below
City of Walnut Springs	(60)	(59)	Projected shortage – see plan below
County-Other	(842)	(919)	Projected shortage – see plan below
Manufacturing	(921)	(1,300)	Projected shortage – see plan below
Steam-Electric	(3,497)	(8,223)	Projected shortage – see plan below
Mining	0	0	No projected need
Irrigation	4,986	5,076	Projected surplus
Livestock	0	0	No projected need

[1] From Tables C-3 and C-4, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.2.1 Childress Creek WSC

4C.2.1.1 Description of Supply

- Source: Groundwater – Trinity Aquifer
- Estimated Reliable Supply: 196 acft/yr
- System Description: The WSC has wells located in the Trinity Aquifer.

4C.2.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Childress Creek WSC:

- Purchase water from the City of Clifton through the Bosque County Regional Project (Section 4B.14.1).

- Conservation was also considered; however, the WSC's current per capita use rate is below the selected target rate of 140 gpcd.

4C.2.1.3 Costs

Costs of the Recommended Plan for Childress Creek WSC.

a. Purchase water from the City of Clifton through the Bosque County Regional Project:
   - Cost Source: Cost estimate from strategy evaluation (Section 4B.14.1)
   - Date to be Implemented: By year 2010
   - Total Project Cost: $2,299,000
   - Annual Cost: $235,000

Table 4C.2-2.
Recommended Plan Costs by Decade for Childress Creek WSC

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(126)	(165)	(193)	(199)	(200)	(206)
Purchase water from City of Clifton						
Supply From Plan Element (acft/yr)	213	213	213	213	213	213
Annual Cost ($/yr)	$235,000	$235,000	$235,000	$235,000	$235,000	$235,000
Unit Cost ($/acft)	$1,103	$1,103	$1,103	$1,103	$1,103	$1,103

4C.2.2 City of Clifton

4C.2.2.1 Description of Supply

The City of Clifton obtains its water supply from groundwater from the Trinity Aquifer and from surface water from the North Bosque River. The City of Clifton owns water rights on the North Bosque River and has recently completed the construction of the first phase of a new surface water supply project. This new project diverts water from the North Bosque River and impounds it for storage in an off-channel reservoir. The project was planned to provide for additional phases to enlarge the project as demand increases. Based on the estimated availability of groundwater to the City and the firm yield of the new surface water supply project, the City of Clifton has a surplus of 588 acft/yr in the year 2030 and 570 acft/yr in the year 2060. The ability to expand the project results in the City being a potential regional provider of water to other Bosque County entities.

4C.2.3 City of Meridian

4C.2.3.1 Description of Supply

The City of Meridian obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, the City is projected to have a shortage of 68 acft/yr in the year 2030 and 69 acft/yr in the year 2060.

4C.2.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Meridian:

- Purchase water from the City of Clifton through the Bosque County Regional Project (Section 4B.14.1).
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.2.3.3 Costs

Costs of the recommended plan for the City of Meridian to meet the projected shortages are:

a. Purchase water from the City of Clifton through the Bosque County Regional Project:
   - Cost Source: Cost estimate from strategy evaluation (Section 4B.14.1)
   - Date to be Implemented: before 2010
   - Total Project Cost: $2,261,000
   - Annual Cost: $212,000

Table 4C.2-3.
Recommended Plan Costs by Decade for the City of Meridian

Plan Element	2010	2020	2030	2040	2050	2060
Projected Shortage (acft/yr)	(48)	(61)	(68)	(66)	(66)	(69)
Purchase water from the City of Clifton						
Quantity Available (acft/yr)	80	80	80	80	80	80
Annual Cost ($/yr)	$212,000	$212,000	$212,000	$212,000	$212,000	$212,000
Unit Cost ($/acft)	$2,650	$2,650	$2,650	$2,650	$2,650	$2,650

4C.2.4 City of Valley Mills

4C.2.4.1 Description of Supply

The City of Valley Mills obtains its water supply from groundwater from the Trinity Aquifer. Based on the groundwater supply available, the City of Valley Mills is projected to have a shortage of 103 acft/yr in the year 2030 and 102 acft/yr in the year 2060.

4C.2.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Valley Mills:

- Conservation; and
- Purchase water from the City of Clifton through the Bosque County Regional Project.

4C.2.4.3 Costs

Costs of the Recommended Plan for the City of Valley Mills to meet the projected shortages are:

a. Conservation:

- Cost Source: Volume II, Section 4B.2.1
- Date to be Implemented: before 2010
- Annual Cost: maximum of $7,220 in 2020

b. Purchase water from the City of Clifton through the Bosque County Regional Project:

- Cost Source: Cost estimate from strategy evaluation (Section 4B.14.1)
- Date to be Implemented: before 2010
- Total Project Cost: $3,916,000
- Annual Cost: $357,295

Table 4C.2-4.
Recommended Plan Costs by Decade for the City of Valley Mills

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Shortage (acft/yr)	(96)	(101)	(103)	(101)	(101)	(102)
Conservation						
Quantity Available (acft/yr)	9	19	15	11	10	10
Annual Cost ($/yr)	$3,420	$7,220	$5,700	$4,180	$3,800	$3,800
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Purchase Water from the City of Clifton						
Quantity Available (acft/yr)	190	190	190	190	190	190
Annual Cost ($/yr)	$357,295	$357,295	$357,295	$357,295	$357,295	$357,295
Unit Cost ($/acft)	$1,881	$1,881	$1,881	$1,881	$1,881	$1,881

4C.2.5 City of Walnut Springs

4C.2.5.1 Description of Supply

The City of Walnut Springs obtains its water supply from groundwater from the Trinity Aquifer. Based on the groundwater availability in the Trinity Aquifer, the City of Walnut Springs is projected to have a shortage of 60 acft/yr in the year 2030 and 59 acft/yr in the year 2060.

4C.2.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Walnut Springs:

- Purchase water from the City of Clifton through the Bosque County Regional Project.
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.2.5.3 Costs

Costs of the Recommended Plan for the City of Walnut Springs to meet the projected shortages are:

a. Purchase water from the City of Clifton through the Bosque County Regional Project:
   - Cost Source: Cost estimate from strategy evaluation (Section 4B.14.1)
   - Date to be Implemented: before 2010
   - Total Project Cost: $3,991,000
   - Annual Cost: $346,000

Table 4C.2-5.
Recommended Plan Costs by Decade for the City of Walnut Springs

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Shortage (acft/yr)	(56)	(59)	(60)	(59)	(58)	(59)
Clifton System to Walnut Springs						
Quantity Available (acft/yr)	67	67	67	67	67	67
Annual Cost ($/yr)	$346,000	$346,000	$346,000	$346,000	$346,000	$346,000
Unit Cost ($/acft)	$5,164	$5,164	$5,164	$5,164	$5,164	$5,164

4C.2.6 County-Other

4C.2.6.1 Description of Supply

Municipal entities included in Bosque County-Other obtain water supply from groundwater from the Trinity Aquifer. None of the County-Other entities utilize surface water as a water supply. Based on the available groundwater supply in the Trinity Aquifer, County-Other is projected to have a shortage of 842 acft/yr in the year 2030 and 919 acft/yr in the year 2060.

4C.2.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the County-Other:

- Purchase water from the City of Clifton through the Bosque County Regional Project; and
- BRA System Operations Supply to Bosque County – Volume II, Section 4B.4.
- Conservation was also considered; however, the entity's current per capita use rate is below the selected target rate of 140 gpcd.

4C.2.6.3 Costs

Costs of the Recommended Plan for County-Other to meet the projected shortages are:

a. Purchase water from the City of Clifton through the Bosque County Regional Project:
   - Cost Source: Unit costs based on strategy evaluation for Walnut Springs. Most system connections would be small, and therefore economies of scale would not reduce unit costs.
   - Date to be Implemented: before 2010
   - Total Project Cost: Not determined.
   - Annual Cost: $2,582,000 at full implementation

b. BRA System Operation:
   - Cost Source: BRA System Operations Supply to Bosque County – WUG4 (Section 4B.4), which do not include treatment costs. Additional treatment costs (desalination) and transmission costs to County-Other are estimated on a unit basis of $3.00/1000 gallons ($978/acft).
   - Date to be Implemented: before 2010
   - Total Project Cost: Not Determined
   - Annual Cost: $646,000 at full implementation

Table 4C.2-6.
Recommended Plan Costs by Decade for Bosque County-Other

Plan Element	2010	2020	2030	2040	2050	2060
Projected Shortage (acft/yr)	(543)	(722)	(842)	(884)	(894)	(919)
Clifton System Supply						
Quantity Available (acft/yr)	400	400	500	500	500	500
Annual Cost ($/yr)	$2,065,600	$2,065,600	$2,582,000	$2,582,000	$2,582,000	$2,582,000
Unit Cost ($/acft)	$5,164	$5,164	$5,164	$5,164	$5,164	$5,164
BRA System Operation						
Quantity Available (acft/yr)	200	400	475	475	475	475
Annual Cost ($/yr)	$272,000	$544,000	$646,000	$646,000	$646,000	$646,000
Unit Cost ($/acft)	$1,360	$1,360	$1,360	$1,360	$1,360	$1,360

4C.2.7 Manufacturing

4C.2.7.1 Description of Supply

Water supply for manufacturing in Bosque County is obtained by purchase from a city or water supply corporation, from private wells operated by the manufacturing entity, or by limited surface water supplies. Based on the available supplies, Manufacturing is projected to have a shortage of 921 acft/yr in the year 2030 and 1,300 acft/yr in the year 2060.

4C.2.7.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages for manufacturing:

- Conservation, and
- BRA System Operations Supply to Bosque County – WUG4 (Section 4B.4).

4C.2.7.3 Costs

Costs of the Recommended Plan for Manufacturing to meet the projected shortages are:

a. Conservation
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. BRA System Operation

- Cost Source: BRA System Operations Supply to Bosque County – WUG4 (Section 4B.4)
- Date to be Implemented: before 2010
- Total Project Cost: $25,492,000 (total cost for WUG-4 analysis)
- Annual Cost: $496,600 at full implementation

Table 4C.2-7.
Recommended Plan Costs by Decade for Bosque County Manufacturing

Plan Element	2010	2020	2030	2040	2050	2060
Projected Shortage (acft/yr)	(641)	(787)	(921)	(1,053)	(1,167)	(1,300)
Conservation						
Quantity Available (acft/yr)	30	58	90	99	107	116
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
BRA System Operation						
Quantity Available (acft/yr)	700	800	1,000	1,100	1,200	1,300
Annual Cost ($/yr)	$267,400	$305,600	$382,000	$420,200	$458,400	$496,600
Unit Cost ($/acft)	$382	$382	$382	$382	$382	$382

4C.2.8 Steam-Electric

4C.2.8.1 Description of Supply

The water supply for Steam-Electric use in Bosque County consists of surface water contracts with the Brazos River Authority and a limited amount of groundwater from the Trinity Aquifer. Steam-Electric is projected to have a shortage of 3,497 acft/yr in the year 2030 and a shortage of 8,223 acft/yr in the year 2060.

4C.2.8.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage for Steam-Electric:

- Conservation.
- BRA System Operations Supply to Bosque County – WUG4 (Section 4B.4).

4C.2.8.3 Costs

Costs of the Recommended Plan for Steam-Electric to meet the projected shortages are:

a. Conservation
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. BRA System Operation
   - Cost Source: BRA System Operations Supply to Bosque County – WUG4 (Section 4B.4)
   - Date to be Implemented: before 2010
   - Total Project Cost: $25,492,000 (total cost for WUG-4 analysis)
   - Annual Cost: $3,141,186 at full implementation

Table 4C.2-8.
Recommended Plan Costs by Decade for Bosque County Steam-Electric

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Shortage (acft/yr)	(585)	(2,450)	(3,497)	(4,772)	(6,327)	(8,223)
Conservation						
Quantity Available (acft/yr)	130	309	506	596	705	837
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
BRA System Operation						
Quantity Available (acft/yr)	585	2,450	3,497	4,772	6,327	8,223
Annual Cost ($/yr)	$223,470	$935,900	$1,335,854	$1,822,904	$2,416,914	$3,141,186
Unit Cost ($/acft)	$382	$382	$382	$382	$382	$382

4C.2.9 Mining

Mining is not projected to need additional water supplies through the year 2060 and no changes in water supply are recommended.

4C.2.10 Irrigation

Irrigation is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.2.11 Livestock

No shortages are projected for Livestock and no changes in water supply are recommended.

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4C.3 Brazos County Water Supply Plan

Table 4C.3-1 lists each water user group in Brazos County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.3-1.
Brazos County Surplus/(Shortage)

Water User Group	*Surplus/(Shortage)*[1]		*Comment*
	2030 (acft/yr)	*2060 (acft/yr)*	
City of Bryan	927	(1,341)	Projected shortage – see plan below
City of College Station	(5,603)	(11,166)	Projected shortage – see plan below
Wellborn SUD	3,692	3,288	Projected surplus
Wickson Creek SUD	(1,160)	(2,116)	Projected shortage – see plan below
County-Other	390	588	Projected surplus
Manufacturing	(96)	(232)	Projected shortage – see plan below
Steam-Electric	276	0	Projected surplus
Mining	0	0	No projected needs
Irrigation	47,653	48,216	Projected surplus
Livestock	0	0	No projected needs

[1] From Tables C-5 and C-6, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.3.1 City of Bryan

4C.3.1.1 Description of Supply

- Source: Sparta and Carrizo-Wilcox Aquifers
- Estimated Reliable Supply: 15,152 acft/yr
- System Description: Wells located in the Sparta and Carrizo-Wilcox Aquifers

4C.3.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Bryan:

- Wastewater Reuse; and
- Additional Carrizo-Wilcox Aquifer Development.

- In addition to these recommended plan elements, BRA System Operation, Millican Reservoir and the Little River Off-Channel reservoir are considered to be alternative water management strategies.
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.3.1.3 Costs

Costs of the Recommended Plan for the City of Bryan.

a. Wastewater Reuse for the City of Bryan (4B.3.1):
   - Cost Source: Strategy Evaluation (4B.3.1)
   - Date to be Implemented: By year 2050
   - Total Project Cost: $6,485,000
   - Annual Cost: $576,000

b. Additional Carrizo-Wilcox Aquifer Development (4B.15.2):
   - Cost Source: Strategy Evaluation (4B.15.2)
   - Date to be Implemented: By year 2050
   - Total Project Cost: $33,380,000 for full Brazos County evaluation
   - Annual Cost: $309,600 (based on unit cost for Brazos County evaluation)

Table 4C.3-2.
Recommended Plan Costs by Decade for the City of Bryan

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Shortage (acft/yr)	3,191	1,969	927	126	(948)	(1,345)
Wastewater Reuse						
Quantity Available (acft/yr)	—	—	—	—	605	605
Annual Cost ($/yr)					$576,000	$576,000
Unit Cost ($/acft)					$952	$952
Additional Carrizo-Wilcox Aquifer Development						
Quantity Available (acft/yr)	—	—	—	—	400	800
Annual Cost ($/yr)					$154,800	$309,600
Unit Cost ($/acft)					$387	$387

4C.3.2 City of College Station

4C.3.2.1 Description of Supply

- Source: Groundwater from Carrizo-Wilcox Aquifer
- Estimated Reliable Supply: 20,176 acft/yr

4C.3.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of College Station:

- Conservation,
- Wastewater Reuse; and
- Additional Carrizo-Wilcox Aquifer Development.
- In addition to these recommended plan elements, BRA System Operation, Millican Reservoir and the Little River Off-Channel reservoir are considered to be alternative water management strategies.

4C.3.2.3 Costs

Costs of the recommended plan for the City of College Station to meet the projected shortages are:

a. Conservation:
   - Cost Source: Strategy Evaluation (4B.2.1)
   - Date to be Implemented: By year 2010
   - Annual Cost: maximum of $523,640 in 2020

b. Wastewater Reuse for the City of College Station (4B.3.1):
   - Cost Source: Volume II, Section 4B.3.1
   - Date to be Implemented: By year 2040
   - Total Project Cost: $2,358,000
   - Annual Cost: $200,000

c. Additional Carrizo-Wilcox Aquifer Development (4B.15.2):
   - Cost Source: Strategy Evaluation (4B.15.2)
   - Date to be Implemented: By year 2050
   - Total Project Cost: $33,380,000 for full Brazos County evaluation
   - Annual Cost: $4,644,000 (based on unit cost for Brazos County evaluation)

Table 4C.3-3.
Recommended Plan Costs by Decade for the City of College Station

Plan Element	2010	2020	2030	2040	2050	2060
Projected Shortage (acft/yr)	144	(2,801)	(5,603)	(7,668)	(10,256)	(11,166)
Conservation						
Quantity Available (acft/yr)	545	1,378	1,320	1,177	1,149	1,184
Annual Cost ($/yr)	$207,100	$523,640	$501,600	$447,260	$436,620	$449,920
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Wastewater Reuse						
Quantity Available (acft/yr)	—	—	—	137	137	137
Annual Cost ($/yr)				$200,000	$200,000	$200,000
Unit Cost ($/acft)				$1,462	$1,462	$1,462
Additional Carrizo-Wilcox Aquifer Development						
Quantity Available (acft/yr)	—	3,000	6,000	8,000	11,000	12,000
Annual Cost ($/yr)		$1,161,000	$2,322,000	$3,096,000	$4,257,000	$4,644,000
Unit Cost ($/acft)		$387	$387	$387	$387	$387

4C.3.3 Wellborn SUD

Wellborn SUD currently obtains water from the Carrizo-Wilcox Aquifer and through a contract with the BRA. Wellborn SUD does not have any projected shortages and no changes in water supply are recommended.

4C.3.4 Wickson Creek SUD

4C.3.4.1 Description of Supply

- Source: Sparta and Carrizo-Wilcox Aquifers
- Estimated Reliable Supply: 1,620 acft/yr

4C.3.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Wickson Creek SUD:

- Additional Carrizo-Wilcox Aquifer Development.
- In addition to the recommended plan element, BRA System Operation, Millican Reservoir and the Little River Off-Channel reservoir are considered to be alternative water management strategies.
- Conservation was also considered; however, the SUD's current per capita use rate is below the selected target rate of 140 gpcd.

4C.3.4.3 Costs

Costs of the Recommended Plan for Wickson Creek SUD.

a. Additional Carrizo-Wilcox Aquifer Development:
   - Cost Source: Strategy Evaluation (4B.15.2)
   - Date to be Implemented: By year 2020
   - Total Project Cost: $33,380,000 for full Brazos County evaluation
   - Annual Cost: $851,400 at full implementation

Table 4C.3-4.
Recommended Plan Costs by Decade for Wickson Creek SUD

Plan Element	2010	2020	2030	2040	2050	2060
Projected Shortage (acft/yr)	(151)	(739)	(1,160)	(1,518)	(1,911)	(2,116)
Additional Carrizo-Wilcox Aquifer Development						
Quantity Available (acft/yr)	200	800	1,200	1,600	2,000	2,200
Annual Cost ($/yr)	$77,400	$309,600	$464,400	$619,200	$774,000	$851,400
Unit Cost ($/acft)	$387	$387	$387	$387	$387	$387

4C.3.5 County-Other

No shortages are projected for Brazos County-Other entities and no changes in water supply are recommended.

4C.3.5 Manufacturing

4C.3.5.1 Description of Supply

- Source: Groundwater from Carrizo-Wilcox Aquifer
- Estimated Reliable Supply: 27,899 acft/yr

4C.3.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Brazos County Manufacturing:

- Conservation, and
- Additional Carrizo-Wilcox Aquifer Development.
- In addition to these recommended plan elements, BRA System Operation, Millican Reservoir and the Little River Off-Channel reservoir are considered to be alternative water management strategies.

4C.3.5.3 Costs

Costs of the recommended plan for Brazos County Manufacturing to meet the projected shortages are:

a. Conservation:
   - Date to be Implemented: By year 2010
   - Annual Cost: Not determined

b. Additional Carrizo-Wilcox Aquifer Development:
   - Cost Source: Strategy Evaluation (4B.15.2)
   - Date to be Implemented: By year 2020
   - Total Project Cost: $33,380,000 for full Brazos County evaluation
   - Annual Cost: $116,100 at full implementation

Table 4C.3-5.
Recommended Plan Costs by Decade for Brazos County Manufacturing

Plan Element	2010	2020	2030	2040	2050	2060
Projected Shortage (acft/yr)	1	(48)	(96)	(145)	(189)	(232)
Conservation						
Quantity Available (acft/yr)	9	18	29	32	35	38
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Additional Carrizo-Wilcox Aquifer Development						
Quantity Available (acft/yr)	—	300	300	300	300	300
Annual Cost ($/yr)		$116,100	$116,100	$116,100	$116,100	$116,100
Unit Cost ($/acft)		$387	$387	$387	$387	$387

4C.4 Burleson County Water Supply Plan

Table 4C.4-1 lists each water user group in Burleson County and their corresponding surplus or shortage in years 2030 and 2060.

Table 4C.4-1.
Burleson County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Caldwell	1,622	1,582	Projected Surplus
City of Snook	16	0	Projected Surplus – see plan below
City of Somerville	50	31	Projected Surplus
County-Other	155	0	Projected Surplus
Manufacturing	2	(98)	Projected Shortage – see plan below
Steam-Electric	0	0	No Demand/No Shortage
Mining	0	0	No Projected Need
Irrigation	(3,993)	(2,991)	Projected Shortage – see plan below
Livestock	0	0	No Projected Need

[1] From Tables C-7 and C-8, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.4.1 City of Caldwell

The City of Caldwell obtains its water supply from groundwater from the Carrizo-Wilcox Aquifer. This supply is projected to be sufficient through the planning period and no change in water supply is recommended.

4C.4.2 City of Snook

The City of Snook obtains its water supply from groundwater from the Sparta Aquifer. This supply is projected to be sufficient through the planning period and no change in water supply is recommended. However, the Brazos G Planning Group decided to develop a plan for each entity for which total supplies were less than 105 percent of the projected demands. The plan developed for the City of Snook follows.

4C.4.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Snook:

- Conservation

4C.4.2.3 Costs

Costs of the Recommended Plan for the City of Snook.

a. Conservation:
  - Cost Source: Volume II, Section 4B.2.1
  - Date to be Implemented: By year 2010
  - Annual Cost: maximum of $4,180 in 2060

Table 4C.4-2.
Recommended Plan Costs by Decade for the City of Snook

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Shortage (acft/yr)	36	23	16	10	5	0
Conservation						
Quantity Available (acft/yr)	3	11	8	7	6	7
Annual Cost ($/yr)	$1,140	$4,180	$3,040	$2,660	$2,280	$2,660
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380

4C.4.3 City of Somerville

The City of Somerville obtains its water supply from groundwater from the Sparta Aquifer. This supply is projected to be sufficient through the planning period and no change in water supply is recommended.

4C.4.4 County-Other Category

The water supply entities for County-Other show a projected surplus and no changes in water supply are recommended.

4C.4.5 Manufacturing

4C.4.5.1 Description of Supply

- Source: Groundwater from Sparta Aquifer and run-of-river rights.
- Estimated Reliable Supply: 272 acft/yr

4C.4.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Burleson County Manufacturing:

- Conservation, and
- Additional Carrizo-Wilcox Aquifer Development.

4C.4.5.3 Costs

Costs of the recommended plan for Burleson County Manufacturing to meet the projected shortages are:

a. Conservation:
   - Date to be Implemented: By year 2010
   - Annual Cost: Not determined

b. Additional Carrizo-Wilcox Aquifer Development:
   - Cost Source: estimated wholesale treated water rate
   - Date to be Implemented: By year 2030
   - Annual Cost: $124,624 in 2060

   The annual costs were calculated by multiplying the Manufacturing projected supply from this strategy by an estimated wholesale water rate of $831/acft.

Table 4C.4-3.
Recommended Plan Costs by Decade for Burleson County Manufacturing

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Shortage (acft/yr)	76	39	2	(35)	(68)	(98)
Conservation						
Quantity Available (acft/yr)	6	12	19	21	24	26
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Additional Carrizo-Wilcox Aquifer Development						
Quantity Available (acft/yr)	—	—	50	50	100	150
Annual Cost ($/yr)			$41,537	$41,537	$83,080	$124,624
Unit Cost ($/acft)			$831	$831	$831	$831

4C.4.6 Steam-Electric

No Steam-Electric demand exists or is projected for the county.

4C.4.7 Mining

Mining water use category shows a projected surplus and no changes in water supply are recommended.

4C.4.8 Irrigation

4C.4.8.1 Description of Supply

- Source: Groundwater from Brazos River Alluvium Aquifer and run-of-river rights.
- Estimated Reliable Supply: 11,091 acft/yr in 2060

4C.4.8.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Burleson County Irrigation:

- Conservation, and
- Additional Carrizo-Wilcox Aquifer Development.

4C.4.8.3 Costs

Costs of the recommended plan for Burleson County Irrigation to meet the projected shortages are:

a. Conservation:
   - Cost Source: Volume II, Section 4B.2
   - Date to be Implemented: 2010
   - Unit Cost: $160/acft of water saved
   - Annual Cost: $179,840 in 2030

b. Additional Carrizo-Wilcox Aquifer Development:
   - Date to be Implemented: By year 2010
   - Total Project Cost: $8,718,000
   - Annual Cost: $825,000

   The project cost includes seven 1,000 gpm wells drilled to a depth of 2,500 feet in the Carrizo-Wilcox Aquifer.

Table 4C.4-4.
Recommended Plan Costs by Decade for Burleson County Irrigation

Plan Element	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
Projected Shortage (acft/yr)	(4,720)	(4,348)	(3,993)	(3,677)	(3,326)	(2,991)
Conservation						
Quantity Available (acft/yr)	524	837	1,124	1,080	1,032	986
Annual Cost ($/yr)	$83,840	$133,920	$179,840	$172,800	$165,120	$157,760
Unit Cost ($/acft)	$160	$160	$160	$160	$160	$160
Additional Carrizo-Wilcox Aquifer Development						
Quantity Available (acft/yr)	5,000	5,000	5,000	5,000	5,000	5,000
Annual Cost ($/yr)	$825,000	$825,000	$825,000	$825,000	$825,000	$825,000
Unit Cost ($/acft)	$165	$165	$165	$165	$165	$165

4C.4.9 Livestock

Livestock water use category shows no projected need and no changes in water supply are recommended.

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4C.5 Callahan County Water Supply Plan

Table 4C.5-1 lists each water user group in Callahan County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.5-1.
Callahan County Surplus/(Shortage)

Water User Group	*Surplus/(Shortage)*[1] *2030 (acft/yr)*	*Surplus/(Shortage)*[1] *2060 (acft/yr)*	*Comment*
City of Baird	145	154	Projected surplus
City of Clyde	339	375	Projected surplus
Coleman County WSC	(64)	(44)	Projected shortage – see plan below
City of Cross Plains	272	278	Projected surplus
County-Other	204	261	Projected surplus
Manufacturing	0	0	No demand or supply
Steam-Electric	0	0	No demand or supply
Mining	0	0	No demand or supply
Irrigation	25	25	Projected surplus
Livestock	0	0	No demand or supply

[1] From Tables C-9 and C-10, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.5.1 City of Baird

The City of Baird obtains its water supply from surface water supplied from Lake Baird and from the City of Abilene. From 2000 through 2060, the City's contractual purchase from the City of Abilene is 138 acft/yr and the total amount of surface water availability from Lake Baird is 385 acft/yr. Baird also receives reuse water from the City of Clyde in trade for potable water. No shortages are projected for the City of Baird and no changes in water supply are recommended.

4C.5.2 City of Clyde

The City of Clyde uses surface water from local sources which is projected to supply 500 acft/yr from 2000 through 2060. Clyde also has a contractual purchase plan of 307 acft/yr from the City of Abilene that can cover the city's projected demands. Clyde also has an arrangement with City of Baird to receive potable water in trade for reuse water. No current or future shortages are projected. Clyde also has contractual sales to Eula WSC of 221 acft/yr through 2060. No change in water supply uses are projected or recommended.

4C.5.3 Coleman County WSC

4C.5.3.1 Description of Supply

Coleman County WSC obtains its water supply from the City of Coleman via Lake Coleman. Coleman County WSC is projected to have a maximum shortage of 71 acft/yr in 2020.

4C.5.3.2 Water Supply Plan

After implementation of a subordination strategy developed jointly by Region F and the Lower Colorado Region (see Region F and Region K Regional plans for a description of this strategy), the available supply from Lake Coleman increases by approximately 8,000 acft/yr and the previously existing shortages disappear. Conservation was also considered; however, the current per capita use rate is below the selected target rate of 140 gpcd.

4C.5.3.3 Costs

Since the available supply from Lake Coleman increases, there are no costs involved.

Table 4C.5-2.
Recommended Plan Costs by Decade for Coleman County WSC

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(68)	(71)	(64)	(57)	(50)	(44)
Water Supply from City of Coleman						
Supply From Plan Element (acft/yr)	68	71	64	57	50	44
Annual Cost ($/yr)	0	0	0	0	0	0
Unit Cost ($/acft)	0	0	0	0	0	0

4C.5.4 City of Cross Plains

The City of Cross Plains uses locally available groundwater for all of its water supply and no future shortage is projected. No changes in water supply are recommended.

4C.5.5 County-Other Category

The water supply entities for County-Other show a projected surplus and no changes in water supply are recommended. Currently there is a contractual purchase of 61 acft/yr through 2060 from the City of Abilene.

4C.5.6 Manufacturing

No Manufacturing demand exists or is projected for the county.

4C.5.7 Steam-Electric

No Steam-Electric demand exists or is projected for the county.

4C.5.8 Mining

No Mining demand exists or is projected for the county.

4C.5.9 Irrigation

Irrigation water use shows a projected surplus and no changes in water supply are recommended.

4C.5.10 Livestock

No Livestock demand exists or is projected for the county.

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4C.6 Comanche County Water Supply Plan

Table 4C.6-1 lists each water user group in Comanche County and their corresponding surplus or shortage in years 2030 and 2050. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.6-1.
Comanche County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Comanche	0	0	No projected needs
City of De Leon	0	0	No projected needs
County-Other	393	481	Projected surplus
Manufacturing	7	0	Projected surplus
Steam-Electric	0	0	No projected needs
Mining	0	0	No projected needs
Irrigation	4,892	5,373	Projected surplus
Livestock	0	0	No projected needs

[1] From Tables C-11 and C-12, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.6.1 City of Comanche

The City of Comanche receives its water from the Upper Leon MWD (Lake Proctor surface water), which has an agreement to meet Comanche's water needs. Therefore, no shortage is projected for the City of Comanche and no changes in water supply are recommended.

4C.6.2 City of DeLeon

The City of DeLeon receives its water from the Upper Leon MWD (Lake Proctor surface water), which has an agreement to meet DeLeon's water needs. Therefore, no shortage is projected for the City of DeLeon and no changes in water supply are recommended.

4C.6.3 County-Other

No shortage is projected for Comanche County-Other entities and no changes in water supply are recommended.

4C.6.4 Manufacturing

No shortage is projected for Comanche County Manufacturing and no changes in water supply are recommended.

4C.6.5 Steam-Electric

No shortage is projected for Comanche County Steam-Electric and no changes in water supply are recommended.

4C.6.6 Mining

No shortage is projected for Comanche County Mining and no changes in water supply are recommended.

4C.6.7 Irrigation

No shortage is projected for Comanche County Irrigation and no changes in water supply are recommended.

4C.6.8 Livestock

No shortages are projected for Comanche County Livestock and no changes in water supply are recommended.

4C.7 Coryell County Water Supply Plan

Table 4C.7-1 lists each water user group in Coryell County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.7-1.
Coryell County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Copperas Cove	3,179	2,260	Projected surplus
Fort Gates	0	0	No projected needs
City of Gatesville	176	(1,232)	Projected shortage – see plan below
Kempner WSC	3,153	1,974	Projected surplus
County-Other	(2,103)	(2,776)	Projected shortage – see plan below
Manufacturing	3	0	Projected surplus
Steam-Electric	0	0	No projected needs
Mining	0	0	No projected needs
Irrigation	1,739	1,739	Projected surplus
Livestock	0	0	No projected needs

[1] From Tables C-13 and C-14, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.7.1 City of Copperas Cove

No shortages are projected for the City of Copperas Cove and no changes in water supply are recommended.

4C.7.2 Fort Gates WSC

No shortages are projected for Fort Gates WSC and no changes in water supply are recommended.

4C.7.4 City of Gatesville

4C.7.4.1 Description of Supply

- Source: Surface Water – From Lake Belton
- Estimated Reliable Supply: 4,931 acft/yr in 2060

- System Description: The City of Gatesville owns and operates a regional treatment plant. Raw water is transferred from a raw water intake site at Lake Belton through approximately 8 miles of transmission line to the regional treatment plant from which the water enters the distribution system.

4C.7.4.3 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Gatesville:

- Conservation
- Purchase additional supply from the Brazos River Authority (Lake Belton)

4C.7.4.4 Costs

Costs of the recommended plan for the City of Gatesville to meet the projected shortages are:

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: By Year 2010
   - Annual Cost: maximum of $158,080 in 2060

b. Purchase additional water from BRA (Lake Belton):
   - Cost Source: estimated wholesale rate of $45.75/acft
   - Date to be Implemented: By Year 2040
   - Annual Cost: $59,475 in 2060

   The annual cost was calculated assuming the current BRA System rate of $45.75/acft.

Table 4C.7-2.
Recommended Plan Costs by Decade for the City of Gatesville

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	1,707	931	176	(363)	(826)	(1,232)
Conservation						
Supply From Plan Element (acft/yr)	131	381	388	395	390	416
Annual Cost ($/yr)	$49,780	$144,780	$147,440	$150,100	$148,200	$158,080
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Purchase Additional Supply from BRA						
Supply From Plan Element (acft/yr)	—	—	—	250	1,000	1,300
Annual Cost ($/yr)				$11,438	$45,750	$59,475
Unit Cost ($/acft)				$45.75	$45.75	$45.75

4C.7.4 Kempner WSC

No shortages are projected for Kempner WSC and no changes in water supply are recommended.

4C.7.4 County-Other

4C.7.4.1 Description of Supply

- Source: Surface Water – various contracts with the Brazos River Authority (Lake Belton); Groundwater – Trinity Aquifer
- Estimated Reliable Supply: 1,104 acft/yr in 2060

4C.7.4.3 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Coryell County-Other:

- Conservation
- Additional Trinity Aquifer Development
- Increase Contract with Central Texas WSC

4C.7.4.4 Costs

Costs of the recommended plan for Coryell County-Other to meet the projected shortages are:

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: By Year 2010
   - Annual Cost: maximum of $58,520 in 2020

b. Additional Trinity Aquifer Development:
   - Date to be Implemented: By year 2010
   - Total Project Cost: $4,821,000
   - Annual Cost: $438,000

   The project cost includes 15 100 gpm wells drilled to a depth of 700 feet in the Trinity Aquifer.

c. Increase Contract with Central Texas WSC:
   - Cost Source: estimated wholesale treated water rate
   - Date to be Implemented: By year 2010
   - Annual Cost: $1,094,400 in 2060

   The annual cost was calculated by multiplying the County-Other projected supply from this strategy by an estimated wholesale water rate of $684/acft.

Table 4C.7-3.
Recommended Plan Costs by Decade for Coryell County-Other

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(1,374)	(1,744)	(2,103)	(2,353)	(2,581)	(2,776)
Conservation						
Supply From Plan Element (acft/yr)	61	154	135	117	109	116
Annual Cost ($/yr)	$23,180	$58,520	$51,300	$44,460	$41,420	$44,080
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Additional Trinity Aquifer Development						
Supply From Plan Element (acft/yr)	1,200	1,200	1,200	1,200	1,200	1,200
Annual Cost ($/yr)	$438,000	$438,000	$438,000	$438,000	$438,000	$438,000
Unit Cost ($/acft)	$365	$365	$365	$365	$365	$365
Increase Contract with Central Texas WSC						
Supply From Plan Element (acft/yr)	200	600	1,000	1,200	1,400	1,600
Annual Cost ($/yr)	$136,800	$410,400	$684,000	$820,800	$957,600	$1,094,400
Unit Cost ($/acft)	$684	$684	$684	$684	$684	$684

4C.7.6 Manufacturing

No shortages are projected for Coryell County Manufacturing and no changes in water supply are recommended.

4C.7.7 Steam-Electric

Coryell County has no current or projected future demand for Steam-Electric; therefore, no recommendations have been made.

4C.7.8 Mining

No shortages are projected for Coryell County Mining and no changes in water supply are recommended.

4C.7.9 Irrigation

No shortages are projected for Coryell County Irrigation and no changes in water supply are recommended.

4C.7.10 Livestock

No shortages are projected for Coryell County Livestock and no changes in water supply are recommended.

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4C.8 Eastland County Water Supply Plan

Table 4C.8-1 lists each water user group in Eastland County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.8-1.
Eastland County Surplus/(Shortage)

Water User Group	*Surplus/(Shortage)*[1]		*Comment*
	2030 (acft/yr)	*2060 (acft/yr)*	
City of Cisco	499	589	Projected surplus
City of Eastland	846	949	Projected surplus
City of Gorman	0	0	Supply matches demand
City of Ranger	416	458	Projected surplus
City of Rising Star	(10)	(1)	Projected shortage – see plan below
County-Other	(205)	(99)	Projected shortage – see plan below
Manufacturing	410	401	Projected surplus
Steam-Electric	0	0	No demand or supply
Mining	675	669	Projected surplus
Irrigation	(9,224)	(9,257)	Projected shortage – see plan below
Livestock	0	0	No demand or supply

[1] From Tables C-15 and C-16, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.8.1 The City of Cisco

The City of Cisco uses surface water from Lake Cisco which yields 1,340 acft/yr through 2060. Cisco also has a contract sale to supply water to Westbound WSC of 147 acft/yr through 2060. No shortages are projected for the City of Cisco and no changes in water supply are recommended.

4C.8.2 The City of Eastland

The City of Eastland receives its surface water from a contract with Eastland County WSD. This contract supplies 1,671 acft/yr through 2060. No shortages are projected for the City of Eastland and no changes in water supply are recommended.

4C.8.3 The City of Gorman

The City of Gorman purchases treated water from Upper Leon River MWD and no current or future shortage is projected. Therefore, no changes in water supply are recommended.

4C.8.4 The City of Ranger

The City of Ranger is supplied with surface water from a contract with Eastland Co. WSD. This contract is scheduled to supply 710 acft/yr through 2060. No shortages are projected for the City of Ranger and no changes in water supply are recommended.

4C.8.5 City of Rising Star

4C.8.5.1 Description of Supply

The City of Rising Star uses locally available groundwater for its water supply; however, 2010 through 2060 show projected shortages.

4C.8.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of the City of Rising Star:

- Connect to Westbound WSC
- Conservation was also considered; however, the City's current per capita use rate is below the selected target of 140 gpcd.

4C.8.5.3 Costs

Costs of the Recommended Plan for the City of Rising Star.

b. Water Supply from Westbound WSC
    - Cost Source: Trinity Aquifer well cost
    - Date to be Implemented: before 2010
    - Total Project Cost: $744,098

- Annual Cost: $89,400
- Unit Cost: $596/acft

Table 4C.8-2.
Recommended Plan Costs by Decade for City of Rising Star

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(17)	(14)	(10)	(6)	(2)	1
Water Supply from Connection to Westbound WSC						
Supply From Plan Element (acft/yr)	150	150	150	150	150	150
Annual Cost ($/yr)	$89,400	$89,400	$89,400	$89,400	$89,400	$89,400
Unit Cost ($/acft)	$596	$596	$596	$596	$596	$596

4C.8.6 County-Other Category

4C.8.6.1 Description of Supply

The water supply entities for County-Other show a projected shortage from 2010 through 2060. Currently contract purchases through 2060 exist with the City of Cisco (147 acft/yr), the City of Clyde (221 acft/yr), and Eastland County WSC (120 acft/yr).

4C.8.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of County-Other:

- Purchase additional water from Eastland County WSD
- Conservation was also considered; however, the County-Other's current per capita use rate is below the selected target of 140 gpcd.

4C.8.6.3 Costs

Costs of the Recommended Plan for the County-Other.

a. Water Supply from Eastland County WSD:
   - Cost Source: assumed wholesale water rate
   - Date to be Implemented: before 2010
   - Total Project Cost: $1,834,540
   - Annual Cost: $317,700

Table 4C.8-3.
Recommended Plan Costs by Decade for Eastland County-Other

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(257)	(239)	(205)	(166)	(129)	(99)
Water Supply from Eastland County WSD (Lake Leon)						
Supply From Plan Element (acft/yr)	300	300	300	300	300	300
Annual Cost ($/yr)	$317,700	$317,700	$317,700	$317,700	$317,700	$317,700
Unit Cost ($/acft)	$1,059	$1,059	$1,059	$1,059	$1,059	$1,059

4C.8.7 Manufacturing

Eastland County Manufacturing shows a projected surplus and no changes in water supply are recommended.

4C.8.8 Steam-Electric

No Steam-Electric demand exists or is projected for the county.

4C.8.9 Mining

Eastland County Mining shows a projected surplus and no changes in water supply are recommended.

4C.8.10 Irrigation

4C.8.10.1 Description of Supply

Surface water supplies for Eastland County Irrigation are obtained from Lake Leon, the Leon River, and its tributaries. As demonstrated in Table 4C.8-1, a current and long-term shortage in Irrigation water supplies exists through the year 2060.

4C.8.10.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to partially mitigate projected shortages for Irrigation:

- Conservation
- Brush Control and Weather Mod – these supplies are unquantifiable, see sections 4B.9 and 4B.10 for more detailed information.

4C.8.10.3 Costs

Cost of the Recommended Plan for Eastland County Irrigation.

a. Water Supply from Conservation:

- Cost Source: Volume II, Section 4B.2
- Date to be Implemented: By 2010.
- Annual Cost: maximum of $183,520 in 2060

Table 4C.8-4.
Recommended Plan Costs by Decade for Eastland County Irrigation

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(9,172)	(9,198)	(9,224)	(9,242)	(9,249)	(9,257)
Conservation						
Supply From Plan Element (acft/yr)	489	816	1,145	1,146	1,146	1,147
Annual Cost ($/yr)	$78,240	$130,560	$183,200	$183,360	$183,360	$183,520
Unit Cost ($/acft)	$160	$160	$160	$160	$160	$160

4C.8.11 Livestock

No Livestock demand exists or is projected for the county.

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4C.9 Erath County Water Supply Plan

Table 4C.9-1 lists each water user group in Erath County and their corresponding surplus or shortage in years 2030 and 2060.

Table 4C.9-1.
Erath County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Dublin	0	0	No projected needs
City of Stephenville	3,043	2,268	Projected surplus
County-Other	1,009	0	Projected surplus
Manufacturing	(16)	(40)	Projected shortage – see plan below
Steam-Electric	0	0	No projected needs
Mining	0	0	No projected needs
Irrigation	2,322	2,453	Projected surplus
Livestock	0	0	No projected needs

[1] From Tables C-17 and C-18, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.9.1 City of Dublin

The City of Dublin obtains its water supply from the Upper Leon Municipal Water District (Upper Leon MWD). The Upper Leon MWD has contracted for surface water from Lake Proctor and treats and delivers it to the City of Dublin. The City of Dublin and Upper Leon MWD have contracted for adequate quantities of water to provide a firm supply and meet their needs through the year 2060.

4C.9.2 City of Stephenville

The City of Stephenville obtains its water supply from groundwater from the Trinity Aquifer. The City has also recently completed the construction of a pipeline to Lake Proctor to receive water supplied through a contract with the Upper Leon MWD. With the completion of this project, the City has adequate water supplies to meet their needs through the year 2060.

4C.9.3 County-Other

County-Other is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.9.4 Manufacturing

4C.9.4.1 Description of Supply

Manufacturing entities in Erath County currently obtain their water supply from the Trinity Aquifer.

4C.9.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Erath County Manufacturing:

- Conservation
- Additional Trinity Aquifer Development

4C.9.4.3 Costs

Costs of the recommended plan for Erath County Manufacturing to meet the shortages are:

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Additional Trinity Aquifer Development:
   - Date to be Implemented: By year 2020
   - Total Project Cost: $198,000
   - Annual Cost: $18,000

   The project cost includes one 150 gpm well drilled to a depth of 400 feet in the Trinity Aquifer.

Table 4C.9-2.
Recommended Plan Costs by Decade for Erath County Manufacturing

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	1	(8)	(16)	(24)	(31)	(40)
Conservation						
Supply From Plan Element (acft/yr)	2	4	6	7	7	8
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Additional Trinity Aquifer Development						
Supply From Plan Element (acft/yr)	—	50	50	50	50	50
Annual Cost ($/yr)		$18,000	$18,000	$18,000	$18,000	$18,000
Unit Cost ($/acft)		$360	$360	$360	$360	$360

4C.9.5 Steam-Electric

No Steam-Electric demand exists or is projected for the county.

4C.9.6 Mining

No Mining demand exists or is projected for the county.

4C.9.7 Irrigation

Irrigation is projected to have a surplus of water from available groundwater and surface water supplies and no changes in water supply are recommended.

4C.9.8 Livestock

No shortages are projected for Livestock use and no changes in water supply are recommended.

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4C.10 Falls County Water Supply Plan

Table 4C.10-1 lists each water user group in Falls County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.10-1.
Falls County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Lott	92	96	Projected surplus
City of Marlin	2,606	2,324	Projected surplus
City of Rosebud	663	672	Projected surplus
Tri-County SUD	145	56	Projected surplus
West Brazos WSC	(430)	(580)	Projected shortage – see plan below
County-Other	(111)	55	Projected shortage – see plan below
Manufacturing	1,465	1,427	Projected surplus
Steam-Electric	0	0	No projected demand
Mining	0	0	No projected needs
Irrigation	4,393	4,475	Projected surplus
Livestock	0	0	No Projected Needs

[1] From Tables C-19 and C-20, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.10.1 City of Lott

The City of Lott obtains its water supply from the Central Texas WSC, which treats and delivers water from Lake Stillhouse Hollow. The City of Lott has contracted with Central Texas WSC for 184 acft/yr of supply, which exceeds its 2060 water demand of 88 acft/yr. No change in water supply is recommended.

4C.10.2 City of Marlin

The City of Marlin obtains its water supply from surface water from local reservoirs and the Brazos River. The City owns and operates two existing reservoirs—Marlin City Lake and New Marlin Reservoir—that impound runoff from Big Sandy Creek. The City also owns water rights that authorize diversion of 4,000 acft/yr from the Brazos River and have contracted with the Brazos River Authority for 1,200 acft/yr from the BRA System. Currently, the City utilizes surface water from the two existing reservoirs as its primary supply and diverts water from Brazos River only in an emergency, to supplement the supply in the two existing reservoirs.

4C.10.2.1 Water Supply Plan

While the supplies are projected to be adequate to meet the City's water demand through 2060, the City is developing additional surface water supply to decrease the need for water from the Brazos River. In conjunction with Falls County and the U.S. Dept. of Agriculture, Natural Resources Conservation Service (NRCS), the City of Marlin has been actively pursuing the implementation of the new Brushy Creek Reservoir, which is part of the Big Creek Watershed Project. Brushy Creek Reservoir is proposed as a multi-purpose reservoir for water supply, flood control and recreation. Water rights have been granted and implementation of the project is continuing.

In order to support the efforts of the City of Marlin and others, the following plan is recommended by the Brazos G RWPG for the City of Marlin:

- Conservation.
- Brushy Creek Reservoir

4C.10.2.2 Costs

a. Conservation

- Date to be Implemented: before 2010 – use rate exceeds 140 gpcd
- Annual Cost: maximum of $42,560 in 2020

b. Brushy Creek Reservoir

- Cost Source: 2001 Brazos G Regional Water Plan, updated to Second Quarter 2002 dollars
- Date to be Implemented: 2010
- Total Project Cost: $6,301,610 (Brushy Creek Reservoir only)
- Annual Cost: $513,339

Table 4C.10-2.
Recommended Plan Costs by Decade for the City of Marlin

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	2,815	2,711	2,606	2,517	2,432	2,324
Conservation						
Supply From Plan Element (acft/yr)	46	112	91	68	61	63
Annual Cost ($/yr)	$17,480	$42,560	$34,580	$25,840	$23,180	$23,940
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Brushy Creek Reservoir						
Supply From Plan Element (acft/yr)	2,000	2,000	2,000	2,000	2,000	2,000
Annual Cost ($/yr)	$513,339	$513,339	$513,339	$513,339	$513,339	$513,339
Unit Cost ($/acft)	$257	$257	$257	$257	$257	$257

4C.10.3 City of Rosebud

The City of Rosebud obtains its water supply from the Central Texas WSC, which treats and delivers water from Lake Belton. The City of Rosebud has contracted with Central Texas WSC for 500 acft/yr of supply, which exceeds its 2060 projected water demand of 152 acft/yr. No change in water supply is recommended.

4C.10.4 Tri-County SUD

Tri-County SUD obtains its water supply from the Trinity and Carrizo-Wilcox Aquifers. Tri-County SUD has adequate water supplies to meet its projected water demands. No change in water supply is recommended.

4C.1.5 West Brazos WSC

4C.1.5.1 Description of Supply

- Source: Groundwater – Trinity Aquifer
- Estimated Reliable Supply: 32 acft/yr

4C.1.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of West Brazos WSC:

- Purchase water from the City of Waco.
- Conservation was also considered; however, the WSC's current per capita use rate is below the selected target rate of 140 gpcd.

4C.1.5.3 Costs

Costs of the Recommended Plan for West Brazos WSC.

a. Purchase water from City of Waco:
   - Cost Source: Assumed $850/acft for wholesale water costs and necessary transmission line improvements
   - Date to be Implemented: By year 2010
   - Annual Cost: $510,000 at full implementation

Table 4C.10-3.
Recommended Plan Costs by Decade for West Brazos WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(319)	(379)	(430)	(486)	(523)	(580)
Purchase water from City of Waco						
Supply From Plan Element (acft/yr)	400	400	450	500	550	600
Annual Cost ($/yr)	$340,000	$340,000	$382,500	$425,000	$467,500	$510,000
Unit Cost ($/acft)	$850	$850	$850	$850	$850	$850

4C.1.6 County-Other

4C.1.6.1 Description of Supply

- Source: Groundwater – Trinity Aquifer; Surface Water – contracts with Central Texas WSC
- Estimated Reliable Supply: 102 acft/yr

4C.1.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Falls County-Other:

- Additional Carrizo-Wilcox Aquifer Development.
- Conservation was also considered; however, this entity's current per capita use rate is below the selected target rate of 140 gpcd.

4C.1.6.3 Costs

Costs of the Recommended Plan for Falls County-Other.

a. Additional Carrizo-Wilcox Aquifer Development:
   - Date to be Implemented: By year 2010
   - Total Project Cost: $1,376,000
   - Annual Cost: $176,000

   The project cost includes four 100 gpm wells drilled to a depth of 250 feet in the Carrizo-Wilcox Aquifer.

Table 4C.10-4.
Recommended Plan Costs by Decade for Falls County-Other

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(258)	(184)	(111)	(44)	5	55
Additional Carrizo-Wilcox Aquifer Development						
Supply From Plan Element (acft/yr)	300	300	300	300	300	300
Annual Cost ($/yr)	$176,000	$176,000	$176,000	$176,000	$176,000	$176,000
Unit Cost ($/acft)	$587	$587	$587	$587	$587	$587

4C.10.7 Manufacturing

Manufacturing is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.10.8 Steam-Electric

No Steam-Electric demand exists nor is projected for the county.

4C.10.9 Mining

Mining is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.10.10 Irrigation

Irrigation is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.10.11 Livestock

Livestock is projected to have a no additional need for water through the year 2060 and no changes in water supply are recommended.

4C.11 Fisher County Water Supply Plan

Table 4C.11-1 lists each water user group in Fisher County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.11-1.
Fisher County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Roby	117	113	Projected surplus
City of Rotan	0	0	Supply based on projected demand
County-Other	94	152	Projected surplus
Manufacturing	(155)	(236)	Projected shortage – see plan below
Steam-Electric	0	0	No demand or supply
Mining	0	0	No demand or supply
Irrigation	556	572	Projected surplus
Livestock	0	0	No demand or supply

[1] From Tables C-21 and C-22, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.11.1 City of Roby

4C.11.1.1 Description of Supply

Surface water supplies are obtained from the City of Sweetwater through contract purchase from the Oak Creek Reservoir. No shortages are projected for the City of Roby and no changes in water supply are recommended.

4C.11.2 City of Rotan

The City of Rotan is currently purchasing water under contract from the City of Snyder; however, supply is allocated based on projected demands.

4C.11.3 County-Other

The water supply entities for Fisher County-Other show a projected surplus and no changes in water supply are recommended.

4C.11.4 Manufacturing

4C.11.4.1 Description of Supply

Fisher County Manufacturing shows a projected shortage from 2010 through 2060.

4C.11.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of Manufacturing:

- Conservation.
- Purchase water from Sweetwater; however, Sweetwater must complete projects in order to have a surplus.

4C.11.4.3 Costs

Cost of the Recommended Plan for Manufacturing

a. Conservation:

- Date to be Implemented: before 2010
- Annual Cost: not determined

b. Water Supply from Sweetwater:

- Cost Source: assumed wholesale water rate
- Date to be Implemented: before 2010
- Total Project Cost: none (Current infrastructure is assumed to be adequate)
- Annual Cost: $73,140 in 2060

Table 4C.11-2.
Recommended Plan Costs by Decade for Fisher County Manufacturing

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(92)	(125)	(155)	(184)	(210)	(236)
Conservation						
Supply from Plan Element (acft/yr)	6	11	18	20	22	24
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Water Supply from Sweetwater						
Supply From Plan Element (acft/yr)	86	114	137	164	188	212
Annual Cost ($/yr)	$29,670	$39,330	$47,265	$56,580	$64,860	$73,140
Unit Cost ($/acft)	$345	$345	$345	$345	$345	$345

4C.11.5 Steam-Electric

No Steam-Electric demand exists or is projected for the county.

4C.11.6 Mining

No Mining demand exists or is projected for the county.

4C.11.7 Irrigation

No shortages are projected for Fisher County Irrigation and no changes in water supply are recommended.

4C.11.8 Livestock

No shortages are projected for Fisher County Livestock and no changes in water supply are recommended.

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4C.12 Grimes County Water Supply Plan

Table 4C.12-1 lists each water user group in Grimes County and their corresponding surplus or shortage in years 2030 and 2060.

Table 4C.12-1.
Grimes County Surplus/(Shortage)

Water User Group	*Surplus/(Shortage)*[1] 2030 (acft/yr)	*Surplus/(Shortage)*[1] 2060 (acft/yr)	*Comment*
City of Navasota	1,257	1,196	Projected surplus
County-Other	229	195	Projected surplus
Manufacturing	(80)	(189)	Projected shortage – see plan below
Steam-Electric	(727)	(9,715)	Projected shortage – see plan below
Mining	16	16	Projected surplus
Irrigation	953	953	Projected surplus
Livestock	0	0	No projected surplus/shortage

[1] From Tables C-23 and C-24, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.12.2 City of Navasota

The City of Navasota obtains its water supply from groundwater from the Gulf Coast Aquifer. The existing production capacity of the wells and groundwater availability is adequate to supply the needs of the City of Navasota through the year 2060. No change in water supply is recommended.

4C.12.3 County-Other

County-Other is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.12.4 Manufacturing

4C.12.4.1 Description of Supply

- Source: Groundwater – Gulf Coast Aquifer
- Estimated Reliable Supply: 256 acft/yr

4C.12.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Grimes County Manufacturing:

- Conservation, and
- Additional Gulf Coast Aquifer Development.

4C.12.4.3 Costs

Costs of the Recommended Plan for Grimes County Manufacturing.

a. Conservation:
   - Date to be Implemented: By year 2010
   - Annual Cost: Not determined

b. Additional Gulf Coast Aquifer Development:
   - Date to be Implemented: By year 2010
   - Total Project Cost: $312,000
   - Annual Cost: $26,000

   The project cost includes two 100 gpm wells drilled to a depth of 300 feet in the Gulf Coast Aquifer.

Table 4C.12-2.
Recommended Plan Costs by Decade for Grimes County Manufacturing

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(1)	(41)	(80)	(119)	(154)	(189)
Conservation						
Supply From Plan Element (acft/yr)	8	15	24	26	29	31
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Additional Gulf Coast Aquifer Development						
Supply From Plan Element (acft/yr)	250	250	250	250	250	250
Annual Cost ($/yr)	$26,000	$26,000	$26,000	$26,000	$26,000	$26,000
Unit Cost ($/acft)	$104	$104	$104	$104	$104	$104

4C.12.5 Steam-Electric Power

4C.12.5.1 Description of Supply

- Source: Surface Water – Gibbons Creek Reservoir (Texas Municipal Power Agency (TMPA)), BRA contract for water from Lake Limestone, and a contract with the City of Huntsville (Trinity River Authority - Lake Livingston)
- Estimated Reliable Supply: 13,031 acft/yr

4C.12.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Grimes County Steam-Electric:

- Conservation,
- Purchase water from the Brazos River Authority, and
- Raise the level of Gibbons Creek Reservoir. The TMPA operates the Gibbons Creek Power Station, which uses Gibbons Creek Reservoir to provide cooling water supply. The TMPA is considering alternatives for increasing supply from Gibbons Creek Reservoir. Raising the conservation pool from 247 feet to 251 feet would provide up to 3,870 acre-feet of additional supply.

4C.12.5.3 Costs

Costs of the Recommended Plan for Grimes County Steam-Electric.

a. Conservation:
   - Date to be Implemented: By year 2010
   - Annual Cost: Not determined

b. Raise level of Gibbons Creek Reservoir:
   - Cost Source: Cost estimate provided by TMPA
   - Date to be Implemented: By year 2010
   - Total Project Cost: $8,003,000
   - Annual Cost: $618,000

c. Purchase water from the Brazos River Authority:
   - Cost Source: Cost estimate provided by TMPA
   - Date to be Implemented: By year 2040
   - Unit Cost: $203/acft (includes intake and conveyance, and purchase of water from BRA at $45.75/acft)

Table 4C.12-3.
Recommended Plan Costs by Decade for Grimes County Steam-Electric

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	3,729	1,263	(727)	(3,153)	(6,110)	(9,715)
Conservation						
Supply From Plan Element (acft/yr)	279	588	963	1,133	1,340	1,592
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Raise Level of Gibbons Creek Reservoir						
Supply From Plan Element (acft/yr)	3,870	3,870	3,870	3,870	3,870	3,870
Annual Cost ($/yr)	$618,000	$618,000	$618,000	$618,000	$618,000	$86,000
Unit Cost ($/acft)	$160	$160	$160	$160	$160	$22
Purchase water from the Brazos River Authority						
Supply From Plan Element (acft/yr)	—	—	—	1,000	1,000	4,500
Annual Cost ($/yr)				$203,000	$203,000	$913,500
Unit Cost ($/acft)				$203	$203	$203

4C.12.6 Mining

Mining is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.12.7 Irrigation

Irrigation is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.12.8 Livestock

Livestock is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.13 Hamilton County Water Supply Plan

Table 4C.13-1 lists each water user group in Hamilton County and their corresponding surplus or shortage in years 2030 and 2060.

Table 4C.13-1. Hamilton County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Hamilton	515	533	Projected surplus
City of Hico	47	54	Projected surplus
County-Other	232	261	Projected surplus
Manufacturing	3	0	Projected surplus
Steam-Electric	0	0	No projected demands
Mining	0	0	No projected demands
Irrigation	3,150	3,175	Projected surplus
Livestock	0	0	No projected needs

[1] From Tables C-25 and C-26, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.13.1 City of Hamilton

The City of Hamilton obtains its water supply from Lake Proctor through the Upper Leon Municipal Water District with a contract for 2,000 acft/yr of supply. The City of Hamilton sells a portion of its supply to Multi-County WSC. The City's available supply exceeds the 2060 demands. No change in water supply is recommended.

4C.13.2 City of Hico

The City of Hico obtains its water supply from groundwater from the Trinity Aquifer. The existing production capacity of the wells and groundwater availability is adequate to supply the needs of the City of Hico through the year 2060. No change in water supply is recommended.

4C.13.3 County-Other

County-Other is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.13.4 Manufacturing

Manufacturing is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.13.5 Steam-Electric

No Steam-Electric demand exists or is projected for the county.

4C.13.6 Mining

No Mining demand exists or is projected for the county.

4C.13.7 Irrigation

Irrigation is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.13.8 Livestock

Livestock water supply is projected to meet demands through the year 2060 and no changes in water supply are recommended.

4C.14 Haskell County Water Supply Plan

Table 4C.14-1 lists each water user group in Haskell County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4C.14-1.
Haskell County Surplus/(Shortage)**

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Haskell	(383)	(472)	Projected shortage –see plan below
City of Rule	4	13	Projected shortage –see plan below
County-Other	54	77	Projected surplus
Manufacturing	0	0	No demand or supply
Steam-Electric	1,807	1,550	Projected surplus
Mining	(52)	(47)	Projected shortage –see plan below
Irrigation	(25,936)	(21,950)	Projected shortage –see plan below
Livestock	0	0	No demand or supply

[1] From Tables C-27 and C-28, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.14.1 City of Haskell

4C.14.1.1 Description of Supply

Surface water supplies are obtained from a contract with North Central Texas MWD (NCTMWD). The current contract is not sufficient to meet demands through 2060.

4C.14.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of the city of Haskell:

- Conservation.
- Purchase additional supply from NCTMWD (additional supply would require implementation of the Millers Creek Reservoir Augmentation strategy by NCTMWD (Section 4B.7))

4C.14.1.3 Costs

Cost of the recommended plan for the City of Haskell.

a. Conservation

- Date to be Implemented: before 2010
- Annual Cost: $6,840 in 2060

b. Water Supply from NCTMWD:

- Date to be Implemented: before 2010
- Total Project Cost: none (Current infrastructure assumed to be adequate)
- Annual Cost: $211,500 (based on a unit cost of treated wholesale water of $423/acft)

Table 4C.14-2.
Recommended Plan Costs by Decade for the City of Haskell

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(334)	(358)	(383)	(413)	(442)	(472)
Conservation						
Supply From Plan Element (acft/yr)	23	47	36	26	19	18
Annual Cost ($/yr)	$8,740	$17,860	$13,680	$9,880	$7,220	$6,840
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Water Supply from NCTMWD						
Supply From Plan Element (acft/yr)	500	500	500	500	500	500
Annual Cost ($/yr)	$211,500	$211,500	$211,500	$211,500	$211,500	$211,500
Unit Cost ($/acft)	$423	$423	$423	$423	$423	$423

4C.14.2 City of Rule

4C.14.2.1 Description of Supply

Water supplies are obtained from a contract with NCTMWD and local groundwater. The current supplies are not sufficient to meet demands through 2020.

4C.14.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of the City of Rule:

- Purchase additional supply from NCTMWD (additional supply would require implementation of the Millers Creek Reservoir Augmentation strategy by NCTMWD (Section 4B.7)).
- Conservation was also considered; however, the current per capita use rate is below the selected target rate of 140 gpcd.

4C.14.2.3 Costs

Cost of the Recommended Plan for the City of Rule.

a. Water Supply from NCTMWD:

- Date to be Implemented: before 2010
- Total Project Cost: none (Current infrastructure assumed to be adequate)
- Annual Cost: $19,550 (based on a unit cost of treated wholesale water of $423/acft)

Table 4C.14-3.
Recommended Plan Costs by Decade for the City of Rule

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(3)	(0)	4	7	10	13
Water Supply from NCTMWD						
Supply From Plan Element (acft/yr)	50	50	50	50	50	50
Annual Cost ($/yr)	$21,150	$21,150	$21,150	$21,150	$21,150	$21,150
Unit Cost ($/acft)	$423	$423	$423	$423	$423	$423

4C.14.3 The City of Stamford

The City of Stamford is primarily in Jones County and its proposed plan is described in Section 4C.18.

4C.14.4 County-Other Category

The water supplies for Haskell County-Other are from contract purchases from the City of Stamford and from NCTMWD. Haskell County-Other shows a projected surplus and no changes in water supply are recommended.

4C.14.5 Manufacturing

No Manufacturing demand exists or is projected for the county.

4C.14.6 Steam-Electric

Haskell County Steam-Electric shows a projected surplus and no changes in water supply are recommended.

4C.14.7 Mining

4C.14.7.1 Description of Supply

The current supply comes from the Seymour Aquifer. With current supplies Mining shows a projected shortage through 2060.

4C.14.7.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected Mining shortage:

- Conservation, and
- Overdraft aquifer.

4C.14.7.3 Costs

Cost of the Recommended Plan for the Haskell County Mining.

a. Conservation
   - Date to be Implemented: before 2010
   - Annual Cost: not determined

b. Water Supply from Overdraft Aquifer:
   - Cost Source: Seymour Aquifer (max quantity of 53 acft/yr)
   - Date to be Implemented: before 2010
   - Total Project Cost: none (current infrastructure assumed to be adequate)
   - Annual Cost: none (costs would be the same current operational costs.)

Table 4C.14-4.
Recommended Plan Costs by Decade for Haskell County Mining

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(56)	(53)	(52)	(50)	(48)	(47)
Conservation						
Supply From Plan Element (acft/yr)	3	5	6	6	6	6
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Overdraft Aquifer						
Supply From Plan Element (acft/yr)	53	48	46	44	42	41
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—

4C.14.8 Irrigation

4C.14.8.1 Description of Supply

Current surface water supplies Irrigation are not sufficient to meet demands through 2060.

4C.14.8.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to mitigate a portion of the shortages for Haskell County Irrigation:

- Conservation.
- Implement brush control and weather modification programs. These supplies are unquantifiable; see sections 4B.9 and 4B.10 for more detailed information.

Neither option is sufficient to meet all of the projected needs for Irrigation in Haskell County.

4C.14.8.3 Costs

Costs of the Recommended Plan for Haskell County Irrigation.

a. Conservation:

- Cost Source: Strategy Evaluation (Section 4B.2.2)
- Date to be Implemented: before 2010
- Annual Cost: maximum of $520,000 in 2030

Table 4C.14-5.
Recommended Plan Costs by Decade for Haskell County Irrigation

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(28,805)	(27,349)	(25,936)	(24,564)	(23,236)	(21,950)
Conservation						
Supply From Plan Element (acft/yr)	1,479	2,392	3,250	3,153	3,059	2,968
Annual Cost ($/yr)	$236,640	$382,720	$520,000	$504,480	$489,440	$474,880
Unit Cost ($/acft)	$160	$160	$160	$160	$160	$160

4C.14.9 Livestock

No shortages are projected for Haskell County Livestock and no changes in water supply are recommended.

4C.15 Hill County Water Supply Plan

Table 4C.15-1 lists each water user group in Hill County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections. Water supply plans are also presented for some entities that need pumping/conveyance facilities to utilize their existing water resources, or to become a regional provider.

Table 4C.15-1.
Hill County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
Brandon-Irene WSC	51	(92)	Projected shortage – see plan below
Files Valley WSC	323	32	Projected surplus
City of Hillsboro	1,283	(20)	Projected shortage – see plan below
City of Hubbard	0	0	No projected needs
City of Itasca	34	44	Projected surplus
Lake Whitney Water Co.	33	29	Projected surplus
White Bluff Community WS	(341)	(663)	Projected shortage – see plan below
City of Whitney	39	10	Projected surplus – see plan below
Woodrow-Osceola WSC	(119)	(154)	Projected shortage – see plan below
County-Other	624	399	Projected surplus
Manufacturing	(21)	(53)	Projected shortage – see plan below
Steam-Electric	0	0	No projected demands
Mining	0	0	No projected needs
Irrigation	1,004	1,005	Projected surplus
Livestock	0	0	No projected needs

[1] From Tables C-29 and C-30, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.15.1 Brandon-Irene WSC

4C.15.1.1 Description of Supply

- Source: Groundwater – Trinity Aquifer; Surface water – purchase from Aquilla WSD
- Estimated Reliable Supply: 181 acft/yr in 2060

4C.15.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Brandon-Irene WSC:

- BRA System Operation.
- Conservation was also considered; however, the WSC's current per capita use rate is below the selected target rate of 140 gpcd.

4C.15.1.3 Costs

Costs of the Recommended Plan for Brandon-Irene WSC.

a. BRA System Operation:
   - Cost Source: Strategy Evaluation (Section 4B.4)
   - Date to be Implemented: By year 2050
   - Annual Cost: $235,500

Table 4C.15-2.
Recommended Plan Costs by Decade for Brandon-Irene WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	104	77	51	25	(6)	(92)
BRA System Operation						
Supply From Plan Element (acft/yr)	—	—	—	—	100	100
Annual Cost ($/yr)					$235,500	$235,500
Unit Cost ($/acft)					$2,355	$2,355

4C.15.2 Files Valley WSC

Files Valley WSC obtains its water supply from the Aquilla Water Supply District (WSD). Aquilla WSD has contracted with the Brazos River Authority for surface water from Lake Aquilla and diverts, treats, and delivers water to Files Valley WSC. The existing facilities are adequate to supply the needs of Files Valley WSC through the year 2060. No change in water supply is recommended.

4C.15.3 City of Hillsboro

4C.15.3.1 Description of Supply

- Source: Surface water – purchase from Aquilla WSD
- Estimated Reliable Supply: 1,997 acft/yr in 2060

4C.15.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Hillsboro:

- Conservation, and
- BRA System Operation.

4C.15.3.3 Costs

Costs of the Recommended Plan for the City of Hillsboro.

a. Conservation:
  - Cost Source: Volume II, Section 4B.2.1
  - Date to be Implemented: By year 2010
  - Annual Cost: maximum of $56,240 in 2020

b. BRA System Operation:
  - Cost Source: Strategy Evaluation (Section 4B.4)
  - Date to be Implemented: By year 2060
  - Annual Cost: $235,500

Table 4C.15-3.
Recommended Plan Costs by Decade for the City of Hillsboro

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	2,105	1,698	1,283	872	436	(20)
Conservation						
Supply From Plan Element (acft/yr)	66	148	123	96	89	94
Annual Cost ($/yr)	$25,080	$56,240	$46,740	$36,480	$33,820	$35,720
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
BRA System Operation						
Supply From Plan Element (acft/yr)	—	—	—	—	—	100
Annual Cost ($/yr)						$235,500

Unit Cost ($/acft)						$2,355

4C.15.4 City of Hubbard

The City of Hubbard obtains its water supply from surface water from Lake Navarro Mills through the Post Oak Special Utility District (SUD). The Post Oak SUD purchases treated water from the City of Corsicana and delivers it to the City of Hubbard. The existing contractual arrangements and conveyance capacity of the system are adequate to meet the needs of the City of Hubbard through the year 2060. No change in water supply is recommended.

4C.15.5 City of Itasca

The City of Itasca obtains its water supply from groundwater from the Trinity Aquifer. The existing production capacity of the wells and groundwater availability are adequate to supply the needs of the City of Itasca through the year 2060. No change in water supply is recommended.

4C.15.6 Lake Whitney Water Co.

The Lake Whitney Water Co. obtains its water supply from groundwater from the Trinity Aquifer and run-of-river rights. The existing production capacity of the wells and the run-of-river rights are adequate to supply the needs of the entity through the year 2060. No change in water supply is recommended.

4C.15.7 White Bluff Community WS

4C.15.7.1 Description of Supply

- Source: Groundwater – Trinity Aquifer
- Estimated Reliable Supply: 212 acft/yr

4C.15.7.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the White Bluff Community WS:

- Conservation, and
- BRA System Operation.

4C.15.7.3 Costs

Costs of the Recommended Plan for the White Bluff Community WS.

a. Conservation:
- Date to be Implemented: By year 2010
- Annual Cost: maximum of $17,100 in 2060

a. BRA System Operation:
- Cost Source: Volume II, Section 4B.4
- Date to be Implemented: By year 2010
- Annual Cost: $1,648,500

Table 4C.15-4.
Recommended Plan Costs by Decade for the White Bluff Community WS

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(157)	(244)	(341)	(438)	(545)	(663)
Conservation						
Supply From Plan Element (acft/yr)	11	29	31	33	40	45
Annual Cost ($/yr)	$4,180	$11,020	$11,780	$12,540	$15,200	$17,100
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
BRA System Operation						
Supply From Plan Element (acft/yr)	200	300	400	500	600	700
Annual Cost ($/yr)	$471,000	$706,500	$942,000	$1,177,500	$1,413,000	$1,648,500
Unit Cost ($/acft)	$2,355	$2,355	$2,355	$2,355	$2,355	$2,355

4C.15.8 City of Whitney

The City of Whitney obtains its water supply from groundwater from the Trinity Aquifer. The City of Whitney has also contracted with the Brazos River Authority for 750 acft of surface water supply from Lake Whitney; however, the City has not implemented the required infrastructure to utilize this supply. The production capacity of the City's existing wells and groundwater availability are adequate to supply the needs of the City of Whitney through the year 2060; however, the available supply is not greater than 105 percent of the City's projected water demand.

4C.15.8.1 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Whitney:

- Conservation.

4C.15.8.2 Costs

Costs of the Recommended Plan for the City of Whitney.

a. Conservation:
   - Date to be Implemented: By year 2010
   - Annual Cost: maximum of $13,680 in 2020

Table 4C.15-5.
Recommended Plan Costs by Decade for the City of Whitney

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	48	44	39	34	24	10
Conservation						
Supply From Plan Element (acft/yr)	16	36	29	23	21	22
Annual Cost ($/yr)	$6,080	$13,680	$11,020	$8,740	$7,980	$8,360
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380

4C.15.9 Woodrow-Osceola WSC

4C.15.9.1 Description of Supply

- Source: Groundwater – Trinity Aquifer
- Estimated Reliable Supply: 165 acft/yr

4C.15.9.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Woodrow-Osceola WSC:

- BRA System Operation.
- Conservation was also considered; however, the WSC's current per capita use rate is below the selected target rate of 140 gpcd.

4C.15.9.3 Costs

Costs of the Recommended Plan for Woodrow-Osceola WSC.

a. BRA System Operation:
- Cost Source: Strategy Evaluation (Section 4B.4)
- Date to be Implemented: By year 2010
- Annual Cost: $471,000

Table 4C.15-6.
Recommended Plan Costs by Decade for Woodrow-Osceola WSC

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(121)	(120)	(119)	(122)	(133)	(154)
BRA System Operation						
Supply From Plan Element (acft/yr)	200	200	200	200	200	200
Annual Cost ($/yr)	$471,000	$471,000	$471,000	$471,000	$471,000	$471,000
Unit Cost ($/acft)	$2,355	$2,355	$2,355	$2,355	$2,355	$2,355

4C.15.10 County-Other

County-Other is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.15.11 Manufacturing

4C.15.11.1 Description of Supply

- Source: Groundwater – Woodbine Aquifer
- Estimated Reliable Supply: 87 acft/yr

4C.15.11.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Hill County Manufacturing:

- Conservation, and
- BRA System Operation.

4C.15.11.3 Costs

Costs of the Recommended Plan for Hill County Manufacturing.

a. Conservation:
   - Date to be Implemented: By year 2010
   - Annual Cost: Not determined

b. BRA System Operation:
   - Cost Source: Strategy Evaluation (Section 4B.4)
   - Date to be Implemented: By year 2020
   - Annual Cost: $235,500 (at full implementation)

Table 4C.15-7.
Recommended Plan Costs by Decade for Hill County Manufacturing

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	2	(10)	(21)	(32)	(42)	(53)
Conservation						
Supply From Plan Element (acft/yr)	3	5	8	8	9	10
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
BRA System Operation						
Supply From Plan Element (acft/yr)	—	50	50	50	50	100
Annual Cost ($/yr)		$117,750	$117,750	$117,750	$117,750	$235,500
Unit Cost ($/acft)		$2,355	$2,355	$2,355	$2,355	$2,355

4C.15.12 Steam-Electric

No Steam-Electric demand exists nor is projected for the county.

4C.15.13 Mining

Mining is projected to have adequate water supplies to meet the projected demands through the year 2060 and no changes in water supply are recommended.

4C.15.14 Irrigation

Irrigation is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.15.15 Livestock

Livestock water supply is projected to meet demands through the year 2060 and no changes in water supply are recommended.

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4C.16 Hood County Water Supply Plan

Table 4C.16-1 lists each water user group in Hood County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.16-1.
Hood County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2030 (acft/yr)	2060 (acft/yr)	
Acton MUD	2,347	484	Projected surplus
City of Granbury	4,888	3,252	Projected surplus
Oak Trail Shores Subdivision	(114)	(101)	Projected shortage – see plan below
City of Tolar	58	62	Projected surplus
County-Other	(1,195)	(3,543)	Projected shortage – see plan below
Manufacturing	(8)	(15)	Projected shortage – see plan below
Steam-Electric	33,980	27,794	Projected surplus
Mining	(25)	(24)	Projected shortage – see plan below
Irrigation	10,346	10,628	Projected surplus
Livestock	0	0	No projected surplus/shortage

[1] From Tables C-31 and C-32, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.16.1 Acton MUD

Acton MUD obtains its water supply from groundwater from the Trinity Aquifer and a contract with the Brazos River Authority for water from Lake Granbury. No shortages are projected for Acton MUD and no changes in water supply are recommended.

4C.16.2 City of Granbury

The City of Granbury obtains its water supply from groundwater from the Trinity Aquifer and from surface water from Lake Granbury. No shortages are projected for the City of Granbury and no changes in water supply are recommended.

4C.16.3 Oak Trail Shores Subdivision

4C.16.3.1 Description of Supply

- Source: Groundwater – Trinity Aquifer
- Estimated Reliable Supply: 379 acft/yr

4C.16.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Oak Trail Shores Subdivision:

- Purchase water from the City of Granbury.
- Conservation was also considered; however, the entity's current per capita use rate is below the selected target rate of 140 gpcd.

4C.16.3.3 Costs

Costs of the Recommended Plan for Oak Trail Shores Subdivision.

a. Purchase Water from the City of Granbury:
   - Cost Source: Assumed unit cost of $815/acft treated water ($2.50/1,000 gal)
   - Date to be Implemented: before 2010
   - Annual Cost: $122,250

Table 4C.16-2.
Recommended Plan Costs by Decade for Oak Trail Shores Subdivision

Plan Element	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
Projected Surplus/(Shortage) (acft/yr)	(133)	(126)	(114)	(105)	(101)	(101)
Purchase water from City of Granbury						
Supply From Plan Element (acft/yr)	150	150	150	150	150	150
Annual Cost ($/yr)	$122,250	$122,250	$122,250	$122,250	$122,250	$122,250
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.16.4 City of Tolar

The City of Tolar obtains its water supply from groundwater from the Trinity Aquifer. The city owns and operates five wells that are projected to supply the needs of the City of Tolar through the year 2060. No shortages are projected for the City of Tolar and no changes in water supply are recommended.

4C.16.5 County-Other

4C.16.5.1 Description of Supply

- Source: Groundwater – Trinity Aquifer; Surface water – Brazos River Authority contracts (Lake Granbury)
- Estimated Reliable Supply: 3,729 acft/yr in 2060

4C.16.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Hood County-Other:

- Purchase water from the City of Granbury.
- Conservation was also considered; however, the entity's current per capita use rate is below the selected target rate of 140 gpcd.

4C.16.5.3 Costs

Costs of the Recommended Plan for Hood County-Other.

a. Purchase Water from the City of Granbury:
   - Cost Source: Assumed unit cost of $815/acft treated water ($2.50/1,000 gal)
   - Date to be Implemented: before 2010
   - Annual Cost: $3,015,500 (at full implementation)

Table 4C.16-3.
Recommended Plan Costs by Decade for Hood County-Other

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(19)	(627)	(1,195)	(1,816)	(2,596)	(3,543)
Purchase water from City of Granbury						
Supply From Plan Element (acft/yr)	20	700	1,300	2,000	2,700	3,700
Annual Cost ($/yr)	$16,300	$570,500	$1,059,500	$1,630,000	$2,200,500	$3,015,500
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.16.6 Manufacturing

4C.16.6.1 Description of Supply

- Source: Groundwater – Trinity Aquifer
- Estimated Reliable Supply: 22 acft/yr

4C.16.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Hood County Manufacturing:

- Conservation, and
- Purchase water from the City of Granbury.

4C.16.6.3 Costs

Costs of the Recommended Plan for Hood County Manufacturing.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Purchase Water from the City of Granbury:
   - Cost Source: Assumed unit cost of $815/acft treated water ($2.50/1,000 gal)
   - Date to be Implemented: before 2010
   - Annual Cost: 16,300 in 2060

Table 4C.16-4.
Recommended Plan Costs by Decade for Hood County Manufacturing

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(3)	(6)	(8)	(10)	(12)	(15)
Conservation						
Supply From Plan Element (acft/yr)	1	1	2	2	2	3
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Purchase water from City of Granbury						
Supply From Plan Element (acft/yr)	5	10	10	15	15	20
Annual Cost ($/yr)	$4,075	$8,150	$8,150	$12,225	$12,225	$16,300
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.16.7 Steam-Electric

Steam-Electric water demand in Hood County is associated with the DeCordova Power Plant owned and operated by Texas Utilities Company (TXU). The DeCordova Power Plant is supplied by water from Lake Granbury. TXU has contracted with the Brazos River Authority for water from the BRA system in sufficient quantity to exceed its needs through the year 2060. No changes in water supply are recommended.

4C.16.8 Mining

4C.1.4.1 Description of Supply

- Source: Groundwater – Trinity Aquifer
- Estimated Reliable Supply: 133 acft/yr in 2060

4C.16.1.3 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Hood County Mining:

- Conservation, and
- Purchase water from the City of Granbury.

4C.16.1.4 Costs

Costs of the Recommended Plan for Hood County Mining.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Purchase Water from the City of Granbury:
   - Cost Source: Assumed raw water unit cost of $75/acft
   - Date to be Implemented: before 2010
   - Annual Cost: $2,250

Table 4C.16-5.
Recommended Plan Costs by Decade for Hood County Mining

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(25)	(25)	(25)	(25)	(24)	(24)
Conservation						
Supply From Plan Element (acft/yr)	5	8	11	11	11	11
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Purchase water from City of Granbury						
Supply From Plan Element (acft/yr)	30	30	30	30	30	30
Annual Cost ($/yr)	$2,250	$2,250	$2,250	$2,250	$2,250	$2,250
Unit Cost ($/acft)	$75	$75	$75	$75	$75	$75

4C.16.9 Irrigation

Irrigation is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.16.10 Livestock

No shortages are projected for Livestock use and no changes in water supply are recommended.

4C.17 Johnson County Water Supply Plan

Table 4C.17-1 lists each water user group in Johnson County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.17-1.
Johnson County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Alvarado	(473)	(647)	Projected shortage – see plan below
Bethany WSC	(344)	(515)	Projected shortage – see plan below
Bethesda WSC	(3,722)	(6,703)	Projected shortage – see plan below
City of Burleson	(1,910)	(3,996)	Projected shortage – see plan below
City of Cleburne	1,791	(2,853)	Projected shortage – see plan below
City of Godley	(224)	(403)	Projected shortage – see plan below
City of Grandview	55	(1)	Projected shortage – see plan below
Johnson County FWSD #1	64	(609)	Projected shortage – see plan below
Johnson County SUD	(2,456)	(13,252)	Projected shortage – see plan below
City of Joshua	(782)	(1,163)	Projected shortage – see plan below
City of Keene	1,338	934	Projected surplus
City of Mansfield	0	0	No projected surplus/shortage
Mountain Peak WSC	(421)	(888)	Projected shortage – see plan below
Parker WSC	(400)	(675)	Projected shortage – see plan below
City of Rio Vista	(69)	(106)	Projected shortage – see plan below
City of Venus	1,015	1,021	Projected surplus
County-Other	(2,516)	(2,977)	Projected shortage – see plan below
Manufacturing	(2,546)	(3,639)	Projected shortage – see plan below
Steam-Electric	(1,200)	(1,200)	Projected shortage – see plan below
Mining	(285)	(315)	Projected shortage – see plan below
Irrigation	571	571	Projected surplus
Livestock	0	0	No projected surplus/shortage

[1] From Tables C-33 and C-34, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.17.1 City of Alvarado

4C.17.1.1 Description of Supply

- Source: Groundwater – Trinity Aquifer; Surface water from Johnson County SUD
- Estimated Reliable Supply: 86 acft/yr

4C.17.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Alvarado:

- Overdraft the Trinity Aquifer, and
- Purchase water from the City of Venus.
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.17.1.3 Costs

Costs of the Recommended Plan for the City of Alvarado.

a. Overdraft Trinity Aquifer:
    - Cost Source: None
    - Date to be Implemented: before 2010
    - Total Project Cost: No project cost – assumes current infrastructure is sufficient
    - Annual Cost: No annual cost – assumes current operating costs are sufficient

b. Purchase Water from the City of Venus:
    - Cost Source: Assumed unit cost of $815/acft treated water ($2.50/1,000 gal)
    - Date to be Implemented: before 2030
    - Annual Cost: $536,270 (at full implementation)

Table 4C.17-2.
Recommended Plan Costs by Decade for the City of Alvarado

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(401)	(433)	(473)	(510)	(569)	(647)
Overdraft Trinity Aquifer						
Supply From Plan Element (acft/yr)	401	444	—	—	—	—
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Purchase water from City of Venus						
Supply From Plan Element (acft/yr)	—	—	484	521	580	658
Annual Cost ($/yr)			$394,460	$424,615	$472,700	$536,270
Unit Cost ($/acft)			$815	$815	$815	$815

4C.17.2 Bethany WSC

4C.17.2.1 Description of Supply

- Source: Groundwater – Trinity Aquifer;
- Estimated Reliable Supply: 87 acft/yr

4C.17.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Bethany WSC:

- Purchase water from Johnson County SUD. This will require Johnson County SUD to implement recommended water management strategies to meet demand.
- Conservation was also considered; however, the WSC's current per capita use rate is below the selected target rate of 140 gpcd.

4C.17.2.3 Costs

Costs of the Recommended Plan for Bethany WSC.

a. Purchase water from Johnson County SUD:
   - Cost Source: Based on unit costs from Section 4B.11.1 (Reuse through Joe Pool Reservoir)
   - Date to be Implemented: before 2010
   - Unit Cost: $617/acft
   - Annual Cost: $1,721,43

Table 4C.17-3.
Recommended Plan Costs by Decade for Bethany WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(276)	(310)	(344)	(384)	(440)	(515)
Purchase water from Johnson County SUD						
Supply From Plan Element (acft/yr)	276	310	344	384	440	515
Annual Cost ($/yr)	$170,292	$191,270	$212,248	$236,928	$271,480	$317,755
Unit Cost ($/acft)	$617	$617	$617	$617	$617	$617

4C.17.3 Bethesda WSC

4C.17.3.1 Description of Supply

- Source: Groundwater – Trinity Aquifer;
- Estimated Reliable Supply: 393 acft/yr

4C.17.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Bethesda WSC:

- Purchase water from the City of Fort Worth.
- Conservation was also considered; however, the WSC's current per capita use rate is below the selected target rate of 140 gpcd.

4C.17.3.3 Costs

Costs of the Recommended Plan for Bethesda WSC.

a. Purchase Water from the City of Fort Worth:
    - Cost Source: Assumed unit cost of $815/acft treated water ($2.50/1,000 gal)
    - Date to be Implemented: before 2010
    - Annual Cost: $5,462,945 in 2060

Table 4C.17-4.
Recommended Plan Costs by Decade for Bethesda WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(2,358)	(3,022)	(3,722)	(4,505)	(5,470)	(6,703)
Purchase water from City of Fort Worth (TRWD)						
Supply From Plan Element (acft/yr)	2,358	3,022	3,722	4,505	5,470	6,703
Annual Cost ($/yr)	$1,921,770	$2,462,930	$3,033,430	$3,671,575	$4,458,050	$5,462,945
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.17.4 City of Burleson

4C.17.4.1 Description of Supply

The City of Burleson obtains its water supply from Tarrant Regional Water District (TRWD). The city purchases water through the City of Fort Worth supply system. Based on the amount of supply currently available from TRWD, the City of Burleson is projected to have a shortage of 1,910 acft/yr in the year 2030 and 3,996 acft/yr in the year 2060.

4C.17.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Burleson:

- Purchase water from the City of Fort Worth.
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.17.4.3 Costs

Costs of the Recommended Plan for the City of Burleson.

a. Purchase Water from the City of Fort Worth:
   - Cost Source: Assumed unit cost of $815/acft treated water ($2.50/1,000 gal)
   - Date to be Implemented: before 2010
   - Annual Cost: $3,256,740 in 2060

Table 4C.17-5.
Recommended Plan Costs by Decade for the City of Burleson

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(990)	(1,422)	(1,910)	(2,432)	(3,116)	(3,996)
Purchase water from City of Fort Worth (TRWD)						
Supply From Plan Element (acft/yr)	990	1,422	1,910	2,432	3,116	3,996
Annual Cost ($/yr)	$806,850	$1,158,930	$1,556,650	$1,982,080	$2,539,540	$3,256,740
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.17.5 City of Cleburne

4C.17.5.1 Description of Supply

The City of Cleburne obtains its water supply from Lake Pat Cleburne, Lake Aquilla, and groundwater from the Trinity Aquifer. The City of Cleburne is projected to have a surplus of 1,791 acft/yr in the year 2030 and a shortage of 2,853 acft/yr in the year 2060.

4C.17.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Cleburne:

- Conservation
- Reuse (The City has implemented a reuse program, which it has committed to expanding.)

4C.17.5.3 Costs

Costs of the Recommended Plan for the City of Cleburne.

a. Conservation
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: $195,700 (maximum annual cost in 2020)

b. Reuse:
   - Cost Source: Strategy Evaluation (Section 4B.3)
   - Date to be Implemented: before 2010
   - Annual Cost: $1,512,090 (Based on unit costs from Section 4B.3)

Table 4C.17-6.
Recommended Plan Costs by Decade for the City of Cleburne

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	4,225	3,013	1,791	483	(1,051)	(2,853)
Conservation						
Supply From Plan Element (acft/yr)	229	515	454	413	416	473
Annual Cost ($/yr)	$87,020	$195,700	$172,520	$156,940	$158,080	$179,740
Unit Cost ($/acft)	$530	$530	$530	$530	$530	$530
Reuse						
Supply From Plan Element (acft/yr)	351	351	351	351	1,051	2,853
Annual Cost ($/yr)	$186,030	$186,030	$186,030	$186,030	$557,030	$1,512,090
Unit Cost ($/acft)	$530	$530	$530	$530	$530	$530

4C.17.6 City of Godley

4C.17.6.1 Description of Supply

The City of Godley obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, the City of Godley is projected to have a shortage of 224 acft/yr in the year 2030 and 403 acft/yr in the year 2060.

4C.17.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Godley:

- Purchase water from the BRA SWATS plant.
- Reuse is considered an alternative to the SWATS supply.
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.17.6.3 Costs

Costs of the Recommended Plan for the City of Godley.

a. Purchase from BRA SWATS:
   - Cost Source: Based on treatment costs of $3.50/1000 gal plus purchase and transmission costs

- Date to be Implemented: before 2010
- Unit Cost: $1,512/acft ($4.64/1,000 gal)
- Annual Cost: $609,336

Table 4C.17-7. Recommended Plan Costs by Decade for the City of Godley

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(141)	(180)	(224)	(269)	(329)	(403)
Purchase from BRA SWATS						
Supply From Plan Element (acft/yr)	141	180	224	269	329	403
Annual Cost ($/yr)	$213,192	$272,160	$338,688	$406,728	$497,448	$609,336
Unit Cost ($/acft)	$1,512	$1,512	$1,512	$1,512	$1,512	$1,512

4C.17.7 City of Grandview

4C.17.7.1 Description of Supply

The City of Grandview obtains its water supply from groundwater from the Woodbine Aquifer. The City of Grandview is projected to have a shortage of 1 acft/yr in the year 2060.

4C.17.7.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Grandview:

- Conservation.

4C.17.7.3 Costs

Costs of the Recommended Plan for the City of Grandview.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2060
   - Annual Cost: $360 in 2060

Table 4C.17-8.
Recommended Plan Costs by Decade for the City of Grandview

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	76	65	55	43	25	(1)
Conservation						
Supply From Plan Element (acft/yr)	—	—	—	—	—	1
Annual Cost ($/yr)						$380
Unit Cost ($/acft)						$380

4C.17.8 Johnson County FWSD No. 1

4C.17.8.1 Description of Supply

The Johnson County FWSD No. 1 obtains its water supply from groundwater from the Trinity Aquifer and surface water supplies from the Brazos River Authority. Johnson County FWSD No. 1 is projected to have a shortage of 609 acft/yr in the year 2060.

4C.17.8.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the Johnson County FWSD No. 1:

- Additional supply from BRA SWATS.
- Conservation was also considered; however, the utility's current per capita use rate is below the selected target rate of 140 gpcd.

4C.17.8.3 Costs

Costs of the Recommended Plan for the Johnson County FWSD No. 1.

- Cost Source: Based on treatment costs of $3.50/1000 gal plus purchase and transmission costs
- Date to be Implemented: before 2010
- Unit Cost: $1,512/acft ($4.64/1,000 gal)
- Annual Cost: $982,800

Table 4C.17-9.
Recommended Plan Costs by Decade for the Johnson County FWSD No. 1

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	355	209	64	(112)	(329)	(609)
Additional Supply from BRA SWATS						
Supply From Plan Element (acft/yr)	—	—	—	150	350	650
Annual Cost ($/yr)				$226,800	$529,200	$982,800
Unit Cost ($/acft)				$1,512	$1,512	$1,512

4C.17.9 Johnson County SUD (Formerly Johnson County Rural WSC)

4C.17.9.1 Description of Supply

Johnson County SUD (which remains Johnson County Rural WSC in the TWDB database) obtains its water supply from groundwater from the Trinity Aquifer, and a contract with the Brazos River Authority for water from Lake Granbury through the SWATS system. Johnson County SUD is projected to have a shortage of 2,456 acft/yr in the year 2030, and a shortage of 13,252 acft/yr in the year 2060.

4C.17.9.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Johnson County SUD:

- Conservation, and
- Purchase water from the Trinity River Authority Joe Pool Reservoir Reuse Project.
- Alternatives to this strategy are additional use of Lake Granbury supply (Volume II, Section 4B.6.1) and Aquifer Storage and Recover (ASR) in the Trinity Aquifer (Volume II, Section 4B.8.2).

4C.17.9.3 Costs

Costs of the Recommended Plan for Johnson County SUD.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $1,820,960 in 2060

b. Reuse from Trinity River Authority (Joe Pool Reservoir):

- Cost Source: Volume II, Section 4B.11.1
- Date to be Implemented: before 2030
- Total Project Cost: $79,257,000
- Annual Cost: $12,003,200

Table 4C.17-10.
Recommended Plan Costs by Decade for Johnson County SUD

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	2,284	39	(2,456)	(5,431)	(9,212)	(13,252)
Conservation						
Supply From Plan Element (acft/yr)	423	1,307	1,883	2,761	3,941	4,792
Annual Cost ($/yr)	$160,740	$496,660	$715,540	$1,049,180	$1,497,580	$1,820,960
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Reuse from Trinity River Authority (Joe Pool Reservoir)						
Supply From Plan Element (acft/yr)	—	—	20,000	20,000	20,000	20,000
Annual Cost ($/yr)			$12,003,200	$12,003,200	$12,003,200	$12,003,200
Unit Cost ($/acft)			$600	$600	$600	$600

4C.17.10 City of Joshua

4C.17.10.1 Description of Supply

The City of Joshua obtains its water supply from Johnson County Fresh Water Supply District No. 1 (Johnson Co. FWSD No. 1). Johnson Co. FWSD No. 1 utilizes groundwater from the Trinity Aquifer and surface water from Lake Granbury through the BRA SWATS plant. Based on the existing supply available from groundwater and SWATS, a shortage of 782 acft/yr is projected in the year 2030 and 1,163 acft/yr in the year 2060.

4C.17.10.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Joshua:

- Purchase additional water from BRA SWATS through Johnson County FWSD No. 1.

- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.17.10.3 Costs

Costs of the Recommended Plan for the City of Joshua.

a. Purchase additional water from BRA SWATS through Johnson County FWSD No. 1:
   - Cost Source: Based on treatment costs of $3.50/1000 gal plus purchase and transmission costs
   - Date to be Implemented: before 2010
   - Unit Cost: $1,512/acft ($4.64/1,000 gal)
   - Annual Cost: $982,800

Table 4C.17-11.
Recommended Plan Costs by Decade for the City of Joshua

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(626)	(702)	(782)	(875)	(1,000)	(1,163)
Purchase Additional Water from SWATS through Johnson County FWSD No. 1						
Supply From Plan Element (acft/yr)	626	702	782	875	1,000	1,163
Annual Cost ($/yr)	$946,512	$1,061,424	$1,182,384	$1,323,000	$1,512,000	$1,758,456
Unit Cost ($/acft)	$1,512	$1,512	$1,512	$1,512	$1,512	$1,512

4C.17.11 City of Keene

The City of Keene obtains its water supply from groundwater from the Trinity Aquifer and a contract with the Brazos River Authority. No shortages are projected for the City of Keene and no changes in water supply are recommended.

4C.17.12 City of Mansfield

The City of Mansfield obtains its water supply from surface water from the Tarrant Regional Municipal Water District (TRMWD), principally located in Region C. The city has contracted for sufficient quantity of water supply to meet its projected needs through the year 2060. No shortage is projected for the City of Mansfield and no changes in water supply are recommended.

4C.17.13 Mountain Peak WSC

4C.17.13.1 Description of Supply

Mountain Peak WSC obtains its water supply from groundwater from the Trinity Aquifer. Based on the existing supply available from groundwater, a shortage of 421 acft/yr is projected in the year 2030 and 888 acft/yr in the year 2060.

4C.17.13.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Mountain Peak WSC:

- Conservation, and
- Purchase water from the City of Midlothian.

4C.17.13.3 Costs

Costs of the Recommended Plan for Mountain Peak WSC.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $26,980 in 2060

b. Purchase water from the City of Midlothian:
   - Cost Source: Assumed unit cost of $815/acft treated water ($2.50/1,000 gal)
   - Date to be Implemented: before 2010
   - Annual Cost: $723,270 in 2060

Table 4C.17-12.
Recommended Plan Costs by Decade for Mountain Peak WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(200)	(307)	(421)	(540)	(696)	(888)
Conservation						
Supply From Plan Element (acft/yr)	10	37	44	46	57	71
Annual Cost ($/yr)	$3,800	$14,060	$16,720	$17,480	$21,660	$26,980
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Purchase Water from the City of Midlothian						
Supply From Plan Element (acft/yr)	200	307	421	540	696	888
Annual Cost ($/yr)	$163,000	$250,205	$343,115	$440,100	$567,240	$723,720
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.17.14 Parker WSC

4C.17.14.1 Description of Supply

Parker WSC obtains its water supply from groundwater from the Trinity Aquifer. Based on the existing supply available from groundwater, a shortage of 400 acft/yr is projected in the year 2030 and 675 acft/yr in the year 2060.

4C.17.14.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Parker WSC:

- Purchase water from Johnson County SUD. This will require Johnson County SUD to implement recommended water management strategies to meet demand.
- Conservation was also considered; however, the WSC's current per capita use rate is below the selected target rate of 140 gpcd.

4C.17.14.3 Costs

Costs of the Recommended Plan for Parker WSC.

a. Purchase Water from Johnson County SUD:
   - Cost Source: Based on unit costs from Section 4B.11.1 (Reuse through Joe Pool Reservoir)
   - Date to be Implemented: before 2010
   - Unit Cost: $617/acft
   - Annual Cost: $416,475 (at full implementation)

Table 4C.17-13.
Recommended Plan Costs by Decade for Parker WSC

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(280)	(339)	(400)	(471)	(562)	(675)
Purchase water from Johnson County SUD						
Supply From Plan Element (acft/yr)	280	339	400	471	562	675
Annual Cost ($/yr)	$172,760	$209,163	$246,800	$290,607	$346,754	$416,475
Unit Cost ($/acft)	$617	$617	$617	$617	$617	$617

4C.17.15 City of Rio Vista

4C.17.15.1 Description of Supply

The City of Rio Vista obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, the City of Rio Vista is projected to have a shortage of 69 acft/yr in the year 2030 and 106 acft/yr in the year 2060.

4C.17.15.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Rio Vista:

- Purchase water from Johnson County SUD. This will require Johnson County SUD to implement recommended water management strategies to meet demand.
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.17.15.3 Costs

Costs of the recommended plan for the City of Rio Vista to meet the projected shortages are:

a. Purchase water from Johnson County SUD:
   - Cost Source: Based on unit costs from Section 4B.11.1 (Reuse through Joe Pool Reservoir)
   - Date to be Implemented: before 2010
   - Unit Cost: $617/acft
   - Annual Cost: $65,402 (at full implementation)

Table 4C.17-14.
Recommended Plan Costs by Decade for the City of Rio Vista

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(54)	(61)	(69)	(77)	(89)	(106)
Purchase water from Johnson County SUD						
Supply From Plan Element (acft/yr)	54	61	69	77	89	106
Annual Cost ($/yr)	$33,318	$37,637	$42,573	$47,509	$54,913	$65,402
Unit Cost ($/acft)	$617	$617	$617	$617	$617	$617

4C.17.16 City of Venus

The City of Venus obtains its water supply from groundwater from the Woodbine Aquifer and surface water from the City of Midlothian. The city has a sufficient quantity of water supply to meet its projected needs through the year 2060. No shortage is projected for the City of Venus and no changes in water supply are recommended.

4C.17.17 County-Other

4C.17.17.1 Description of Supply

Johnson County-Other obtains its water supply primarily from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Johnson County-Other is projected to have a shortage of 2,516 acft/yr in the year 2030 and 2,977 acft/yr in the year 2060.

4C.17.17.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Johnson County-Other:

- Conservation, and
- Purchase water from Johnson County SUD. This will require Johnson County SUD to implement recommended water management strategies to meet demand.

4C.17.17.3 Costs

Costs of the recommended plan for Johnson County-Other to meet the projected shortages are:

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $79,040 in 2020

b. Purchase water from Johnson County SUD:
   - Cost Source: Based on unit costs from Section 4B.11.1 (Reuse through Joe Pool Reservoir)
   - Date to be Implemented: before 2010
   - Unit Cost: $617/acft
   - Annual Cost: $1,680,091

Table 4C.17-15.
Recommended Plan Costs by Decade for Johnson County-Other

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(2,323)	(2,418)	(2,516)	(2,623)	(2,775)	(2,977)
Conservation						
Supply From Plan Element (acft/yr)	87	208	190	171	166	175
Annual Cost ($/yr)	$33,060	$79,040	$72,200	$64,980	$63,080	$66,500
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Purchase water from Johnson County SUD						
Supply From Plan Element (acft/yr)	2,236	2,210	2,326	2,452	2,609	2,723
Annual Cost ($/yr)	$1,379,512	$1,363,570	$1,435,142	$1,512,884	$1,609,753	$1,680,091
Unit Cost ($/acft)	$617	$617	$617	$617	$617	$617

4C.17.18 Manufacturing

4C.17.18.1 Description of Supply

Johnson County Manufacturing obtains its water supply primarily from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Johnson County Manufacturing is projected to have a shortage of 2,546 acft/yr in the year 2030 and 3,639 acft/yr in the year 2060.

4C.17.18.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Johnson County Manufacturing:

- Conservation, and
- Purchase reuse water from the City of Cleburne.
- Alternative strategy considered was purchase of water from BRA System.

4C.17.18.3 Costs

Costs of the recommended plan for Johnson County Manufacturing to meet the projected shortages are:

a. Conservation:
- Date to be Implemented: before 2010
- Annual Cost: Not determined

b. Purchase reuse water from the City of Cleburne:
- Cost Source: Volume II (Section 4B.3)
- Date to be Implemented: before 2010
- Annual Cost: $1,780,270

Table 4C.17-16.
Recommended Plan Costs by Decade for Johnson County Manufacturing

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(1,762)	(2,159)	(2,546)	(2,939)	(3,291)	(3,639)
Conservation						
Supply From Plan Element (acft/yr)	64	126	203	231	255	280
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Purchase reuse water from the City of Cleburne						
Supply From Plan Element (acft/yr)	1,698	2,033	2,343	2,708	3,036	3,359
Annual Cost ($/yr)	$899,940	$1,077,490	$1,241,790	$1,435,240	$1,609,080	$1,780,270
Unit Cost ($/acft)	$530	$530	$530	$530	$530	$530

4C.17.19 Steam-Electric

4C.17.19.1 Description of Supply

Johnson County Steam-Electric currently does not a supply value assigned. Johnson County Steam-Electric is projected to have a shortage of 1,200 acft/yr in the year 2030 and 2060.

4C.17.19.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Johnson County Steam-Electric:

- Conservation, and
- Purchase reuse water from the City of Cleburne.

4C.17.19.3 Costs

Costs of the recommended plan for Johnson County Steam-Electric to meet the projected shortages are:

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Purchase reuse water from the City of Cleburne:
   - Cost Source: Strategy Evaluation (Section 4B.3)
   - Date to be Implemented: before 2010
   - Annual Cost: $591,480 (Based on unit costs from Section 4B.3)

Table 4C.17-17.
Recommended Plan Costs by Decade for Johnson County Steam-Electric

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)	(1,200)
Conservation						
Supply From Plan Element (acft/yr)	36	60	84	84	84	84
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Purchase Reuse Water from the City of Cleburne						
Supply From Plan Element (acft/yr)	1,164	1,140	1,116	1,116	1,116	1,116
Annual Cost ($/yr)	$616,920	$604,200	$591,480	$591,480	$591,480	$591,480
Unit Cost ($/acft)	$530	$530	$530	$530	$530	$530

4C.17.20 Mining

4C.17.20.1 Description of Supply

Johnson County Mining obtains its water supply from groundwater from the Trinity Aquifer and various run-of-river rights. Based on the available groundwater and surface water supply, Johnson County Mining is projected to have a shortage of 285 acft/yr in the year 2030 and 315 acft/yr in the year 2060.

4C.17.20.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Johnson County Mining:

- Conservation, and
- Purchase water from the BRA System.

4C.17.20.3 Costs

Costs of the recommended plan for Johnson County Mining to meet the projected shortages are:

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Purchase water from the BRA System:
   - Cost Source: Strategy Evaluation (Section 4B.4), less treatment costs
   - Date to be Implemented: before 2010
   - Unit Cost: $434/acft
   - Annual Cost: $123,256

Table 4C.17-18.
Recommended Plan Costs by Decade for Johnson County Mining

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(257)	(274)	(285)	(296)	(307)	(315)
Conservation						
Supply From Plan Element (acft/yr)	11	20	28	29	30	31
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Purchase water from the BRA System						
Supply From Plan Element (acft/yr)	246	254	257	267	277	284
Annual Cost ($/yr)	$106,764	$110,236	$111,538	$115,878	$120,218	$123,256
Unit Cost ($/acft)	$434	$434	$434	$434	$434	$434

4C.17.21 Irrigation

No shortage is projected for Johnson County Irrigation and no changes in water supply are recommended.

4C.17.22 Livestock

No shortage is projected for Johnson County Livestock and no changes in water supply are recommended.

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4C.18 Jones County Water Supply Plan

Table 4C.18-1 lists each water user group in Jones County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.18-1.
Jones County Surplus/(Shortage)

Water User Group	*Surplus/(Shortage)*[1]		*Comment*
	2030 (acft/yr)	*2060 (acft/yr)*	
City of Anson	1,740	1,857	Projected surplus
City of Hamlin	1,372	1,413	Projected surplus
City of Hawley	0	0	Supply equals demand
Hawley WSC	25	25	Projected surplus
City of Stamford	1,854	1,695	Projected surplus
County-Other	7	24	Projected surplus
Manufacturing	0	0	Supply equals demand
Steam-Electric	1,330	565	Projected surplus
Mining	0	0	Supply equals demand
Irrigation	2,046	2,074	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables C-35 and C-36, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.18.1 City of Anson

The City of Anson obtains water from Hubbard Creek Reservoir through the WCTMWD. It has a projected surplus for the study period and no changes in water supply are recommended.

4C.18.2 City of Hamlin

The City of Hamlin obtains water from the Lake Stamford through the City of Stamford. The City has a projected surplus and no changes in water supply are recommended.

4C.18.3 City of Hawley

The City of Hawley is supplied with water from Hawley WSC. No shortages are projected and no changes in water supply are recommended.

4C.18.4 Hawley WSC

Hawley WSC is supplied with water from the City of Abilene. No shortages are projected and no changes in water supply are recommended. However as an alternate strategy

Hawley WSC could receive water from the City of Anson's connection to the Abilene-Hamlin line.

4C.18.5 City of Stamford

The City of Stamford is supplied with water from Lake Stamford. No shortages are projected and no changes in water supply are recommended

4C.18.6 County-Other

No shortages are projected for County-Other and no changes in water supply are recommended.

4C.18.7 Manufacturing

No shortages are projected for Jones County Manufacturing and no changes in water supply are recommended.

4C.18.8 Steam-Electric

No shortages are projected for Steam-Electric and no changes in water supply are recommended.

4C.18.9 Mining

No shortages are projected for Mining and no changes in water supply are recommended.

4C.18.10 Irrigation

No shortages are projected for Irrigation and no changes in water supply are recommended.

4C.18.11 Livestock

No shortages are projected for Livestock and no changes in water supply are recommended.

4C.19 Kent County Water Supply Plan

Table 4C.19-1 lists each water user group in Kent County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.19-1.
Kent County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Jayton	167	205	Projected surplus
County-Other	(16)	(3)	Projected shortage- see plan below
Manufacturing	0	0	No demand or supply
Steam-Electric	0	0	No demand or supply
Mining	0	0	Supply equals demand
Irrigation	310	307	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables C-37 and C-38, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.19.1 City of Jayton

Water supply for the City of Jayton is groundwater from the Seymour and Dockum Aquifers. No shortages are projected and no changes in water supply are recommended.

4C.19.2 County-Other

4C.19.2.1 Description of Supply

Supplies are currently obtained from local groundwater, and the Seymour and Dockum Aquifers. Due to water quality limitations, current supplies are not sufficient to meet demands through 2060. Surface water supplies are projected to become available from the Lake Alan Henry Water Supply District.

4C.19.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortages for entities included in Kent County-Other:

- Purchase supply from Lake Alan Henry Water District.
- Conservation was also considered; however, the current per capita use rate is below the selected target rate of 140 gpcd.

4C.19.2.3 Costs

Cost of the Recommended Plan for the County-Other.

c. Water Supply from Lake Alan Henry Water Supply District:

- Cost Source: Cost estimate prepared in coordination with the Lake Alan Henry Water Supply District and the City of Lubbock
- Date to be Implemented: before 2010
- Total Project Cost: $5,613,000
- Annual Cost: $757,000 (total project); $140,200 (County-Other portion)

Table 4C.19-2.
Recommended Plan Costs by Decade for the Kent County-Other

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(22)	(20)	(16)	(9)	(5)	(3)
Water Supply from Lake Alan Henry Water Supply District						
Supply From Plan Element (acft/yr)	50	50	50	50	50	50
Annual Cost ($/yr)	$140,200	$140,200	$140,200	$140,200	$140,200	$140,200
Unit Cost ($/acft)	$2,804	$2,804	$2,804	$2,804	$2,804	$2,804

4C.19.3 Manufacturing

No Manufacturing demand exists or is projected for the county.

4C.19.4 Steam-Electric

No Steam-Electric demand exists or is projected for the county.

4C.19.5 Mining

No shortages are projected for Mining and no changes in water supply are recommended.

4C.19.6 Irrigation

No shortages are projected for Irrigation and no changes in water supply are recommended.

4C.19.7 Livestock

No shortages are projected for Livestock and no changes in water supply are recommended.

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4C.20 Knox County Water Supply Plan

Table 4C.20-1 lists each water user group in Knox County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.20-1.
Knox County Surplus/(Shortage)

Water User Group	*Surplus/(Shortage)*[1] 2030 (acft/yr)	*Surplus/(Shortage)*[1] 2060 (acft/yr)	*Comment*
Knox City	(153)	(216)	Projected shortage – see plan below
City of Munday	(185)	(250)	Projected shortage – see plan below
County-Other	(26)	(22)	Projected shortage – see plan below
Manufacturing	0	0	No demand or supply
Steam-Electric	0	0	No demand or supply
Mining	(3)	(3)	Projected shortage – see plan below
Irrigation	(13,317)	(10,460)	Projected shortage – see plan below
Livestock	0	0	No demand or supply

[1] From Tables C-39 and C-40, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.20.1 Knox City

4C.20.1.1 Description of Supply

Knox City obtains surface water via a contract with North Central Texas MWD (NCTMWD) and current supplies are insufficient to meet projected demands in years 2010 through 2060.

4C.20.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of Knox City:

- Conservation
- Purchase additional water from NCTMWD; however, NCTMWD must complete the recommended Wholesale Provider Strategy described in Section 4B.7 to ensure sufficient supplies.

4C.20.1.3 Costs

Costs of the Recommended Plan for Knox City

a. Conservation

- Cost Source: Volume II, Section 4B.2.1
- Date to be Implemented: 2010
- Annual Cost: $4,180 in 2060

c. Additional water supply from NCTMWD:

- Date to be Implemented: 2010
- Total Project Cost:none (current infrastructure assumed sufficient)
- Unit Cost: $423/acft (wholesale treated water cost)
- Annual Cost: $ 105,750

Table 4C.20-2.
Recommended Plan Costs by Decade for Knox City

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(106)	(134)	(153)	(174)	(195)	(216)
Conservation						
Supply From Plan Element (acft/yr)	9	21	17	13	11	11
Annual Cost ($/yr)	$3,420	$7,980	$6,460	$4,940	$4,180	$4,180
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Additional Water from NCTMWD						
Supply From Plan Element (acft/yr)	250	250	250	250	250	250
Annual Cost ($/yr)	$105,750	$105,750	$105,750	$105,750	$105,750	$105,750
Unit Cost ($/acft)	$423	$423	$423	$423	$423	$423

4C.20.2 City of Munday

4C.20.2.1 Description of Supply

The City of Munday obtains surface water via a contract with North Central Texas MWD (NCTMWD) and current supplies are insufficient to meet projected demands in years 2010 through 2060.

4C.20.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the shortages projected for the City of Munday:

- Conservation
- Purchase additional water from NCTMWD; however, NCTMWD must complete the recommended Wholesale Provider Strategy described in Section 4B.7 to ensure sufficient supplies.

4C.20.2.3 Costs

Costs of the Recommended Plan for the City of Munday:

a. Conservation

- Cost Source: Volume II, Section 4B.2.1
- Date to be Implemented: 2010
- Annual Cost: maximum of $9,500 in 2020

b. Additional water supply from NCTMWD:

- Date to be Implemented: 2010
- Total Project Cost: none (current infrastructure assumed to be adequate)
- Annual Cost: $ 105,750

Table 4C.20-3.
Recommended Plan Costs by Decade for the City of Munday

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(142)	(165)	(185)	(205)	(226)	(250)
Conservation						
Supply From Plan Element (acft/yr)	10	25	20	15	11	10
Annual Cost ($/yr)	$3,800	$9,500	$7,600	$5,700	$4,180	$3,800
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Additional Water from NCTMWD						
Supply From Plan Element (acft/yr)	250	250	250	250	250	250
Annual Cost ($/yr)	$105,750	$105,750	$105,750	$105,750	$105,750	$105,750
Unit Cost ($/acft)	$423	$423	$423	$423	$423	$423

4C.20.3 County-Other Category

4C.20.3.1 Description of Supply

Supplies for County-Other are insufficient to meet demands and shortages are projected from 2010 through 2060.

4C.20.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortages of the County-Other entities.

- Purchase additional water from NCTMWD; however, NCTMWD must complete the recommended Wholesale Provider Strategy described in Section 4B.7 to ensure sufficient supplies.
- Conservation was also considered; however, the County-Other's current per capita use rate is below the selected target of 140 gpcd.

4C.20.3.3 Costs

Costs of the Recommended Plan for the City of Munday

a. Additional water supply from NCTMWD:

- Date to be Implemented: 2010
- Total Project Cost: none (current infrastructure is assumed to be adequate)
- Annual Cost: $ 21,150

Table 4C.20-4.
Recommended Plan Costs by Decade for Knox County-Other

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(21)	(27)	(26)	(24)	(24)	(22)
Water Supply from NCTMWD						
Supply From Plan Element (acft/yr)	50	50	50	50	50	50
Annual Cost ($/yr)	$21,150	$21,150	$21,150	$21,150	$21,150	$21,150
Unit Cost ($/acft)	$423	$423	$423	$423	$423	$423

4C.20.4 Manufacturing

No Manufacturing demand exists or is projected for the county.

4C.20.5 Steam-Electric

No Steam-Electric demand exists or is projected for the county.

4C.20.6 Mining

4C.20.6.1 Description of Supply

Shortages are projected for Mining in years 2010 to 2060.

4C.20.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortages for Mining:

- Conservation
- Overdraft Seymour Aquifer using existing infrastructure

4C.20.6.3 Costs

Costs of the Recommended Plan for Knox County Mining

a. Overdraft Seymour Aquifer:

- Cost Source: Seymour Aquifer
- Date to be Implemented: 2010
- Total Project Cost: none (current infrastructure assumed to be adequate)
- Annual Cost: N/A (unit cost would be the same current operational costs.)

b. Conservation

- Date to be Implemented: 2010
- Annual Cost: not determined

Table 4C.20-5.
Recommended Plan Costs by Decade for Knox County Mining

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(3)	(3)	(3)	(3)	(3)	(3)
Conservation						
Supply From Plan Element (acft/yr)	1	1	2	2	2	2
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Overdraft Seymour Aquifer						
Supply From Plan Element (acft/yr)	2	2	1	1	1	1
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—

4C.20.7 Irrigation

4C.20.7.1 Description of Supply

Surface water supplies for Irrigation in Knox County are obtained from Wild Horse Creek, Lake Catherine, and Lake Davis. Irrigation shortages are projected through 2060.

4C.20.7.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected Irrigation shortages in the county, however the recommended strategies cannot meet the entire projected shortages:

- Conservation
- Brush Control (unquantifiable costs and savings)
- Weather Modification (unquantifiable costs and savings)

4C.20.7.3 Costs

Costs of the Recommended Plan for Irrigation.

a. Additional water supply from Conservation

- Cost Source: Volume II, Section 4B.2
- Date to be Implemented: 2010
- Unit Cost: $160/acft of water saved
- Annual Cost: $448,320

Table 4C.20-6.
Recommended Plan Costs by Decade for Knox County Irrigation

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(15,343)	(14,318)	(13,317)	(12,340)	(11,388)	(10,460)
Conservation						
Supply From Plan Element (acft/yr)	1,262	2,052	2,802	2,733	2,666	2,600
Annual Cost ($/yr)	$201,920	$328,320	$448,320	$437,280	$426,560	$416,000
Unit Cost ($/acft)	$160	$160	$160	$160	$160	$160

4C.20.8 Livestock

No future shortages are projected for Livestock uses and no changes in water supply are recommended.

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4C.21 Lampasas County Water Supply Plan

Table 4C.21-1 lists each water user group in Lampasas County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.21-1.
Lampasas County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Kempner	0	0	No projected need
City of Lampasas	274	293	Projected surplus
City of Lometa	0	0	No projected surplus/shortage
County-Other	(703)	(845)	Projected shortage – see plan below
Manufacturing	(135)	(169)	Projected shortage – see plan below
Steam-Electric	0	0	No projected demand
Mining	(24)	(23)	Projected shortage – see plan below
Irrigation	1,222	1,223	Projected surplus
Livestock	0	0	No projected need

[1] From Tables C-41 and C-42, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.21.1 City of Kempner

The City of Kempner obtains its water supply from surface water from Kempner WSC. The city has a sufficient quantity of water supply to meet its projected needs through the year 2060. No shortage is projected for the City of Kempner and no changes in water supply are recommended.

4C.21.2 City of Lampasas

The City of Lampasas obtains its water supply from surface water from the Central Texas WSC via Kempner WSC (Lake Stillhouse Hollow). The city has a sufficient quantity of water supply to meet its projected needs through the year 2060. No shortage is projected for the City of Lampasas and no changes in water supply are recommended.

4C.21.3 City of Lometa

4C.21.3.1 Description of Supply

City of Lometa water system is owned by the Lower Colorado River Authority, and is supplied water from the LCRA Highland Lakes System. The city has a sufficient quantity of water supply to meet its projected needs through the year 2060. No shortage is projected for the City of Lometa and no changes in water supply are recommended.

4C.21.4 County-Other

4C.21.4.1 Description of Supply

Lampasas County-Other obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Lampasas County-Other is projected to have a shortage of 703 acft/yr in the year 2030 and 845 acft/yr in the year 2060.

4C.21.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Lampasas County-Other:

- Conservation, and
- Additional Trinity Aquifer Development.

4C.21.4.3 Costs

Costs of the recommended plan for Lampasas County-Other to meet the projected shortages are:

a. Conservation:
    - Cost Source: Volume II, Section 4B.2.1
    - Date to be Implemented: before 2010
    - Annual Cost: maximum of $50,920 in 2020

b. Additional Trinity Aquifer Development:
    - Date to be Implemented: By year 2010
    - Total Project Cost: $2,576,000
    - Annual Cost: $245,000

    The project cost includes eleven 100 gpm wells drilled to a depth of 200 feet in the Trinity Aquifer.

Table 4C.21-2.
Recommended Plan Costs by Decade for Lampasas County-Other

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(473)	(608)	(703)	(767)	(810)	(845)
Conservation						
Supply From Plan Element (acft/yr)	55	134	126	114	107	110
Annual Cost ($/yr)	$20,900	$50,920	$47,880	$43,320	$40,660	$41,800
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Additional Trinity Aquifer Development						
Supply From Plan Element (acft/yr)	850	850	850	850	850	850
Annual Cost ($/yr)	$245,000	$245,000	$245,000	$245,000	$245,000	$245,000
Unit Cost ($/acft)	$288	$288	$288	$288	$288	$288

4C.21.5 Manufacturing

4C.21.5.1 Description of Supply

Lampasas County Manufacturing obtains its water supply from run-of-river rights. Based on the available surface water supply, Lampasas County Manufacturing is projected to have a shortage of 135 acft/yr in the year 2030 and 169 acft/yr in the year 2060.

4C.21.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Lampasas County Manufacturing:

- Conservation, and
- Purchase water from the City of Lampasas.

4C.21.5.3 Costs

Costs of the recommended plan for Lampasas County Manufacturing to meet the projected shortages are:

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Purchase water from the City of Lampasas:
   - Cost Source: estimated wholesale treated water rate
   - Date to be Implemented: By year 2010
   - Annual Cost: $155,040 in 2060

   The annual cost was calculated by multiplying the Manufacturing projected supply from this strategy by an estimated wholesale water rate of $912/acft.

Table 4C.21-3.
Recommended Plan Costs by Decade for Lampasas County Manufacturing

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(111)	(124)	(135)	(146)	(156)	(169)
Conservation						
Supply From Plan Element (acft/yr)	4	7	11	11	12	13
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Purchase water from the City of Lampasas						
Supply From Plan Element (acft/yr)	150	150	150	150	160	170
Annual Cost ($/yr)	$136,800	$136,800	$136,800	$136,800	$145,920	$155,040
Unit Cost ($/acft)	$912	$912	$912	$912	$912	$912

4C.21.6 Steam-Electric

No Steam-Electric demand is projected for Lampasas County.

4C.21.7 Mining

4C.21.7.1 Description of Supply

Lampasas County Mining obtains its water supply from groundwater from the Trinity and Marble Falls Aquifers. Based on the available groundwater supply, Lampasas County Mining is projected to have a shortage of 24 acft/yr in the year 2030 and 23 acft/yr in the year 2060.

4C.21.7.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Lampasas County Mining:

- Conservation, and
- Purchase water from the City of Lampasas.

4C.21.7.3 Costs

Costs of the recommended plan for Lampasas County Mining to meet the projected shortages are:

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Purchase water from the City of Lampasas:
   - Cost Source: estimated wholesale treated water rate
   - Date to be Implemented: By year 2010
   - Annual Cost: $27,360 in 2060

   The annual cost was calculated by multiplying the Mining projected supply from this strategy by an estimated wholesale water rate of $912/acft.

Table 4C.21-4.
Recommended Plan Costs by Decade for Lampasas County Mining

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(26)	(25)	(24)	(24)	(22)	(23)
Conservation						
Supply From Plan Element (acft/yr)	5	7	10	9	9	9
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Purchase water from the City of Lampasas						
Supply From Plan Element (acft/yr)	30	30	30	30	30	30
Annual Cost ($/yr)	$27,360	$27,360	$27,360	$27,360	$27,360	$27,360
Unit Cost ($/acft)	$912	$912	$912	$912	$912	$912

4C.21.8 Irrigation

No shortages are projected for Irrigation and no changes in water supply are recommended.

4C.21.9 Livestock

No shortages are projected for Livestock and no changes in water supply are recommended.

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4C.22 Lee County Water Supply Plan

Table 4C.22-1 lists each water user group in Lee County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.22-1.
Lee County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
Aqua WSC	(113)	(264)	Projected shortage – see plan below
City of Giddings	(91)	(354)	Projected shortage – see plan below
Lee County WSC	(515)	(726)	Projected shortage – see plan below
City of Lexington	432	369	Projected surplus
County-Other	119	139	Projected surplus
Manufacturing	3	0	Projected surplus
Steam-Electric	0	0	No projected demand
Mining	0	0	No projected need
Irrigation	104	106	Projected surplus
Livestock	0	0	No projected need

[1] From Tables C-43 and C-44, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.22.1 Aqua WSC

4C.22.1.1 Description of Supply

Aqua WSC obtains its water supply from groundwater from the Carrizo-Wilcox Aquifer. Based on the existing supply available from groundwater, a shortage of 113 acft/yr is projected in the year 2030 and 264 acft/yr in the year 2060.

4C.22.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Aqua WSC:

- Additional Carrizo-Wilcox Aquifer Development.
- Conservation was also considered; however, the WSC’s current per capita use rate is below the selected target rate of 140 gpcd.

4C.22.1.3 Costs

Costs of the Recommended Plan for Aqua WSC.

a. Additional Carrizo-Wilcox Aquifer Development:
- Date to be Implemented: By year 2020
- Total Project Cost: $1,047,000
- Annual Cost: $158,000

The project cost includes one 500 gpm well drilled to a depth of 500 feet in the Carrizo-Wilcox Aquifer.

Table 4C.22-2.
Recommended Plan Costs by Decade for Aqua WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	3	(30)	(113)	(166)	(214)	(264)
Additional Carrizo-Wilcox Aquifer Development						
Supply From Plan Element (acft/yr)		300	300	300	300	300
Annual Cost ($/yr)		$158,000	$158,000	$158,000	$158,000	$158,000
Unit Cost ($/acft)		$527	$527	$527	$527	$527

4C.22.2 City of Giddings

4C.22.2.1 Description of Supply

The City of Giddings obtains its water supply from groundwater from the Carrizo-Wilcox Aquifer. Based on the existing supply available from groundwater, a shortage of 91 acft/yr is projected in the year 2030 and 354 acft/yr in the year 2060.

4C.22.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Giddings:

- Conservation, and
- Additional Carrizo-Wilcox Aquifer Development.

4C.22.2.3 Costs

Costs of the Recommended Plan for the City of Giddings.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $40,660 in 2020

b. Additional Carrizo-Wilcox Aquifer Development:
   - Date to be Implemented: By year 2030
   - Total Project Cost: $2,099,000
   - Annual Cost: $270,000

   The project cost includes one 1,000 gpm well drilled to a depth of 2,000 feet in the Carrizo-Wilcox Aquifer.

Table 4C.22-3.
Recommended Plan Costs by Decade for the City of Giddings

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	185	33	(91)	(185)	(273)	(354)
Conservation						
Supply From Plan Element (acft/yr)	39	107	101	91	87	91
Annual Cost ($/yr)	$14,820	$40,660	$38,380	$34,580	$33,060	$34,580
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Additional Carrizo-Wilcox Aquifer Development						
Supply From Plan Element (acft/yr)	—	—	400	400	400	400
Annual Cost ($/yr)			$270,000	$270,000	$270,000	$270,000
Unit Cost ($/acft)			$675	$675	$675	$675

4C.22.3 Lee County WSC

4C.22.3.1 Description of Supply

Lee County WSC obtains its water supply from groundwater from the Queen City Aquifer. Based on the existing supply available from groundwater, a shortage of 515 acft/yr is projected in the year 2030 and 726 acft/yr in the year 2060.

4C.22.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Lee County WSC:

- Carrizo-Wilcox Aquifer Development.
- Conservation was also considered; however, the WSC's current per capita use rate is below the selected target rate of 140 gpcd.

4C.22.3.3 Costs

Costs of the Recommended Plan for Lee County WSC.

a. Carrizo-Wilcox Aquifer Development:
   - Date to be Implemented: By year 2010
   - Total Project Cost: $1,762,000
   - Annual Cost: $312,000

   The project cost includes two 1,000 gpm wells drilled to a depth of 800 feet in the Carrizo-Wilcox Aquifer.

Table 4C.22-4.
Recommended Plan Costs by Decade for Lee County WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(305)	(418)	(515)	(595)	(663)	(726)
Carrizo-Wilcox Aquifer Development						
Supply From Plan Element (acft/yr)	750	750	750	750	750	750
Annual Cost ($/yr)	$312,000	$312,000	$312,000	$312,000	$312,000	$312,000
Unit Cost ($/acft)	$416	$416	$416	$416	$416	$416

4C.22.4 City of Lexington

The City of Lexington obtains its water supply from groundwater from the Carrizo-Wilcox Aquifer. No shortages are projected for the City of Lexington and no changes in water supply are recommended.

4C.22.5 County-Other

County-Other is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.22.6 Manufacturing

Manufacturing is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.22.7 Steam-Electric

No Steam-Electric demand exists nor is projected for the county.

4C.22.8 Mining

Mining is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

Projected Mining demand in Lee County is primarily associated with Alcoa's Sandow Mine, which is located in Lee and Milam Counties. The operation includes depressurization of the groundwater in the layer below the underground lignite formation in order to extract the lignite resource. The water supply available is essentially the amount of water that is produced in the depressurization operation. This operation is largely non-consumptive and the water produced is available for other uses. Mining demands in Lee County are expected to decrease from a present 20,000 acft/yr to 5,450 acft/yr in 2010 through 2040 with the expected closing of the Sandow Mine. Mining demands are projected to decrease further to 13 acft/yr after 2040. Continued mining demand in Lee County is expected from mine reclamation activities and the portion of the new Three Oaks Mine that is located in Lee County.

4C.22.9 Irrigation

Irrigation is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.22.10 Livestock

Livestock is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

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4C.23 Limestone County Water Supply Plan

Table 4C.23-1 lists each water user group in Limestone County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.23-1. Limestone County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
Bistone MWSD	511	7	Projected surplus
City of Coolidge	117	105	Projected surplus
City of Groesbeck	136	(87)	Projected shortage – see plan below
City of Mexia	692	541	Projected surplus
City of Thornton	208	210	Projected surplus
County-Other	353	507	Projected surplus
Manufacturing	(44)	(69)	Projected shortage – see plan below
Steam-Electric	1,447	(15,814)	Projected shortage – see plan below
Mining	0	0	No projected surplus/shortage
Irrigation	19	19	Projected surplus
Livestock	0	0	No projected surplus/shortage

[1] From Tables C-45 and C-46, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.23.1 Bistone MWSD

Bistone MWSD obtains its water supply from groundwater from the Carrizo-Wilcox Aquifer and surface water from Lake Mexia. Bistone MWSD has adequate water supplies to meet its projected needs and no changes in water supply are recommended. However, Bistone MWSD is recommended to participate with the City of Groesbeck on development of additional Carrizo-Wilcox Aquifer supplies.

4C.23.2 City of Coolidge

The City of Coolidge obtains its water supply from Lake Mexia through service from Bistone MWSD. The City of Coolidge has contracted for sufficient water supply to meet its needs through the year 2060.

4C.23.3 City of Groesbeck

4C.23.3.1 Description of Supply

The City of Groesbeck obtains its water supply from the Navasota River. The City owns senior water rights (priority date of 1921) on the Navasota River and has limited storage available from Springfield Lake. Based on the available surface water supply, the City of Groesbeck is projected to have a shortage of 87 acft/yr in the year 2060.

4C.23.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Groesbeck:

- Development of Carrizo-Wilcox Aquifer.[1]
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.23.3.3 Costs

Costs of the recommended plan for the City of Groesbeck to meet the projected shortages are:

a. Development of the Carrizo-Wilcox Aquifer:
  - Date to be Implemented: By year 2060
  - Total Project Cost: $566,000
  - Annual Cost: $75,000

  The project cost includes one 150 gpm well drilled to a depth of 400 feet in the Carrizo-Wilcox Aquifer.

Table 4C.23-2.
Recommended Plan Costs by Decade for the City of Groesbeck

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	382	219	136	71	7	(87)
Development of the Carrizo-Wilcox Aquifer						
Supply From Plan Element (acft/yr)	—	—	—	—	—	100
Annual Cost ($/yr)						$75,000
Unit Cost ($/acft)						$750

[1] Possibly in cooperation with Bistone MWSD.

4C.23.4 City of Mexia

The City of Mexia obtains its water supply from its own groundwater sources and purchased groundwater from the Bistone Water Supply District. The City of Mexia has sufficient water supply to meet its needs through the year 2060.

4C.23.5 City of Thornton

The City of Thornton obtains its water supply from groundwater from the Carrizo-Wilcox Aquifer. No shortages are projected for the City of Thornton and no changes in water supply are recommended.

4C.23.6 County-Other

County-Other is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.23.7 Manufacturing

4C.23.7.1 Description of Supply

Limestone County Manufacturing obtains its water supply from various run-of-river rights. Based on the available surface water supply, Limestone County Manufacturing is projected to have a shortage of 44 acft/yr in the year 2030 and 69 acft/yr in the year 2060.

4C.23.7.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Limestone County Manufacturing:

- Conservation, and
- Development of the Carrizo-Wilcox Aquifer.

4C.23.7.3 Costs

Costs of the recommended plan for Limestone County Manufacturing to meet the projected shortages are:

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Development of the Carrizo-Wilcox Aquifer:

- Date to be Implemented: By year 2010
- Total Project Cost: $566,000
- Annual Cost: $75,000

The project cost includes one 150 gpm well drilled to a depth of 400 feet in the Carrizo-Wilcox Aquifer.

Table 4C.23-3.
Recommended Plan Costs by Decade for Limestone County Manufacturing

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(26)	(35)	(44)	(52)	(60)	(69)
Conservation						
Supply From Plan Element (acft/yr)	1	3	4	4	5	5
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Development of the Carrizo-Wilcox Aquifer						
Supply From Plan Element (acft/yr)	100	100	100	100	100	100
Annual Cost ($/yr)	$75,000	$75,000	$75,000	$75,000	$75,000	$75,000
Unit Cost ($/acft)	$750	$750	$750	$750	$750	$750

4C.23.8 Steam-Electric

4C.23.8.1 Description of Supply

Steam-Electric water demand in Limestone County is associated with the Texas Genco (formerly Reliant Energy) power plant located at Lake Limestone. Texas Genco has contracted with the Brazos River Authority for water supply from Lake Limestone. Based on the available surface water supply, Limestone County Steam-Electric is projected to have a surplus of 1,447 acft/yr in the year 2030 and a shortage of 15,814 acft/yr in the year 2060.

4C.23.8.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Limestone County Steam-Electric:

- Conservation, and
- BRA System Operation.

4C.23.8.3 Costs

Costs of the recommended plan for Limestone County Steam-Electric to meet the projected shortages are:

a. Conservation:
- Date to be Implemented: before 2010
- Annual Cost: Not determined

b. BRA System Operation:
- Cost Source: Unit costs associated with BRA System Operation strategy analysis for WUG #8 - Robertson County Steam Electric (Volume II, Section 4B.4)
- Date to be Implemented: before 2040
- Unit Cost: $286/acft
- Annual Cost: $4,576,000

Table 4C.23-4.
Recommended Plan Costs by Decade for Limestone County Steam-Electric

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	5,535	5,269	1,447	(3,212)	(8,891)	(15,814)
Conservation						
Supply From Plan Element (acft/yr)	670	1,130	1,849	2,176	2,573	3,058
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
BRA System Operation						
Supply From Plan Element (acft/yr)	—	—	—	16,000	16,000	16,000
Annual Cost ($/yr)				$4,576,000	$4,576,000	$4,576,000
Unit Cost ($/acft)				$286	$286	$286

4C.23.9 Mining

Mining is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.23.10 Irrigation

Irrigation is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.23.11 Livestock

Livestock is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.24 McLennan County Water Supply Plan

Table 4C.24-1 lists each water user group in McLennan County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.24-1.
McLennan County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Bellmead	113	113	Projected surplus
City of Beverly Hills	0	0	No projected need
City of Bruceville-Eddy	35	35	Projected surplus
Chalk Bluff WSC	(550)	(749)	Projected shortage – see plan below
City of Crawford	(60)	(65)	Projected shortage – see plan below
Cross Country WSC	(521)	(644)	Projected shortage – see plan below
City of Gholson	(175)	(222)	Projected shortage – see plan below
City of Hallsburg	(148)	(172)	Projected shortage – see plan below
City of Hewitt	123	123	Projected surplus
City of Lacy-Lakeview	0	0	Projected surplus
City of Lorena	591	498	Projected surplus
City of Mart	(342)	(390)	Projected shortage – see plan below
City of McGregor	841	836	Projected surplus
City of Moody	14	14	Projected surplus
North Bosque WSC	(479)	(679)	Projected shortage – see plan below
City of Riesel	(112)	(129)	Projected shortage – see plan below
City of Robinson	1,407	1,298	Projected surplus
City of Waco	7,729	(11,941)	Projected shortage – see section 4C.38.17
City of West	(411)	(442)	Projected shortage – see plan below
Western Hills WS	(489)	(663)	Projected shortage – see plan below
City of Woodway	214	214	Projected surplus
County-Other	(6,067)	(6,786)	Projected shortage – see plan below
Manufacturing	(1,089)	(1,508)	Projected shortage – see plan below
Steam-Electric	(21,628)	(34,016)	Projected shortage – see plan below
Mining	0	0	No projected needs
Irrigation	7,516	7,521	Projected surplus
Livestock	0	0	No projected needs

[1] From Tables C-47 and C-48, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.24.1 City of Bellmead

4C.24.1.1 Description of Supply

The City of Bellmead obtains its water supply from groundwater from the Trinity Aquifer. The City of Bellmead also has contracted with the City of Waco for supplemental surface water supply from Lake Waco. No shortages are projected for the City of Bellmead; however, the City of Waco and the City of Bellmead are currently negotiating a contract for water supply in order to reduce Bellmead's dependence on Trinity Aquifer groundwater.

4C.24.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended for the City of Bellmead:

- Purchase water from the City of Waco. In order to reduce demands on the Trinity Aquifer, provide for future growth, and coordinate with the City of Waco's plans, water purchased from the City of Waco is in excess of projected future demands for this WUG.

4C.24.1.3 Costs

Costs of the Recommended Plan for the City of Bellmead.

a. Water Supply from City of Waco:
   - Date to be Implemented: before 2010
   - Unit Cost: assumed unit cost of $815/acft ($2.50/1,000 gallons) for wholesale treated water, including transmission costs
   - Annual Cost: $2,609,630

Table 4C.24-2.
Recommended Plan Costs by Decade for the City of Bellmead

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	113	113	113	113	113	113
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	2,622	2,751	2,873	2,984	3,065	3,202
Annual Cost ($/yr)	$2,136,930	$2,242,065	$2,341,495	$2,431,960	$2,497,975	$2,609,630
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.24.2 City of Beverly Hills

The City of Beverly Hills obtains its water supply from surface water from the City of Waco. No shortages are projected for the City of Beverly Hills and no changes in water supply are recommended.

4C.24.3 City of Bruceville-Eddy

The City of Bruceville-Eddy obtains its water supply from groundwater from the Trinity Aquifer. The City of Bruceville-Eddy also has contracted for surface water from Lake Belton from Bluebonnet WSC. No shortages are projected for the City of Bruceville-Eddy and no changes in water supply are recommended.

4C.24.4 Chalk Bluff WSC

4C.24.4.1 Description of Supply

Chalk Bluff WSC obtains its water supply from groundwater from the Trinity Aquifer. Chalk Bluff WSC is projected to have a shortage of 550 acft/yr in the year 2030, and a shortage of 749 acft/yr in the year 2060.

4C.24.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Chalk Bluff WSC:

- Purchase water from the City of Waco. In order to reduce demands on the Trinity Aquifer, provide for future growth, and coordinate with the City of Waco's plans, water purchased from the City of Waco is in excess of projected future demands for this WUG.
- An alternative water management strategy is to develop supplies from the Carrizo-Wilcox Aquifer in Burleson County in conjunction with the FHLM Water Supply Corporation, an entity comprised of 15 water supply corporations and cities in Falls, Hill, Limestone, and McLennan Counties, including Chalk Bluff WSC. Other alternatives include purchasing supply from BRA System Operation and/or reuse water from WMARSS.
- Conservation was also considered; however, the WSC's current per capita use rate is below the selected target rate of 140 gpcd.

4C.24.4.3 Costs

Costs of the Recommended Plan for Chalk Bluff WSC.

a. Water Supply from City of Waco:

- Date to be Implemented: before 2010
- Unit Cost: assumed unit cost of $815/acft ($2.50/1,000 gallons) for wholesale treated water, including transmission costs
- Annual Cost: $2,408,325

Table 4C.24-3.
Recommended Plan Costs by Decade for Chalk Bluff WSC

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(392)	(478)	(550)	(627)	(673)	(749)
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	1,160	1,766	2,846	2,881	2,918	2,955
Annual Cost ($/yr)	$945,400	$1,439,290	$2,319,490	$2,348,015	$2,378,170	$2,408,325
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.24.5 City of Crawford

4C.24.5.1 Description of Supply

The City of Crawford obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, the City of Crawford is projected to have a shortage of 60 acft/yr in the year 2030 and 65 acft/yr in the year 2060.

4C.24.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Crawford:

- Purchase water from the City of Waco.
- An alternative to this strategy is to purchase water from BRA System Operation.
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.24.5.3 Costs

Costs of the Recommended Plan for the City of Crawford.

a. Water Supply from City of Waco:
   - Date to be Implemented: before 2010
   - Unit Cost: assumed unit cost of $815/acft ($2.50/1,000 gallons) for wholesale treated water, including transmission costs
   - Annual Cost: $57,050

Table 4C.24-4.
Recommended Plan Costs by Decade for the City of Crawford

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(57)	(59)	(60)	(61)	(62)	(65)
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	65	65	65	65	65	70
Annual Cost ($/yr)	$52,975	$52,975	$52,975	$52,975	$52,975	$57,050
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.24.6 Cross Country WSC

4C.24.6.1 Description of Supply

Cross Country WSC obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Cross Country WSC is projected to have a shortage of 521 acft/yr in the year 2030 and 644 acft/yr in the year 2060.

4C.24.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Cross Country WSC:

- Purchase water from the City of Waco.
- An alternative to this strategy is to purchase water from BRA System Operation.
- Conservation was also considered; however, the WSC’s current per capita use rate is below the selected target rate of 140 gpcd.

4C.24.6.3 Costs

Costs of the Recommended Plan for Cross Country WSC.

a. Water Supply from City of Waco:
   - Date to be Implemented: before 2010
   - Unit Cost: assumed unit cost of $815/acft ($2.50/1,000 gallons) for wholesale treated water, including transmission costs
   - Annual Cost: $570,500

Table 4C.24-5.
Recommended Plan Costs by Decade for Cross Country WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(412)	(472)	(521)	(566)	(596)	(644)
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	450	500	550	600	650	700
Annual Cost ($/yr)	$366,750	$407,500	$448,250	$489,000	$529,750	$570,500
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.24.7 City of Gholson

4C.24.7.1 Description of Supply

The City of Gholson obtains its water supply from groundwater from the Trinity Aquifer through Gholson WSC. Based on the available groundwater supply, the City of Gholson is projected to have a shortage of 175 acft/yr in the year 2030 and 222 acft/yr in the year 2060.

4C.24.7.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Gholson:

- Purchase water from the City of Waco. In order to reduce demands on the Trinity Aquifer, provide for future growth, and coordinate with the City of Waco's plans, water purchased from the City of Waco is in excess of projected future demands for this WUG.
- An alternative water management strategy is to develop supplies from the Carrizo-Wilcox Aquifer in Burleson County in conjunction with the FHLM Water Supply

Corporation, an entity comprised of 15 water supply corporations and cities in Falls, Hill, Limestone, and McLennan Counties, including Gholson WSC. Other alternatives include purchasing supply from BRA System Operation and/or reuse water from WMARSS.

- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.24.7.3 Costs

Costs of the Recommended Plan for the City of Gholson.

a. Water Supply from City of Waco:
   - Date to be Implemented: before 2010
   - Unit Cost: assumed unit cost of $815/acft ($2.50/1,000 gallons) for wholesale treated water, including transmission costs
   - Annual Cost: $2,157,305

Table 4C.24.6.
Recommended Plan Costs by Decade for the City of Gholson

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(141)	(160)	(175)	(193)	(204)	(222)
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	956	1,462	2,539	2,574	2,611	2,647
Annual Cost ($/yr)	$779,140	$1,191,530	$2,069,285	$2,097,810	$2,127,965	$2,157,305
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.24.8 City of Hallsburg

4C.24.8.1 Description of Supply

The City of Hallsburg obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, the City of Hallsburg is projected to have a shortage of 148 acft/yr in the year 2030 and 172 acft/yr in the year 2060.

4C.24.8.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Hallsburg:

- Conservation, and
- Purchase water from the City of Waco.
- Alternatives to these strategies are purchasing from BRA System Operation and/or reuse water from WMARSS.

4C.24.8.3 Costs

Costs of the Recommended Plan for the City of Hallsburg.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $3,800 in 2020

b. Water Supply from City of Waco:
   - Date to be Implemented: before 2010
   - Unit Cost: assumed unit cost of $815/acft ($2.50/1,000 gallons) for wholesale treated water, including transmission costs
   - Annual Cost: $146,700

Table 4C.24-7.
Recommended Plan Costs by Decade for the City of Hallsburg

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(129)	(140)	(148)	(156)	(162)	(172)
Conservation						
Supply From Plan Element (acft/yr)	4	10	8	6	6	6
Annual Cost ($/yr)	$1,520	$3,800	$3,040	$2,280	$2,280	$2,280
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	150	150	150	160	170	180
Annual Cost ($/yr)	$122,250	$122,250	$122,250	$130,400	$138,550	$146,700
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.24.9 City of Hewitt

The City of Hewitt obtains its water supply from groundwater from the Trinity Aquifer. The City also has contracted with the City of Waco for supplemental surface water supply from Lake Waco. No shortages are projected for the City of Hewitt and no changes in water supply are recommended.

4C.24.10 City of Lacy-Lakeview

The City of Lacy-Lakeview obtains its water supply from the City of Waco. No shortages are projected for the City of Lacy-Lakeview and no changes in water supply are recommended.

4C.24.11 City of Lorena

The City of Lorena obtains its water supply from groundwater from the Trinity Aquifer and run-of-river rights. No shortages are projected for the City of Lorena and no changes in water supply are recommended.

4C.24.12 City of Mart

4C.24.12.1 Description of Supply

The City of Mart obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, the City of Mart is projected to have a shortage of 342 acft/yr in the year 2030 and 390 acft/yr in the year 2060.

4C.24.12.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Mart:

- Purchase water from the City of Waco.
- An alternative water management strategy is to develop supplies from the Carrizo-Wilcox Aquifer in Burleson County in conjunction with the FHLM Water Supply Corporation, an entity comprised of 15 water supply corporations and cities in Falls, Hill, Limestone, and McLennan Counties, including the City of Mart. Other alternatives include purchasing supply from BRA System Operation and/or reuse water from WMARSS.
- Conservation was also considered; however, the City’s current per capita use rate is below the selected target rate of 140 gpcd.

4C.24.12.3 Costs

Costs of the Recommended Plan for the City of Mart.

a. Water Supply from City of Waco:
- Date to be Implemented: before 2010
- Unit Cost: assumed unit cost of $815/acft ($2.50/1,000 gallons) for wholesale treated water, including transmission costs
- Annual Cost: $326,000

Table 4C.24-8.
Recommended Plan Costs by Decade for the City of Mart

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(310)	(329)	(342)	(358)	(369)	(390)
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	350	350	350	400	400	400
Annual Cost ($/yr)	$285,250	$285,250	$285,250	$326,000	$326,000	$326,000
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.24.13 City of McGregor

The City of McGregor obtains its water supply from the Trinity Aquifer, and from surface water from Lake Belton and run-of-river rights. No shortages are projected for the City of McGregor and no changes in water supply are recommended.

4C.24.14 City of Moody

The City of Moody obtains its water supply from groundwater from the Trinity Aquifer and from surface water from Lake Belton via Bluebonnet WSC. No shortages are projected for the City of Moody and no changes in water supply are recommended.

4C.24.15 North Bosque WSC

4C.24.15.1 Description of Supply

North Bosque WSC obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, North Bosque WSC is projected to have a shortage of 479 acft/yr in the year 2030 and 679 acft/yr in the year 2060.

4C.24.15.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of North Bosque WSC:

- Conservation, and
- Purchase water from the City of Waco.
- An alternative to this strategy is to purchase water from BRA System Operation.

4C.24.15.3 Costs

Costs of the Recommended Plan for North Bosque WSC.

a. Conservation:
  - Cost Source: Volume II, Section 4B.2.1
  - Date to be Implemented: before 2010
  - Annual Cost: maximum of $15,960 in 2060

b. Water Supply from City of Waco:
  - Date to be Implemented: before 2010
  - Unit Cost: assumed unit cost of $815/acft ($2.50/1,000 gallons) for wholesale treated water, including transmission costs
  - Annual Cost: $570,500

Table 4C.24-9. Recommended Plan Costs by Decade for North Bosque WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(316)	(403)	(479)	(557)	(604)	(679)
Conservation						
Supply From Plan Element (acft/yr)	10	33	36	38	37	42
Annual Cost ($/yr)	$3,800	$12,540	$13,680	$14,440	$14,060	$15,960
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	350	450	500	600	650	700
Annual Cost ($/yr)	$285,250	$366,750	$407,500	$489,000	$529,750	$570,500
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.24.16 City of Riesel

4C.24.16.1 Description of Supply

The City of Riesel obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, the City of Riesel is projected to have a shortage of 112 acft/yr in the year 2030 and 129 acft/yr in the year 2060.

4C.24.16.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Riesel:

- Purchase water from the City of Waco.
- An alternative water management strategy is to develop supplies from the Carrizo-Wilcox Aquifer in Burleson County in conjunction with the FHLM Water Supply Corporation, an entity comprised of 15 water supply corporations and cities in Falls, Hill, Limestone, and McLennan Counties, including the City of Riesel. Other alternatives include purchasing supply from BRA System Operation and/or reuse water from WMARSS.
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.24.16.3 Costs

Costs of the Recommended Plan for the City of Riesel.

a. Water Supply from City of Waco:
   - Date to be Implemented: before 2010
   - Unit Cost: assumed unit cost of $815/acft ($2.50/1,000 gallons) for wholesale treated water, including transmission costs
   - Annual Cost: $122,250

Table 4C.24-10.
Recommended Plan Costs by Decade for the City of Riesel

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(101)	(108)	(112)	(118)	(121)	(129)
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	150	150	150	150	150	150
Annual Cost ($/yr)	$122,250	$122,250	$122,250	$122,250	$122,250	$122,250
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.24.17 City of Robinson

The City of Robinson obtains its water supply from groundwater from the Trinity Aquifer and from surface water from the Brazos River. No shortages are projected for the City of Robinson and no changes in water supply are recommended.

4C.24.18 City of Waco

The City of Waco obtains its water supply from surface water from Lake Waco, for which it owns water rights. The City supplies several neighboring communities and projected wholesale water sales are projected to cause a shortage before 2050. Refer to Section 4B.38.17 for the City's plan as a Wholesale Water Provider.

4C.24.19 City of West

4C.24.19.1 Description of Supply

The City of West obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, the City of West is projected to have a shortage of 411 acft/yr in the year 2030 and 442 acft/yr in the year 2060.

4C.24.19.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage for the City of West:

- Purchase water from the City of Waco.
- An alternative to this strategy is to purchase supply from BRA System Operation.

- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.24.19.3 Costs

Costs of the Recommended Plan for the City of West.

a. Water Supply from City of Waco:
   - Date to be Implemented: before 2010
   - Unit Cost: assumed unit cost of $815/acft ($2.50/1,000 gallons) for wholesale treated water, including transmission costs
   - Annual Cost: $326,000

Table 4C.24-11.
Recommended Plan Costs by Decade for the City of West

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(395)	(403)	(411)	(418)	(426)	(442)
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	450	450	450	450	450	450
Annual Cost ($/yr)	$366,750	$366,750	$366,750	$366,750	$366,750	$366,750
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.24.20 Western Hills WS

4C.24.20.1 Description of Supply

Western Hills WS obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Western Hills WS is projected to have a shortage of 489 acft/yr in the year 2030 and 663 acft/yr in the year 2060.

4C.24.20.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Western Hills WS:

- Purchase water from the City of Waco.
- An alternative to this strategy is to purchase water from BRA System Operation.
- Conservation was also considered; however, the entity's current per capita use rate is below the selected target rate of 140 gpcd.

4C.24.20.3 Costs

Costs of the Recommended Plan for Western Hills WS.

a. Water Supply from City of Waco:
   - Date to be Implemented: before 2010
   - Unit Cost: assumed unit cost of $815/acft ($2.50/1,000 gallons) for wholesale treated water, including transmission costs
   - Annual Cost: $570,500

Table 4C.24-12.
Recommended Plan Costs by Decade for Western Hills WS

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(353)	(427)	(489)	(557)	(596)	(663)
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	400	500	550	600	650	700
Annual Cost ($/yr)	$326,000	$407,500	$448,250	$489,000	$529,750	$570,500
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.24.21 City of Woodway

The City of Woodway obtains its water supply from groundwater from the Trinity Aquifer and from surface water from Lake Waco from the City of Waco. No shortage is projected for the City of Woodway and no changes in water supply are recommended.

4C.24.22 County-Other

4C.24.22.1 Description of Supply

McLennan County-Other obtains its water supply from groundwater from the Trinity Aquifer and surface water from Lake Belton and Lake Waco. Based on the available groundwater and surface water supply, McLennan County-Other is projected to have a shortage of 6,067 acft/yr in the year 2030 and 6,786 acft/yr in the year 2060.

4C.24.22.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of McLennan County-Other:

- Conservation, and
- Purchase water from the City of Waco.

- Alternatives to this strategy are purchasing from BRA System Operation and/or reuse water from WMARSS.

4C.24.22.3 Costs

Costs of the Recommended Plan for McLennan County-Other.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $159,980 in 2020

b. Water Supply from City of Waco:
   - Date to be Implemented: before 2010
   - Unit Cost: assumed unit cost of $815/acft ($2.50/1,000 gallons) for wholesale treated water, including transmission costs
   - Annual Cost: $5,705,000

Table 4C.24-13.
Recommended Plan Costs by Decade for McLennan County-Other

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(5,596)	(5,828)	(6,067)	(6,297)	(6,478)	(6,786)
Conservation						
Supply From Plan Element (acft/yr)	184	421	374	284	256	266
Annual Cost ($/yr)	$69,920	$159,980	$142,120	$107,920	$97,280	$101,080
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	6,000	6,000	6,500	6,500	6,500	7,000
Annual Cost ($/yr)	$4,890,000	$4,890,000	$5,297,500	$5,297,500	$5,297,500	$5,705,000
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.24.23 Manufacturing

4C.24.23.1 Description of Supply

McLennan County Manufacturing obtains its water supply from groundwater from the Trinity Aquifer and surface water from run-of-river rights and Lake Waco. Based on the available groundwater and surface water supply, McLennan County Manufacturing is projected to have a shortage of 1,089 acft/yr in the year 2030 and 1,508 acft/yr in the year 2060.

4C.24.23.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of McLennan County Manufacturing:

- Conservation, and
- Purchase water from the City of Waco.
- An alternative to this strategy is to purchase water from BRA System Operation.

4C.24.23.3 Costs

Costs of the Recommended Plan for McLennan County Manufacturing.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Water Supply from City of Waco:
   - Date to be Implemented: before 2010
   - Unit Cost: assumed unit cost of $815/acft ($2.50/1,000 gallons) for wholesale treated water, including transmission costs
   - Annual Cost: $122,250

Table 4C.24-14.
Recommended Plan Costs by Decade for McLennan County Manufacturing

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(784)	(941)	(1,089)	(1,239)	(1,374)	(1,508)
Conservation						
Supply From Plan Element (acft/yr)	106	203	320	357	389	422
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	1,000	1,000	1,500	1,500	1,500	1,700
Annual Cost ($/yr)	$815,000	$815,000	$1,222,500	$1,222,500	$1,222,500	$1,385,500
Unit Cost ($/acft)	$815	$815	$815	$815	$815	$815

4C.24.24 Steam-Electric

4C.24.24.1 Description of Supply

McLennan County Steam-Electric obtains its water supply from Tradinghouse Reservoir. Based on the available surface water supply, McLennan County Steam-Electric is projected to have a shortage of 21,628 acft/yr in the year 2030 and 34,016 acft/yr in the year 2060.

4C.24.24.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of McLennan County Steam-Electric:

- Conservation,
- Reuse from WMARSS, and
- Purchase water from the City of Waco.
- An alternative to this strategy is BRA System Operation.

4C.24.24.3 Costs

Costs of the Recommended Plan for McLennan County Steam-Electric.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Reuse from WMARSS:
   - Cost Source: Volume II, Section 4B.3
   - Date to be Implemented: before 2010
   - Total Project Cost: $2,995,000
   - Annual Cost: $1,776,000

c. Water Supply from City of Waco:
   - Cost Source: assumed unit cost for raw water delivered
   - Date to be Implemented: before 2010
   - Unit Cost: $286/acft
   - Annual Cost: $15,485,000

Table 4C.24-15.
Recommended Plan Costs by Decade for McLennan County Steam-Electric

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(22,987)	(18,881)	(21,628)	(24,973)	(29,049)	(34,016)
Conservation						
Supply From Plan Element (acft/yr)	1,113	1,649	2,500	2,734	3,019	3,366
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Reuse from WMARSS						
Supply From Plan Element (acft/yr)	16,000	16,000	16,000	16,000	16,000	16,000
Annual Cost ($/yr)	$1,776,000	$1,776,000	$1,776,000	$1,776,000	$1,776,000	$1,776,000
Unit Cost ($/acft)	$111	$111	$111	$111	$111	$111
Water Supply from City of Waco						
Supply From Plan Element (acft/yr)	7,000	3,000	6,000	9,000	14,000	19,000
Annual Cost ($/yr)	$5,705,000	$2,445,000	$4,890,000	$7,335,000	$11,410,000	$15,485,000
Unit Cost ($/acft)	$286	$286	$286	$286	$286	$286

4C.24.25 Mining

No shortage is projected for McLennan County Mining and no changes in water supply are recommended.

4C.24.26 Irrigation

No shortage is projected for McLennan County Irrigation and no changes in water supply are recommended.

4C.24.27 Livestock

No shortage is projected for McLennan County Livestock and no changes in water supply are recommended.

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4C.25 Milam County Water Supply Plan

Table 4C.25-1 lists each water user group in Milam County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.25-1. Milam County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Cameron	1,215	1,247	Projected surplus
Milano WSC	105	70	Projected surplus
City of Rockdale	1,267	1,240	Projected surplus
Southwest Milam WSC	(147)	(552)	Projected shortage – see plan below
City of Thorndale	17	11	Projected surplus
County-Other	615	744	Projected surplus
Manufacturing	2,071	494	Projected surplus
Steam-Electric	(4,700)	(8,200)	Projected shortage – see plan below
Mining	0	0	No projected needs
Irrigation	8,961	9,016	Projected surplus
Livestock	0	0	No projected need

[1] From Tables C-49 and C-50, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.25.1 City of Cameron

The City of Cameron obtains its water supply from run-of-the-river rights. No shortages are projected for the City of Cameron and no changes in water supply are recommended.

4C.25.2 Milano WSC

Milano WSC obtains its water supply from the Carrizo-Wilcox Aquifer. No shortages are projected for Milano WSC and no changes in water supply are recommended.

4C.25.3 City of Rockdale

The City of Rockdale obtains its water supply from the Carrizo-Wilcox Aquifer. No shortages are projected for the City of Rockdale and no changes in water supply are recommended.

4C.25.4 Southwest Milam WSC

4C.25.4.1 Description of Supply

Southwest Milam WSC obtains its water supply from groundwater from the Carrizo-Wilcox Aquifer. Southwest Milam WSC is projected to have a shortage of 147 acft/yr in the year 2030, and a shortage of 552 acft/yr in the year 2060.

4C.25.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Southwest Milam WSC:

- Additional Carrizo-Wilcox Aquifer Development.
- Conservation was also considered; however, the WSC's current per capita use rate is below the selected target rate of 140 gpcd.

4C.25.4.3 Costs

Costs of the Recommended Plan for Southwest Milam WSC.

a. Additional Carrizo-Wilcox Aquifer Development:
   - Date to be Implemented: By year 2030
   - Total Project Cost: $2,079,000
   - Annual Cost: $294,000

   The project cost includes two 400 gpm wells drilled to a depth of 800 feet in the Carrizo-Wilcox Aquifer.

Table 4C.25-2.
Recommended Plan Costs by Decade for Southwest Milam WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	273	32	(147)	(309)	(426)	(552)
Additional Carrizo-Wilcox Aquifer Development						
Supply From Plan Element (acft/yr)	—	—	600	600	600	600
Annual Cost ($/yr)			$294,000	$294,000	$294,000	$294,000
Unit Cost ($/acft)			$490	$490	$490	$490

4C.25.5 City of Thorndale

The City of Thorndale obtains its water supply from the Carrizo-Wilcox Aquifer. No shortages are projected for the City of Thorndale and no changes in water supply are recommended.

4C.25.6 County-Other

The water supply entities for County-Other show a projected surplus and no changes in water supply are recommended.

4C.25.7 Manufacturing

The water supply entities for Milam County Manufacturing show a projected surplus and no changes in water supply are recommended.

4C.25.8 Steam-Electric

4C.25.8.1 Description of Supply

Milam County Steam-Electric obtains its water supply from Lake Alcoa. Based on the available surface water supply, Milam County Steam-Electric is projected to have a shortage of 4,700 acft/yr in the year 2030 and a shortage of 8,200 acft/yr in the year 2060.

4C.25.8.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Milam County Steam-Electric:

- Conservation, and
- Carrizo-Wilcox Aquifer Development.

4C.25.8.3 Costs

Costs of the Recommended Plan for Milam County Steam-Electric.

a. Conservation:
    - Date to be Implemented: before 2010
    - Annual Cost: Not determined

b. Carrizo-Wilcox Aquifer Development:

- Date to be Implemented: By year 2010
- Total Project Cost: $3,923,000
- Annual Cost: $611,000

The project cost includes six 1,000 gpm wells drilled to a depth of 500 feet in the Carrizo-Wilcox Aquifer.

Table 4C.25-3.
Recommended Plan Costs by Decade for Milam County Steam-Electric

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(880)	(4,700)	(4,700)	(4,700)	(8,200)	(8,200)
Conservation						
Supply From Plan Element (acft/yr)	260	625	875	875	1,120	1,120
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Carrizo-Wilcox Aquifer Development						
Supply From Plan Element (acft/yr)	8,200	8,200	8,200	8,200	8,200	8,200
Annual Cost ($/yr)	$611,000	$611,000	$611,000	$611,000	$611,000	$611,000
Unit Cost ($/acft)	$75	$75	$75	$75	$75	$75

4C.25.9 Mining

No shortage is projected for the Milam County Mining and no changes in water supply are recommended.

Mining demand in Milam County has been primarily associated with Alcoa's Sandow Mine, which is located in Lee and Milam Counties in Region G. The operation includes depressurization of the groundwater in the layer below the underground lignite formation in order to extract the lignite resource. The water supply available is essentially the amount of water that is produced in the depressurization operation. This operation is largely non-consumptive and the water produced is available for other uses. Mining demands in Milam County are expected to decrease with the expected closing of the Sandow Mine from a present 30,000 acft/yr to 4,000 acft/yr in 2010, to 1,500 acft/yr in 2050. Continued mining demands in Milam County are associated with mine reclamation activities and operation of the new Three Oaks Mine.

4C.25.10 Irrigation

No shortage is projected for the Milam County's Irrigation and no changes in water supply are recommended.

4C.25.11 Livestock

No shortage is projected for the Milam County's Livestock and no changes in water supply are recommended.

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4C.26 Nolan County Water Supply Plan

Table 4C.26-1 lists each water user group in Nolan County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.26-1.
Nolan County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2030 (acft/yr)	2060 (acft/yr)	
Bitter Creek WSC	19	31	Projected surplus
City of Roscoe	(42)	(17)	Projected shortage –see plan below
City of Sweetwater	(2,026)	(1,693)	Projected shortage –see plan below
County-Other	(27)	(4)	Projected shortage –see plan below
Manufacturing	100	(239)	Projected shortage –see plan below
Steam-Electric	(1,377)	(2,817)	Projected shortage –see plan below
Mining	(199)	(197)	Projected shortage –see plan below
Irrigation	(2,914)	(2,566)	Projected shortage –see plan below
Livestock	0	0	Supply equals demand

[1] From Tables C-51 and C-52, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.26.1 Bitter Creek WSC

The Bitter Creek WSC obtains its water from groundwater and treated water from the City of Sweetwater. No current or future shortages are projected and no changes in water supply uses are projected or recommended

4C.26.2 City of Roscoe

4C.26.2.1 Description of Supply

The City of Roscoe obtains surface water from local sources and groundwater from the Dockum and Edwards-Trinity (Plateau) aquifers. Based on available supplies, the City of Roscoe is projected to have shortages starting in 2010.

4C.26.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of the City of Roscoe:

- Reallocation of existing groundwater supply from the City of Sweetwater. Sweetwater would replace this amount within their recommended strategy.
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.26.2.3 Costs

Costs of the Recommended Plan for the City of Roscoe

a. Reallocation of existing groundwater from the City of Sweetwater:

- Date to be Implemented: 2010
- Total Project Cost: none (current infrastructure assumed to be adequate)
- Annual Cost: $17,250 (assumed to be equal to Sweetwater's cost for developing a new groundwater source).

Table 4C.26-2.
Recommended Plan Costs by Decade for the City of Roscoe

Plan Element	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
Projected Surplus/(Shortage) (acft/yr)	(45)	(45)	(42)	(36)	(26)	(17)
Reallocation of existing groundwater						
Supply From Plan Element (acft/yr)	50	50	50	50	50	50
Annual Cost ($/yr)	$17,250	$17,250	$17,250	$17,250	$17,250	$17,250
Unit Cost ($/acft)	$345	$345	$345	$345	$345	$345

4C.26.3 City of Sweetwater

4C.26.3.1 Description of Supply

Surface water supplies are obtained from Oak Creek Reservoir, Lake Tramell, Lake Sweetwater and the Dockum Aquifer. The City of Sweetwater is projected to have a maximum shortage of 2,026 acft occurring in 2030.

4C.26.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of the city of Sweetwater:

- Conservation
- Champion Well Field Phase 1
- Champion Well Field Phase 2
- Oak Creek Reservoir Subordination (see Region F and Region K regional plans for a description of this strategy). The available supply from Oak Creek Reservoir increases by approximately 2,100 and 1,700 ac-ft/yr in 2010 and 2060, respectively.
- Alternate Strategy: Wastewater Reuse (Volume II, Section 4B.3)
- Alternate Strategy: Double Mountain Fort Reservoir (Volume II, Section 4B.12.4)
- Alternate Strategy: Connect with the City of Abilene for treated water supply (Volume II, Section 4B.14.3)

4C.26.3.3 Costs

Cost of the Recommended Plan for the City of Sweetwater.

a. Conservation
   - Cost Source: Volume II, Section 4B.2
   - Date to be Implemented: 2010
   - Annual Cost: maximum of $74,100 in 2020

b. Water Supply from Champion Well Field Phase 1 (max quantity of 2,400 acft/yr):
   - Cost Source: *Champion Well Field Collection and Transmission Study*, Freese and Nichols, 1988. Costs updated to 2002 dollars.
   - Date to be Implemented: 2010
   - Total Project Cost: $12,833,426
   - Annual Cost: $1,602,230

c. Water Supply from Champion Well Field Phase 2 (max quantity of 1,090 acft/yr):
   - Cost Source: *Champion Well Field Collection and Transmission Study*, Freese and Nichols, 1988. Costs updated to 2002 dollars.
   - Date to be Implemented: 2040

- Total Project Cost: $4,227,045
- Annual Cost: $702,370

d. Oak Creek Reservoir Subordination Agreement

- Date to be Implemented: 2010
- Total Project Cost: none
- Annual Cost: none

Table 4C.26-3.
Recommended Plan Costs by Decade for the City of Sweetwater

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(1,969)	(2,022)	(2,026)	(1,969)	(1,835)	(1,693)
Conservation						
Supply From Plan Element (acft/yr)	94	195	156	113	95	91
Annual Cost ($/yr)	$35,720	$74,100	$59,280	$42,940	$36,100	$34,580
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Water Supply from Champion Well Field Phases 1 & 2						
Supply From Plan Element (acft/yr)	1,264	831	550	1,260	796	736
Phase 1 Annual Cost ($/yr)	$1,602,230	$1,602,230	$1,602,230	$1,602,230	$1,602,230	$1,602,230
Phase 1 Unit Cost ($/acft)	$517	$517	$517	$517	$517	$517
Phase 2 Annual Cost ($/yr)	—	—	—	$702,370	$702,370	$702,370
Phase 2 Unit Cost ($/acft)	—	—	—	$351	$351	$351
Oak Creek Reservoir Subordination Agreement						
Supply From Plan Element (acft/yr)	1,679	1,671	1,557	1,435	1,301	1,154
Annual Cost ($/yr)	0	0	0	0	0	0
Unit Cost ($/acft)	0	0	0	0	0	0

4C.26.3 County-Other Category

4C.26.3.1 Description of Supply

The Nolan County-Other entities obtain their water from the City of Sweetwater. Projected shortages begin in 2010.

4C.26.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortages for the County-Other entities:

- Purchase additional water supply from Sweetwater
- Conservation was also considered; however, the County-Other's current per capita use rate is below the selected target rate of 140 gpcd.

4C.26.3.3 Costs

Cost of the Recommended Plan for Manufacturing:

a. Water Supply from Sweetwater:

- Cost Source: Assumed wholesale rate for treated water
- Date to be Implemented: 2010
- Total Project Cost: none (existing infrastructure assumed adequate)
- Annual Cost: $23,000

Table 4C.26-4.
Recommended Plan Costs by Decade for Nolan County-Other

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(31)	(30)	(27)	(21)	(13)	(4)
Water Supply from Sweetwater						
Supply From Plan Element (acft/yr)	50	50	50	50	50	50
Annual Cost ($/yr)	$23,000	$23,000	$23,000	$23,000	$23,000	$23,000
Unit Cost ($/acft)	$461	$461	$461	$461	$461	$461

4C.26.4 Manufacturing

4C.26.4.1 Description of Supply

The current water supply is supplied from the Edwards-Trinity (Plateau) Aquifer and the City of Sweetwater. The projected demands will exceed the current supplies by 2050.

4C.26.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage for Nolan County Manufacturing:

- Conservation
- Purchase water from Sweetwater

4C.26.4.3 Costs

Cost of the Recommended Plan for the Manufacturing.

a. Conservation

- Date to be Implemented: 2010
- Annual Cost: not determined

b. Water Supply from Sweetwater:

- Cost Source: Assumed wholesale rate for treated water
- Date to be Implemented: 2050
- Total Project Cost: none (Current infrastructure assumed to be adequate)
- Annual Cost: $51,750

Table 4C.26-5.
Recommended Plan Costs by Decade for Nolan County Manufacturing

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	362	224	100	(23)	(132)	(239)
Conservation						
Supply From Plan Element (acft/yr)	23	46	73	81	89	96
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Water Supply from Sweetwater						
Supply From Plan Element (acft/yr)	0	0	0	0	150	150
Annual Cost ($/yr)	0	0	0	0	$51,750	$51,750
Unit Cost ($/acft)	0	0	0	0	$345	$345

4C.26.5 Steam-Electric

4C.26.5.1 Description of Supply

The current supply comes from the Edwards-Trinity Aquifer and the City of Sweetwater. Projected demands exceed current supplies.

4C.26.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortages for Steam-Electric:

- Conservation
- Water supply from City of Sweetwater
- Wastewater Reuse

4C.26.5.3 Costs

Cost of the recommended plan for Steam-Electric:

a. Conservation

- Date to be Implemented: 2010
- Annual Cost: not determined

b. Water Supply from City of Sweetwater:

- Cost Source: Assumed unit costs
- Date to be Implemented: 2020
- Total Project Cost: none (Current infrastructure assumed to be adequate)
- Annual Cost: $690,000 at full implementation

c. Wastewater Reuse

- Cost Source: Volume II, Section 4B.3
- Date to be Implemented: 2010
- Total Project Cost: $2,115,000
- Annual Cost: $187,000

Table 4C.26-6.
Recommended Plan Costs by Decade for Nolan County Steam-Electric

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(492)	(1,059)	(1,377)	(1,767)	(2,240)	(2,817)
Conservation						
Supply From Plan Element (acft/yr)	39	94	154	181	214	255
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Water Supply from City of Sweetwater						
Supply From Plan Element (acft/yr)	0	700	700	1100	1,500	2,000
Annual Cost ($/yr)	0	$241,500	$241,500	$379,500	$517,500	$690,000
Unit Cost ($/acft)	0	$345	$345	$345	$345	$345
Water Supply from Wastewater Reuse						
Supply From Plan Element (acft/yr)	560	560	560	560	560	560
Annual Cost ($/yr)	$187,000	$187,000	$187,000	$187,000	$187,000	$187,000
Unit Cost ($/acft)	$334	$334	$334	$334	$334	$334

4C.26.6 Mining

4C.26.6.1 Description of Supply

Mining uses are supplied from the Dockum aquifer. Projected demands exceed available supply.

4C.26.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage for Nolan County Mining:

- Conservation
- Develop Brackish Groundwater

4C.26.6.3 Costs

Cost of the Recommended Plan for Nolan County Mining.

a. Conservation

- Date to be Implemented: 2010
- Annual Cost: not determined

b. Water Supply from Brackish Groundwater:

- Cost Source: Assumed unit cost
- Date to be Implemented: 2010
- Total Project Cost: $268,188
- Annual Cost: $25,200

Table 4C.26-7.
Recommended Plan Costs by Decade for the Nolan County Mining

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(200)	(199)	(199)	(197)	(197)	(197)
Conservation						
Supply From Plan Element (acft/yr)	8	14	19	19	19	19
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Water Supply from Brackish Groundwater						
Supply From Plan Element (acft/yr)	200	200	200	200	200	200
Annual Cost ($/yr)	$25,200	$25,200	$25,200	$25,200	$25,200	$25,200
Unit Cost ($/acft)	$126	$126	$126	$126	$126	$126

4C.26.7 Irrigation

4C.26.7.1 Description of Supply

The current supply includes the Dockum aquifer and run-of-river diversions from the Brazos River. The water supply for Nolan County Irrigation shows a projected shortage.

4C.26.72 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to mitigate some of the projected shortage Nolan County Irrigation:

- Conservation
- Brush Control and Weather Mod – these supplies are unquantifiable, see sections 4B.9 and 4B.10 for more detailed information.

4C.26.7.3 Costs

Cost of the Recommended Plan for Nolan County Irrigation.

a. Conservation

- Cost Source: Volume II, Section 4B.2
- Date to be Implemented: 2010
- Annual Cost: $50,400 in 2060

Table 4C.26-8.
Recommended Plan Costs by Decade for the Nolan County Irrigation

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(3,164)	(3,038)	(2,914)	(2,794)	(2,679)	(2,566)
Conservation						
Supply From Plan Element (acft/yr)	154	250	341	332	323	315
Annual Cost ($/yr)	$24,640	$40,000	$54,560	$53,120	$51,680	$50,400
Unit Cost ($/acft)	$160	$160	$160	$160	$160	$160

4C.26.8 Livestock

No shortages are projected for Livestock uses and no changes in water supply are recommended.

4C.27 Palo Pinto County Water Supply Plan

Table 4C.27-1 lists each water user group in Palo Pinto County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.27-1.
Palo Pinto County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Graford	76	73	Projected surplus
City of Mineral Wells	3,219	3,156	Projected surplus
City of Strawn	(7)	(23)	Projected shortage–see plan below
County-Other	(203)	(637)	Projected shortage–see plan below
Manufacturing	114	104	Projected surplus
Steam-Electric	563	(1,658)	Projected shortage–see plan below
Mining	410	410	Projected surplus
Irrigation	6,053	6,100	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables C-53 and C-54, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.27.1 City of Graford

The City of Graford obtains surface water from Keechi Creek and purchases water from Palo Pinto County MWD No. 1. No shortages are projected and no changes in water supply are recommended.

4C.27.2 City of Mineral Wells

The City of Mineral Wells obtains surface water from Lake Palo Pinto from a contract with the Palo Pinto County Municipal Water District No. 1. No shortages are projected and no changes in water supply are recommended.

4C.27.3 City of Strawn

4C.27.3.1 Description of Supply

Surface water supplies are obtained from Lake Tucker. Supplies will not be sufficient to meet demands through 2060.

4C.27.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of the City of Strawn:

- Conservation
- Water supply from Eastland County WSD.

4C.27.3.3 Costs

Cost of the Recommended Plan for the City of Strawn.

a. Conservation
  - Cost Source: Volume II, Section 4B.2
  - Date to be Implemented: 2010
  - Annual Cost: maximum of $5,320 in 2020

b. Water Supply from Eastland County WSD:
  - Cost Source: Cost estimate to provide service
  - Date to be Implemented: by 2020
  - Total Project Cost: $1,488,262
  - Annual Cost: $218,400

Table 4C.27-2.
Recommended Plan Costs by Decade for the City of Strawn

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	0	(4)	(7)	(10)	(16)	(23)
Conservation						
Supply From Plan Element (acft/yr)	7	14	11	9	9	9
Annual Cost ($/yr)	$2,660	$5,320	$4,180	$3,420	$3,420	$3,420
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Water Supply from Eastland County WSD						
Supply From Plan Element (acft/yr)	0	200	200	200	200	200
Annual Cost ($/yr)	0	$218,400	$218,400	$218,400	$218,400	$218,400
Unit Cost ($/acft)	0	$1,092	$1,092	$1,092	$1,092	$1,092

4C.27.4 County-Other

4C.27.4.1 Description of Supply

The current supply includes water purchased from Lake Palo Pinto through the Palo Pinto County MWD No. 1 and run-of-the-river diversions. The water supply entities for County-Other show a projected shortage beginning in 2010.

4C.27.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of the County-Other entities:

- Purchase water from Mineral Wells
- Conservation was also considered; however, current per capita use rate is below the selected target rate of 140 gpcd.

4C.27.4.3 Costs

Cost of the Recommended Plan for the Palo Pinto County-Other.

a. Purchase water from Mineral Wells.
    - Cost Source: assumed wholesale treated water rate of $489/acft ($1.50/1,000 gallons)
    - Date to be Implemented: 2010
    - Annual Cost: $24,450

Table 4C.27-3.
Recommended Plan Costs by Decade for Palo Pinto County-Other

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(26)	(121)	(203)	(302)	(446)	(637)
Water Supply from Mineral Wells						
Supply From Plan Element (acft/yr)	100	200	250	350	450	650
Annual Cost ($/yr)	$48,900	$97,800	$122,250	$171,150	$220,050	$317,850
Unit Cost ($/acft)	$489	$489	$489	$489	$489	$489

4C.27.5 Manufacturing

Manufacturing supplies are obtained from local surface water sources and groundwater from the Trinity Aquifer. Palo Pinto County Manufacturing shows a projected surplus and no changes in water supply are recommended.

4C.27.6 Steam-Electric

4C.27.6.1 Description of Supply

Surface water supplies are obtained from a contract with Palo Pinto County MWD No. 1. The current contract is not sufficient to meet demands through 2060.

4C.27.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage for Palo Pinto County Steam-Electric:

- Conservation
- Additional Supply from Palo Pinto County MWD No. 1

4C.27.6.3 Costs

Cost of the Recommended Plan for Palo Pinto County Steam-Electric.

a. Conservation
   - Cost Source: Volume II, Section 4B.2
   - Date to be Implemented: 2010
   - Annual Cost: not determined

b. Additional Supply from Lake Palo Pinto (requires Palo Pinto County MWD No. 1 to implement strategies to increase supply):
   - Cost Source: Volume II, Section 4B.13.6 (Lake Palo Pinto Off-Channel Reservoir)
   - Date to be Implemented: 2040
   - Total Project Cost: $19,314,000
   - Annual Cost: $1,621,000

Table 4C.27-4.
Recommended Plan Costs by Decade for Palo Pinto County Steam-Electric

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	659	774	563	(19)	(782)	(1,658)
Conservation						
Supply From Plan Element (acft/yr)	41	63	102	120	142	169
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Additional Supply from Palo Pinto County MWD No. 1						
Supply From Plan Element (acft/yr)	—	—	—	3,110	3,110	3,110
Annual Cost ($/yr)				$1,621,000	$1,621,000	$1,621,000
Unit Cost ($/acft)				$521	$521	$521

4C.27.8 Mining

No future shortages are projected and no changes in water supply are recommended.

4C.27.9 Irrigation

No future shortages are projected and no changes in water supply are recommended.

4C.27.10 Livestock

No future shortages are projected and no changes in water supply are recommended.

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4C.28 Robertson County Water Supply Plan

Table 4C.28-1 lists each water user group in Robertson County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.28-1.
Robertson County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Bremond	385	390	Projected surplus
City of Calvert	239	247	Projected surplus
City of Franklin	305	299	Projected surplus
City of Hearne	1,831	1,858	Projected surplus
Robertson County WSC	177	160	Projected surplus
County-Other	76	74	Projected surplus
Manufacturing	(31)	(77)	Projected shortage – see plan below
Steam-Electric	1,791	(8,284)	Projected shortage – see plan below
Mining	9	9	Projected surplus
Irrigation	779	1,104	Projected surplus
Livestock	0	0	No projected surplus/shortage

[1] From Tables C-55 and C-56, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.28.1 City of Bremond

The City of Bremond obtains its water supply from groundwater from the Carrizo-Wilcox Aquifer. No shortages are projected for the City of Bremond and no changes in water supply are recommended.

4C.28.2 City of Calvert

The City of Calvert obtains its water supply from groundwater from the Carrizo-Wilcox Aquifer. No shortages are projected for the City of Calvert and no changes in water supply are recommended.

4C.28.3 City of Franklin

The City of Franklin obtains its water supply from groundwater from the Carrizo-Wilcox Aquifer. No shortages are projected for the City of Franklin and no changes in water supply are recommended.

4C.28.4 City of Hearne

The City of Hearne obtains its water supply from groundwater from the Carrizo-Wilcox Aquifer. No shortages are projected for the City of Hearne and no changes in water supply are recommended.

4C.28.4 Robertson County WSC

Robertson County WSC obtains its water supply from groundwater from the Carrizo-Wilcox Aquifer. No shortages are projected for Robertson County WSC and no changes in water supply are recommended.

4C.28.5 County-Other

County-Other is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.28.6 Manufacturing

4C.28.6.1 Description of Supply

Robertson County Manufacturing obtains its water supply from groundwater from the Carrizo-Wilcox Aquifer. Based on the available groundwater supply, Robertson County Manufacturing is projected to have a shortage of 31 acft/yr in the year 2030 and 77 acft/yr in the year 2060.

4C.28.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Robertson County Manufacturing:

- Conservation, and
- Additional Carrizo-Wilcox Aquifer Development.

4C.28.6.3 Costs

Costs of the Recommended Plan for Robertson County Manufacturing.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Additional Carrizo-Wilcox Aquifer Development:
   - Date to be Implemented: By year 2010
   - Total Project Cost: $707,000
   - Annual Cost: $77,000

   The project cost includes one 500 gpm well drilled to a depth of 1,300 feet in the Carrizo-Wilcox Aquifer.

Table 4C.28-2.
Recommended Plan Costs by Decade for Robertson County Manufacturing

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	1	(15)	(31)	(48)	(64)	(77)
Conservation						
Supply From Plan Element (acft/yr)	3	5	8	9	11	11
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Additional Carrizo-Wilcox Aquifer Development						
Supply From Plan Element (acft/yr)	85	85	85	85	85	85
Annual Cost ($/yr)	$77,000	$77,000	$77,000	$77,000	$77,000	$77,000
Unit Cost ($/acft)	$906	$906	$906	$906	$906	$906

4C.28.7 Steam-Electric

4C.28.7.1 Description of Supply

Robertson County Steam-Electric entities obtain water supply from the Carrizo-Wilcox Aquifer, a contract with the Brazos River Authority for water from Lake Limestone, and various run-of-river rights. Based on the available groundwater and surface water supply, Robertson County Steam-Electric is projected to have a surplus of 1,791 acft/yr in the year 2030 and a shortage of 8,284 acft/yr in the year 2060.

4C.28.7.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Robertson County Steam-Electric:

- Conservation, and
- Purchase depressurization water from Walnut Creek Mine.
- An alternative to this strategy is BRA System Operation.

4C.28.7.3 Costs

Costs of the Recommended Plan for Robertson County Steam-Electric.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Purchase depressurization water from Walnut Creek Mine:
   - Cost Source: assumed unit cost for raw water supply delivered
   - Date to be Implemented: before 2040
   - Unit Cost: $275/acft
   - Annual Cost: $2,475,000

Table 4C.28-3.
Recommended Plan Costs by Decade for Robertson County Steam-Electric

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	3,840	1,816	1,791	(3,234)	(8,259)	(8,284)
Conservation						
Supply From Plan Element (acft/yr)	840	1,500	2,100	2,450	2,800	2,800
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Purchase reuse water from Walnut Creek Mine						
Supply From Plan Element (acft/yr)	—	—	—	4,000	9,000	9,000
Annual Cost ($/yr)				$1,100,000	$2,475,000	$2,475,000
Unit Cost ($/acft)				$275	$275	$275

4C.28.8 Mining

Mining is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.28.9 Irrigation

Irrigation is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.28.10 Livestock

No shortage is projected for Livestock and no changes in water supply are recommended.

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4C.29 Shackelford County Water Supply Plan

Table 4C.29-1 lists each water user group in Shackelford County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.29-1.
Shackelford County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Albany	1,329	1,631	Projected surplus
County-Other	0	0	Supply equals demand
Manufacturing	50	50	Projected surplus
Steam-Electric	0	0	No demand or supply
Mining	0	0	Supply equals demand
Irrigation	(99)	(81)	Projected shortage –see plan below
Livestock	0	0	Supply equals demand

[1] From Tables C-57 and C-58, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.29.1 City of Albany

Water supply for the City of Albany is from Hubbard Creek Reservoir, owned by the West Central Texas MWD and from Lake McCarty. No future shortages are projected and no changes in water supply are recommended.

4C.29.2 County-Other Category

4C.29.2.1 Description of Supply

Supply equals demands for County-Other users, which include Shackelford Co. WSC. The WSC obtains its supply from Possum Kingdom Lake and the City of Albany.

4C.29.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to increase supplies for Shackelford County-Other:

- Purchase additional supply from the West Central Brazos Distribution System (WCBDS), formerly known as the Kerr-McGee Pipeline.

4C.29.2.3 Costs

Cost of the Recommended Plan for Shackelford County-Other.

a. Water Supply from WCBDS (with regional WTP):

- Cost Source: *West Central Brazos River Basin Regional Water Treatment and Distribution Facility Plan*, Freese and Nichols, 2004.
- Date to be Implemented: 2010
- Total Project Cost: $15,877,792
- Annual Cost: $1,800,000 (total project)
  $321,500 (Shackelford Co Rural WSC portion)

Table 4C.29-2.
Recommended Plan Costs by Decade for the Shackelford County-Other

Plan Element	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
Projected Surplus/(Shortage) (acft/yr)	0	0	0	0	0	0
Water Supply from WCBDS						
Supply From Plan Element (acft/yr)	250	250	250	250	250	250
Annual Cost ($/yr)	$321,500	$321,500	$321,500	$321,500	$321,500	$321,500
Unit Cost ($/acft)	$1,286	$1,286	$1,286	$1,286	$1,286	$1,286

4C.29.3 Manufacturing

Projections indicate a surplus of water for Manufacturing supply and no changes in water supply are recommended.

4C.29.4 Steam-Electric

No Steam-Electric demand exists or is projected for the county.

4C.29.5 Mining

Projections indicate Mining supply equals demand and no changes in water supply are recommended.

4C.29.6 Irrigation

4C.29.6.1 Description of Supply

Surface water for Irrigation in Shackelford County is obtained from the Clear Fork of the Brazos River. Estimated reliable supply of surface water for irrigated agriculture is 31 acft/yr. There are no significant groundwater supplies available in the county.

4C.29.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to mitigate the unmet Irrigation needs:

- Conservation, and
- Brush Control and Weather Modification – these supplies are unquantifiable, see sections 4B.9 and 4B.10 for more detailed information.

4C.29.6.3 Costs

Cost of the Recommended Plan for Irrigation in Shackelford Co.

a. Conservation:

- Cost Source: Volume II, Section 4B.2
- Date to be Implemented: 2010
- Unit: $160/acft of water saved
- Annual Cost: maximum of $1,920 in 2030

Table 4C.29-3.
Recommended Plan Costs by Decade for Shackelford County Irrigation

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(111)	(104)	(99)	(93)	(87)	(81)
Conservation						
Supply From Plan Element (acft/yr)	6	9	12	12	12	11
Annual Cost ($/yr)	$960	$1,140	$1,920	$1,920	$1,920	$1,760
Unit Cost ($/acft)	$160	$160	$160	$160	$160	$160

4C.29.7 Livestock

No future shortages are projected in the Livestock category and no changes in water supply are recommended.

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4C.30 Somervell County Water Supply Plan

Table 4C.30-1 lists each water user group in Somervell County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.30-1.
Somervell County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Glen Rose	38	37	Projected surplus
County-Other	(231)	(260)	Projected shortage – see plan below
Manufacturing	(4)	(7)	Projected shortage – see plan below
Steam-Electric	25,570	25,510	Projected surplus
Mining	(94)	(85)	Projected shortage – see plan below
Irrigation	945	953	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables C-59 and C-60, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.30.1 The City of Glen Rose

The City of Glen Rose obtains groundwater from the Trinity Aquifer. No shortage is projected for the City of Glen Rose and no changes in water supply are recommended.

4C.30.2 County-Other

4C.30.2.1 Description of Supply

Somervell County-Other obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Somervell County-Other is projected to have a shortage of 231 acft/yr in the year 2030 and 260 acft/yr in the year 2060.

4C.30.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Somervell County-Other:

- Wheeler Branch Off-Channel Reservoir – the project has obtained a water rights permit from the TCEQ and is projected to be completed by 2010
- Conservation was also considered; however, the County-Other's per capita use rate is below the selected target rate of 140 gpcd.

4C.30.2.3 Costs

Costs of the Recommended Plan for Somervell County-Other.

a. Wheeler Branch Off-Channel Reservoir:
   - Cost Source: Volume II, Section 4B.13.3
   - Date to be Implemented: before 2010
   - Total Project Cost: $27,195,000
   - Annual Cost: $2,117,000

Table 4C.30-2.
Recommended Plan Costs by Decade for Somervell County-Other

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(133)	(189)	(231)	(251)	(257)	(260)
Wheeler Branch Off-Channel Reservoir						
Supply From Plan Element (acft/yr)	1,800	1,800	1,800	1,800	1,800	1,800
Annual Cost ($/yr)	$2,117,000	$2,117,000	$2,117,000	$2,117,000	$2,117,000	$2,117,000
Unit Cost ($/acft)	$1,176	$1,176	$1,176	$1,176	$1,176	$1,176

4C.30.3 Manufacturing

4C.30.3.1 Description of Supply

Somervell County Manufacturing obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Somervell County Manufacturing is projected to have a shortage of 4 acft/yr in the year 2030 and 7 acft/yr in the year 2060.

4C.30.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Somervell County Manufacturing:

- Conservation, and
- Purchase water from the City of Glen Rose.

4C.30.3.3 Costs

Costs of the Recommended Plan for Somervell County Manufacturing.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Water Supply from City of Glen Rose:
   - Cost Source: estimated wholesale treated water rate
   - Date to be Implemented: By year 2010
   - Annual Cost: $16,161 in 2060

   The annual cost was calculated by multiplying the Manufacturing projected supply from this strategy by an estimated wholesale water rate of $162/acft.

Table 4C.30-3.
Recommended Plan Costs by Decade for Somervell County Manufacturing

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(2)	(3)	(4)	(5)	(6)	(7)
Conservation						
Supply From Plan Element (acft/yr)	0	0	1	1	1	1
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Water Supply from City of Glen Rose						
Supply From Plan Element (acft/yr)	10	10	10	10	10	10
Annual Cost ($/yr)	$16,161	$16,161	$16,161	$16,161	$16,161	$16,161
Unit Cost ($/acft)	$162	$162	$162	$162	$162	$162

4C.30.4 Steam-Electric

Somervell County Steam-Electric is projected to have a surplus of water through 2060 and no changes in water supply are recommended.

4C.30.5 Mining

4C.30.5.1 Description of Supply

Somervell County Mining obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, Somervell County Mining is projected to have a shortage of 94 acft/yr in the year 2030 and 85 acft/yr in the year 2060.

4C.30.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Somervell County Mining:

- Conservation, and
- Voluntary Redistribution from Steam-Electric.

4C.30.5.3 Costs

Costs of the Recommended Plan for Somervell County Mining.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Voluntary Redistribution from Steam-Electric:
   - Cost Source: assumed unit cost for raw water transfer between entities
   - Date to be Implemented: before 2010
   - Unit Cost: $75/acft
   - Annual Cost: $11,250

Table 4C.30-4.
Recommended Plan Costs by Decade for Somervell County Mining

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(106)	(98)	(94)	(91)	(88)	(85)
Conservation						
Supply From Plan Element (acft/yr)	9	14	19	19	18	18
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Voluntary Redistribution from Steam-Electric						
Supply From Plan Element (acft/yr)	150	150	150	150	150	150
Annual Cost ($/yr)	$11,250	$11,250	$11,250	$11,250	$11,250	$11,250
Unit Cost ($/acft)	$75	$75	$75	$75	$75	$75

4C.30.6 Irrigation

Somervell County Irrigation is projected to have a surplus of water through 2060 and no changes in water supply are recommended.

4C.30.7 Livestock

No shortages are projected for Somervell County Livestock and no changes in water supply are recommended.

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4C.31 Stephens County Water Supply Plan

Table 4C.31-1 lists each water user group in Stephens County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.31-1. Stephens County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Breckenridge	1,389	1,487	Projected surplus
Stephens County Rural WSC	917	960	Projected surplus
County-Other	(216)	(193)	Projected shortage –see plan below
Manufacturing	53	50	Projected surplus
Steam-Electric	0	0	No demand or supply
Mining	(5,884)	(6,662)	Projected shortage –see plan below
Irrigation	51	56	Projected surplus
Livestock	0	0	Supply equals demand
Livestock	0	0	Supply equals demand

[1] From Tables C-61 and C-62, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.31.1 The City of Breckenridge

The City of Breckenridge obtains water from Hubbard Creek Reservoir through the West Central Texas Municipal Water District and from Lake Daniel. No future shortages are projected; however an alternative strategy consisting of purchasing water from the WCBDS would supplement current contracted supplies.

4C.31.2 Stephens County Rural WSC

4C.31.2.1 Description of Supply

The current supply comes from the Lake Daniel and Hubbard Creek Reservoir through the City of Breckenridge.

4C.31.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected needs of Stephens Co Rural WSC:

- Purchase additional supply from WCBDS.
- Conservation was also considered; however, current per capita use rate is below the selected target rate of 140 gpcd.

4C.31.2.3 Costs

Cost of the Recommended Plan for Stephens Co Rural WSC.

a. Water Supply from WCBDS (with regional WTP):

- Cost Source: *West Central Brazos River Basin Regional Water Treatment and Distribution Facility Plan*, Freese and Nichols, 2004.
- Date to be Implemented: 2010
- Total Project Cost: $15,877,792
- Annual Cost: $1,800,000 (total project)
  $514,400 (Stephens Co Rural WSC portion)

Table 4C.31-2.
Recommended Plan Costs by Decade for the Stephens County Rural WSC

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	906	911	917	934	952	960
Water Supply from WCBDS						
Supply From Plan Element (acft/yr)	400	400	400	400	400	400
Annual Cost ($/yr)	$514,400	$514,400	$514,400	$514,400	$514,400	$514,400
Unit Cost ($/acft)	$1,286	$1,286	$1,286	$1,286	$1,286	$1,286

4C.31.3 County-Other

4C.31.3.1 Description of Supply

The current supply comes from groundwater. The projected demands will exceed current supplies.

4C.31.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of Stephens County-Other:

- Conservation, and
- Purchase additional supply from WCBDS through local suppliers (City of Breckenridge and Stephens Co. Rural WSC).

4C.31.3.3 Costs

Cost of the Recommended Plan for Stepens County-Other:

a. Conservation

- Cost Source: Volume II, Section 4B.2
- Date to be Implemented: 2010
- Unit Cost: maximum of $8,360 in 2020

b. Water Supply from WCBDS (with regional WTP):

- Cost Source: West Central Brazos River Basin Regional Water Treatment and Distribution Facility Plan, Freese and Nichols, 2004.
- Date to be Implemented: 2010
- Total Project Cost: $15,877,792
- Annual Cost: $1,800,000 (total project)
  $514,400 (Stephens County-Other portion)

Table 4C.31-3.
Recommended Plan Costs by Decade for the Stephens County Other

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(218)	(219)	(216)	(210)	(199)	(193)
Conservation						
Supply From Plan Element (acft/yr)	11	22	18	13	10	10
Annual Cost ($/yr)	$4,180	$8,360	$6,840	$4,940	$3,800	$3,800
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Water Supply from WCBDS						
Supply From Plan Element (acft/yr)	400	400	400	400	400	400
Annual Cost ($/yr)	$514,400	$514,400	$514,400	$514,400	$514,400	$514,400
Unit Cost ($/acft)	$1,286	$1,286	$1,286	$1,286	$1,286	$1,286

4C.31.4 Manufacturing

No shortages are projected for Manufacturing and no changes in water supply are recommended.

4C.31.5 Steam-Electric

No Steam-Electric demand or supply exists for the county.

4C.31.6 Mining

4C.31.6.1 Description of Supply

The current supply comes from groundwater and Possum Kingdom Reservoir; the supplies will not be sufficient through 2060.

4C.31.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage for Stephens County Mining:

- Conservation
- Purchase water from BRA through new pipeline from Possum Kingdom Reservoir.

4C.31.6.3 Costs

Cost of the Recommended Plan for Stephens County Mining.

a. Conservation
   - Date to be Implemented: 2010
   - Annual Cost: Not determined

b. Water Supply from BRA:
   - Cost Source: Freese and Nichols cost estimate
   - Date to be Implemented: 2010
   - Total Project Cost: $ 10,586,000
   - Annual Cost: $1,470,000

Table 4C.31-4.
Recommended Plan Costs by Decade for the Stephens County Mining

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(5,034)	(5,646)	(5,884)	(6,115)	(6,340)	(6,662)
Conservation						
Supply From Plan Element (acft/yr)	261	466	670	686	702	724
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Water Supply from BRA (Possum Kingdom Reservoir)						
Supply From Plan Element (acft/yr)	6,000	6,000	6,000	6,000	6,000	6,000
Annual Cost ($/yr)	$1,470,000	$1,470,000	$1,470,000	$1,470,000	$1,470,000	$1,470,000
Unit Cost ($/acft)	$245	$245	$245	$245	$245	$245

4C.31.7 Irrigation

No future shortages are projected in the Irrigation category and no changes in water supply are recommended.

4C.31.8 Livestock

No future shortages are projected in the Livestock category and no changes in water supply are recommended.

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4C.32 Stonewall County Water Supply Plan

Table 4C.32-1 lists each water user group in Stonewall County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.32-1.
Stonewall County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Aspermont	9	35	Short term Projected shortage –see plan below
County-Other	37	54	Projected surplus
Manufacturing	0	0	No demand or supply
Steam-Electric	0	0	No demand or supply
Mining	0	0	Supply equals demand
Irrigation	8	9	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables C-63 and C-64, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.32.1 The City of Aspermont

4C.32.1.1 Description of Supply

The City of Aspermont is supplied from NCTMWA and from local groundwater sources, primarily from the Seymour Aquifer. The short-term shortages are projected that do not exist past the year 2030.

4C.32.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of the City of Aspermont:

- Conservation.

4C.32.1.3 Costs

Cost of the Recommended Plan for the City of Aspermont.

a. Water Supply from Conservation:

- Cost Source: Volume II, Section 4B.2
- Date to be Implemented: 2010
- Total Project Cost: N/A
- Annual Cost: maximum of $6,080 in 2020

Table 4C.32-2.
Recommended Plan Costs by Decade for the City of Aspermont

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(7)	(1)	9	20	28	35
Conservation						
Supply From Plan Element (acft/yr)	8	16	12	9	6	6
Annual Cost ($/yr)	$3,040	$6,080	$4,560	$3,420	$2,280	$2,280
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380

4C.32.2 County-Other

The water supply entities for Stonewall County-Other show a projected surplus and no changes in water supply are recommended.

4C.32.3 Manufacturing

No Manufacturing demand exists or is projected for the county.

4C.32.4 Steam-Electric

No Steam-Electric demand exists or is projected for the county.

4C.32.5 Mining

Stonewall County Mining shows no projected shortages and no changes in water supply are recommended.

4C.32.6 Irrigation

Stonewall County Irrigation shows a projected surplus and no changes in water supply are recommended.

4C.32.7 Livestock

No Livestock shortage is projected.

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4C.33 Taylor County Water Supply Plan

Table 4C.33-1 lists each water user group in Taylor County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.33-1.
Taylor County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Abilene	(14,071)	(12,973)	Projected shortage –see plan below
City of Merkel	(85)	(52)	Projected shortage –see plan below
Potosi WSC	(120)	(84)	Projected shortage –see plan below
Steamboat Mountain WSC	119	149	Projected surplus
City of Tuscola	0	0	Supply equals demand
City of Tye	(43)	(29)	Projected shortage –see plan below
County-Other	1,051	1,086	Projected surplus
Manufacturing	0	0	Supply equals demand
Steam-Electric	16	1	Projected surplus
Mining	(5)	(4)	Projected shortage –see plan below
Irrigation	162	164	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables C-65 and C-66, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.33.1 City of Abilene

4C.33.1.1 Description of Supply

Surface water supplies are obtained from Fort Phantom Hill, Hubbard Creek and O.H. Ivie Reservoirs. Abilene also has a wastewater reuse system for non-potable use, with water stored in Lake Kirby. The City is projected to have supply shortages totaling 14,071 acft in 2030 and 12,973 acft in 2060.

4C.33.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortages for the City of Abilene:

- Conservation
- West Central Brazos System Optimization Plan (WCBSOP)
- Alternate Strategy: BRA System purchase (Possum Kingdom Reservoir)
- Alternate Strategy: purchase from Lake Alan Henry
- Alternate Strategy: Double Mountain Fork Reservoir

The WCBSOP is a combination of the following components, which would operate jointly as a system:

- City of Abilene Reuse (Volume II, Section 4B.3.2)
- Breckenridge Reservoir (Cedar Ridge site) (Volume II, Section 4B.12.1)
  - Double Mountain Fork Reservoir (Volume II, Section 4B.12.4) is an alternative component to Breckenridge Reservoir
- Clear Fork Scalping into Hubbard Creek Reservoir (*West Central Brazos River Basin Regional Water Treatment and Distribution Facility Plan*, Freese and Nichols, 2004)
- Priority Calls Agreement: Possum Kingdom/Hubbard
- Priority Calls Agreement: Possum Kingdom/Fort Phantom Clear Fork Scalping

Under this system, the City would utilize return flows to augment storage in Breckenridge Reservoir. Flood flows and releases from Breckenridge Reservoir (which would include City of Abilene return flows) would be pumped into Hubbard Creek Reservoir through the Clear Fork Scalping Operation. Agreements with the Brazos River Authority regarding priority calls on inflows would augment supplies available to Hubbard Creek Reservoir and Fort Phantom's Clear Fork Scalping Operation, as well as to augment supplies from Breckenridge Reservoir and the Clear Fork Scalping into Hubbard Creek Reservoir. In time, a pipeline could be built to deliver water supply from Breckenridge Reservoir directly to the City of Abilene through Fort Phantom Hill Reservoir. Depending upon final permitting, configuration and sizing of system components, the WCBSOP could provide staged increases of supply in excess of 59,150 acft/yr.

The City and the West Central Texas Municipal Water District (WCTMWD) have begun pursuing each of the components of the overall WCBSOP. Permit applications are pending at the TCEQ for City of Abilene reuse and the Clear Fork Scalping into Hubbard Creek Reservoir. The City and District are evaluating alternative configurations of Breckenridge Reservoir and pursuing initial discussions with affected landowners.

At the request of the City and the District, the Brazos G RWPG considers the WCBSOP to be a single strategy to develop and optimize water supplies in the west central Brazos Basin. This strategy is also recommended in identical form for the WCTMWD as a Wholesale Water Provider.

4C.33.1.3 Costs

Cost of the Recommended Plan for the City of Abilene.

a. Conservation

- Cost Source: Volume II, Section 4B.2
- Date to be Implemented: 2010
- Total Project Cost: N/A
- Annual Cost: $378,100 in 2060

b. Water Supply from West Central Brazos System Optimization Plan (WCBSOP):

- Cost Source: Evaluations of various components (Table 4C.33-2)
- Date to be Implemented: phased implementation, beginning in 2010
- Total Project Cost: $198,055,000
- Annual Cost: $16,795,500
- Unit Cost: $284/acft

Table 4C.33-2,
Component Costs for West Central Brazos System Optimization Plan

System Component	Total Cost	Annual Cost	Initial Supply Contributed (acft/yr)
Breckenridge Reservoir with reuse and priority calls agreement with BRA	$82,755,000	$6,257,000	34,520[1]
Clear Fork Scalping into Hubbard Creek Reservoir with priority calls agreement with BRA	$115,300,000	$10,081,000	7,000
Priority Calls Agreements with BRA for Hubbard Creek Reservoir and Fort Phantom Him Reservoir Scalping (costs for Possum Kingdom Reservoir Impacts – 10,000 acft at $45.75/acft)	$0	$457,500	17,630
Total	**$198,055,000**	**$16,795,500**	**59,150**

[1] Includes 5,600 acft/yr of additional yield provided by Abilene's existing return flows.

Table 4C.33-3.
Recommended Plan Costs by Decade for the City of Abilene

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(13,087)	(13,871)	(14,071)	(13,920)	(13,487)	(12,973)
Conservation						
Supply From Plan Element (acft/yr)	977	2,042	1,636	1,196	1,026	994
Annual Cost ($/yr)	$371,260	$775,960	$621,680	$454,480	$389,880	$377,720
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Water Supply from WCBSOP[1]						
Supply From Plan Element (acft/yr)	25,575	25,575	25,575	25,575	25,575	25,575
Annual Cost ($/yr)	$7,263,300	$7,263,300	$7,263,300	$7,263,300	$7,263,300	$7,263,300
Unit Cost ($/acft)	$284	$284	$284	$284	$284	$284

[1]Costs and supply from WCBSOP are assumed to be split equally between Abilene and the WCTMWD (see Table 4C.38-10).

4C.33.2 City of Merkel

4C.33.2.1 Description of Supply

The City of Merkel obtains surface water from local sources and from the City of Abilene.

4C.33.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of the City of Merkel:

- Purchase additional supply from City of Abilene.
- Conservation was also considered; however, the current per capita use rate is below the selected target rate of 140 gpcd.

4C.33.2.3 Costs

Cost of the Recommended Plan for the City of Merkel.

a. Water Supply from City of Abilene:

- Cost Source: Assumed treated wholesale rate
- Date to be Implemented: 2010
- Total Project Cost: $0 (Current infrastructure assumed to be adequate)
- Annual Cost: $521/acft ($1.60/1,000 gallons)

Table 4C.33-4.
Recommended Plan Costs by Decade for the City of Merkel

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(74)	(85)	(85)	(78)	(66)	(52)
Water Supply from Abilene						
Supply From Plan Element (acft/yr)	100	100	100	100	100	100
Annual Cost ($/yr)	$52,100	$52,100	$52,100	$52,100	$52,100	$52,100
Unit Cost ($/acft)	$521	$521	$521	$521	$521	$521

4C.33.3 Potosi WSC

4C.33.3.1 Description of Supply

The Potosi WSC purchases water from the City of Abilene, and shows a projected shortage.

4C.33.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of the Potosi WSC:

- Purchase additional supply from City of Abilene.
- Conservation was also considered; however, the current per capita use rate is below the selected target rate of 140 gpcd.

4C.33.3.3 Costs

Cost of the Recommended Plan for the Potosi WSC.

a. Water Supply from City of Abilene:

- Cost Source: Assumed treated wholesale rate
- Date to be Implemented: 2010
- Total Project Cost: $0 (Current infrastructure assumed to be adequate)
- Annual Cost: $521/acft ($1.60/1,000 gallons)

Table 4C.33-5
Recommended Plan Costs by Decade for Potosi WSC

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(115)	(121)	(120)	(108)	(96)	(84)
Water Supply from Abilene						
Supply From Plan Element (acft/yr)	150	150	150	150	150	150
Annual Cost ($/yr)	$78,150	$78,150	$78,150	$78,150	$78,150	$78,150
Unit Cost ($/acft)	$521	$521	$521	$521	$521	$521

4C.33.3 Steamboat Mountain WSC

The Steamboat Mountain purchases water from the City of Abilene and shows a projected surplus. No changes in water supply are recommended.

4C.33.4 City of Tuscola

The City of Tuscola purchases water from Taylor Co FWSD #1 and shows a supply equal to demand. No changes in water supply are recommended.

4C.33.5 City of Tye

4C.33.5.1 Description of Supply

The City of Tye purchases water from the City of Abilene, and shows a projected shortage.

4C.33.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage of the City of Tye:

- Purchase additional supply from City of Abilene.
- Conservation was also considered; however, the current per capita use rate is below the selected target rate of 140 gpcd.

4C.33.5.3 Costs

Cost of the Recommended Plan for the City of Tye.

a. Water Supply from City of Abilene:

- Cost Source: Assumed treated wholesale rate
- Date to be Implemented: 2010
- Total Project Cost: $0 (Current infrastructure assumed to be adequate)
- Annual Cost: $521/acft ($1.60/1,000 gallons)

Table 4C.33-6.
Recommended Plan Costs by Decade for the City of Tye

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(40)	(43)	(43)	(39)	(34)	(29)
Water Supply from Abilene						
Supply From Plan Element (acft/yr)	50	50	50	50	50	50
Annual Cost ($/yr)	$26,050	$26,050	$26,050	$26,050	$26,050	$26,050
Unit Cost ($/acft)	$521	$521	$521	$521	$521	$521

4C.33.6 County-Other Category

The water supply entities for Taylor County-Other show a projected surplus and no changes in water supply are recommended.

4C.33.7 Manufacturing

The water supply for Manufacturing equals demand and no changes in water supply are recommended.

4C.33.8 Steam-Electric

The water supply entities for Taylor County Steam-Electric show a projected surplus and no changes in water supply are recommended.

4C.33.9 Mining

4C.33.9.1 Description of Supply

The current supply comes from the Trinity aquifer; Taylor County Mining shows a projected shortage.

4C.33.9.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended to meet the projected shortage Taylor County Mining:

- Conservation

4C.33.9.3 Costs

Cost of the Recommended Plan for Taylor County Mining.

a. Conservation:

- Date to be Implemented: 2010
- Annual Cost: not determined

Table 4C.33-7.
Recommended Plan Costs by Decade for Taylor County Mining

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(5)	(4)	(5)	(4)	(4)	(4)
Conservation						
Supply From Plan Element (acft/yr)	9	15	22	23	23	24
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—

4C.33.10 Irrigation

Taylor County Irrigation shows a projected surplus and no changes in water supply are recommended.

4C.33.11 Livestock

Supplies for Livestock water use equal demand and no changes in water supply are recommended.

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4C.34 Throckmorton County Water Supply Plan

Table 4C.34-1 lists each water user group in Throckmorton County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.34-1.
Throckmorton County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
City of Throckmorton	116	157	Projected surplus
County-Other	16	34	Projected surplus
Manufacturing	0	0	No demand or supply
Steam-Electric	0	0	No demand or supply
Mining	0	0	Supply equals demand
Irrigation	(3,988)	(3,988)	Projected shortage
Livestock	0	0	Supply equals demand

[1] From Tables C-67 and C-68, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.34.1 City of Throckmorton

4C.34.1.1 Description of Supply

The City of Throckmorton obtains water from Lake Throckmorton and Ft. Belknap WSC which shows a projected surplus. Since the city's supply is solely Lake Throckmorton, an alternate source is desired in case of severe drought.

4C.34.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG, the following water supply plan is recommended for the City of Throckmorton:

- Conservation, and
- Purchase additional supply from WCBDS.

- An alternate strategy is to construct a pipeline to purchase water from the City of Graham.

4C.34.1.3 Costs

Cost of the recommended Plan for the City of Throckmorton.

a. Conservation

- Cost Source: Volume II, Section 4B.2
- Date to be Implemented: by 2010
- Annual Cost: $8,360
- Unit Cost: $380/acft of water saved

b. Water Supply from WCBDS (with regional WTP):

- Cost Source: *West Central Brazos Basin Regional Water Treatment and Distribution Facility Plan*, Freese and Nichols, 2004.
- Date to be Implemented: 2010
- Total Project Cost: $15,877,792
- Annual Cost: $1,800,000 (total project)
  $248,198 (City of Throckmorton portion)

Table 4C.34-2.
Recommended Plan Costs by Decade for the City of Throckmorton

Plan Element	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
Projected Surplus/(Shortage) (acft/yr)	93	103	116	134	148	157
Conservation						
Supply From Plan Element (acft/yr)	22	22	18	14	11	11
Annual Cost ($/yr)	$8,360	$8,360	$6,840	$5,320	$4,180	$4,180
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Water Supply from WCBDS						
Supply From Plan Element (acft/yr)	193	193	193	193	193	193
Annual Cost ($/yr)	$248,198	$248,198	$248,198	$248,198	$248,198	$248,198
Unit Cost ($/acft)	$1,286	$1,286	$1,286	$1,286	$1,286	$1,286

4C.34.2 County-Other

The Throckmorton County-Other shows a projected surplus and no changes in water supply are recommended.

4C.34.3 Manufacturing

No Manufacturing demand exists or is projected for the county.

4C.34.4 Steam-Electric

No Steam-Electric demand exists or is projected for the county.

4C.34.5 Mining

No Mining shortages are projected and no changes in water supply system are recommended.

4C.34.6 Irrigation

4C.34.6.1 Description of Supply

- Source: Clear Fork of the Brazos River.
- Estimated Reliable Supply: 12 acft/yr in 2060

4C.34.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Throckmorton County Irrigation:

- Long-term supplies from the West Central Brazos System Optimization Plan (WCBSOP). Unappropriated flows of the Clear Fork of the Brazos River and/or City of Abilene return flows would be used temporarily in conjunction with off-channel storage until the Breckenridge Reservoir (Cedar Ridge site) portion of the WCBSOP is constructed. Water rights obtained by local irrigators through this strategy would become part of the WCBSOP when the WCBSOP is implemented. See Section 4C.33.1.2 for a complete description of the WCBSOP.
- Conservation was also considered; however, this is would be an entirely new irrigation system and would utilize the most water-efficient irrigation technologies that are economically feasible.

4C.34.6.3 Costs

Costs of the recommended plan for Throckmorton County Irrigation to meet the projected shortages are:

a. West Central Brazos System Operation Plan (with temporary unappropriated flows):
   - Cost Source: Evaluations of various components (Table 4C.33-2)
   - Date to be Implemented: By year 2010
   - Annual Cost: $1,136,000 (based on unit cost of $284/acft). Actual costs would be negotiated between the City of Abilene, West Central Texas Municipal Water District, and local irrigators.

Table 4C.34-3.
Recommended Plan Costs by Decade for Throckmorton County Irrigation

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Shortage (acft/yr)	(3,988)	(3,988)	(3,988)	(3,988)	(3,988)	(3,988)
Water Supply from WCBSOP (temporary unappropriated flows until development of WCBSOP)						
Quantity Available (acft/yr)	4,000	4,000	4,000	4,000	4,000	4,000
Annual Cost ($/yr)	$1,136,000	$1,136,000	$1,136,000	$1,136,000	$1,136,000	$1,136,000
Unit Cost ($/acft)	$284	$284	$284	$284	$284	$284

4C.34.7 Livestock

No projected shortage exists and no change in water supply is recommended.

4C.35 Washington County Water Supply Plan

Table 4C.35-1 lists each water user group in Washington County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.35-1.
Washington County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Brenham	232	120	Projected surplus
County-Other	234	135	Projected surplus
Manufacturing	(70)	(199)	Projected shortage – see plan below
Steam-Electric	0	0	No projected demand
Mining	0	0	No projected surplus/shortage
Irrigation	4,696	4,696	Projected surplus
Livestock	0	0	No projected surplus/shortage

[1] From Tables C-69 and C-70, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.35.1 City of Brenham

The City of Brenham obtains its water supply through a contract with the Brazos River Authority for 3,535 acft/yr of water supply from Lake Somerville. This contract exceeds its year 2060 projected demand of 3,415 acft/yr. No changes in water supply are recommended.

4C.35.2 County-Other

County-Other is projected to have a surplus of water through the year 2060 and no changes in water supply are recommended.

4C.35.3 Manufacturing

4C.35.3.1 Description of Supply

Washington County Manufacturing obtains its water supply from groundwater from the Gulf Coast Aquifer. Based on the available groundwater supply, Washington County Manufacturing is projected to have a shortage of 70 acft/yr in the year 2030 and 199 acft/yr in the year 2060.

4C.35.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Washington County Manufacturing:

- Conservation, and
- Purchase water from the Brazos River Authority.

4C.35.3.3 Costs

Costs of the Recommended Plan for Washington County Manufacturing.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

b. Water Supply from Brazos Rive Authority:
   - Cost Source: estimated wholesale treated water rate
   - Date to be Implemented: By year 2020
   - Annual Cost: $208,154 in 2060

   The annual cost was calculated by multiplying the Manufacturing projected supply from this strategy by an estimated wholesale water rate of $1,046/acft.

Table 4C.35-2.
Recommended Plan Costs by Decade for Washington County Manufacturing

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	20	(27)	(70)	(113)	(151)	(199)
Conservation						
Supply From Plan Element (acft/yr)	12	23	35	38	41	44
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Water Supply from Brazos River Authority						
Supply From Plan Element (acft/yr)	—	27	70	113	151	199
Annual Cost ($/yr)		$28,242	$73,220	$118,198	$157,946	$208,154
Unit Cost ($/acft)		$1,046	$1,046	$1,046	$1,046	$1,046

4C.35.4 Steam-Electric

No Steam-Electric demand exists nor is projected for the county.

4C.35.5 Mining

No shortages are projected for Mining use and no changes in water supply are recommended.

4C.35.6 Irrigation

Irrigation is projected to have a surplus of water from available groundwater and surface water supplies and no changes in water supply are recommended.

4C.35.7 Livestock

No shortages are projected for Livestock use and no changes in water supply are recommended.

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4C.36 Williamson County Water Supply Plan

Table 4C.36-1 lists each water user group in Williamson County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.36-1.
Williamson County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1]		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Bartlett	(146)	(189)	Projected shortage – see plan below
Blockhouse MUD	0	0	No projected surplus/shortage
Brushy Creek MUD	109	87	Projected surplus – see plan below
City of Cedar Park	(6,650)	(26,819)	Projected shortage – see plan below
Chisholm Trail SUD	(941)	(7,883)	Projected shortage – see plan below
Fern Bluff MUD	0	0	No projected surplus/shortage
City of Florence	(63)	(232)	Projected shortage – see plan below
City of Georgetown	9,500	(3,429)	Projected shortage – see plan below
City of Granger	130	77	Projected surplus
City of Hutto	(407)	(780)	Projected shortage – see plan below
Jarrell-Schwertner WSC	(329)	(1,416)	Projected shortage – see plan below
Jonah Water SUD	543	(1,531)	Projected shortage – see plan below
City of Leander	2,977	(232)	Projected shortage – see plan below
Liberty Hill	(788)	(1,722)	Projected shortage – see plan below
Manville WSC	2,369	623	Projected surplus
City of Round Rock	(10,566)	(42,548)	Projected shortage – see plan below
City of Taylor	5,258	3,794	Projected surplus
City of Thrall	(144)	(239)	Projected shortage – see plan below
City of Weir	(277)	(557)	Projected shortage – see plan below
Wells Branch MUD	0	0	No projected surplus/shortage
Williamson-Travis County MUD #1	0	0	No projected surplus/shortage
County-Other	1,165	(3,125)	Projected shortage – see plan below
Manufacturing	(1,583)	(2,328)	Projected shortage – see plan below
Steam-Electric	0	0	No demand or supply
Mining	(1,576)	(1,882)	Projected shortage – see plan below
Irrigation	947	947	Projected surplus
Livestock	0	0	No projected surplus/shortage

[1] From Tables C-71 and C-72, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.36.1 City of Bartlett

4C.36.1.1 Description of Supply

The City of Bartlett obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater supply, the City of Bartlett is projected to have a shortage of 146 acft/yr in the year 2030 and 189 acft/yr in the year 2060.

4C.36.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Bartlett:

- Conservation, and
- New contract with Central Texas WSC.

4C.36.1.3 Costs

Costs of the Recommended Plan for the City of Bartlett.

a. Conservation:
  - Cost Source: Volume II, Section 4B.2.1
  - Date to be Implemented: before 2010
  - Annual Cost: maximum $11,400 in 2020

b. New contract with Central Texas WSC:
  - Cost Source: Assumed wholesale treated water cost of $684/acft ($2.10/1,000 gallons)
  - Date to be Implemented: before 2010
  - Annual Cost: $123,120

Table 4C.36-2.
Recommended Plan Costs by Decade for the City of Bartlett

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(112)	(129)	(146)	(158)	(173)	(189)
Conservation						
Supply From Plan Element (acft/yr)	12	30	25	19	18	18
Annual Cost ($/yr)	$4,560	$11,400	$9,500	$7,220	$6,840	$6,840
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
New Contract with Central Texas WSC						
Supply From Plan Element (acft/yr)	180	180	180	180	180	180
Annual Cost ($/yr)	$123,120	$123,120	$123,120	$123,120	$123,120	$123,120
Unit Cost ($/acft)	$684	$684	$684	$684	$684	$684

4C.36.2 Blockhouse MUD

Blockhouse MUD obtains its water supply from the City of Cedar Park. No shortages are projected for Blockhouse MUD and no changes in water supply are recommended.

4C.36.3 Brushy Creek MUD

4C.36.3.1 Description of Supply

Brushy Creek MUD obtains its water supply from a contract with the Brazos River Authority for water from Stillhouse Hollow Reservoir. Although Brushy Creek MUD does not have a projected shortage, their projected supplies are less than 105 percent of their projected demands, and additional conservation is recommended.

4C.36.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Brushy Creek MUD:

- Conservation.

4C.36.3.3 Costs

Costs of the Recommended Plan for Brushy Creek MUD.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $162,260 in 2030

Table 4C.36-3.
Recommended Plan Costs by Decade for Brushy Creek MUD

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	1,350	389	109	102	94	87
Conservation						
Supply From Plan Element (acft/yr)	92	398	427	427	427	427
Annual Cost ($/yr)	$34,960	$151,240	$162,260	$162,260	$162,260	$162,260
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380

4C.36.4 City of Cedar Park

4C.36.4.1 Description of Supply

The City of Cedar Park obtains its water supply from a contract with the Lower Colorado River Authority (LCRA) in Region K. Based on the available surface water supply, the City of Cedar Park is projected to have a shortage of 6,650 acft/yr in the year 2030 and 26,819 acft/yr in the year 2060.

4C.36.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Cedar Park:

- Conservation, and
- Purchase additional water from LCRA.

4C.36.4.3 Costs

Costs of the Recommended Plan for the City of Cedar Park.

a. Conservation:
- Cost Source: Volume II, Section 4B.2.1
- Date to be Implemented: before 2010
- Annual Cost: maximum of $1,279,840 in 2060

b. Purchase water from LCRA:
- Cost Source: Volume II, Section 4B.11.2
- Date to be Implemented: before 2030
- Total Project Cost: $81,748,000
- Annual Cost: $14,906,000

Table 4C.36-4.
Recommended Plan Costs by Decade for the City of Cedar Park

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	4,852	10	(6,650)	(12,721)	(18,915)	(26,819)
Conservation						
Supply From Plan Element (acft/yr)	413	1,398	1,840	2,300	2,761	3,368
Annual Cost ($/yr)	$156,940	$531,240	$699,200	$874,000	$1,049,180	$1,279,840
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Purchase water from LCRA						
Supply From Plan Element (acft/yr)	—	—	25,000	25,000	25,000	25,000
Annual Cost ($/yr)			$14,906,000	$14,906,000	$14,906,000	$14,906,000
Unit Cost ($/acft)			$596	$596	$596	$596

4C.36.5 Chisholm Trail SUD

4C.36.5.1 Description of Supply

Chisholm Trail SUD obtains its water supply from groundwater from the Edwards-BFZ (Northern Segment) Aquifer and a contract with the Brazos River Authority for water from Lake Georgetown. Based on the available groundwater and surface water supply, Chisholm Trail SUD is projected to have a shortage of 941 acft/yr in the year 2030 and 7,883 acft/yr in the year 2060.

4C.36.5.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Chisholm Trail SUD:

- Conservation
- Obtain supply through the LCRA/BRA Alliance, and
- BRA System Operations.

4C.36.5.3 Costs

Costs of the Recommended Plan for Chisholm Trail SUD.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $710,220 in 2060
b. BRA/LCRA Alliance:
   - Cost Source: Volume II, Section 4B.11.2
   - Date to be Implemented: before 2030
   - Total Project Cost: $18,518,000
   - Annual Cost: $2,653,000
c. BRA System Operations (Lake Granger Conjunctive Use Project):
   - Cost Source: Volume II, Section 4B.5
   - Date to be Implemented: before 2040
   - Total Project Cost: $303,288,000
   - Annual Cost: $3,370,500 (based on unit cost for overall strategy of $749/acft)

Table 4C.36-5.
Recommended Plan Costs by Decade for Chisholm Trail SUD

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	2,588	976	(941)	(3,120)	(5,480)	(7,883)
Conservation						
Supply From Plan Element (acft/yr)	154	456	721	1,114	1,538	1,869
Annual Cost ($/yr)	$58,520	$173,280	$273,980	$423,320	$584,440	$710,220
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
BRA/LCRA Alliance						
Supply From Plan Element (acft/yr)	—	—	3,472	3,472	3,472	3,472
Annual Cost ($/yr)			$2,653,000	$2,653,000	$2,653,000	$2,653,000
Unit Cost ($/acft)			$764	$764	$764	$764
BRA System Operation – Lake Granger Augmentation (conjunctive use)						
Supply From Plan Element (acft/yr)	—	—	—	—	4,500	4,500
Annual Cost ($/yr)					$3,370,500	$3,370,500
Unit Cost ($/acft)					$749	$749

4C.36.6 Fern Bluff MUD

Fern Bluff MUD obtains its water supply from the City of Round Rock. No shortages are projected for Fern Bluff MUD and no changes in water supply are recommended.

4C.36.7 City of Florence

4C.36.7.1 Description of Supply

The City of Florence obtains its water supply from groundwater from the Trinity Aquifer. Based on the City's available groundwater supply, the City of Florence is projected to have a shortage of 63 acft/yr in the year 2030 and 232 acft/yr in the year 2060.

4C.36.7.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Florence:

- Conservation, and

- Additional groundwater development.

4C.36.7.3 Costs

Costs of the Recommended Plan for the City of Florence.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $9,120 in 2060

b. Additional groundwater development:
   - Date to be Implemented: before 2030
   - Total Project Cost: $803,500
   - Annual Cost: $73,000

   Costs based on drilling three 100 gpm wells into the Trinity Aquifer.

Table 4C.36-6.
Recommended Plan Costs by Decade for the City of Florence

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	20	(18)	(63)	(113)	(169)	(232)
Conservation						
Supply From Plan Element (acft/yr)	8	22	20	20	20	24
Annual Cost ($/yr)	$3,040	$8,360	$7,600	$7,600	$7,600	$9,120
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Additional Groundwater Development						
Supply From Plan Element (acft/yr)	—	—	250	250	250	250
Annual Cost ($/yr)			$73,000	$73,000	$73,000	$73,000
Unit Cost ($/acft)			$292	$292	$292	$292

4C.36.8 City of Georgetown

4C.36.8.1 Description of Supply

The City of Georgetown obtains its water supply from groundwater from the Edwards-BFZ (Northern Segment) Aquifer and contracts with the Brazos River Authority for water from Lake Georgetown and Stillhouse Hollow Reservoir. Based on the available groundwater and surface water supply, the City of Georgetown is projected to have a surplus of 9,500 acft/yr in the year 2030 and a shortage 3,429 acft/yr in the year 2060.

4C.36.8.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Georgetown:

- Conservation, and
- BRA System Operation.

4C.36.8.3 Costs

Costs of the Recommended Plan for the City of Georgetown.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $636,500 in 2060

b. BRA System Operation (Lake Granger Conjunctive Use Project):
   - Cost Source: Volume II, Section 4B.5
   - Date to be Implemented: before 2040
   - Total Project Cost: $303,288,000
   - Annual Cost: $2,996,000 (based on unit cost for overall strategy of $749/acft)

Table 4C.36-7.
Recommended Plan Costs by Decade for the City of Georgetown

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	16,162	13,083	9,500	5,578	1,228	(3,429)
Conservation						
Supply From Plan Element (acft/yr)	228	873	986	1,141	1,398	1,675
Annual Cost ($/yr)	$86,640	$331,740	$374,680	$433,580	$531,240	$636,500
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
BRA System Operation – Lake Granger Augmentation (conjunctive use)						
Supply From Plan Element (acft/yr)	—	—	—	—	4,000	4,000
Annual Cost ($/yr)					$2,996,000	$2,996,000
Unit Cost ($/acft)					$749	$749

4C.36.9 City of Granger

The City of Granger obtains its water supply from groundwater from the Trinity Aquifer. No shortages are projected for the City of Granger and no changes in water supply are recommended.

4C.36.10 City of Hutto

4C.36.10.1 Description of Supply

The City of Hutto obtains its water supply from groundwater from the Edwards-BFZ (Northern Segment) Aquifer. Based on the available groundwater water supply, the City of Hutto is projected to have a shortage of 407 acft/yr in the year 2030 and 780 acft/yr in the year 2060. The City has an agreement to obtain 0.5 MGD (560 acft/yr) from Manville WSC, but this interconnect will be used primarily for emergency supplies.

4C.36.10.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Hutto:

- Purchase water from the City of Taylor. The City has recently entered into an agreement with the City of Taylor to purchase 2,016 acft/yr through 2010, increasing to 3,136 acft/yr in years 2020 through 2060. The City of Taylor is supplied by the BRA through Lake Granger.
- Purchase from private groundwater supplier. The City has recently entered into a contract with a private groundwater supplier for 3 MGD of supply. Plans call for the water to be produced from the Hooper Formation in eastern Williamson County near the Lee and Milam County lines. The Hooper Formation is part of the overall Carrizo-Wilcox Aquifer system; however, the BGRWPG has not identified any groundwater available from the Carrizo-Wilcox Aquifer in Williamson County. Due to the proximity of the proposed well field to Lee and Milam Counties, it is assumed that the water supplied through this strategy will be drawn equally from both Lee and Milam Counties.
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.36.10.3 Costs

Costs of the Recommended Plan for the City of Hutto.

a. Purchase from City of Taylor:

- Cost Source: Assumed wholesale treated water rate of $978/acft ($3.00/1,000 gallons)

- Date to be Implemented: before 2010
- Annual Cost: $3,067,008 (2020 through 2060)

b. Purchase from private water supplier:

- Cost Source: Assumed wholesale treated water rate of $1,147/acft ($3.52/1,000 gallons)
- Date to be Implemented: before 2010
- Annual Cost: $3,854,000

Table 4C.36-8.
Recommended Plan Costs by Decade for the City of Hutto

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(214)	(303)	(407)	(519)	(645)	(780)
Purchase from City of Taylor (BRA supply from Lake Granger)						
Supply From Plan Element (acft/yr)	2,016	3,136	3,136	3,136	3,136	3,136
Annual Cost ($/yr)	$1,971,648	$3,067,008	$3,067,008	$3,067,008	$3,067,008	$3,067,008
Unit Cost ($/acft)	$978	$978	$978	$978	$978	$978
Purchase from Private Groundwater Supplier						
Supply From Plan Element (acft/yr)	3,360	3,360	3,360	3,360	3,360	3,360
Annual Cost ($/yr)	$3,854,000	$3,854,000	$3,854,000	$3,854,000	$3,854,000	$3,854,000
Unit Cost ($/acft)	$1,147	$1,147	$1,147	$1,147	$1,147	$1,147

4C.36.11 Jarrell-Schwertner WSC

4C.36.11.1 Description of Supply

Jarrell-Schwertner WSC obtains its water supply from groundwater from the Edwards-BFZ (Northern Segment) Aquifer. Based on the available groundwater water supply, Jarrell-Schwertner WSC is projected to have a shortage of 329 acft/yr in the year 2030 and 1,416 acft/yr in the year 2060.

4C.36.11.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Jarrell-Schwertner WSC:

- Conservation,
- Contract with Central Texas WSC, and
- BRA System Operations.

4C.36.11.3 Costs

Costs of the Recommended Plan for Jarrell-Schwertner WSC.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $60,040 in 2060

b. Contract with Central Texas WSC:
   - Cost Source: assumed wholesale treated water rate of $684/acft ($2.10/1,000 gallons)
   - Date to be Implemented: before 2020
   - Annual Cost: $1,026,000

c. BRA System Operations (Lake Granger Conjunctive Use Project):
   - Cost Source: Volume II, Section 4B.5
   - Date to be Implemented: before 2050
   - Total Project Cost: $303,288,000
   - Annual Cost: $1,123,500 (based on unit cost for overall strategy of $749/acft)

Table 4C.36-9.
Recommended Plan Costs by Decade for Jarrell-Schwertner WSC

Plan Element	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***
Projected Surplus/(Shortage) (acft/yr)	283	(5)	(329)	(659)	(1,026)	(1,416)
Conservation						
Supply From Plan Element (acft/yr)	30	107	115	116	136	158
Annual Cost ($/yr)	$11,400	$40,660	$43,700	$44,080	$51,680	$60,040
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Contract with CTWSC						
Supply From Plan Element (acft/yr)	—	1,500	1,500	1,500	—	—
Annual Cost ($/yr)		$1,026,000	$1,026,000	$1,026,000		
Unit Cost ($/acft)		$684	$684	$684		
BRA System Operation – Lake Granger Augmentation (conjunctive use)						
Supply From Plan Element (acft/yr)	—	—	—	—	1,500	1,500
Annual Cost ($/yr)					$1,123,500	$1,123,500
Unit Cost ($/acft)					$749	$749

4C.36.12 Jonah Water SUD

4C.36.12.1 Description of Supply

Jonah Water SUD obtains its water supply from groundwater from the Edwards-BFZ (Northern Segment) Aquifer and a contract with the Brazos River Authority for water from Stillhouse Hollow Reservoir. Based on the available groundwater and surface water supply, Jonah Water SUD is projected to have a surplus of 543 acft/yr in the year 2030 and a shortage 1,531 acft/yr in the year 2060.

4C.36.12.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Jonah Water SUD:

- Purchase from BRA (EWCRWTS).
- Conservation was also considered; however, the SUD's current per capita use rate is below the selected target rate of 140 gpcd.

4C.36.12.3 Costs

Costs of the Recommended Plan for Jonah Water SUD.

a. Purchase from BRA (EWCRWTS):
   - Cost Source: Assumed wholesale treated water rate of $978/acft ($3.00/1,000 gallons)
   - Date to be Implemented: before 2040
   - Annual Cost: $1,564,800

Table 4C.36-10.
Recommended Plan Costs by Decade for Jonah Water SUD

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	1,697	1,129	543	(80)	(769)	(1,531)
Purchase from BRA (EWCRWTS)						
Supply From Plan Element (acft/yr)	—	—	—	100	1,600	1,600
Annual Cost ($/yr)				$97,800	$1,564,800	$1,564,800
Unit Cost ($/acft)				$978	$978	$978

4C.36.13 City of Leander

4C.36.13.1 Description of Supply

The City of Leander obtains its water supply from groundwater from the Edwards-BFZ (Northern Segment) Aquifer and contracts with the Lower Colorado River Authority for water from Lake Travis. Based on the available groundwater and surface water supply, the City of Leander is projected to have a surplus of 2,977 acft/yr in the year 2030 and a shortage 232 acft/yr in the year 2060.

4C.36.13.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Leander:

- Conservation
- Increase supply from the LCRA

4C.36.13.3 Costs

Costs of the Recommended Plan for the City of Leander.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $193,420 in 2060

b. Additional supply from LCRA:
   - Cost Source: LCRA wholesale water price of $115/acft
   - Date to be Implemented: before 2040
   - Total Project Cost: 0$ (assumes existing facilities adequate to handle additional supply)
   - Annual Cost: $28,750

Table 4C.36-11.
Recommended Plan Costs by Decade for the City of Leander

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	4,619	3,860	2,977	2,007	927	(232)
Conservation						
Supply From Plan Element (acft/yr)	65	254	292	342	422	509
Annual Cost ($/yr)	$24,700	$96,520	$110,960	$129,960	$160,360	$193,420
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Additional Supply from LCRA						
Supply From Plan Element (acft/yr)	—	—	—	—	250	250
Annual Cost ($/yr)					$28,750	$28,750
Unit Cost ($/acft)					$115	$115

4C.36.14 City of Liberty Hill

4C.36.14.1 Description of Supply

The City of Liberty Hill obtains its water supply from groundwater from the Trinity Aquifer. Based on the available groundwater, the City of Liberty Hill is projected to have a shortage of 788 acft/yr in the year 2030 and 1,722 acft/yr in the year 2060.

4C.36.14.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Liberty Hill:

- Conservation, and
- Purchase water from the Brazos River Authority.
- An alternative is to obtain a short term supply from the City of Leander until larger needs develop.

4C.36.14.3 Costs

Costs of the Recommended Plan for the City of Liberty Hill.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1

- Date to be Implemented: before 2010
- Annual Cost: maximum of $61,940 in 2060

b. Purchase water from the Brazos River Authority:

- Cost Source: Cost Source: Assumed wholesale treated water rate of $978/acft ($3.00/1,000 gallons)
- Date to be Implemented: before 2010
- Annual Cost: $1,760,400

Table 4C.36-12.
Recommended Plan Costs by Decade for the City of Liberty Hill

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(302)	(521)	(788)	(1,071)	(1,385)	(1,722)
Conservation						
Supply From Plan Element (acft/yr)	17	62	87	107	134	163
Annual Cost ($/yr)	$6,460	$23,560	$33,060	$40,660	$50,920	$61,940
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Purchase from BRA						
Supply From Plan Element (acft/yr)	1,800	1,800	1,800	1,800	1,800	1,800
Annual Cost ($/yr)	$1,760,400	$1,760,400	$1,760,400	$1,760,400	$1,760,400	$1,760,400
Unit Cost ($/acft)	$978	$978	$978	$978	$978	$978

4C.36.15 Manville WSC

Manville WSC obtains its water supply from groundwater from the Edwards and Trinity Aquifers as well as other minor aquifers. No shortages are projected for Manville WSC and no changes in water supply are recommended.

4C.36.16 City of Round Rock

4C.36.16.1 Description of Supply

The City of Round Rock obtains its water supply from groundwater from the Edwards-BFZ (Northern Segment) Aquifer and contracts with the Brazos River Authority for water from Lake Georgetown and Stillhouse Hollow Reservoir. Based on the available groundwater and surface water supply, the City of Round Rock is projected to have a shortage of 10,566 acft/yr in the year 2030 and 42,548 acft/yr in the year 2060.

4C.36.16.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Round Rock:

- Conservation,
- Reuse,
- LCRA/BRA Alliance water, and
- BRA System Operation.

4C.36.16.3 Costs

Costs of the Recommended Plan for the City of Round Rock.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $1,372,560 in 2060

b. Reuse:
   - Cost Source: Volume II, Section 4B.3.1
   - Date to be Implemented: before 2010
   - Total Project Cost: $6,369,000 (prior to 2040)
   - Annual Cost: $772,000 (prior to 2040); $3,751,270 (after 2040 at full reuse potential)

c. LCRA/BRA Alliance Water:
   - Cost Source: Volume II, Section 4B.11.2
   - Date to be Implemented: before 2020
   - Total Project Cost: $101,336,000
   - Annual Cost: $15,084,000

d. BRA System Operation (Lake Granger Conjunctive Use Project):
   - Cost Source: Volume II, Section 4B.5
   - Date to be Implemented: before 2050
   - Total Project Cost: $303,288,000
   - Annual Cost: $11,235,000 (based on unit cost for overall strategy of $749/acft)

Table 4C.36-13.
Recommended Plan Costs by Decade for the City of Round Rock

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	5,799	(1,703)	(10,566)	(20,278)	(31,027)	(42,548)
Conservation						
Supply From Plan Element (acft/yr)	586	1,872	2,120	2,455	3,014	3,612
Annual Cost ($/yr)	$222,680	$711,360	$805,600	$932,900	$1,145,320	$1,372,560
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Reuse						
Supply From Plan Element (acft/yr)	1,532	1,532	1,532	7,443	7,443	7,443
Annual Cost ($/yr)	$772,000	$772,000	$772,000	$3,751,270	$3,751,270	$3,751,270
Unit Cost ($/acft)	$504	$504	$504	$504	$504	$504
LCRA/BRA Alliance						
Supply From Plan Element (acft/yr)	—	20,928	20,928	20,928	20,928	20,928
Annual Cost ($/yr)		$15,084,000	$15,084,000	$15,084,000	$15,084,000	$15,084,000
Unit Cost ($/acft)		$721	$721	$721	$721	$721
BRA System Operation – Lake Granger Augmentation (conjunctive use)						
Supply From Plan Element (acft/yr)	—	—	—	—	15,000	15,000
Annual Cost ($/yr)					$11,235,000	$11,235,000
Unit Cost ($/acft)					$749	$749

4C.36.17 City of Taylor

The City of Taylor obtains its water supply from a contract with the Brazos River Authority for water from Lake Granger. No shortages are projected for the City of Taylor and no changes in water supply are recommended.

4C.36.18 City of Thrall

4C.36.18.1 Description of Supply

The City of Thrall obtains its water supply from groundwater from a minor aquifer. Based on the available groundwater, the City of Thrall is projected to have a shortage of 144 acft/yr in the year 2030 and 239 acft/yr in the year 2060.

4C.36.18.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Thrall:

- Purchase from BRA (EWCRWTS).
- Conservation was also considered; however, the City's current per capita use rate is below the selected target rate of 140 gpcd.

4C.36.18.3 Costs

Costs of the Recommended Plan for the City of Thrall.

a. Purchase from BRA (EWCRWTS):

- Cost Source: Assumed wholesale treated water rate of $978/acft ($3.00/1,000 gallons)
- Date to be Implemented: before 2010
- Annual Cost: $254,280

Table 4C.36-14.
Recommended Plan Costs by Decade for the City of Thrall

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(95)	(117)	(144)	(172)	(203)	(239)
Purchase from BRA (EWCRWTS)						
Supply From Plan Element (acft/yr)	260	260	260	260	260	260
Annual Cost ($/yr)	$254,280	$254,280	$254,280	$254,280	$254,280	$254,280
Unit Cost ($/acft)	$978	$978	$978	$978	$978	$978

4C.36.19 City of Weir

4C.36.19.1 Description of Supply

The City of Weir obtains its water supply from groundwater from the Edwards-BZF (Northern Segment) Aquifer. Based on the available groundwater, the City of Weir is projected to have a shortage of 277 acft/yr in the year 2030 and 557 acft/yr in the year 2060.

4C.36.19.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the City of Weir:

- Conservation, and

- Purchase from BRA (EWCRWTS).
- Voluntary redistribution from the City of Georgetown and BRA System Operation were considered as alternative strategies.

4C.36.19.3 Costs

Costs of the Recommended Plan for the City of Weir.

a. Conservation:
   - Cost Source: Volume II, Section 4B.2.1
   - Date to be Implemented: before 2010
   - Annual Cost: maximum of $22,040 in 2060

b. Purchase from BRA (EWCRWTS):
   - Cost Source: Assumed wholesale treated water rate of $978/acft ($3.00/1,000 gallons)
   - Date to be Implemented: before 2010
   - Annual Cost: $586,800

Table 4C.36-15.
Recommended Plan Costs by Decade for the City of Weir

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(132)	(199)	(277)	(362)	(456)	(557)
Conservation						
Supply From Plan Element (acft/yr)	7	25	31	38	47	58
Annual Cost ($/yr)	$2,660	$9,500	$11,780	$14,440	$17,860	$22,040
Unit Cost ($/acft)	$380	$380	$380	$380	$380	$380
Purchase from BRA (EWCRWTS)						
Supply From Plan Element (acft/yr)	600	600	600	600	600	600
Annual Cost ($/yr)	$586,800	$586,800	$586,800	$586,800	$586,800	$586,800
Unit Cost ($/acft)	$978	$978	$978	$978	$978	$978

4C.36.20 Wells Branch MUD

Wells Branch MUD obtains its water supply from the City of Austin (Region K). No shortages are projected for Wells Branch MUD and no changes in water supply are recommended.

4C.36.21 Williamson-Travis County MUD #1

Williamson-Travis County MUD #1 obtains its water supply from the City of Cedar Park. No shortages are projected for Williamson-Travis County MUD #1 and no changes in water supply are recommended.

4C.36.22 County-Other

4C.36.22.1 Description of Supply

Williamson County-Other obtains its water supply from groundwater from the Trinity and Edwards Aquifers as well as other minor aquifers. Williamson County-Other also obtains a portion of its water supply from the City of Round Rock, the City of Taylor, and run-of-river rights. Based on the available groundwater and surface water supply, Williamson County-Other is projected to have a surplus of 1,165 acft/yr in the year 2030 and a shortage of 3,125 acft/yr in the year 2060.

4C.36.22.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Williamson County-Other:

- Additional groundwater development, and
- BRA System Operation.
- Conservation was also considered; however, the WUG's current per capita use rate is below the selected target rate of 140 gpcd.

4C.36.22.3 Costs

Costs of the Recommended Plan for Williamson County-Other.

a. Additional Groundwater Development:
   - Date to be Implemented: before 2030
   - Total Project Cost: 0$ (primarily single-family residences)
   - Annual Cost: 0$

b. BRA System Operation (Lake Granger Conjunctive Use Project):
   - Cost Source: Volume II, Section 4B.5
   - Date to be Implemented: before 2040
   - Total Project Cost: $303,288,000

- Annual Cost: $2,621,500 (based on unit cost for overall strategy of $749/acft)

Table 4C.36-16.
Recommended Plan Costs by Decade for Williamson County-Other

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	1,153	1,273	1,165	(188)	(2,001)	(3,125)
Additional Groundwater Development						
Supply From Plan Element (acft/yr)	—	—	280	280	280	280
Annual Cost ($/yr)			$0	$0	$0	$0
Unit Cost ($/acft)			$0	$0	$0	$0
BRA System Operation – Lake Granger Augmentation (conjunctive use)						
Supply From Plan Element (acft/yr)	—	—	—	—	3,500	3,500
Annual Cost ($/yr)					$2,621,500	$2,621,500
Unit Cost ($/acft)					$749	$749

4C.36.23 Manufacturing

4C.36.23.1 Description of Supply

Williamson County Manufacturing obtains its water supply from groundwater from the Edwards-BFZ (Northern Segment) Aquifer as well as other minor aquifers. Williamson County Manufacturing also obtains a portion of its water supply from run-of-river rights. Based on the available groundwater and surface water supply, Williamson County Manufacturing is projected to have a shortage of 1,583 acft/yr in the year 2030 and 2,328 acft/yr in the year 2060.

4C.36.23.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Williamson County Manufacturing:

- Conservation,
- Purchase from the City of Georgetown, and
- BRA System Operation.

4C.36.23.3 Costs

Costs of the Recommended Plan for Williamson County Manufacturing.

a. Conservation:
- Date to be Implemented: before 2010
- Annual Cost: Not determined

b. Purchase water from the City of Georgetown:
- Cost Source: Assumed wholesale treated water rate of $978/acft ($3.00/1,000 gallons)
- Date to be Implemented: before 2010 through 2040
- Annual Cost: $1,858,200

c. BRA System Operation (Lake Granger Conjunctive Use Project):
- Cost Source: Volume II, Section 4B.5
- Date to be Implemented: before 2040
- Total Project Cost: $303,288,000
- Annual Cost: $1,872,500 (based on unit cost for overall strategy of $749/acft)

Table 4C.36-17.
Recommended Plan Costs by Decade for Williamson County Manufacturing

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(1,042)	(1,314)	(1,583)	(1,855)	(2,100)	(2,328)
Conservation						
Supply From Plan Element (acft/yr)	48	93	148	167	184	200
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—
Purchase water from the City of Georgetown						
Supply From Plan Element (acft/yr)	1,000	1,300	1,600	1,900	—	—
Annual Cost ($/yr)	$978,000	$1,271,400	$1,564,800	$1,858,200		
Unit Cost ($/acft)	$978	$978	$978	$978		
BRA System Operation – Lake Granger Augmentation (conjunctive use)						
Supply From Plan Element (acft/yr)	—	—	—	—	2,500	2,500
Annual Cost ($/yr)					$1,872,500	$1,872,500
Unit Cost ($/acft)					$749	$749

4C.36.24 Steam-Electric

There is no Steam-Electric demand or supply in Williamson County.

4C.36.25 Mining

4C.36.25.1 Description of Supply

Williamson County Mining obtains its water supply from groundwater from the Edwards-BFZ (Northern Segment) Aquifer and run-of-river rights. Based on the available groundwater and surface water supply, Williamson County Mining is projected to have a shortage of 1,583 acft/yr in the year 2030 and 2,328 acft/yr in the year 2060.

4C.36.25.2 Water Supply Plan

The majority of the mining demand in Williamson County is likely dewatering at quarry operations, and a lack of groundwater supply is not detrimental. Therefore, the following plan only includes conservation recommendations as proffered by the Brazos G RWPG. Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of Williamson County Mining:

- Conservation.

4C.36.25.3 Costs

Costs of the Recommended Plan for Williamson County Mining.

a. Conservation:
   - Date to be Implemented: before 2010
   - Annual Cost: Not determined

Table 4C.36-18.
Recommended Plan Costs by Decade for Williamson County Mining

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(1,305)	(1,465)	(1,576)	(1,687)	(1,798)	(1,882)
Conservation						
Supply From Plan Element (acft/yr)	71	131	196	208	220	230
Annual Cost ($/yr)	—	—	—	—	—	—
Unit Cost ($/acft)	—	—	—	—	—	—

4C.36.26 Irrigation

No shortages are projected for Williamson County Irrigation and no changes in water supply are recommended.

4C.36.27 Livestock

No shortages are projected for Williamson County Livestock and no changes in water supply are recommended.

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4C.37 Young County Water Supply Plan

Table 4C.37-1 lists each water user group in Young County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

Table 4C.37-1.
Young County Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
Fort Belknap WSC	8	9	Projected surplus
City of Graham	1,874	1,852	Projected surplus
City of Newcastle	0	0	Supply equals demand
County-Other	57	73	Projected surplus
Manufacturing	291	7	Projected surplus
Steam-Electric	11,977	10,656	Projected surplus
Mining	0	0	Supply equals demand
Irrigation	818	830	Projected surplus
Livestock	0	0	Supply equals demand

[1] From Tables C-73 and C-74, Appendix C – Comparison of Water Demands with Water Supplies to Determine Needs.

4C.37.1 Fort Belknap WSC

Fort Belknap WSC obtains water from the City of Graham and shows no projected shortages. No changes in water supply are recommended.

4C.37.2 City of Graham

The City of Graham obtains surface water from Lakes Graham and Eddleman. No future shortages are projected and no changes in water supply are recommended.

4C.37.3 City of Newcastle

No future shortages are projected for the City of Newcastle and no changes in water supply are recommended.

4C.37.4 County-Other Category

No future shortages are projected and no changes in water supply are recommended.

4C.37.5 Manufacturing

No future shortages are projected and no changes in water supply are recommended.

4C.37.6 Steam-Electric

No future shortages are projected and no changes in water supply are recommended.

4C.37.7 Mining

No future shortages are projected and no changes in water supply are recommended.

4C.37.8 Irrigation

Irrigation use shows a projected surplus and no changes in water supply are recommended.

4C.37.9 Livestock

Livestock water use category shows no projected shortage and no changes in water supply are recommended.

4C.38 Wholesale Water Providers

Table 4C.38-1 lists each wholesale water provider in the Brazos G Area and their corresponding surplus or shortage in years 2030 and 2060. For each wholesale water provider with a projected shortage, a water supply plan has been developed and is presented in the following subsections, or has previously been presented in a respective county section.

Table 4C.38-1.
Wholesale Water Provider Surplus/(Shortage)

Water User Group	Surplus/(Shortage)[1] 2030 (acft/yr)	Surplus/(Shortage)[1] 2060 (acft/yr)	Comment
Brazos River Authority (Lake Aquilla System)	(1,884)	(6,261)	Projected shortage – see plan below
Brazos River Authority (Little River System)	(5,329)	(43,690)	Projected shortage – see plan below
Brazos River Authority (Main Stem System)[2]	(207,433)	(258,073)	Projected shortage – see plan below
Aquilla Water Supply District	(1,561)	(3,123)	Projected shortage – see plan below
Bell County WCID No. 1	(275)	(3,051)	Projected shortage – see plan below
Bluebonnet WSC	4,417	3,823	Projected surplus
Central Texas WSC	954	(266)	Projected shortage – see plan below
Upper Leon MWD	975	829	Projected surplus
Eastland County WSD	2,980	2,980	Projected surplus
Palo Pinto County MWD No. 1	63	(1,266)	Projected shortage – see plan below
West Central Texas MWD	(10,753)	(11,098)	Projected shortage – see plan below
North Central Texas MWD	(969)	(1,319)	Projected shortage – see plan below
City of Abilene	(14,071)	(12,973)	Projected shortage – see plan below
City of Cedar Park	(6,650)	(26,819)	Projected shortage – see plan below
City of Round Rock	(10,565)	(42,548)	Projected shortage – see plan below
City of Sweetwater	(3,927)	(3,718)	Projected shortage – see plan below
City of Waco	25,638	5,258	Projected surplus – see plan below

[1] From Section 4A.3 – Water Needs for Wholesale Water Providers.
[2] Does not include Region H portion.

4C.38.1 Brazos River Authority (Lake Aquilla System)

4C.38.1.1 Description of Supply

The Brazos River Authority (Lake Aquilla System) obtains water supply from Lake Aquilla. Based on the available surface water supply, the Lake Aquilla System is projected to have a shortage of 1,884 acft/yr in the year 2030 and 6,261 acft/yr in the year 2060. The projected shortages for the Lake Aquilla System may be overstated. The projected shortages for the Lake Aquilla System are based on a comparison of supplies and contracts, as opposed to a comparison of supplies and projected demands. Projected demands are less than the contracted amounts for supply from the Lake Aquilla System. In addition, the yield from Lake Aquilla was computed using estimated sedimentation rates based on a 1995 hydrographic survey. The BRA has noted that recent watershed modeling and hydrographic survey information indicates that sedimentation rates are considerably less, which would increase available supply from the reservoir. The BRA is actively monitoring sedimentation in the reservoir and has participated in programs aimed at reducing sediment load to the reservoir.

4C.38.1.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the Brazos River Authority (Lake Aquilla System):

- **BRA System Operation (Volume II, Section 4B.4)**
  Surplus water supply from the Main Stem/Lower Basin portion of the overall BRA System can be used to augment supply at Lake Aquilla, either through direct diversion to and commingling of water, or through meeting Lake Aquilla water supply obligations from Main Stem/Lower Basin sources (Lake Granbury and/or Lake Whitney).
- **Alternative: Storage Reallocation of Federal Reservoirs (not studied for 2006 Brazos G Plan)**
  The BRA has initiated a study with the U.S. Army Corps of Engineers to study the potential for reallocating flood control storage in Federal reservoirs to water supply. The purpose would be to increase water supply yield to meet the growing water needs in the Brazos River Basin. During Phase I, up to four alternative reallocation scenarios will be analyzed in each of nine reservoirs, taking into account hydrology and hydraulics, geotechnical data, engineering and design information, socioeconomic, environmental and cultural issues, and recreational considerations. Up to three reservoirs may be selected for the more detailed Phase II analyses required for implementation. Lake Aquilla is a candidate Federal reservoir and reallocation of storage in Lake Aquilla could increase supplies from the reservoir and mitigate much of the projected shortage.
- **Alternative: Sediment Reduction Program (not studied for 2006 Brazos G Plan)**
  The BRA is monitoring the sediment accumulation rates in the agency’s reservoirs, and is cognizant that a sediment reduction program at specific reservoirs may be required to maintain yield.

4C.38.1.3 Costs

Costs have not been determined for either strategy for the Brazos River Authority (Lake Aquilla System.)

Table 4C.38-2.
Recommended Plan Costs by Decade for the BRA Lake Aquilla System

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	1,034	(425)	(1,884)	(3,343)	(4,802)	(6,261)
BRA System Operation (Volume II, Section 4B.4)						
Supply From Plan Element (acft/yr)	0	1,000	2,000	4,000	5,000	7,000
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/acft)	ND	ND	ND	ND	ND	ND
Storage Reallocation of Federal Reservoirs (Alternative)						
Supply From Plan Element (acft/yr)	Supplies and Costs not Determined					
Annual Cost ($/yr)						
Unit Cost ($/acft)						
Alternative: Sediment Reduction Program						
Supply From Plan Element (acft/yr)	Supplies and Costs not Determined					
Annual Cost ($/yr)						
Unit Cost ($/acft)						
ND – Costs for supply not determined						

4C.38.2 Brazos River Authority (Little River System)

4C.38.2.1 Description of Supply

The Brazos River Authority Little River System obtains its water supply from Lake Proctor, Lake Belton, Stillhouse Hollow Reservoir, Lake Georgetown, and Lake Granger. Based on the available surface water supply, the Brazos River Authority Little River System is projected to have a shortage of 5,329 acft/yr in the year 2030 and 43,690 acft/yr in the year 2060. Shortages for the BRA Little River System are based on a comparison of supplies and current contractual commitments, not projected demands for those entities holding contracts with the BRA. In addition, the shortages projected include other demands over and above current contractual commitments totaling approximately 31,000 acft/yr by year 2040.

4C.38.2.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages for the BRA Little River System:

- **BRA Systems Operation and Lake Granger Augmentation (Volume II, Sections 4B.4 and 4B.5)**

  The BRA has applied to the TCEQ for an additional appropriation of water that can be developed by utilizing its system of reservoirs to firm up uncontrolled runoff and return flows entering the basin below its reservoir system. Several of the water management strategies recommended to meet Water User Group needs would utilize this large potential supply of water. In addition to the firm supply, the BRA has requested appropriation of a large interruptible supply. The Lake Granger Augmentation project would utilize interruptible water in conjunction with groundwater development to dramatically increase firm supply from the reservoir. Modest needs in early decades would be supplied on an interim basis from existing BRA supplies made available by BRA Systems Operation.

- **Alternative: Groundwater Development (Volume II, Section 4B.15.1)**

  The BRA is exploring areas where groundwater resources could be used to better serve Little River System needs by providing additional supply.

- **Alternative: Millican-Bundic Reservoir (Volume II, Section 4B.12.7)**

  The BRA would develop the Millican-Bundic Reservoir in coordination with local sponsors/customers to meet future water demands in Region G. Supplies not utilized in Region G could be made available by the BRA to lower basin customers in Region H.

- **Alternative: Little River Off-Channel Reservoir (Volume II, Section 4B.13.5)**

  The BRA would develop the Little River Off-Channel Reservoir in coordination with local sponsors/customers to meet future water demands in Region G. Supplies not utilized in Region G could be made available by the BRA to lower basin customers in Region H.

- **Alternative: Storage Reallocation of Federal Reservoirs (not studied for 2006 Brazos G Plan)**

  The BRA has initiated a study with the U.S. Army Corps of Engineers to study the potential for reallocating flood control storage in Federal reservoirs to water supply. The purpose would be to increase water supply yield to meet the growing water needs in the Brazos River Basin. During Phase I, up to four alternative reallocation scenarios will be analyzed in each of nine reservoirs, taking into account hydrology and hydraulics, geotechnical data, engineering and design information, socioeconomic, environmental and cultural issues, and recreational considerations. Up to three reservoirs may be selected for the more detailed Phase II analyses required for implementation. Little River System Reservoirs that are candidates for storage reallocation are Lake Proctor, Lake Stillhouse Hollow, Lake Belton, Lake Georgetown and Lake Granger.

- **Alternative: Sediment Reduction Program (not studied for 2006 Brazos G Plan)**

  The BRA is monitoring the sediment accumulation rates in the agency's reservoirs, and is cognizant that a sediment reduction program at specific reservoirs may be required to maintain yield.

4C.38.2.3 Costs

Costs of the Recommended Plan for the BRA Little River System are shown in Table 4C.38-3.

Table 4C.38-3.
Recommended Plan Costs by Decade for the BRA Little River System

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(467)	(2,898)	(5,329)	(8,012)	(37,793)	(43,690)
BRA Systems Operation & Lake Granger Augmentation Project (Volume II, Sections 4B.4 and 4B.5)						
Groundwater Supply (acft/yr)	—	—	—	*28,263*	*28,263*	*28,263*
Surface Water Supply (acft/yr)	*500*	*3,000*	*5,500*	*26,127*	*26,127*	*26,127*
Total Supply From Plan Element (acft/yr)	500	3,000	5,500	54,390	54,390	54,390
Annual Cost ($/yr)	Costs for interim supplies from BRA System Operations not determined.			$40,711,000	$40,711,000	$40,711,000
Unit Cost ($/acft)				$749	$749	$749
Alternative: Groundwater Development (Volume II, Section 4B.15.1)						
Supply From Plan Element (acft/yr)	—	35,000	35,000	35,000	35,000	35,000
Annual Cost ($/yr)		$27,466,000	$27,466,000	$27,466,000	$27,466,000	$27,466,000
Unit Cost ($/acft)		$785	$785	$785	$785	$785
Alternative: Millican-Bundic Reservoir (Volume II, Section 4B.12.7)						
Supply From Plan Element (acft/yr)	—	—	—	38,080	38,080	38,080
Annual Cost ($/yr)				$34,756,000	$34,756,000	$34,756,000
Unit Cost ($/acft)				$913	$913	$913
Alternative: Little River Off-Channel Reservoir (Volume II, Section 4B.13.5)						
Supply From Plan Element (acft/yr)	—	—	—	32,110	32,110	32,110
Annual Cost ($/yr)				$8,028,000	$8,028,000	$8,028,000
Unit Cost ($/acft)				$250	$250	$250
Alternative: Storage Reallocation of Federal Reservoirs						
Supply From Plan Element (acft/yr)	Supplies and Costs not Determined					
Annual Cost ($/yr)						
Unit Cost ($/acft)						
Alternative: Sediment Reduction Program						
Supply From Plan Element (acft/yr)	Supplies and Costs not Determined					
Annual Cost ($/yr)						
Unit Cost ($/acft)						

4C.38.3 Brazos River Authority (Main Stem/Lower Basin System)

4C.38.3.1 Description of Supply

The Brazos River Authority (Main Stem/Lower Basin System) obtains water supply from Possum Kingdom Reservoir, Lake Granbury, Lake Whitney, Lake Somerville, and Lake Limestone. Based on the available surface water supply, the Brazos River Authority Main Stem/Lower Basin System is projected to have a shortage of 395,001 acft/yr in the year 2030 and 494,566 acft/yr in the year 2060, including the projected demands on the BRA Main Stem/Lower Basin System from Region H and supplies to Regions C and O. The projected shortages for the BRA Main Stem/Lower Basin System may be overstated. The projected shortages are based on a comparison of supplies and contracts, as opposed to a comparison of supplies and projected demands. Projected demands are less than the contracted amounts for several of the entities supplied by the BRA.

4C.38.3.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages for the BRA Main Stem/Lower Basin System:

- **BRA Systems Operation (Volume II, Section 4B.4)**

  The BRA has applied to the TCEQ for an additional appropriation of water that can be developed by utilizing its system of reservoirs to firm up uncontrolled runoff entering the basin below its reservoir system. Several of the water management strategies recommended to meet Water User Group needs would utilize this large potential supply of water. In addition to the firm supply, the BRA has requested appropriation of a large interruptible supply. Conjunctive use of groundwater or other supplies along the main stem and lower basin similar to the Lake Granger Augmentation strategy could be developed with the interruptible appropriation requested by the BRA. Interruptible supplies at Lake Somerville that are in excess of the firm yield of the reservoir could be firmed up through conjunctive use of nearby Carrizo-Wilcox groundwater.

- **Stonewall, Kent, and Garza County Chloride Control Project (This strategy was studied in 2001 Brazos G Plan and recommended for the Brazos River Authority.)**

  The BRA, in coordination with representatives from Stonewall, Kent and Garza Counties is studying the feasibility of installing shallow recovery wells that would intercept chloride-laden groundwater before it discharges to major salt water-producing seeps and springs, and would lower the artesian pressure of the underlying saline aquifer so that the seeps and springs cease to flow. It is estimated that brine control at the site proposed in Stonewall County would reduce chloride concentration in the Brazos River above Possum Kingdom Reservoir by 45 percent. Similar recovery wells installed in Kent County would reduce chloride concentrations in the Brazos River by an additional 10 – 15 percent. The brine would then be transferred to a solar salt evaporation facility near Post, Texas where the salt would be produced for commercial use. This strategy is an expansion of Chloride Control Option 3, which was studied for the 2001 Brazos G Regional Water Plan and was a water management strategy recommended for the Brazos River Authority.

- **Alternative: Storage Reallocation of Federal Reservoirs (not studied for 2006 Brazos G Plan)**

  The BRA has initiated a study with the U.S. Army Corps of Engineers to study the potential for reallocating storage in Federal reservoirs from flood control to water supply. The purpose would be to increase water supply yield to meet the growing water needs in the Brazos River Basin. During Phase I, up to four alternative reallocation scenarios will be analyzed in each of nine reservoirs, taking into account hydrology and hydraulics, geotechnical data, engineering and design information, socioeconomic, environmental and cultural issues, and recreational considerations. Up to three reservoirs may be selected for the more detailed Phase II analyses required for implementation. Main Stem/Lower Basin reservoirs that are candidates for storage reallocation are Lake Whitney and Lake Somerville. Reallocation of Lake Whitney was studied for the 2001 Brazos G Plan, but was not a recommended water management strategy.

- **Alternative: Sediment Reduction Program (not studied for 2006 Brazos G Plan)**

  The BRA is monitoring the sediment accumulation rates in the agency’s reservoirs, and is cognizant that a sediment reduction program at specific reservoirs may be required to maintain yield.

In addition to the above strategies, the Region H RWPG has recommended several additional strategies for the BRA to supply needs in Region H (see Table 4A-21). While the Brazos G RWPG acknowledges those Region H strategies, the Brazos G RWPG makes no recommendations regarding those strategies.

4C.38.3.3 Costs

Costs of the Recommended Plan for the BRA Main Stem/Lower Basin System.

Table 4C.38-4.
Recommended Plan Costs by Decade for the BRA Main Stem/Lower Basin System

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(356,825)	(366,240)	(395,001)	(432,751)	(480,265)	(494,566)
Needs Supplied from Region H Strategies[1]	162,345	162,345	187,568	187,568	230,893	236,493
Brazos G Surplus/(Shortage) (acft/yr)	(194,480)	(203,895)	(207,433)	(245,183)	(249,372)	(258,073)
BRA Systems Operation (Volume II, Section 4B.4)						
Supply From Plan Element (acft/yr)[2]	194,480	203,895	207,433	245,183	249,372	258,073
Annual Cost ($/yr)	ND	ND	ND	ND	ND	ND
Unit Cost ($/acft)	ND	ND	ND	ND	ND	ND
Stonewall, Kent, and Garza County Chloride Control Project (studied in 2001 Brazos G Plan)						
Supply From Plan Element (acft/yr)	Supplies and Costs not Determined					
Annual Cost ($/yr)						
Unit Cost ($/acft)						
Alternative: Storage Reallocation of Federal Reservoirs (not studied for 2006 Brazos G Plan)						
Supply From Plan Element (acft/yr)	Supplies and Costs not Determined					
Annual Cost ($/yr)						
Unit Cost ($/acft)						
Alternative: Sediment Reduction Program (not studied for 2006 Brazos G Plan)						
Supply From Plan Element (acft/yr)	Supplies and Costs not Determined					
Annual Cost ($/yr)						
Unit Cost ($/acft)						

ND – Costs for supply not determined
[1] Supplies from strategies assigned to BRA to meet shortages in Region H. Actual supplies from these strategies may be greater.
[2] Includes 63,510 acft/yr of firm supply from BRA System Operations allocated to Brazos G (Region H allocation is 120,000 acft/yr). Addition supply from BRA System Operations would originate from interruptible supplies firmed up with available groundwater, off-channel storage, or operated conjunctively with other existing water supplies.

4C.38.4 Bell County WCID No. 1

4C.38.4.1 Description of Supply

Bell County WCID No. 1 obtains its water supply from a BRA contract for water from Lake Belton. Based on the available surface water supply, Bell County WCID No. 1 is projected to have a shortage of 275 acft/yr in the year 2030 and 3,051 acft/yr in the year 2060.

4C.38.4.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the Bell County WCID No. 1:

- **BRA System Operation.**

4C.38.4.3 Costs

Costs of the Recommended Plan for the Bell County WCID No. 1.

a. Purchase Additional BRA Supply:
   - Cost Source: BRA System Wholesale Rate of $45.75/acft
   - Date to be Implemented: before 2010
   - Total Project Cost: $0 (assumes existing infrastructure is adequate)
   - Annual Cost: $160,125

Table 4C.38-5.
Recommended Plan Costs by Decade for the Bell County WICD No. 1

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	(92)	(184)	(275)	(367)	(559)	(3,051)
BRA System Operation						
Supply From Plan Element (acft/yr)	500	500	500	500	600	3,500
Annual Cost ($/yr)	$22,875	$22,875	$22,875	$22,875	$27,450	$160,125
Unit Cost ($/acft)	$45.75	$45.75	$45.75	$45.75	$45.75	$45.75

4C.38.5 Bluebonnet WSC

Bluebonnet WSC obtains is water supply through a contract with the Brazos River Authority. No shortages are projected for Bluebonnet WSC and no changes in water supply are recommended.

4C.38.6 Central Texas WSC

4C.38.6.1 Description of Supply

Central Texas WSC obtains its water supply from a BRA contract for water from Lake Stillhouse Hollow. Based on the available surface water supply, Central Texas WSC is projected to have a surplus of 954 acft/yr in the year 2030 and a shortage of 266 acft/yr in the year 2060.

4C.38.6.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the Central Texas WSC:

- **Increase BRA Contract.**

4C.38.6.3 Costs

Costs of the Recommended Plan for the Central Texas WSC.

a. Increase BRA Contract:
   - Cost Source: BRA System Wholesale Rate
   - Date to be Implemented: before 2060
   - Total Project Cost: none (assumes existing infrastructure is adequate)
   - Annual Cost: $12,110.

Table 4C.38-6.
Recommended Plan Costs by Decade for the Central Texas WSC

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	2,451	1,727	954	581	207	(266)
Increase BRA Contract						
Supply From Plan Element (acft/yr)	—	—	—	—	—	266
Annual Cost ($/yr)						$12,170
Unit Cost ($/acft)						$45.75

4C.38.7 Aquilla Water Supply District

4C.38.7.1 Description of Supply

Aquilla WSD obtains is water supply from Lake Aquilla through a contract with the Brazos River Authority. The district is projected to have shortages of 520 acft/yr starting in 2010, increasing to 3,123 acft/yr in 2060. The projected shortages for the Lake Aquilla WSD may be overstated. The projected shortages for the BRA Lake Aquilla System are based on a comparison of supplies and contracts, as opposed to a comparison of supplies and projected demands. Projected demands are less than the contracted amounts for supply from the Lake Aquilla System. In addition, the yield from Lake Aquilla was computed using estimated sedimentation rates based on a 1995 hydrographic survey. The BRA has noted that recent watershed modeling and hydrographic survey information indicates that sedimentation rates are considerably less, which would increase available supply from the reservoir. The BRA is actively monitoring sedimentation in the reservoir and has participated in programs aimed at reducing sediment load to the reservoir.

4C.38.7.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the Aquilla WSD:

- **Increase BRA Contract.**

4C.38.7.3 Costs

Costs of the Recommended Plan for the Aquilla WSD.

a. Increase BRA Contract:
   - Cost Source: BRA System Wholesale Rate (will require BRA to increase supplies at Lake Aquilla through BRA System Operations)
   - Date to be Implemented: before 2060
   - Total Project Cost: none (assumes existing infrastructure is adequate)
   - Annual Cost: $160,125. in 2060

Table 4C.38-7.
Recommended Plan Costs by Decade for Aquilla Water Supply District

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(520)	(1,041)	(1,561)	(2,082)	(2,602)	(3,123)
Increase BRA Contract						
Supply From Plan Element (acft/yr)	1,000	2,000	2,000	3,000	3,000	3,500
Annual Cost ($/yr)	$45,750	$91,500	$91,500	$137,250	$137,250	$160,125
Unit Cost ($/acft)	$45.75	$45.75	$45.75	$45.75	$45.75	$45.75

4C.38.8 Upper Leon Municipal Water District

Upper Leon MWD obtains is water supply through a contract with the Brazos River Authority for water from Lake Proctor. No shortages are projected for Upper Leon MWD and no changes in water supply are recommended.

4C.38.9 Eastland County Water Supply District

Eastland County WSD obtains is water supply from Lake Leon and a run-of-the-river right. No shortages are projected for Eastland County WSD and no changes in water supply are recommended.

4C.38.10 Palo Pinto County Municipal Water District No. 1

4C.38.10.1 Description of Supply

Palo Pinto County MWD No. 1 obtains its water supply from Lake Palo Pinto. Based on the available surface water supply, Palo Pinto County MWD No. 1 is projected to have a surplus of 63 acft/yr in the year 2030 and a shortage of 1,266 acft/yr in the year 2060.

4C.38.10.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the Palo Pinto County MWD No. 1:

- **Lake Palo Pinto Off-Channel Reservoir (Volume II, Section 4B.13.6)**
  This project would restore permitted storage in the Lake Palo Pinto System, thus restoring existing permitted yield.
- **Alternative: Turkey Peak Reservoir (Volume II, Section 4B.12.5)**

4C.38.10.3 Costs

Costs of the Recommended Plan for the Palo Pinto County MWD No. 1.

a. Lake Palo Pinto Off-Channel Reservoir:
   - Cost Source: Volume II, Section 4B.13.6
   - Date to be Implemented: before 2040
   - Total Project Cost: $19,314,000
   - Annual Cost: $1,621,000

Table 4C.38-8.
Recommended Plan Costs by Decade for the Palo Pinto County MWD No. 1

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	951	496	63	(324)	(773)	(1,266)
Lake Palo Pinto Off-Channel Reservoir						
Supply From Plan Element (acft/yr)	—	—	—	3,110	3,110	3,110
Annual Cost ($/yr)				$1,621,000	$1,621,000	$1,621,000
Unit Cost ($/acft)				$521	$521	$521

4C.38.11 West Central Texas Municipal Water District

4C.38.11.1 Description of Supply

West Central Texas MWD obtains its water supply from Hubbard Creek Reservoir. Based on the available surface water supply, West Central Texas MWD is projected to have a shortage of 10,753 acft/yr in the year 2030 and a shortage of 11,098 acft/yr in the year 2060.

4C.38.11.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the West Central Texas MWD:

- **West Central Brazos System Optimization Plan (WCBSOP)**
- **Alternative: BRA System Purchase (Possum Kingdom Reservoir)**

The WCBSOP is a combination of the following components, which would operate jointly as a system:

- City of Abilene Reuse (Volume II, Section 4B.3.2)
- Breckenridge Reservoir (Cedar Ridge site) (Volume II, Section 4B.12.1)
    - Double Mountain Fork Reservoir (Volume II, Section 4B.12.4) is an alternative component to Breckenridge Reservoir
- Clear Fork Scalping into Hubbard Creek Reservoir (*West Central Brazos River Basin Regional Water Treatment and Distribution Facility Plan*, Freese and Nichols, 2004)
- Priority Calls Agreement: Possum Kingdom/Hubbard
- Priority Calls Agreement: Possum Kingdom/Fort Phantom Clear Fork Scalping

The WCBSOP is a joint strategy between the WCTMWD and the City of Abilene. Refer to the plan for the City of Abilene in Taylor County (Volume I, Section 4C.33.1) for a detailed description.

4C.38.11.3 Costs

Costs of the Recommended Plan for the West Central Texas MWD.

a. Water Supply from West Central Brazos System Optimization Plan (WCBSOP):
    - Cost Source: Various individual strategy evaluations (Table 4C.38-9)
    - Date to be Implemented: phased implementation, beginning in 2010
    - Total Project Cost: $198,055,000
    - Annual Cost: $16,795,500
    - Unit Cost: $284/acft

Table 4C.38-9
Component Costs for West Central Brazos System Optimization Plan

System Component	Total Cost	Annual Cost	Initial Supply Contributed (acft/yr)
Breckenridge Reservoir with reuse and priority calls agreement with BRA	$82,755,000	$6,257,000	34,520[1]
Clear Fork Scalping into Hubbard Creek Reservoir with priority calls agreement with BRA	$115,300,000	$10,081,000	7,000
Priority Calls Agreements with BRA for Hubbard Creek Reservoir and Fort Phantom Him Reservoir Scalping (costs for Possum Kingdom Reservoir Impacts – 10,000 acft at $45.75/acft)	$0	$457,500	17,630
Total	$198,055,000	$16,795,500	59,150
[1]Includes 5,600 acft/yr of additional yield provided by Abilene's existing return flows.			

Table 4C.38-10.
Recommended Plan Costs by Decade for the West Central Texas MWD

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(10,523)	(10,638)	(10,753)	(10,868)	(10,983)	(11,098)
Water Supply from West Central Brazos System Optimization Plan[1]						
Supply From Plan Element (acft/yr)	25,575	25,575	25,575	25,575	25,575	25,575
Annual Cost ($/yr)	$7,263,300	$7,263,300	$7,263,300	$7,263,300	$7,263,300	$7,263,300
Unit Cost ($/acft)	$284	$284	$284	$284	$284	$284
[1]Costs and supply from WCBSOP are split equally between WCTMWD and City of Abilene (see Table 4C.33-3).						

4C.38.12 North Central Texas Municipal Water District

4C.38.12.1 Description of Supply

North Central Texas MWD obtains its water supply from Millers Creek Reservoir. Based on the available surface water supply, North Central Texas MWD is projected to have a shortage of 969 acft/yr in the year 2030 and a shortage of 1,319 acft/yr in the year 2060.

4C.38.12.2 Water Supply Plan

Working within the planning criteria established by the Brazos G RWPG and TWDB, the following water supply plan is recommended to meet the projected shortage of the North Central Texas MWD:

- **Millers Creek Reservoir Augmentation (Lake Creek Diversion – Canal Option) with a Priority Calls Agreement with the BRA**

4C.38.12.3 Costs

Costs of the Recommended Plan for the North Central Texas MWD.

a. Millers Creek Reservoir Augmentation with a Priority Calls Agreement with the BRA:
- Cost Source: Volume II, Section 4B.7
- Date to be Implemented: before 2010
- Total Project Cost: $18,222,000
- Annual Cost: $1,350,000

Table 4C.38-11.
Recommended Plan Costs by Decade for the North Central Texas MWD

Plan Element	2010	2020	2030	2040	2050	2060
Projected Surplus/(Shortage) (acft/yr)	(739)	(852)	(969)	(1,086)	(1,202)	(1,319)
Lake Creek Diversion with a Priority Calls Agreement with the BRA						
Supply From Plan Element (acft/yr)	4,870	4,870	4,870	4,870	4,870	4,870
Annual Cost ($/yr)	$1,350,000	$1,350,000	$1,350,000	$1,350,000	$1,350,000	$1,350,000
Unit Cost ($/acft)	$277	$277	$277	$277	$277	$277

4C.38.13 City of Abilene (Wholesale Water Provider)

The recommended water supply plan for the City of Abilene is included in Section 4C.33 with the Taylor County water user groups.

4C.38.14 City of Cedar Park (Wholesale Water Provider)

The recommended water supply plan for the City of Cedar Park is included in Section 4C.36 with the Williamson County water user groups.

4C.38.15 City of Round Rock (Wholesale Water Provider)

The recommended water supply plan for the City of Round Rock is included in Section 4C.36 with the Williamson County water user groups.

4C.38.16 City of Sweetwater (Wholesale Water Provider)

The recommended water supply plan for the City of Sweetwater is included in Section 4C.26 with the Nolan County water user groups.

4C.38.17 City of Waco (Wholesale Water Provider)

4C.38.17.1 Description of Supply

The City of Waco obtains its water supply from surface water from Lake Waco, in which it owns water rights, and from Lake Brazos on the Brazos River. The City supplies several neighboring communities and has sufficient water supply to meet its municipal and regional needs through the year 2030, but is projected to experience shortages prior to year 2050. The City has demonstrated a commitment to provide regional water supply in McLennan County, and could extend regional water supplies beyond the 2060 planning horizon by actively pursuing a reuse program. The City has recently entered into a contract to supply up to 16,000 acft of reuse water per year to LS Power to provide cooling water for steam electric power generation, and is exploring other potential reuse water sales.

4C.38.17.2 Water Supply Plan

The Brazos G RWPG recommends that the City of Waco continue to pursue direct and indirect reuse as a water management strategy in order to diversify and extend regional water supplies in the McLennan County area. Accordingly, the following water supply plan is recommended for the City of Waco:

- **Develop Reuse Supplies to Extend Lake Waco and Trinity Aquifer Supplies.**

4C.38.17.3 Costs

Costs of the Recommended Plan for the City of Waco.

a. Reuse Supplies for the City of Waco:

- Cost Source: Volume II, Section 4B.3
- Date to be Implemented: ongoing
- Unit Cost: Unit costs range widely, depending upon quantity used and type of use:
  - $1,025/acft (average) for small-quantity municipal irrigation use
  - $111/acft for industrial use (steam-electric)
- Annual Cost: $6,355,800 (Annual costs would depend upon application, but is based here on a projected average of $200/acft for large-quantity uses.)

Table 4C.38-12.
Recommended Plan Costs by Decade for the City of Waco

Plan Element	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*
Projected Surplus/(Shortage) (acft/yr)	28,072	23,619	7,729	2,235	(4,612)	(11,941)
Reuse Supply for the City of Waco						
Supply From Plan Element (acft/yr)[1]	31,779	31,779	31,779	31,779	31,779	31,779
Annual Cost ($/yr)	$6,355,800	$6,355,800	$6,355,800	$6,355,800	$6,355,800	$6,355,800
Unit Cost ($/acft)	$200	$200	$200	$200	$200	$200

[1] Based on estimated year 2060 WMARSS effluent (Section 4B.3).

4C.39 Summary of Recommended Water Management Strategies

For convenient reference, the Table 4C.39-1 summarizes the water management strategies recommended by the Brazos G Regional Water Planning Group. The strategies listed below include only those related to developing new sources of supply in the Brazos G Region. Strategies involving system interconnections and purchasing water from existing supplies in Region G are not included.

The 2006 Brazos G Regional Water Plan includes recommendations for 21,393 acft/yr of municipal conservation savings; these savings are on top of those savings already included in the TWDB water demand projections. Total new supplies of water into the Brazos G Region, whether conservation newly developed groundwater, supply imported in from other regions, newly developed surface water supplies, or augmentation of existing facilities, total 590,231 acft/yr. These totals do not reflect water trades between users of existing supplies in Region G, but are entirely new supplies to the Brazos G Region.

Implementation of the 2006 Brazos G Regional Water Plan will result in the development of new water supplies that will be reliable in the event of a repeat of the most severe drought on record. It is evident that implementation of all recommended water management strategies is not likely to be necessary in order to meet projected needs within the planning period. The BGRWPG explicitly recognizes the difference between additional supplies and projected needs as System Management Supplies and has recommended the associated water management strategies in the Regional Water Plan for the following reasons:

- So that water management strategies are identified to replace any planned strategies that may fail to develop, through legal, economic or other reasons;
- To serve as additional supplies in the event that rules, regulations, or other restrictions limit use of any planned strategies;
- To facilitate development of specific projects being pursued by local entities for reasons that may not be captured in the supply and demand projections used to identify future supply shortages; and/or
- To ensure adequate supplies in the event of a drought more severe than that which occurred historically.

Table 4C.39-1.
Summary of Recommended Water Management Strategies Involving New Sources of Supply in the 2006 Brazos G Regional Water Plan

Strategy	WUG or WWP	New Supply by 2060 (acft/yr)	Total Project Cost (2nd Quarter 2002 Prices)
Conservation Strategies			
Municipal	38 WUGs	21,393	N/D[1]
Manufacturing	18 Counties	1,430	N/D
Steam-Electric	9 Counties	13,281	N/D
Mining	10 Counties	1,074	N/D
Irrigation	6 Counties	8,027	N/D
Total Conservation		**45,205**	**N/D**
Reuse Strategies			
Reuse	Steam-Electric – Nolan County	560	$2,115,000
	City of Round Rock	7,443	$6,369,000
	City of Bryan	605	$6,485,000
	City of College Station	137	$2,358,000
	City of Cleburne	2,853	$1,048,000
	Steam-Electric – McLennan County (City of Waco)	16,000	$2,995,000
	City of Waco	15,779	N/D
Total Reuse		**43,377**	**$27,855,000**
Water Supply from other Regions			
LCRA/BRA Alliance	Chisholm Trail SUD	3,472	$18,518,000
	City of Round Rock	20,928	$101,336,000
LCRA Highland Lakes	Cedar Park	25,000	$81,748,000
TRA Reuse through Joe Pool Reservoir	Johnson County SUD	20,000	$79,257,000
Total from Other Regions		**69,400**	**$280,859,000**
Augmentation of Existing Surface Water Supplies			
Lake Palo Pinto Off-Channel Reservoir	Palo Pinto County MWD No. 1	3,110	$19,314,000
Millers Creek Reservoir Augmentation	North Central Texas Municipal Water District	4,870	$18,222,000
Raise Level of Gibbons Creek Reservoir	Steam-Electric – Grimes County	3,870	$8,003,000
BRA System Operation (Lake Granger Augmentation)	Chisholm Trail SUD	26,127[2]	$303,288,000
	City of Georgetown		
	Jarrell-Schwertner WSC		
	City of Round Rock		
	Williamson County – Other		
	Manufacturing – Williamson County		
Total Augmentation of Existing Surface Water Supplies		**37,977**	**$348,827,000**

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Table 4C.39-1.
Summary of Recommended Water Management Strategies Involving New Sources of Supply in the 2006 Brazos G Regional Water Plan (continued)

Strategy	WUG or WWP	New Supply by 2060 (acft/yr)	Total Project Cost (2nd Quarter 2002 Prices)
New Reservoirs			
Wheeler Branch Off-Channel Reservoir	Somervell County - Other	1,800	$27,195,000
Brushy Creek Reservoir	City of Marlin	2,000	$6,301,610
Total New Reservoirs		**3,800**	**$33,496,610**
Systems Approaches			
West Central Brazos System Optimization Plan	City of Abilene	59,150	$198,055,000
	West Central Texas Municipal Water District		
	Irrigation – Throckmorton County		
BRA System Operation (Excluding Lake Granger Augmentation)	Bell County WCID #1	3,500	$0
	Bosque County – Other	475	
	Manufacturing – Bosque County	1,300	$25,492,000
	Steam-Electric – Bosque County	8,225	
	Brandon-Irene WSC	100	
	City of Hillsboro	100	
	White Bluff Community WS	700	$36,151,000
	Woodrow-Osceola WSC	200	
	Manufacturing – Hill County	100	
	Steam-Electric – Limestone County	16,000	ND
	Other Needs to be Met from BRA System Operation[3]	234,373	ND
Total from Systems Approaches		**324,223**	**> $259,698,000**
Groundwater Development			
Brackish Groundwater	Mining - Nolan County	200	$268,188
Champion Well Field Phases 1 & 2	City of Sweetwater	736	$17,060,471
Carrizo-Wilcox Aquifer – Lee and Milam Counties [BRA System Operation (Lake Granger Augmentation)]	Williamson County entities, see BRA System Operation (Lake Granger Augmentation) (above)	28,263[2]	–
Carrizo-Wilcox Aquifer – Brazos County	City of Bryan	15,300	$33,380,000
	City of College Station		
	Wickson Creek SUD		
	Brazos County – Manufacturing		
Carrizo-Wilcox Aquifer – Burleson County	Manufacturing – Burleson County	150	$124,624 (Annual)
	Irrigation – Burleson County	5,000	$8,718,000

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Table 4C.39-1.
Summary of Recommended Water Management Strategies Involving New Sources of Supply in the 2006 Brazos G Regional Water Plan (concluded)

Strategy	WUG or WWP	New Supply by 2060 (acft/yr)	Total Project Cost (2nd Quarter 2002 Prices)
Carrizo Wilcox Aquifer – Falls County	Falls County – Other	300	$1,376,000
Carrizo-Wilcox Aquifer – Lee County	Aqua WSC	300	$1,047,000
	City of Giddings	400	$2,099,000
	Lee County WSC	750	$1,762,000
	City of Hutto	1,680	$1,927,000 (Annual)
Carrizo-Wilcox Aquifer – Limestone County	City of Groesbeck	100	$566,000
	Manufacturing – Limestone County	100	$566,000
Carrizo-Wilcox Aquifer – Milam County	Southwest Milam WSC	600	$2,079,000
	Steam-Electric – Milam County	8,200	$3,923,000
	City of Hutto	1,680	$1,927,000 (Annual)
Carrizo-Wilcox Aquifer – Robertson County	Robertson County (Manufacturing)	85	$707,000
Trinity Aquifer – Coryell County	Coryell County – Other	1,200	$4,821,000
Trinity Aquifer – Erath County	Manufacturing – Erath County	50	$198,000
Trinity Aquifer – Falls County	Falls County – Other	300	$1,376,000
Trinity Aquifer – Lampasas County	Lampasas County – Other	850	$2,576,000
Trinity Aquifer – Williamson County	City of Florence	250	$803,500
Gulf Coast Aquifer – Grimes County	Manufacturing – Grimes County	250	$312,000
Total Groundwater Development		**66,444**	**> $86,116,159**
Total New Supplies		**590,426**	**> $1,030,366,769**

1. Not Determined.
2. The Lake Granger Augmentation includes development of an average annual supply of groundwater from the Carrizo-Wilcox Aquifer of 28,263 acft/yr to develop the total new supply of 54,390 acft/yr (Volume II, Section 4B.5).
3. Includes additional BRA contractual commitments not specifically identified in Section 4B.4. Does not include Region H supplies, but does include minor increases to Region C.

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Section 5
Impacts of Recommended Water Management Strategies on Key Parameters of Water Quality and Moving Water from Rural and Agricultural Areas [31 TAC § 357.7(a)12] & [31 TAC § 357.7(a)8(G)]

The new guidelines for 2006 Regional Water Plans include describing major impacts of recommended water management strategies on key parameters of water quality identified by the regional water planning group and consideration of third party social and economic impacts associated with voluntary redistribution of water from rural and agricultural areas.

5.1 Impacts of Water Management Strategies on Key Parameters of Water Quality

The Brazos G RWPG has identified the following eleven key parameters of water quality to consider for recommended water management strategies:

- Chlorides,
- Sulfates,
- Total Dissolved Solids (TDS),
- Total Suspended Solids (TSS),
- Dissolved Oxygen,
- pH Range,
- Indicator Bacteria (Escherichia coli or fecal coliform),
- Temperature,
- Nitrates,
- Total Phosphorous, and
- Total Nitrogen- ammonia.

The selection of key water quality parameters is based on Texas Surface Water Quality Standards Chapter 307, current water quality concerns identified in the Brazos River Authority's Basin Highlights Report, water user concerns expressed during Regional Water Planning Group meetings, and regional water quality studies. Total Phosphorous and Total Nitrogen were selected based on nutrient concerns in the North Bosque Watershed and will be utilized throughout the Brazos G Area.

The major impacts of recommended water management strategies on key parameters of water quality were identified by the Brazos G RWPG pursuant to Texas Administrative Code Chapter 357-Regional Water Planning Guidelines. The recommended water management strategies for the Brazos G Area and effects of the key water quality parameters are presented in Table 5-1.

Water quality concerns affecting existing supplies are described in greater detail in Section 3.3, which also includes a summary of special water quality studies and activities in the Brazos River Basin. These identified water quality concerns present challenges that may need to be overcome before the water management strategy can be used as a water supply. For water quality parameters that cannot be fully addressed due to lack of available information or inconclusive water quality studies, the Brazos G RWPG recommends further studies prior to implementing a water management strategy.

5.2 Impacts of Voluntary Redistribution of Water from Rural and Agricultural Areas

Several opportunities for voluntary redistribution exist for the Brazos G Area, such as supplying groundwater from the Carrizo-Wilcox Aquifer in Lee and Milam Counties to Williamson County. While this groundwater water management strategy provides regional water supply and economic benefits, it will result in lowering of artesian levels in the Carrizo-Wilcox aquifer and consequently, may increase costs to pump water for water supply in rural and agricultural areas.

The remaining water management strategies recommended to meet water needs (Section 4C) do not include transferring water needed by rural and agricultural users and, therefore, are not considered to impact them.

Table 5-1.
Summary of Water Management Strategies, Potential Water Quality Concerns, and WUGs Potentially Affected

Recommended WMS	Project Origination	Beneficiaries of Project	Potential Water Quality Concerns Affecting Use of Supply
Water Conservation	Varies	All municipal, industrial, and agricultural users with projected needs (shortages)*	total dissolved solids, sulfates, and chlorides
Treated Effluent Reuse	Brazos, Johnson, McLennan, Nolan, Williamson	Steam/Electric (Nolan and McLennan Counties) Municipal (Cities of Round Rock, Bryan, College Station, Cleburne, Waco)	indicator bacteria
Interbasin Transfer of surface water from Lower Colorado River (Region K)			
LCRA/BRA Alliance	Varies	Municipal (cities of Liberty Hill, Chisholm Trail SUD, Round Rock)	none identified
LCRA Highland Lakes	Varies	Municipal (cities of Liberty Hill, Cedar Park)	none identified
New Reservoirs			
Wheeler Branch Off-Channel Reservoir	Somervell	Municipal (Somervell County-Other)	none identified
Brushy Creek Reservoir	Williamson	Municipal (City of Marlin)	none identified
Augmentation of Existing Surface Water Supplies			
Lake Palo Pinto Off-Channel Reservoir	Palo Pinto	Municipal (Palo Pinto County MWD No. 1)	none identified
Millers Creek Reservoir	Throckmorton, Baylor	Municipal (North Central Texas Municipal Water District)	none identified
Gibbons Creek Reservoir	Grimes	Steam/Electric (Grimes County)	indicator bacteria, temperature, pH
Lake Granger (BRA System Operations)	Williamson	Manufacturing (Williamson County); Municipal (Chisholm Trail SUD, Williamson County-Other, Cities of Georgetown and Round Rock, Jarrell-Schwetner WSC,)	increasing trends in sulfates, chlorides, elevated nutrients, and sedimentation from total suspended solids

Table 5-1.
Summary of Water Management Strategies, Potential Water Quality Concerns, and WUGs Potentially Affected (Concluded)

Recommended WMS	Project Origination	Beneficiaries of Project	Potential Water Quality Concerns Affecting Use of Supply
Systems Approaches			
West Central Brazos System	Varies	Municipal (City of Abilene, West Central Texas Municipal Water District)	chlorides, total dissolved solids
BRA System Operations	Varies	Manufacturing (Bosque and Hill Counties); Steam/Electric (Bosque and Limestone Counties); Municipal (Bell County WCID #1, Bosque County-Other, Brandon-Irene WSC, City of Hillsboro, White Bluff Community WS, Woodrow-Osceola WSC)	chlorides, total dissolved solids, total suspended solids, and nutrients
Groundwater Development			
Brackish Groundwater Desalination	Nolan	Mining (Nolan County)	total dissolved solids, chlorides, sulfates, and temperature
Dockum Aquifer (Champion Wellfield)	Nolan	Municipal (City of Sweetwater)	none identified
Carrizo-Wilcox Aquifer	Brazos, Burleson, Lee, Milam, Robertson, Coryell, Erath, Falls, Lampasas, Williamson	Manufacturing (Brazos, Burleson, Limestone, Robertson counties); Irrigation (Burleson County) Steam/Electric (Milam County; Municipal (Wickson Creek SUD, Aqua WSC, Lee County WSC, Southwest Milam WSC; cities of Bryan, College Station, Giddings, Groesbeck, Hutto)	temperature
Trinity Aquifer	Coryell, Erath, Falls, Lampasas, Williamson	Manufacturing (Erath County); Municipal (Coryell County-Other, Falls County-Other, Lampasas County-Other, City of Florence)	none identified
Gulf Coast Aquifer	Grimes	Manufacturing (Grimes County)	none identified

* For municipal users with shortages, additional conservation was recommended only for WUGs exceeding 140 gallons per capita per day.

Section 6
Water Conservation and
Drought Management Recommendations
[31 TAC §357.7(a)(11)]

The 2006 Brazos G Regional Water Plan (2006 Plan) includes water conservation and drought management recommendations pursuant to 31 Texas Administrative Code 357.7(a)11 and Texas Water Code 11.085. The guidelines require water user groups that obtain water from inter-basin transfers consider conservation as a water management strategy. There are several municipal water user groups in the Brazos G Area that benefit from interbasin transfers as listed in Table 6-1. A more detailed description of these interbasin transfers is included in Section 3.1.

Typically, water user groups address their goals and plans to conserve water in their Water Conservation Plan and identify factors used to initiate a drought response and actions to be taken as part of the response in a Drought Contingency Plan. The TCEQ provides guidance for Water Conservation and Drought Contingency Plans in 30 Texas Administrative Code Chapter 288, which requires entities applying for new water rights or an amendment to an existing water right to prepare and implement a water conservation/drought contingency plan to be submitted with their application. Furthermore, 30 TAC Chapter 288, requires "specific, quantified 5- and 10-year targets for water savings to be included in all water conservation plans to be submitted to the TCEQ no later than May 1, 2005."

The specific water conservation target savings for all entities in the Brazos G Area are not yet available and will not be included in the 2006 Plan. Targets identified in specific conservation plans for water user groups in the Brazos G Area should be included in future water planning efforts. The City of Abilene's Water Conservation and Drought Contingency Plan (WC&DCP) is included in Appendix J, along with the City of Waco's WC&DCP in Appendix K as example plans for two water user groups in the Brazos G Area.

6.1 Water Conservation

The Brazos G RWPG has considered water conservation and drought management measures for each water user group with a need (projected water shortage) in accordance with Regional Water Planning Guidelines. The Brazos G RWPG recommends water conservation for municipal and non-municipal entities.

Table 6-1.
Brazos G Municipal Water User Groups that Receive Water from Interbasin Transfers

Water User Group	County	Water Supply
Johnson County-Other	Johnson	Lake Granbury
City of Mexia	Limestone	Lake Mexia
City of Lampasas	Lampasas	Brazos River
Fisher County-Other	Fisher	Lake J B Thomas
City of Sweetwater	Nolan	Oak Creek Reservoir
City of Clyde	Callahan	Lake Clyde
City of Abilene	Taylor	Lake O H Ivie
Williamson County-Other	Williamson	Lake Austin
City of Cedar Park	Williamson	Lake Travis
City of Leander	Williamson	Lake Travis
City of Rotan	Fisher	Colorado River Municipal Water District (City of Snyder)

6.1.1 Municipal Water Conservation

The four largest municipal water users in the Brazos G Area (Waco, Abilene, College Station, and Round Rock) constitute approximately 25% of the regional municipal water demand. Abilene, College Station, and Round Rock have projected shortages during the planning period and have projected water usage ranging from 164 gallons per capita per day (gpcd) to 221 gpcd in 2010.

The Brazos G RWPG encourages all municipal entities in the region to conserve water, regardless of per capita consumption. The current Texas Water Development Board (TWDB) municipal water demand projections account for expected water savings due to implementation of the 1991 State Water-Efficient Plumbing Act. In September 2004, the Brazos G RWPG recommended additional water conservation of 21 gpcd by Year 2020 for water entities with a projected need (shortage) that also exceed 140 gallons per capita per day. Specific conservation measures are not recommended for each user group, as each entity should choose those conservation strategies that best fit their individual situation using Best Management Practices

(BMPs) described by the Water Conservation Implementation Task Force.[1] A discussion of municipal conservation water savings, program costs, and unit costs for the Brazos G Area are included in Section 4B.2.1.

6.1.2 Non-municipal Water Conservation

In February 2005, the Brazos G RWPG recommended that counties with projected needs (shortages) for irrigation or industrial users (manufacturing, steam electric, or mining) reduce their water demands by 3 percent by 2010, 5 percent by 2020, and 7 percent from 2030 to 2060 by using Best Management Practices identified by the Water Conservation Implementation Task Force.

There are six counties within the Brazos G Area with projected irrigation needs: Burleson, Eastland, Haskell, Knox, Nolan, and Shackelford. The total water savings for these six counties is greatest in Year 2030, with an expected savings of 8,674 acft. In 2060, the total expected water savings for these six counties is 8,027 acft/yr as shown in Table 6-2. There are multiple irrigation BMPs that irrigators can select from to attain this water savings, including furrow diking, low elevation spray applications (LESA), and low energy precision application (LEPA). The costs of these BMPs range from $96 to $449 per acft of water saved with a savings potential of 12,359 to 22,691 acft with 100 percent participation. A more detailed description of irrigation BMPs, costs, and water savings for the Brazos G Area are included in Section 4B.2.2.

There are 18 counties in the Brazos G Area with projected manufacturing needs: Bell, Bosque, Brazos, Burleson, Erath, Fisher, Grimes, Hill, Hood, Johnson, Lampasas, Limestone, McLennan, Nolan, Robertson, Somervell, Washington, and Williamson. The total water savings for these 18 counties after 7 percent water demand reduction in 2060 is 1,430 acft/yr (a 12% reduction in total regional manufacturing shortages) as shown in Table 6-3.

There are nine counties in the Brazos G Area with projected steam-electric needs: Bosque, Grimes, Johnson, Limestone, McLennan, Milam, Nolan, Palo Pinto, and Robertson. The total water savings for these nine counties after 7 percent water demand reduction in 2060 is 13,281 acft/yr (a 15% reduction in total regional steam-electric shortages) as shown in Table 6-4.

There are ten counties in the Brazos G Area with projected mining needs: Haskell, Hood, Johnson, Knox, Lampasas, Nolan, Somervell, Stephens, Taylor, and Williamson. The total water

[1] Texas Water Development Board, Water Conservation Best Management Practices Guide, November 2004.

savings for these nine counties after 7 percent water demand reduction in 2060 is 1,074 acft/yr (a 11% reduction in total regional mining shortages) as shown in Table 6-5.

Table 6-2.
Irrigation Water Conservation Savings

Counties with Irrigation Needs	Irrigation Shortages in 2060 (acft/yr)		Water Savings in 2060 (acft/yr)
	Before Conservation	**After Conservation (Reducing Demand By 15 Percent)**	
Burleson	(2,991)	(2,005)	986
Eastland	(9,257)	(8,110)	1,147
Haskell	(21,950)	(18,982)	2,968
Knox	(10,460)	(7,860)	2,600
Nolan	(2,566)	(2,251)	315
Shackelford	(81)	(70)	11
Total	**(47,305)**	**(39,278)**	**8,027**

There are multiple industrial BMPs identified by the Water Conservation Implementation Task Force, however data to quantify savings and costs is unavailable. The Brazos G RWPG recognizes that conservation savings and costs to implement industrial BMPs are facility specific and assumes that industrial users will implement those strategies that are practical, cost effective, and provide good water savings potential. A more detailed description of suggested industrial BMPs for the Brazos G Area is included in Section 4B.2.3.

Table 6-3.
Manufacturing Water Conservation Savings

Counties with Manufacturing Needs	Manufacturing Shortages in 2060 (acft/yr)		Water Savings in 2060 (acft/yr)
	Before Conservation	After Conservation	
Bell	(1,446)	(1,344)	102
Bosque	(1,300)	(1,184)	116
Brazos	(232)	(194)	38
Burleson	(98)	(72)	26
Erath	(40)	(32)	8
Fisher	(236)	(212)	24
Grimes	(189)	(158)	31
Hill	(53)	(43)	10
Hood	(15)	(12)	3
Johnson	(3,639)	(3,359)	280
Lampasas	(169)	(156)	13
Limestone	(69)	(64)	5
McLennan	(1,508)	(1,086)	422
Nolan	(239)	(143)	96
Robertson	(77)	(66)	11
Somervell	(7)	(6)	1
Washington	(199)	(155)	44
Williamson	(2,328)	(2,128)	200
Total	**(11,844)**	**(10,382)**	**1,430**

Table 6-4.
Steam-Electric Water Conservation Savings

Counties with Irrigation Needs	Steam-Electric Shortages in 2060 (acft/yr)		Water Savings in 2060 (acft/yr)
	Before Conservation	After Conservation	
Bosque	(8,223)	(7,386)	837
Grimes	(9,715)	(8,123)	1,592
Johnson	(1,200)	(1,116)	84
Limestone	(15,814)	(12,756)	3,058
McLennan	(34,016)	(30,650)	3,366
Milam	(8,200)	(7,080)	1,120
Nolan	(2,817)	(2,562)	255
Palo Pinto	(1,658)	(1,489)	169
Robertson	(8,284)	(5,484)	2,800
Total	**(90,267)**	**(76,986)**	**13,281**

Table 6-5.
Mining Water Conservation Savings

Counties with Irrigation Needs	Mining Shortages in 2060 (acft/yr)		Water Savings in 2060 (acft/yr)
	Before Conservation	After Conservation	
Haskell	(47)	(41)	6
Hood	(24)	(13)	11
Johnson	(315)	(284)	31
Knox	(3)	(1)	2
Lampasas	(23)	(14)	9
Nolan	(197)	(178)	19
Somervell	(85)	(67)	18
Stephens	(6,662)	(5938)	724
Taylor	(4)	None*	24
Williamson	(1,882)	(1,652)	230
Total	**(9,242)**	**(8,188)**	**1,074**

* Note: surplus of 20 acft exists after conservation.

6.2 Drought Management

All water supply entities and some major water right holders are required by Senate Bill 1 regulations to submit for approval to the Texas Commission for Environmental Quality (TCEQ) a Drought Contingency and Water Conservation Plan. These plans must detail the entities' plans to reduce water demand at times when the demand threatens the total capacity of the water supply delivery system or overall supplies are low (like during a drought). In accordance with 31 Texas Administrative Code 357.7(a)1, the 2006 Plan identifies: 1) factors to consider in determining whether to initiate a drought response; and 2) actions to be taken as part of the response by including model drought contingency plans for City of Abilene (Appendix J) and City of Waco (Appendix K). The Brazos River Authority continues to receive water conservation and drought management plans from regional water user groups.

The cities of Abilene and Waco are comparable in size and have different hydrologic conditions. The City of Waco depends upon essentially one water supply (Lake Waco), whereas the City of Abilene has multiple water sources. Lake Waco is a fairly drought resistant water supply, whereas the City of Abilene is experiencing a drought worse in severity than the drought of record. These two entities were selected to represent a range of different conservation and drought contingency approaches that may be applicable to other water user groups in the Brazos G Area.

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Section 7
Consistency with Long-Term Protection of the State's Water, Agricultural, and Natural Resources [31 TAC §357.7(a)(13) and §357.7(2)(C)

The 2006 Brazos G Regional Water Plan (2006 Plan) is consistent with long-term protection of the state's water resources, agricultural resources, and natural resources and is developed based on guidance principles outlined in the Texas Administrative Code Chapter 358-State Water Planning Guidelines. The 2006 Plan was produced with an understanding of the importance of orderly development, management, and conservation of water resources and is consistent with all laws applicable to water use for the state and regional water planning areas. Furthermore, the plan was developed according to principles governing surface water and groundwater rights. Availability of water for new surface water supplies considered environmental flow needs by adhering to pass-through requirements consistent with the Consensus Criteria for Environmental Flow Needs (Appendix H), and protection of existing water rights. For groundwater, the 2006 Plan recognizes principles for groundwater use in Texas, and estimates of groundwater availability take into consideration regional and local drawdown constraints (Appendix B).

The 2006 Plan identifies actions and policies necessary to meet the Brazos G Area's near and long-term water needs by developing and recommending water management strategies to meet needs with reasonable cost, good water quality, and sufficient protection of agricultural and natural resources of the state. The Brazos G RWPG has recommended water management strategies that consider the public interest of the state, wholesale water providers, protection of existing water rights, and opportunities that encourage voluntary transfers of water resources while balancing economic, social, and ecological viability. When needs could not be met economically with water management strategies, a socioeconomic impact analysis was performed to estimate the economic loss associated with not meeting these needs (Appendix I).

The 2006 Plan considers environmental information resulting from site-specific studies and ongoing water development projects when evaluating water management strategies. Cumulative effects of water management strategies on Brazos River instream flows and inflows to the Gulf of Mexico were considered, as documented in the various evaluations of water management strategies. A list of endangered and threatened species in the Brazos G Area for each county was obtained from the U.S. Fish and Wildlife Service and possible impacts to these habitats were considered for each water management strategy evaluated.

The 2006 Plan consists of initiatives to respond to continuing drought conditions in the western part of the region, and makes use of relatively low-impact strategies such as reuse of wastewater return flows and the Brazos River Authority's proposed System Operations to increase supplies. As a further drought protection provision, the Brazos G RWPG adopted use of safe yield analyses for purposes of determining water supply for municipal supply reservoirs upstream of Possum Kingdom Reservoir. The use of safe yield analyses anticipates that a future drought may occur that is greater in severity than the worst drought of record and reserves a certain amount of water in storage (i.e., a 1-year supply) for such an event. Use of safe yield in the upper Brazos Basin is justified based on the severity of the recent and ongoing drought. Figure 7-1 shows how flows during the first 11 years of the current drought are significantly less than those of the first 11 years of the drought of record (1950's drought).

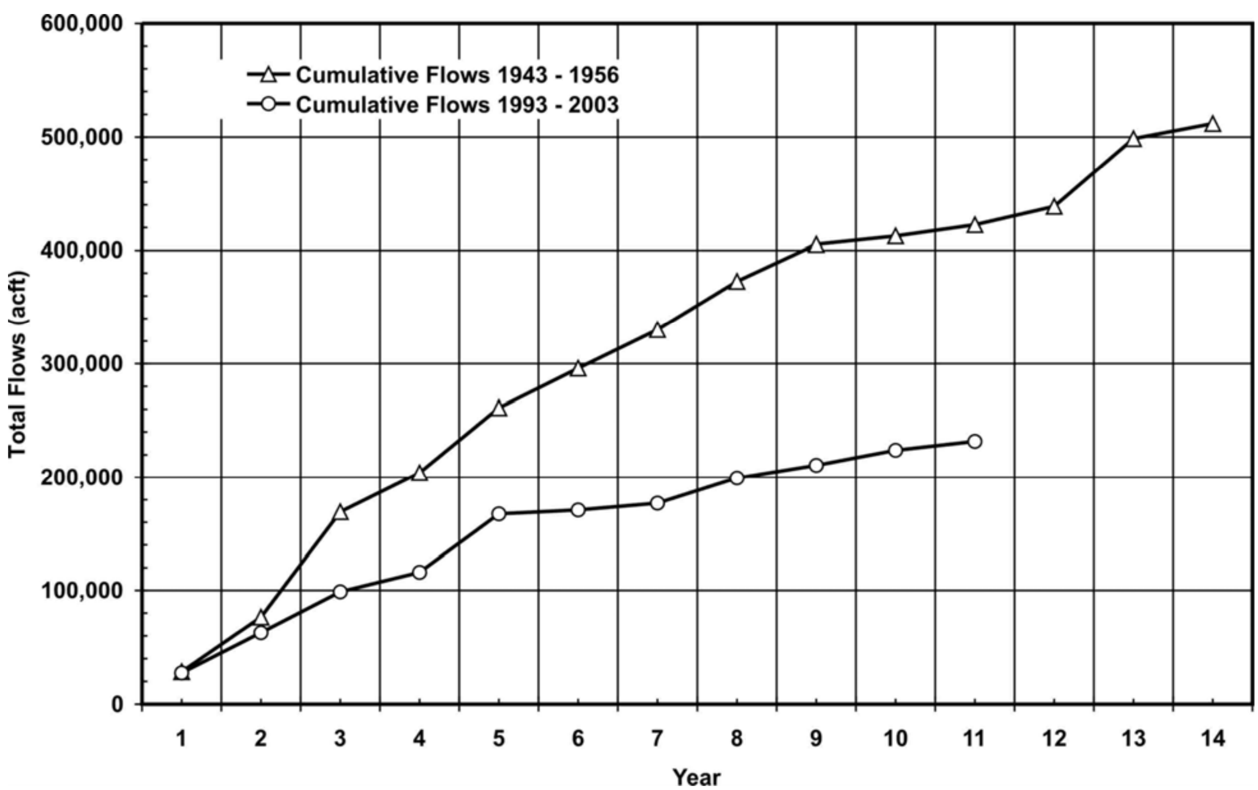


Figure 7-1. Cumulative Gaged Flows at Clear Fork of the Brazos near Nugent

The Brazos G RWPG conducted numerous meetings during the 2006 planning cycle, which were open to the public, and decisions were based on accurate, objective, and reliable information. The Brazos G RWPG coordinated water planning activities with local, regional and state agencies, and was committed to facilitating the initiatives and addressing the concerns of local and regional entities.

The Brazos G RWPG considered recommendations of stream segments with unique ecological value by Texas Parks and Wildlife and sites of unique value for reservoirs. At this time, the Brazos G RWPG recommends that no stream segments or reservoir sites be designated as unique (Section 8). The Brazos G RWPG developed policy recommendations regarding State water policy after extensive consideration and deliberation (Section 8).

The following sections describe in more detail the hydrologic effects of the recommended water management strategies on surface water and groundwater resources.

7.1 Cumulative Hydrologic Effects of Regional Water Plan Implementation

7.1.1 Surface Water

Sophisticated hydrologic models have been employed to quantify the cumulative effects of implementation of the 2006 Brazos G Regional Water Plan through the year 2060. Surface water effects were quantified using the Brazos G WAM, which was the standard tool utilized to determine surface water supplies available in the region and also to evaluate potential water management strategies. The Brazos G WAM utilizes the Water Rights Analysis Package (WRAP) and a modified TCEQ WAM dataset that incorporates approved Brazos G planning assumptions concerning return flows, reservoir sedimentation and priority calls agreements, among others.

The cumulative effects of the plan can be quantified by comparing conditions prior to implementation of the plan (base condition) to conditions with the plan in place. At the direction of the Brazos G RWPG, the base condition against which to compare conditions with the plan in place was streamflow computed by the Brazos G WAM model used to determine availability of surface water supplies in the year 2060. In this scenario, all existing water rights are fully utilized, all major reservoir capacities are reduced to expected year 2060 sedimentation conditions, wastewater effluent discharges (return flows) are include with an aggressive level of reuse assumed, and all BRA contractual commitments are placed at their actual diversion locations.

The conditions with the plan in place include the base condition assumptions, with the addition of any recommended strategies that could measurably affect streamflows, i.e., those that result in development of additional water supply. The recommended water management strategies listed in Table 7-1 were incorporated jointly into the model. Specific strategies not included in the analysis are reuse projects, conservation, strategies transferring water from one entity to another through new or increased purchases, and development of additional groundwater. The base condition already assumes a level of reuse that is somewhat greater than in the plan, therefore, the reuse aspects of the plan will not cause any further reductions in streamflow below the base conditions. The base condition assumes full utilization of water rights, and conservation or transfers of water will not impact the assumption of full utilization of water rights. Surface water/groundwater interactions are difficult to quantify, but reductions in streamflow due to increased utilization of groundwater resources are expected to be low. For example, groundwater availability model (GAM) simulations of the Carrizo-Wilcox Aquifer with pumping at the full estimated groundwater availability resulted in only 22 cubic feet per second (cfs) reduction in base streamflow, summed for all streams crossing the Carrizo-Wilcox Aquifer.

The Brazos G RWPG selected the eight locations presented in Table 7-2 at which to evaluate the cumulative effects of the 2006 Plan on streamflow. Each selected location is located in the Brazos G portion of the Brazos River Basin, except the Brazos River at Richmond. This location was included in the analysis to illustrate the impacts of not only Region G strategies in the lower part of the basin, but also to include the effects of the Region H strategies that were included in the analysis.

The strategies were operated with seniority in an upstream to downstream order, but always senior to the proposed appropriation under the BRA System Operations. It was assumed that some form of priority calls agreement would be reached between the BRA and the entity developing a new water supply project, and the new water supply would not be required to pass flows to the new BRA appropriation. In all cases, the priorities of BRA's existing rights were honored.

Table 7-1.
Recommended Water Management Strategies Included in Cumulative Impacts Analysis

Recommended Water Management Strategy	WUG or WWP	Plan Section
BRA System Operations	Bosque, Hill and Limestone County WUGs	4B.4
BRA System Operations – Lake Granger Augmentation	Williamson County WUGs	4B.5
West Central Brazos System Optimization Plan (WCBSOP) • Clear Fork Scalping into Hubbard Creek Reservoir • Breckenridge Reservoir (Cedar Ridge site)	• City of Abilene • West Central Texas Municipal Water District	4B.12.1 & 4C.33.1
Wheeler Branch Off-Channel Reservoir	Somervell County WUGs	4B.13.3
Millers Creek Reservoir Augmentation	North Central Texas Municipal Water District	4B.7
Raise Level of Gibbons Creek Reservoir	Grimes County Steam Electric	4C.12.5
Allens Creek Reservoir (Region H)[1]	Brazos River Authority	n/a
Little River Off-Channel Reservoir (Region H)[1]	Brazos River Authority (Region H Plan)	4B.13.5

[1] Allens Creek and Little River Off-Channel Reservoirs are recommended strategies in the Region H Plan. Allens Creek is neither recommended nor discouraged in the Region G Plan. The Little River Reservoir is included as an alternative strategy to meet needs in the Region G Plan.

Table 7-2.
Locations for Evaluating the Effects of Recommended Strategies on Streamflow

Location	WAM Control Point Identifier
Brazos River at South Bend	BRSB23
Brazos River near Glen Rose	BRGR30
Brazos River near Aquilla	BRAQ33
Bosque River near Waco	BOWA40
Little River near Cameron	LRCA58
Brazos River near Bryan	BRBR59
Brazos River near Hempstead	BRHE68
Brazos River at Richmond	BRRI70

The Region H portion of the supply made available under BRA System Operations was diverted just downstream of Richmond in the model. The remaining Brazos G portion not assigned to specific WUG strategies was diverted in the model at the Brazos River near Hempstead location, the main stem location furthest downstream in the Brazos G Area. Existing subordination agreements with the BRA were not considered in this model run as the model is currently unable to correctly model those agreements in conjunction with the BRA System Operations scenarios. This relaxation of the base condition assumptions does not affect the resulting streamflows at the selected locations in a substantive manner.

The cumulative effects of the recommended water management strategies on streamflow were evaluated by comparing descriptive streamflow statistics for the base condition with those from the plan condition at the selected evaluation locations. Figures 7-2 through 7-9 present these comparisons for regulated streamflow at each of the evaluation locations. Regulated flow is the total streamflow remaining in the stream after all existing water rights have been exercised and other water management activities have taken place. It is the total flow passing a location (control point) after all water rights have appropriated the flows to which they are entitled.

One noticeable trend in the monthly median graphs for most locations is that monthly median streamflows are significantly greater January through June than July through December. In order to investigate this apparent trend, a comparison of naturalized flows with the regulated flows was completed to verify if this trend was a by-product of the modeling, or if it occurs naturally in the streamflow records. Figure 7-10 illustrates the median naturalized flows at the Brazos River at Richmond location compared to the regulated flows of both the base and the implemented plan scenarios. This graph demonstrates that the trend in flows follows the same pattern in the underlying natural flows upon which the simulations are based.

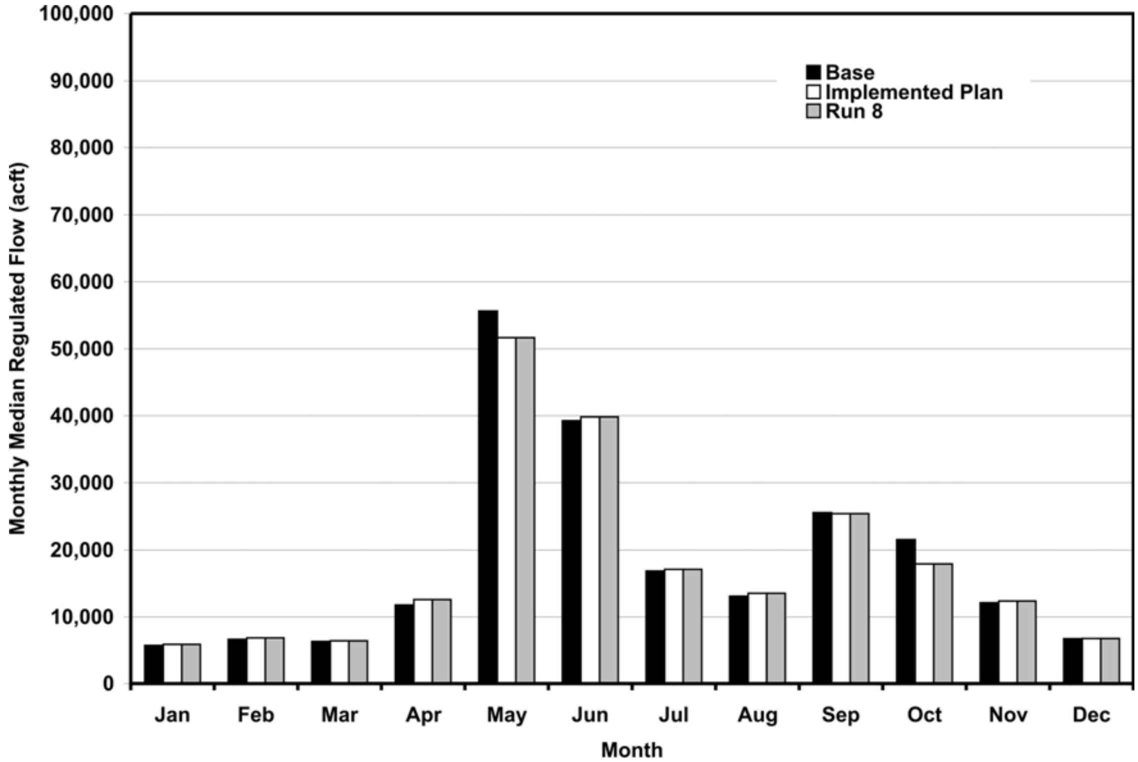
As expected, the streamflows generally tend to decrease between the base run and the implemented plan run for those locations where reservoirs have been recommended upstream. However, some locations exhibit larger flows with implementation of the 2006 plan than with the base condition. This is due primarily to the releases being made from upstream BRA reservoirs as part of the BRA System Operations to the diversions modeled at Hempstead and Richmond.

The Bosque River near Waco location controls a relatively small watershed compared to the other locations investigated in this analysis. Changes associated with this location are relatively negligible. The Little River near Cameron location reflects changes from projects recommended for implementation in the Little River watershed, specifically the Little River Off-Channel Reservoir (recommended in Region H) and the Lake Granger Augmentation. While monthly median flows exhibit a change, little difference is apparent in the overall frequency of flows.

The three most downstream locations, Brazos River near Bryan, Brazos River near Hempstead and the Brazos River at Richmond, are all located on the main stem of the Brazos and the changes in streamflow are similar for each. These locations are located downstream in the basin and downstream from the majority of the recommended water management strategies. These locations have the potential to be impacted by the implementation of any of the proposed strategies. New reservoir and diversion projects will tend to reduce streamflow at these locations, while the BRA System Operations tends to increase streamflows as releases from upstream reservoir pass these locations to satisfy demands at downstream locations.

Overall the cumulative effects of the implemented plan will have a modest effect on streamflows in the Brazos Basin. Locations below new reservoirs or reservoirs with augmented supplies will generally experience reduced streamflows, but not to a significant level. Locations lower in the basin will often experience greater streamflows, as the BRA System Operations releases water during dry times to downstream diversion points. None of the locations will experience significantly different streamflows with implementation of the recommended water management strategies in the 2006 Brazos G Regional Water Plan. Locations immediately downstream of new water supply projects (reservoirs, diversions, augmentation of existing facilities) will often experience reduced streamflows, but the detrimental effects of these reductions can be minimized with proper consideration of reservoir pass-through requirements to maintain flows necessary to meet the needs of the environment.

Also included in Figures 7-2 through 7-10 are flows as obtained from the version of the Brazos WAM maintained by the TCEQ known as Run 8. Run 8 attempts to duplicate flows under “current” conditions of use for individual water rights, return flows, and year 2010 reservoir sedimentation conditions. Differences between Run 8 and the implementation flows are not due solely to the water management strategies recommended in the plan, but also due to full utilization of existing water rights, differences in assumed return flows, reservoir sedimentation conditions, and locations of BRA diversions.



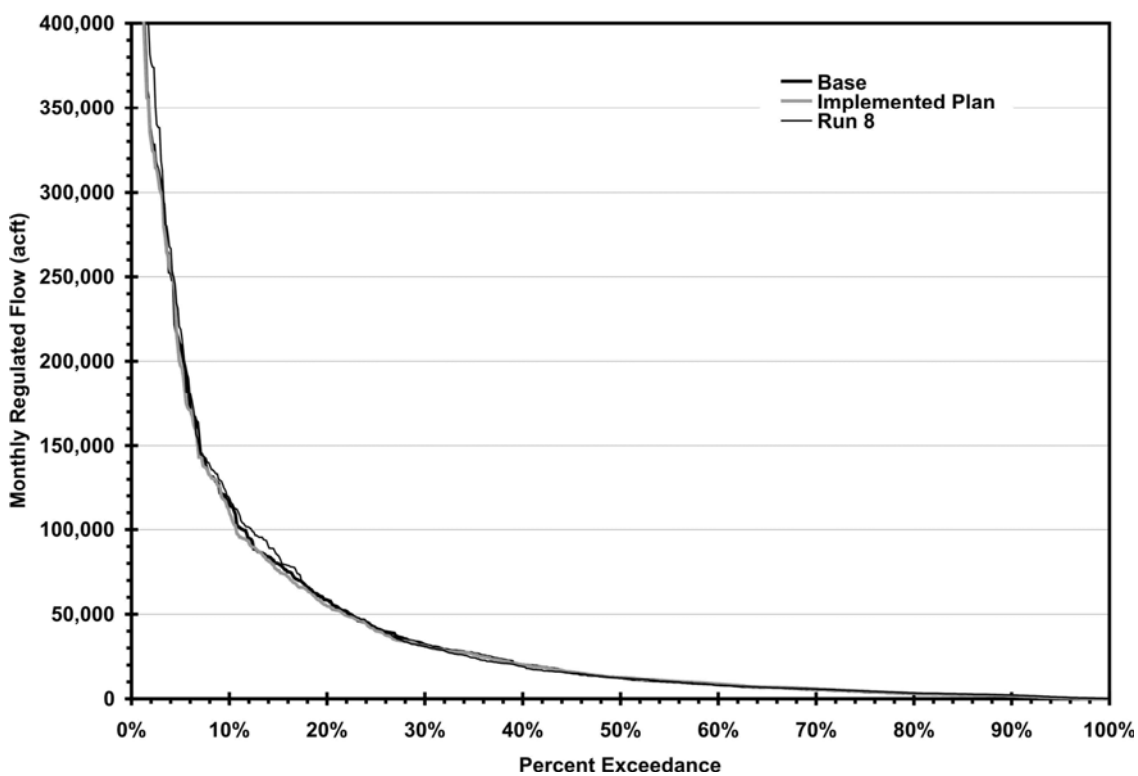
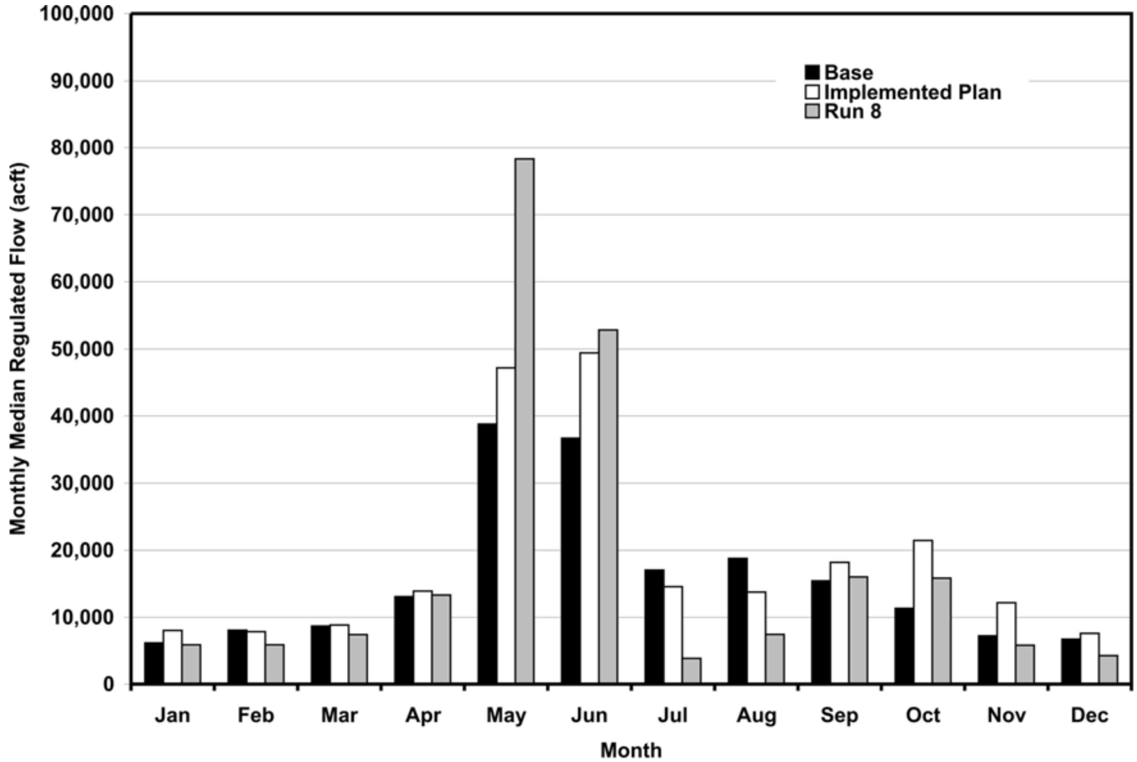


Figure 7-2. Brazos River at South Bend



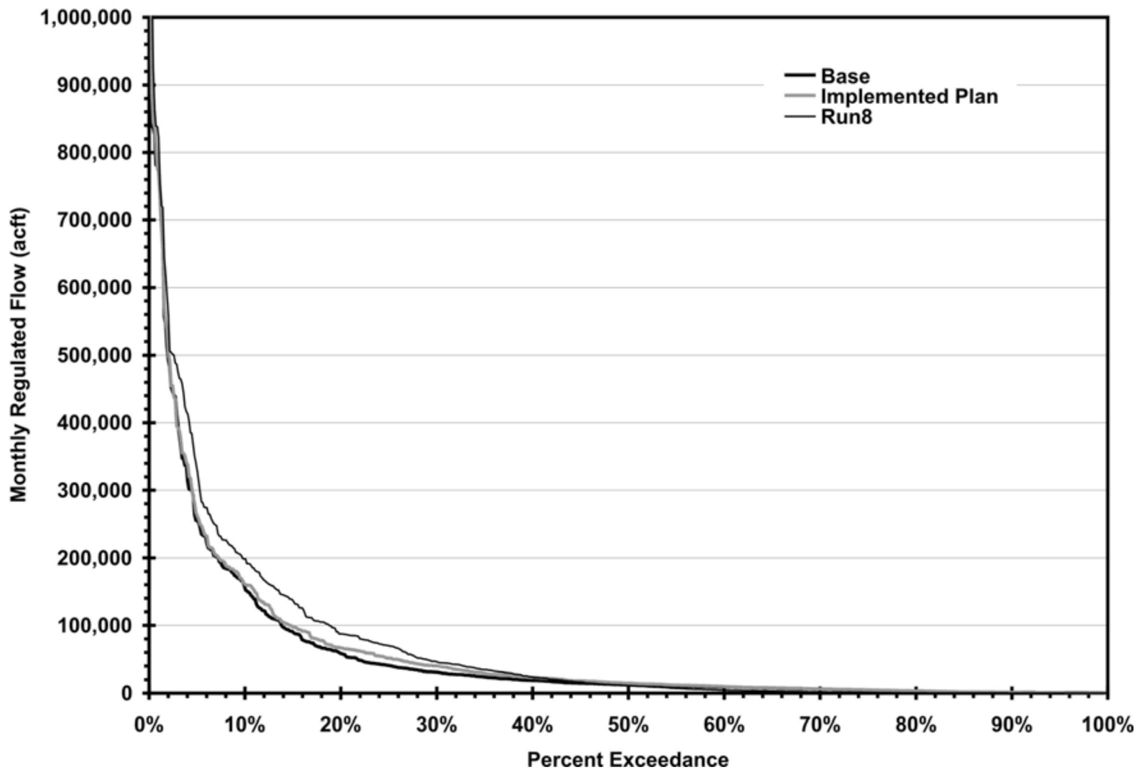
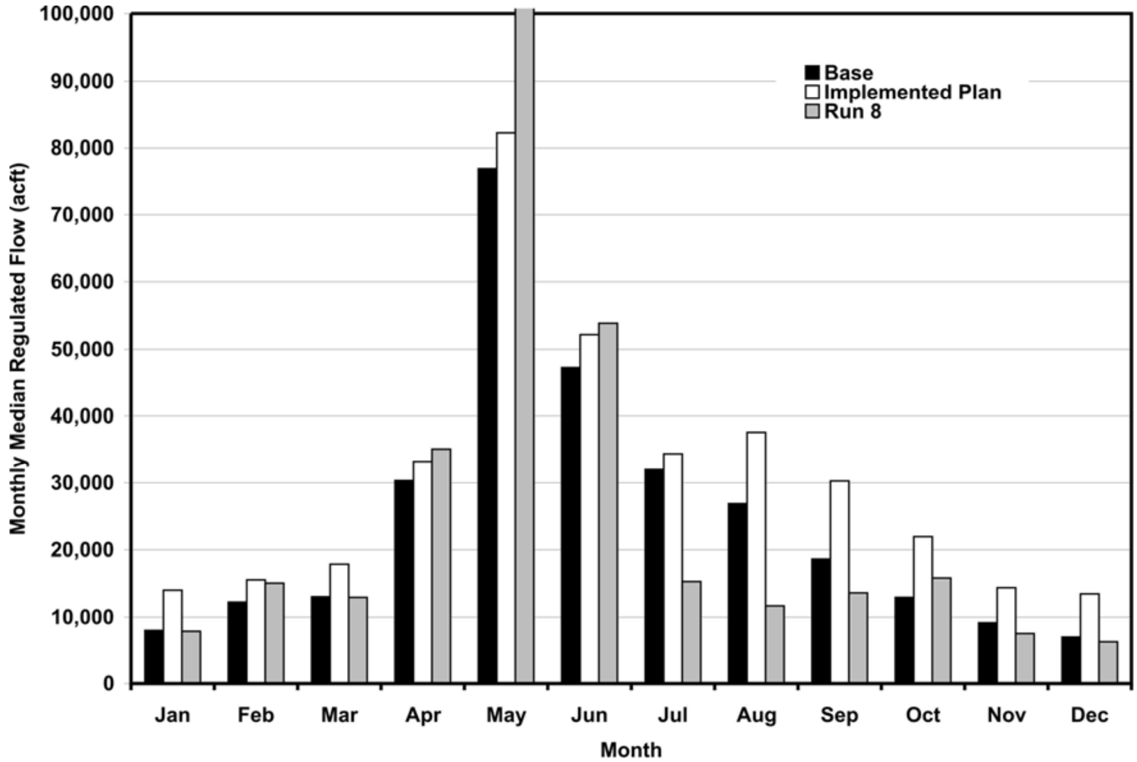


Figure 7-3. Brazos River near Glen Rose



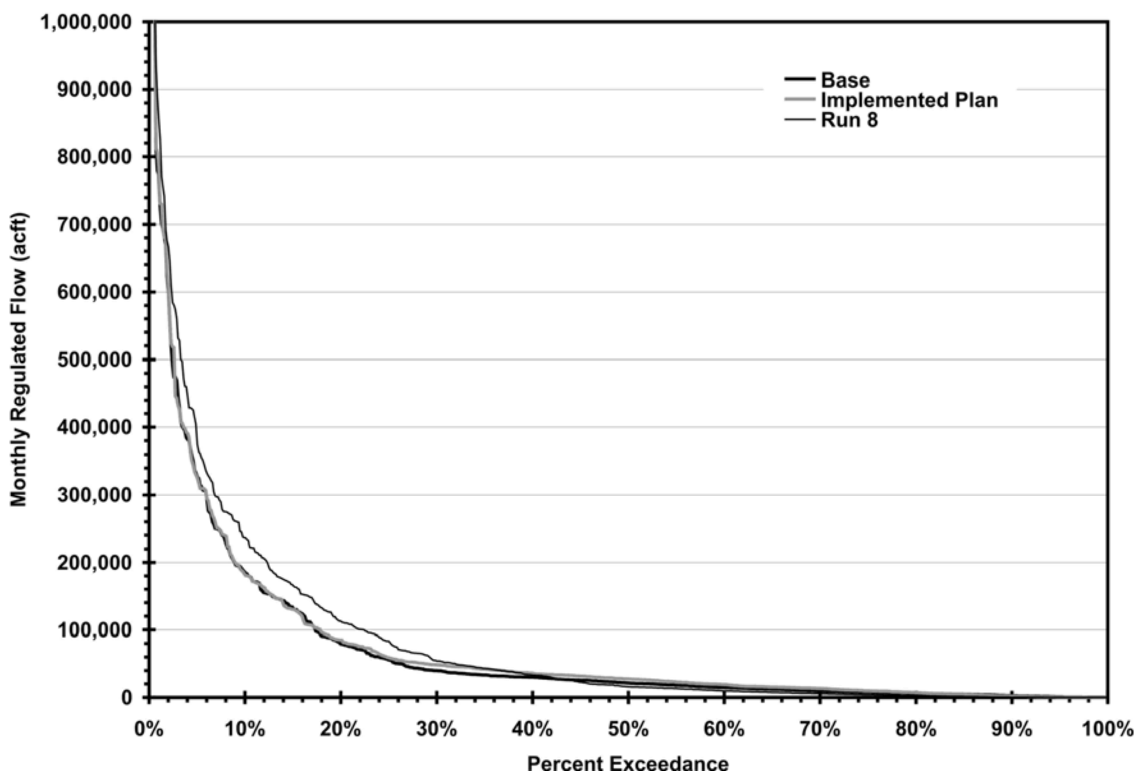
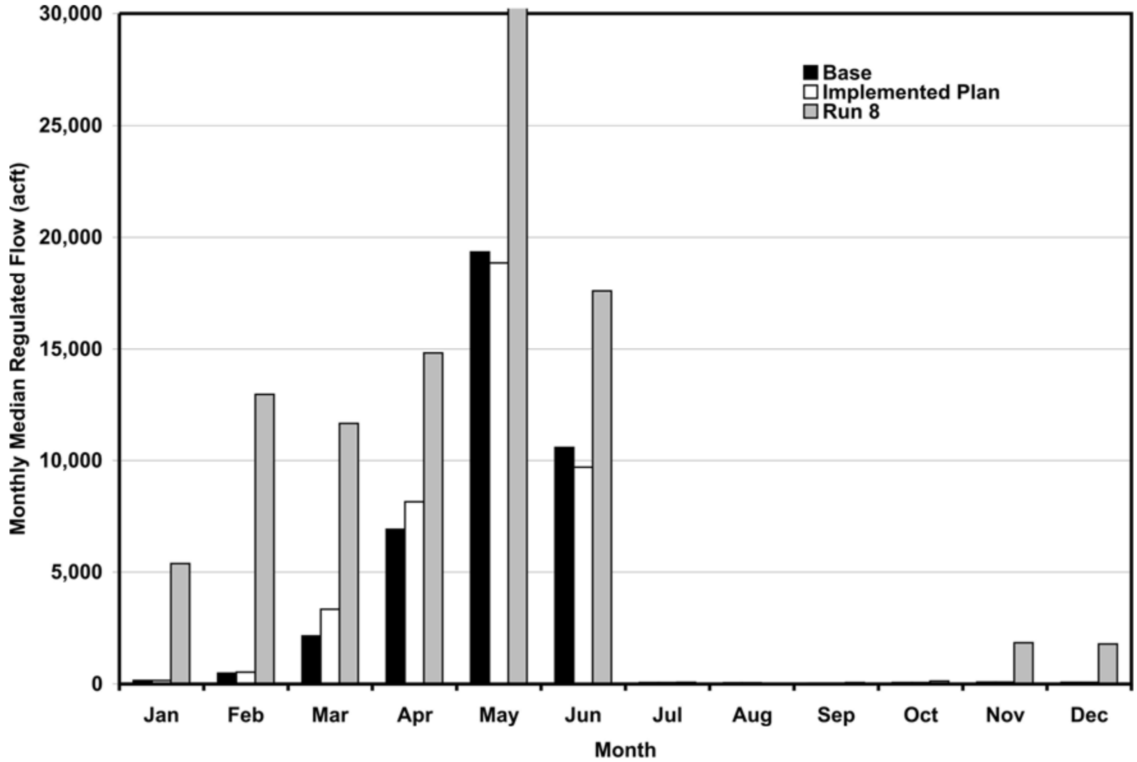


Figure 7-4. Brazos River near Aquilla



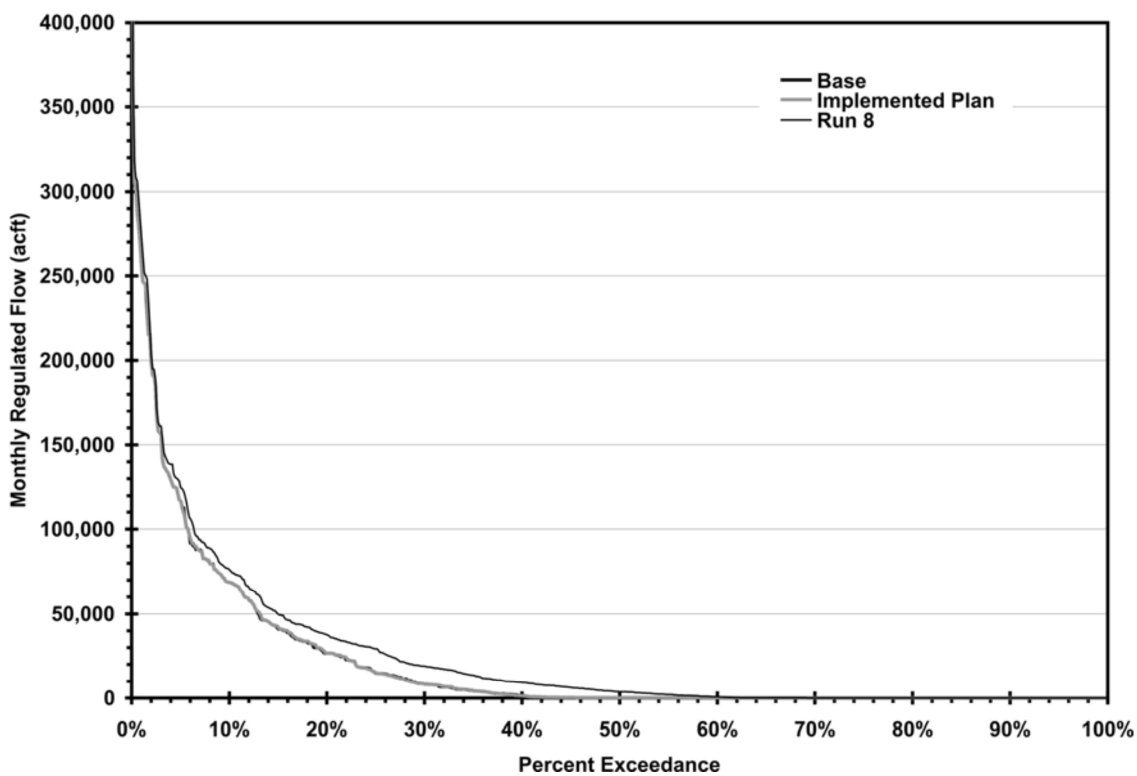
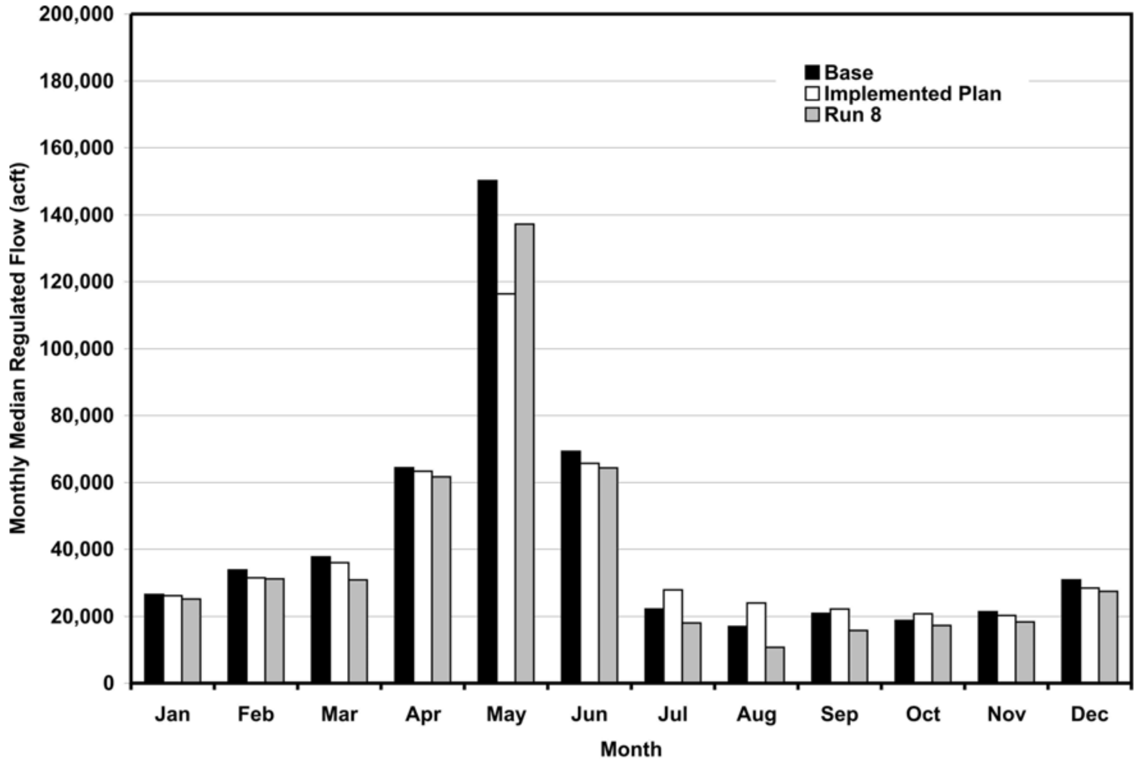


Figure 7-5. Bosque River near Waco



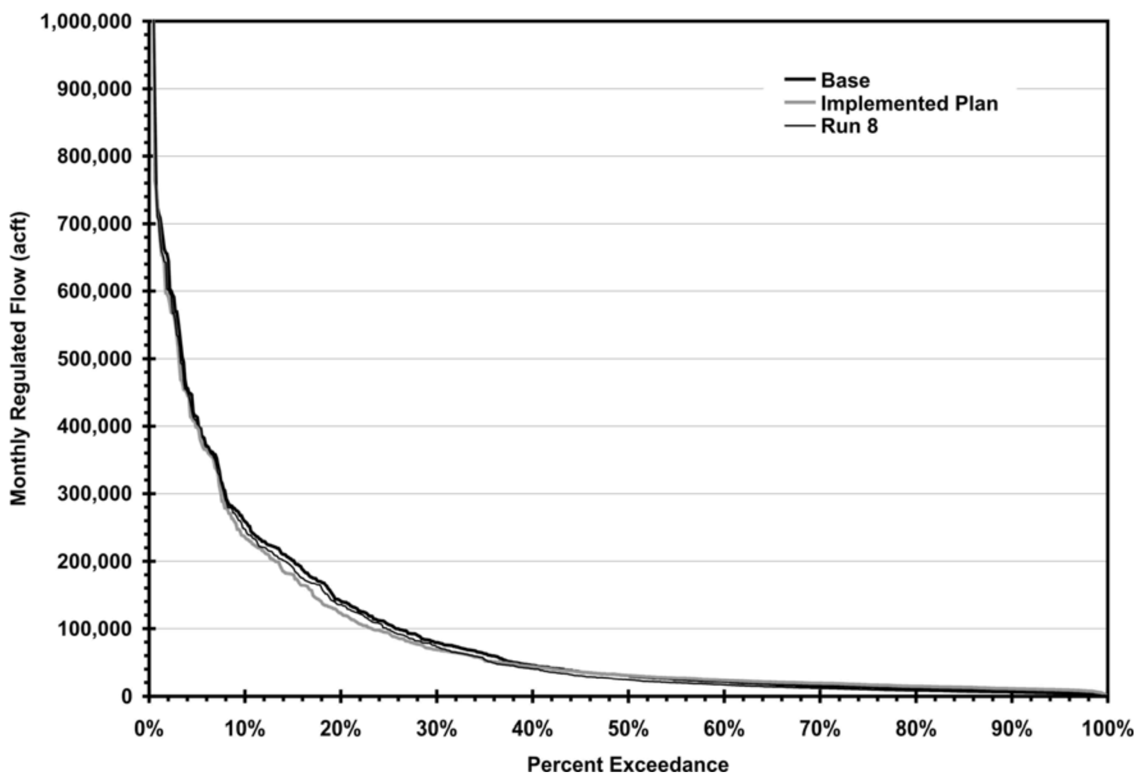
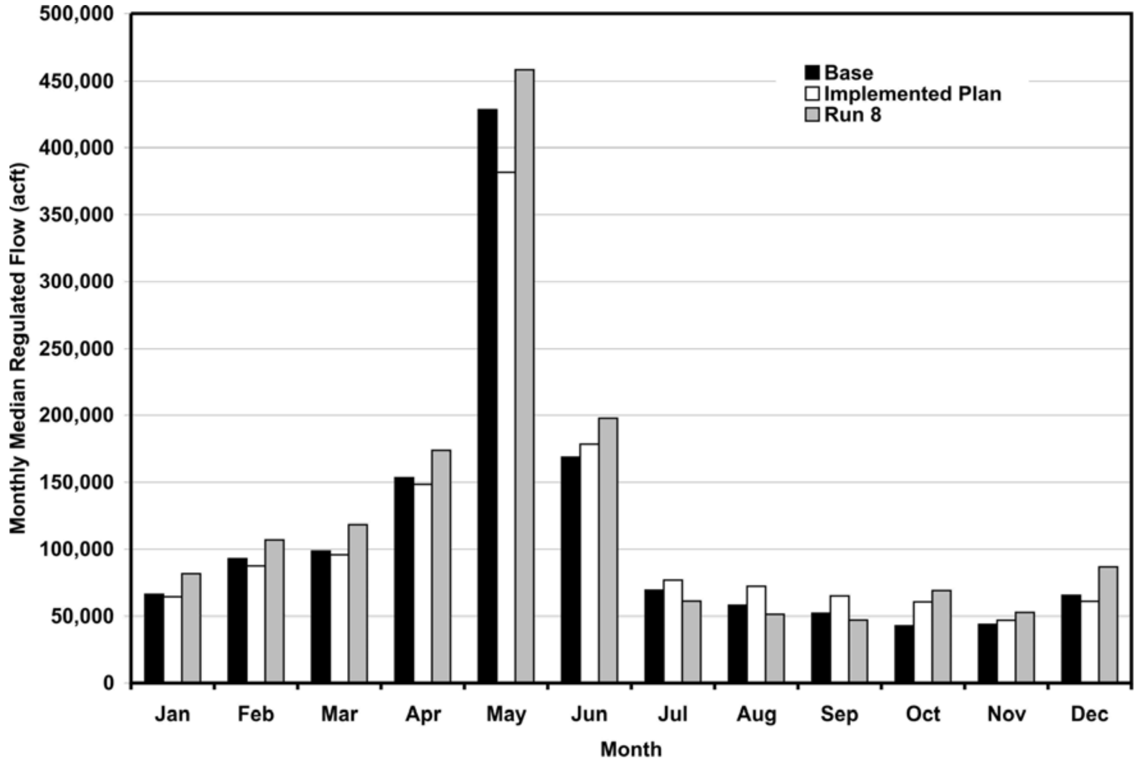


Figure 7-6. Little River near Cameron



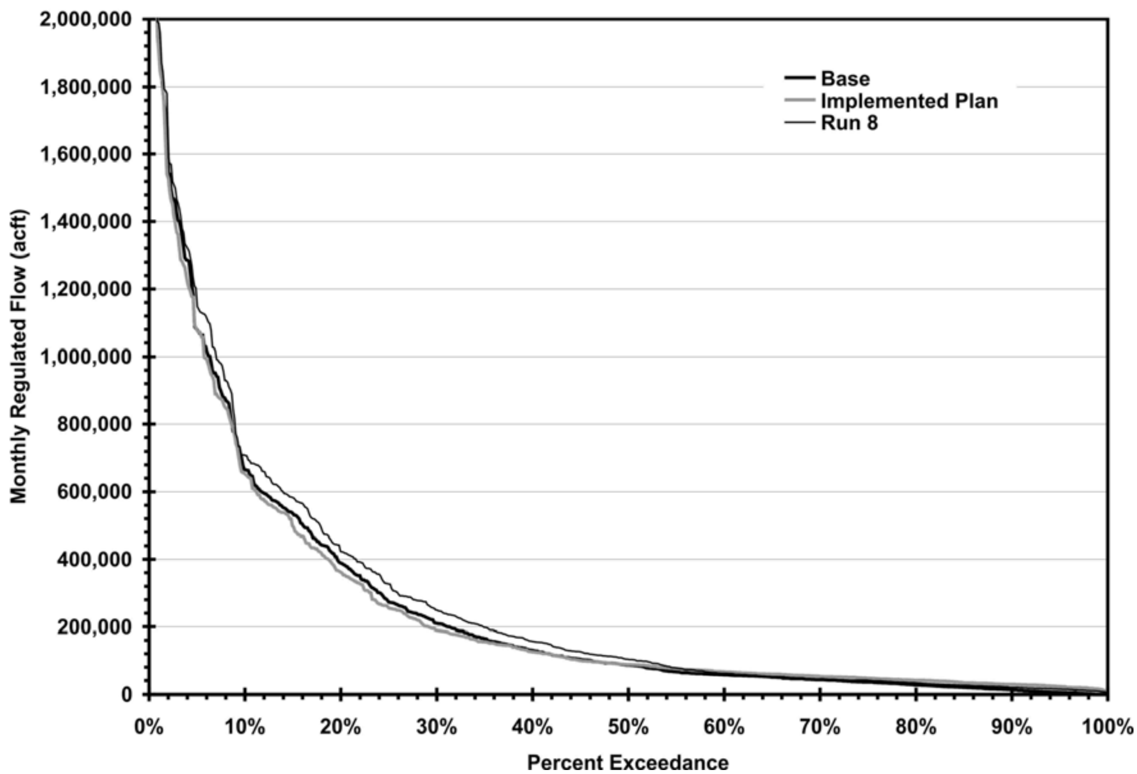
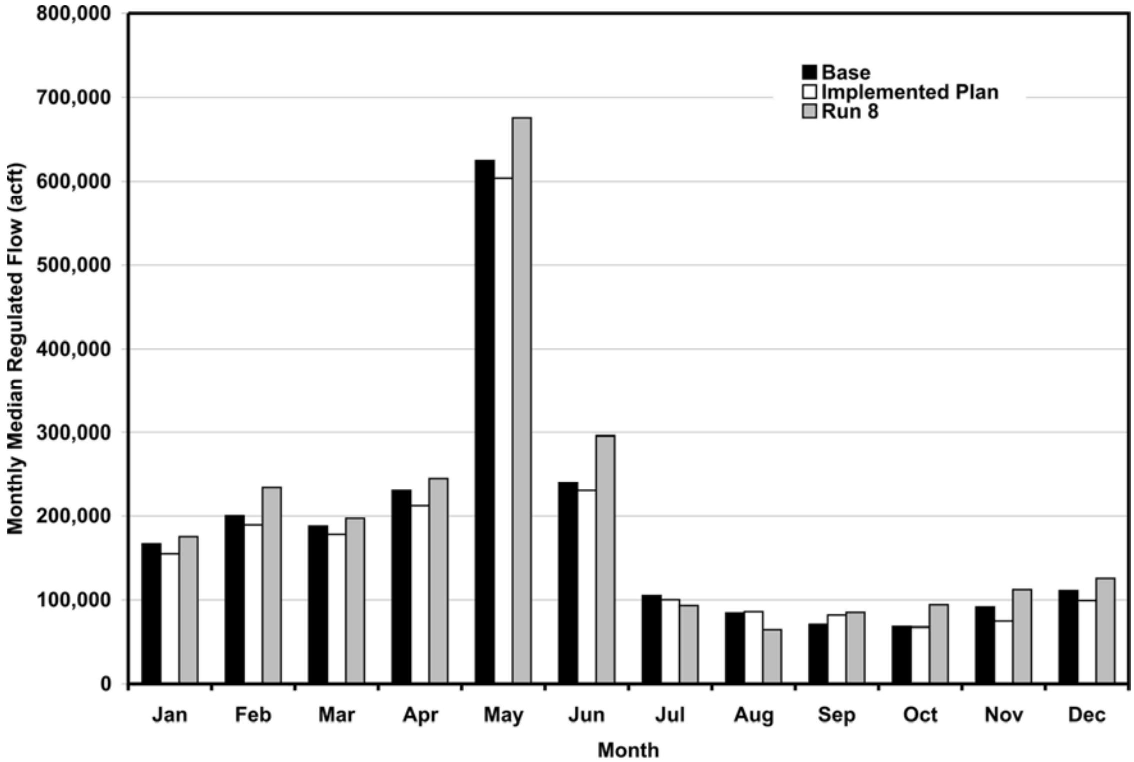


Figure 7-7. Brazos River near Bryan



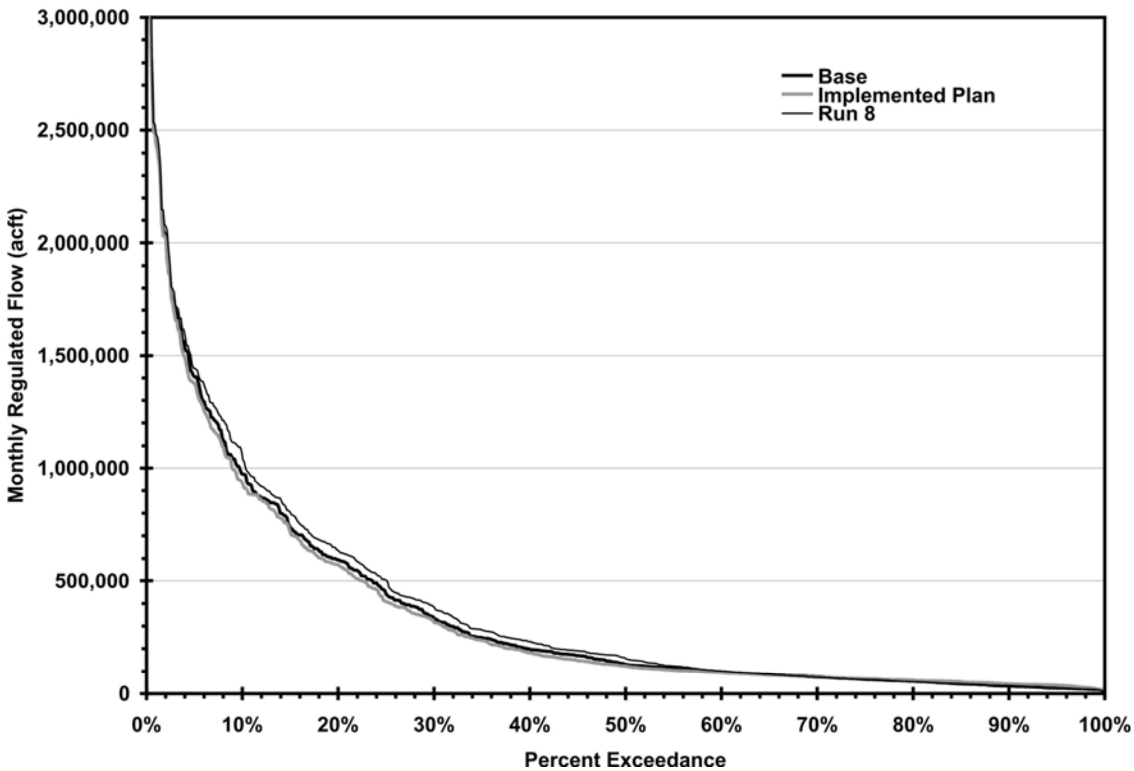
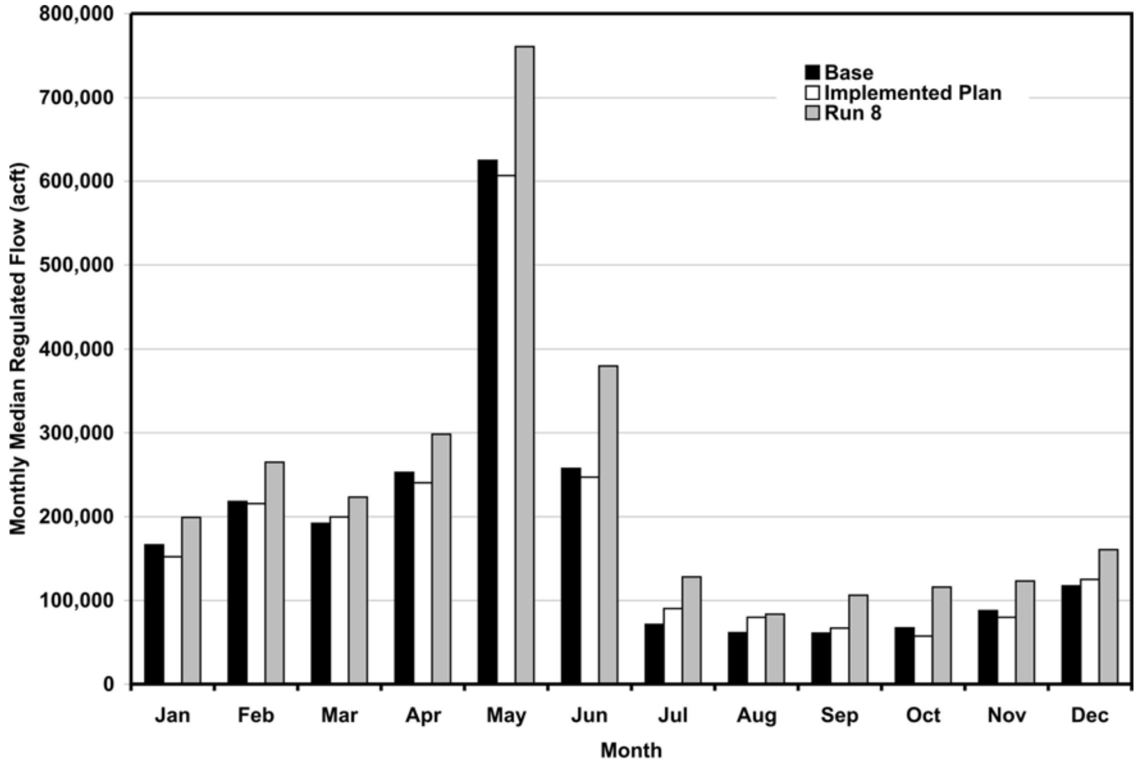


Figure 7-8. Brazos River near Hempstead



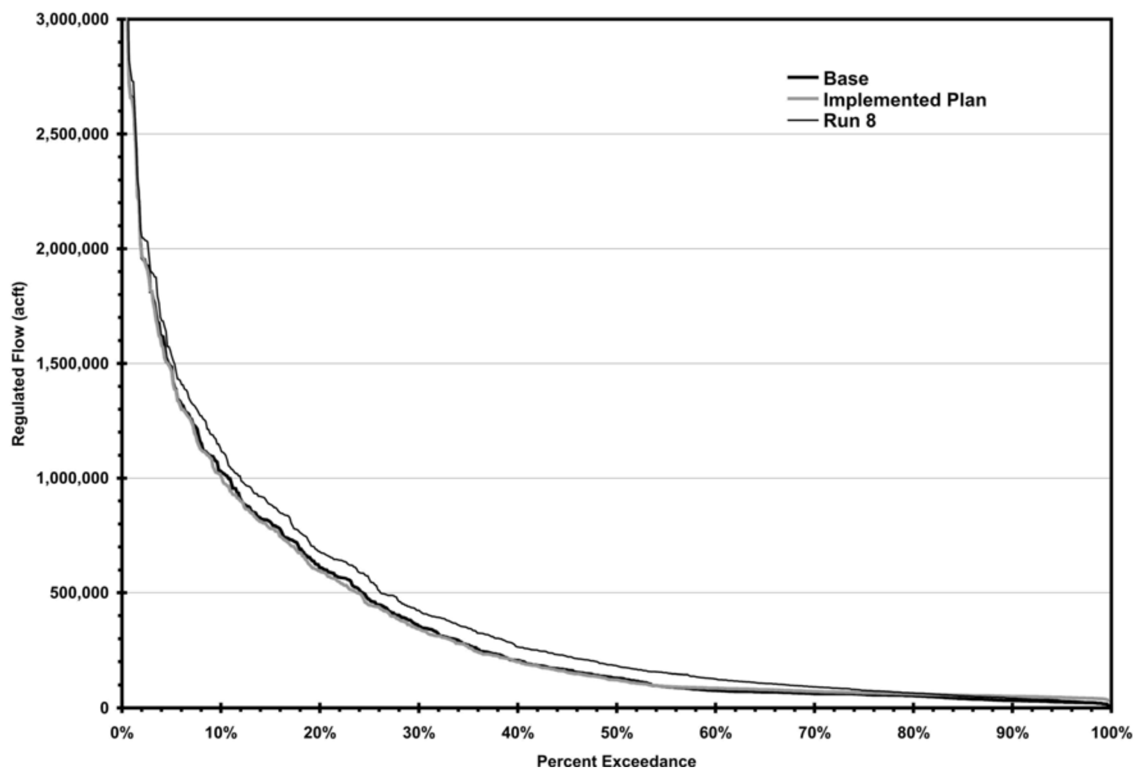


Figure 7-9. Brazos River at Richmond

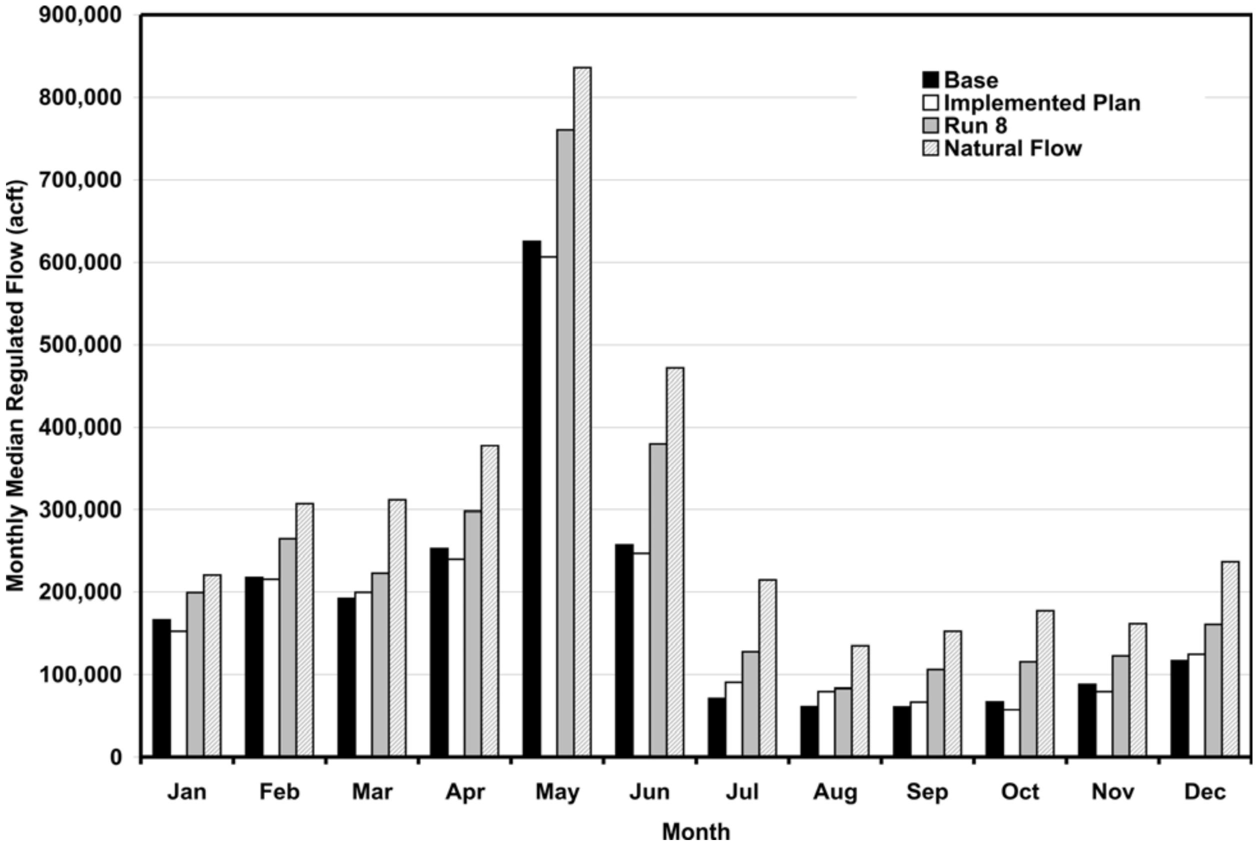


Figure 7-10. Brazos River at Richmond – Comparison of Regulated and Natural Flows

7.1.2 Groundwater

Overall increases in groundwater usage in the Brazos G Area are projected to be relatively small, and are concentrated on development of the Carrizo-Wilcox Aquifer in Brazos, Burleson, Lee and Milam Counties, and some modest increases in use of the Trinity and Gulf Coast Aquifers. Strategies recommending additional groundwater development total 66,249 acft/yr of new groundwater supply developed. This represents a 19.7 percent increase over developed groundwater supplies in the year 2000. While this is a modest increase overall in the region, it is concentrated in just a few areas, which could experience noticeable groundwater or artesian level declines. As none of the strategies increase projected groundwater pumpage beyond the estimated groundwater availability from any single aquifer in any county, projected declines are expected to be within a range that the Brazos G RWPG considers manageable.

7.2 Summary of the Environmental Effects of the Plan

Overall, the strategies recommended in the 2006 Brazos G Regional Water Plan will have limited negative effects on the environment. The largest localized impacts will be from new reservoirs. New reservoirs recommended as strategies in the 2006 Brazos G Plan (Breckenridge Reservoir, Palo Pinto Off-Channel Reservoir, Millers Creek Diversion Dam, Wheeler Branch Off-Channel Reservoir and Brushy Creek Reservoir) will inundate less than 9,000 acres, reducing wildlife habitat, bottomland hardwood forestland and cultivated farmland as documented in the individual strategy evaluations (Volume II, Sections 4B.12 and 4B.13). However, permitting for these projects will require mitigation land of at least equal ecological value, reducing the negative environmental consequences of the projects. Streamflows immediately downstream from these projects will decrease, but permit requirements will also specify reservoir pass-through flows necessary to maintain ecological health in the downstream receiving stream.

Many elements of the 2006 Brazos G Plan augment existing resources and delay or eliminate the need for new constructed projects. For example, the BRA's proposed System Operations will make better use of existing reservoir facilities and make available additional supply that previously would have only been made available through construction of a major water supply project. Utilization of water from the Colorado River Basin's Highland Lakes System in Williamson County eliminates the need for a new major water supply project to serve Williamson County needs. The utilization of indirect reuse of water from Joe Pool Reservoir by Johnson County SUD will extend dwindling supplies in the Trinity Aquifer and make extended use of the facilities of Joe Pool Reservoir. Municipal conservation targets in the plan could increase supplies by over 15,000 acft/yr, with conservation overall accounting for 39,000 acft of new supply. Reuse of highly-treated wastewater effluent is a supply source that will continue to be utilized, and also reduces dependence on large constructed projects. Augmentation of Lake Granger through conjunctive use of groundwater reduces sole dependence on either supply, and maximizes the use of the existing reservoir facility.

Overall the strategies recommended in the 2006 Brazos G Regional Water Plan maximize use of existing resources and reduce the need for several large, costly reservoir projects, minimizing impacts to the environment.

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Section 8
Recommendations for Unique Stream Segments, Unique Reservoir Sites and Other Legislative Recommendations [31 TAC §357.7(a)(8-9); 31 TAC §357.8; and 31 TAC §357.9]

8.1 Recommendations Concerning River and Stream Segments Having Unique Ecological Value

Regional water planning groups are given the option of designating stream segments having "unique ecological value" within their planning areas. Five criteria are utilized to identify such segments:

1. Biological Function
   - Quantity (acreage or areal extent of habitat)
   - Quality (biodiversity, age, uniqueness)
2. Hydrologic Function
   - Water Quality
   - Flood Attenuation and Flow Stabilization
   - Groundwater Recharge and Discharge
3. Occurrence of Riparian Conservation Areas
4. Occurrence of High Water Quality, Exceptional Aquatic Life or High Aesthetic Value
5. Occurrence of Threatened or Endangered Species and/or Unique Communities

In 2000, Hicks & Company prepared a report for the Brazos G RWPG identifying 19 stream segments within the Brazos G Area meeting one or more of the criteria[1]. The Hicks analysis identified 11 segments that had already been identified by the Texas Parks and Wildlife Department in 2000, plus an additional eight segments. A copy of the Hicks & Company report is posted on the Brazos G website (www.brazosgwater.org). In 2002, the TPWD updated its list with an additional four segments. Table 8-1 lists those stream segments identified in the Hicks & Company report and by TPWD as candidates for designation.

The Brazos G Regional Water Planning Group has chosen not to designate any stream segments as having unique ecological value.

[1] Hicks & Company, *River and Stream Segments of Unique Ecological Value in the Brazos G Regional Water Planning Area*, Final Report, prepared for the Brazos G Regional Water Planning Group, August 2000.

Table 8-1.
Stream Segments in the Brazos G Regional Water Planning Area Identified as Candidates for Designation as Unique Stream Segments

Candidate Stream Segment	Source of Original Identification	Year Identified
Brazos River – Bosque, Johnson, Somervell & Hood Counties	TPWD	2000
Brazos River – Palo Pinto County	TPWD	2000
Clear Fork of the Brazos River – Stephens County	Hicks & Company	2000
Colony Creek – Eastland County	TPWD	2000
Colorado River – Lampasas County	TPWD	2000
Cow Bayou – Falls & McLennan Counties	TPWD	2000
East & Middle Yegua Creeks – Lee & Burleson Counties	Hicks & Company	2000
Lake Creek – Grimes County	TPWD	2000
Lampasas River – Lampasas & Hamilton Counties	Hicks & Company	2000
Leon River – Coryell & Bell Counties	Hicks & Company	2000
Little River – Milam & Bell Counties	TPWD	2000
Navasota River – Brazos & Grimes Counties	Hicks & Company	2000
Navasota River – Robertson & Leon Counties	Hicks & Company	2000
Neils Creek – Bosque County	TPWD	2000
Nolan River – Johnson & Hill Counties	Hicks & Company	2000
North Bosque River – McLennan County	Hicks & Company	2000
Paluxy River – Somervell, Hood, & Erath Counties	TPWD	2000
Steele Creek – Bosque County	TPWD	2000
Willis Creek – Williamson County	TPWD	2000
Double Mountain Fork Brazos River – from the confluence with Salt Fork Brazos River upstream to the Kent/Garza County Line	TPWD	2002
North Fork Double Mountain Brazos River – from the confluence with Double Mountain Fork Brazos River upstream to the Kent/Garza County Line	TPWD	2002
Salt Fork Brazos River – from Knox/Baylor County Line upstream to the Kent/Garza County Line	TPWD	2002
San Gabriel River – from the confluence with the Little River upstream to Granger Lake Dam	TPWD	2002

8.2 Recommendations Concerning Sites Uniquely Suited for Reservoirs

The Brazos G RWPG has chosen not to identify any sites uniquely suited for reservoir construction at this time.

8.3 Legislative and Policy Recommendations

The Brazos G RWPG established a Water Policy Workgroup to discuss various issues concerning State water policy and to formulate proposed positions for the planning group to consider for recommendation to the TWDB and the Texas Legislature. The Water Policy Workgroup developed a survey of Brazos G RWPG members that measured the planning group's level of interest in various subjects related to water policy in Texas. The survey was based largely on one developed and utilized by the Region H Water Planning Group. Table 8-2 presents a ranking by importance of those issues, based upon the survey results, for which the Brazos G RWPG has formulated policy recommendations. The Brazos G RWPG elected to not formulate a policy recommendation for those ranked issues not appearing in Table 8-2.

The Brazos G Regional Water Planning Group offers the following specific recommendations concerning State water policy to the TWDB and the Texas Legislature, organized by general topic.

Table 8-2.
Brazos G RWPG Priority Ranking of Water Policy Issues (Approved February 23, 2005) for which the Brazos G RWPG has Formulated Recommendations to the Texas State Legislature

Issue #	***Description***
1	Interaction of State Agencies with Regional Water Planning Groups
2	Coordination between Groundwater Conservation Districts and Regional Water Planning Groups
3	System Operation of Water Facilities
4	Interbasin Transfers (IBTs) of Surface Water
5	Rule of Capture in Groundwater
6	Sustainability and Groundwater Management
7	Conjunctive Use of Groundwater and Surface Water
8	Integrating Water Quality and Water Supply Considerations
9	Reuse/Return Flow
10	Watershed Planning/Source Water Protection
11	Education
13	Retail Customer Pricing (Conservation)
15	Effects of the Federal Safe Drinking Water Act (SDWA) on Small Water Supply Systems
19	Inter-Regional Cooperation/Inter-Regional Water Sharing

Topic: Conservation

Issue #13: Retail Customer Water Pricing

"The Brazos G Regional Water Planning Group recognizes that water management strategy planning includes having the most positive effect on retail water customer pricing balanced with maintaining a long-term reliable plan. Optimizing retail water pricing with a long-term source may include an interbasin transfer when it is determined to be in the best interest of the ratepayers.

Brazos G encourages retail water providers to seriously consider implementing an inclining block rate structure that would be consistent with best management practices for conserving water. By using this methodology, a properly designed rate allows a consistent price signal to the ratepayer, without over earnings to the utility. This increasingly favored approach heightens the interest in water conservation to the end users."

Topic: Environmental

Issue #8: Integrating Water Quality and Water Supply Considerations

"The Brazos G Regional Water Planning Group continues to support existing efforts of State Agencies to protect current and future sources of drinking water, including both groundwater and surface water supplies. We, as well as the Regulatory Agencies, are committed to ensuring both the quality and quantity of water for our constituents. We encourage all governmental agencies, when making decisions or influencing decisions regarding land and resource use, to give preference to alternatives to protect or enhance the quality of water whenever possible. As a planning group, protecting and enhancing these resources and sustaining our supply will always be among Brazos G's priority commitments.

Issue #10: Watershed Planning/Source Water Protection

"The Brazos G Regional Water Planning Group will promote water development policies to support efforts to protect both groundwater and surface water sources by encouraging sound business practices that will not adversely affect water quality. We support other agencies and organizations in their efforts to encourage responsible land management and will oppose any practice or action in our watersheds or recharge zones that could adversely affect our water resources. Maintaining our watershed health, economic sustainability and community viability are all critical elements in our water planning efforts. Sensible stewardship of the areas adjacent to and around river basins, sensitive sub-basins, aquifers and re-charge zones is essential for maintaining these elements. Through source water protection, Texas can promote equitable costs for water sources, present and future."

Topic: Groundwater

Issue #2: Coordination between Groundwater Conservation Districts and Regional Water Planning Groups

"The Brazos G Regional Water Planning Group is committed to working cooperatively with Groundwater Conservation Districts (GCDs) when developing the Regional Plan. Brazos G urges participation from the GCDs early on in the process of planning. The GCDs are requested to review water demand, population projections, and water availability numbers for their respective Districts and comment accordingly.

Brazos G is committed to the sustainable use of groundwater and will not adopt water management strategies that will substantially deplete the aquifers. Brazos G does recognize that there are several definitions of sustainability and the Group will determine the necessary philosophy of sustainability in accordance with aquifer conditions and any applicable state rules and regulations.

If there are disagreements between the Brazos G and a GCD, the GCD must notify the Brazos G Administrative Agency and consultants and then try to work out any differences. If the differences cannot be worked out, the issue will be referred to the Groundwater Committee of the Brazos G and they will consider and recommend to the entire Group any necessary action."

Issue #5: Rule of Capture

"While the Brazos G Regional Water Planning Group recognizes that the Rule of Capture has a history of over 100 years in Texas, the Group also recognizes the advances in science and changes in water marketing that now face us.

The Group recognizes that the State groundwater supply is being threatened and, in many instances landowners risk loss due to depletion by unlimited pumping by their neighbors.

Local control through checks and balances can most effectively and fairly regulate usage. When the public chooses, Groundwater Conservation Districts are the appropriate mechanisms to provide local control of groundwater. The State should continue to develop policy and legislation to fairly protect both historic use and future sustainability."

Issue #6: Sustainability and Groundwater Management

"The Brazos G Regional Water Planning Group is committed to the sustainable use of groundwater. The sustainable use of groundwater is an approach to the use of groundwater that does not result essentially in the total depletion of the groundwater resource or the deterioration of the environmental quality of the area dependant on the groundwater resource. There are several key benchmarks that may be used to determine the annual amount of sustainable groundwater use in an area (availability). The benchmarks that may be employed to determine groundwater availability include but are not limited to; the amount of draw down from current water levels that is allowable, the maintenance of spring flows or aquifer contributions to surface water systems or the amount of recharge occurring in the aquifer."

Issue #7: Conjunctive Use of Groundwater and Surface Water

"The Brazos G Regional Water Planning Group recognizes conjunctive use as an important management strategy. Conjunctive use is the systematic blending of groundwater with surface water to optimize the combined yield from both sources. Conjunctive use seeks to maximize the advantages and minimize the disadvantages of each source when both are blended together. As conjunctive use projects are recognized, they should be included as management strategies for the regional water plan. Water providers should explore resources and mechanisms which promote conjunctive use projects. Brazos G encourages development of conceptual modeling for alternative conjunctive use projects, including aquifer storage and recovery (ASR) operations as needed."

Topic: Innovative Strategies

Issue #9: Reuse/Return Flow

"The Brazos G Regional Water Planning Group recognizes that return flows should be managed. Municipalities and other entities may manage by direct and indirect reuse within their

ETJs and CCN where applicable. River Authorities and/or other regional entities may manage all return flows otherwise not used. No action should be taken that will be a disincentive for return flows into a stream. Any management of return flows should be evaluated to determine its impact on environmental instream flows."

Topic: Rural Water

Issue #15: Effects of the Federal Safe Drinking Water Act (SDWA) on Small Water Supply Systems

"Because of the difficulty in meeting the standards of the Federal Safe Drinking Water Act for small water systems, the Brazos G Regional Water Planning Group encourages the regionalization of these systems, and/or education and proactive planning. This approach would prevent systems from being a burden to the State because of noncompliance."

Topic: Surface Water

Issue #3: System Operation of Water Facilities

"The Brazos G Regional Water Planning Group recognizes the inherent benefit of system operations of existing water supply sources and recommends that State water planning as well as permitting continue to promote such water management strategies.

System operation involves coordinated operation of two or more water supply sources (including reservoirs and run-of-river diversions) such that the system yield is greater than the sum of the individual sources.

System operation provides several significant benefits to the State, including: better utilization of existing infrastructure; increased water supply to meet needs; delay or avoidance of expensive new water supply infrastructure; and, reduced environmental impact potentially occurring due to major new projects."

Issue #4: Interbasin Transfers (IBTs) of Surface Water

"The Brazos G Regional Water Planning Group recognizes that Interbasin Transfers have been a critical component of water management in Region G, as there are currently over 80 permitted IBTs statewide. The Texas Water Development Board projects that the State's population will double in the next 50 years. It is intuitive that IBTs will be a necessary component of the water management strategies. The real issue is how to accomplish future IBTs in fairness."

Topic: Other Issues

Issue #1: Interaction of State Agencies with Regional Water Planning Groups

"The Brazos G Regional Water Planning Group recognizes that all State agencies, when planning and/or permitting significant new regional water projects, needs to be consistent with the current statewide water plan and to become involved with Regional Water Planning Groups with significant new regional water projects and/or permits."

Issue #2: Education

"The Brazos G Regional Water Planning Group believes strongly that water education is important and recommends to the State Legislature creation of a Water Conservation Awareness Program through the Texas Water Development Board, a statewide water conservation awareness campaign, funding for ongoing water education programs through River Authorities and similar programs."

Issue #19: Inter-Regional Cooperation/Inter-Regional Water Sharing

"The Brazos G Regional Water Planning Group will be proactive in communication and interaction with neighboring Regional Water Planning Groups on water issues of mutual concern. Regional Water Planning Areas are not intended to be barriers to prevent interaction between Regional Water Planning Groups."

Section 9
Report to the Legislature on
Water Infrastructure Funding Recommendations
[31 TAC §357.7(a)(14)]

9.1 Introduction

Senate Bill 2 (77th Texas Legislature) requires that an Infrastructure Financing Report (IFR) be incorporated into the regional water planning process. In order to meet this requirement, each regional water planning group (RWPG) is required to examine the funding needed to implement the water management strategies and projects identified and recommended in the region's January 2006 regional water plan.

9.2 Objectives of the Infrastructure Financing Report

The primary objectives of the Infrastructure Financing Report are as follows:

- To determine the financing options proposed by political subdivisions to meet future water infrastructure needs (including the identification of any State funding sources considered); and
- To determine what role(s) the RWPGs propose for the State in financing the recommended water supply projects.

9.3 Methods and Procedures

For the Brazos G Regional Water Planning Area, all municipal water user groups having water needs and recommended water management strategies in the regional plan with an associated capital cost were surveyed using the questionnaire provided by the TWDB (Exhibit 9-A). For individual cities the survey was mailed to either the mayor or the city manager.

The surveys were mailed via first class U.S. Mail, along with supporting documentation that summarized the water management strategies included in the regional plan for that entity.

9.4 Survey Responses

The Brazos G RWPG mailed survey packages to 29 municipal water user groups and received 10 responses, a 34 percent response rate. Copies of the completed surveys and related documentation are included in Exhibit 9-B. As shown in Table 9-1, the 10 responses represent about 89 percent of the estimated capital costs of water management strategies included in the

Table 9-1.
Summary of Survey Responses

Name of Political Subdivision	Recommended Project/Strategy	Implementation Date	Capital Cost to be Paid by Political Subdivision	Planning on Implementing the Recommended Strategy? (Y/N)	Cash Reserves	Bonds	Bank Loans	Govt. Programs (Federal)	Govt. Programs (State)	Other
Brazos River Authority	BRA System Operation	2007	$ 221,630,000	Y	$4,432,600	$128,545,400	$0	$44,326,000	$44,326,000	$0
Brazos River Authority	Groundwater Development	2015	$ 238,641,000	Y	$4,772,820	$138,411,780	$0	$47,728,200	$47,728,200	$0
Brazos River Authority	Lake Granger Augmentation	2045	$ 303,288,000	Y	$6,065,760	$175,907,040	$0	$60,657,600	$60,657,600	$0
Childress Creek WSC	Purchase water from City of Clifton	2007	$ 2,299,000	Y	$229,900	$0	$0	$0	$2,069,100	$0
City of Abilene	Water Supply from WCBSOP	2007	$ 99,027,500	Y	$0	$40,601,275	$0	$18,815,225	$39,611,000	$0
City of Cedar Park	Purchase water from LCRA	2025	$ 81,748,000	N	$0	$0	$0	$0	$0	$0
City of Round Rock	Reuse	2007	$ 6,369,000	Y	$0	$4,776,750	$0	$0	$636,900	$955,350
City of Round Rock	LCRA/BRA Alliance	2015	$ 101,336,000	Y	$0	$76,002,000	$0	$0	$10,133,600	$15,200,400
City of Round Rock	Lake Granger Augmentation	2045	$ 83,642,581	N	$0	$0	$0	$0	$0	$0
Johnson County SUD	Reuse from Trinity River Authority	2025	$ 79,257,000	Y	$2,377,710	$37,250,790	$0	$0	$39,628,500	$0
Lee County WSC	Carrizo-Wilcox Aquifer Development	2007	$ 1,762,000	N	$0	$0	$0	$0	$0	$0
North Central Texas MWA	Lake Creek Diversion	2007	$ 18,222,000	Y	$911,100	$6,559,920	$0	$4,191,060	$6,559,920	$0
Palo Pinto County MWD #1	Lake Palo-Pinto OCR	2035	$ 19,314,000	Y	$4,249,080	$15,064,920	$0	$0	$0	$0
West Central Texas MWD	West Central Brazos System Optimization Plan	2007	$ 99,027,500	Y	$0	$40,601,275	$0	$18,815,225	$39,611,000	$0
		Totals	**$1,355,563,581**		**$23,038,970**	**$663,721,150**	**$0**	**$194,533,310**	**$290,961,820**	**$16,155,750**
DID NOT RESPOND										
Aqua WSC	Carrizo-Wilcox Aquifer Development	2015	$ 1,047,000							
Chisholm Trail SUD	Lake Granger Augmentation	2045	$ 18,518,000							
City of Bryan	Wastewater Reuse	2045	$ 6,485,000							
City of Bryan	Carrizo-Wilcox Aquifer Development	2045	$ 2,384,286							
City of College Station	Wastewater Reuse	2035	$ 2,358,000							
City of College Station	Carrizo-Wilcox Aquifer Development	2015	$ 33,380,000							
City of Florence	Groundwater Development	2025	$ 803,500							
City of Giddings	Carrizo-Wilcox Aquifer Development	2025	$ 2,099,000							
City of Groesbeck	Carrizo-Wilcox Aquifer Development	2055	$ 566,000							
City of Liberty Hill	Purchase from LCRA	2007	$ 10,217,000							
City of Marlin	Brushy Creek Reservoir	2007	$ 6,301,610							
City of Meridian	Purchase water from City of Clifton	2007	$ 2,261,000							
City of Rising Star	Voluntary Redistribution	2007	$ 50,000							
City of Rising Star	Nitrate Treatment	2007	$ 694,000							
City of Strawn	Purchase from Eastland Co. WSD	2015	$ 1,488,262							
City of Sweetwater	Chamption Well Field	2007	$ 17,060,471							
City of Sweetwater	Wastewater Reuse	2007	$ 2,115,000							
City of Throckmorton	Midway Pipeline Project	2007	$ 2,465,337							
City of Valley Mills	Purchase water from City of Clifton	2007	$ 3,916,000							
City of Waco	Wastewater Reuse	2007	$ 34,143,000							
City of Walnut Springs	Purchase water from City of Clifton	2007	$ 3,991,000							
Southwest Milam WSC	Carrizo-Wilcox Aquifer Development	2025	$ 2,079,000							
Wickson Creek SUD	Carrizo-Wilcox Aquifer Development	2007	$ 6,556,786							
		Total	**$ 160,979,252**							

Regional Water Plan. Of those responding, for which total capital costs are $1,355,563,581, the survey shows that approximately $23 million (1.5 percent of the total capital costs) would be paid from local cash reserves. Approximately $663.7 million (43.8 percent of the total capital costs) would be financed through bonds, $194.5 million (12.8 percent of the total capital costs) would be paid with Federal Government programs, $291 million (19.2 percent of the total capital costs) would be financed through State Government programs, and $16.2 million (1.1 percent of the total capital costs) would be financed through other means. Some entities did not provide quantifiable responses to the survey due to concerns about data accuracy and the potential for the amounts given to be taken out of context. It is also important to note that it is unclear how the remaining 21.6 percent of the capital costs ($328,131,833) (for those entities not responding or indicating that they would not implement the recommended plan) would be financed. Table 9-2 provides a brief summary of responses from all utilities that provided written comments.

With respect to the role of the State in financing the recommended water supply projects, significant State participation is required in order to provide adequate funding for the implementation of water management strategies in the plan.

Table 9-2.
Survey Responses — Comments and Proposed Options
Brazos G Regional Water Planning Area

ABILENE	Possible sources of State funding include the State Participation Fund, Drinking Water SRF, TWDB Fund II, Water Infrastructure Fund, and the Rural Water Assistance Fund.
BRAZOS RIVER AUTHORITY	See comments in Exhibit 9-B.
CEDAR PARK	The projected shortages in this plan are incorrect for Cedar Park. Cedar Park's water demand projections are for 18,600 acft/yr at full build out, which will result in a shortage of only 600 acft/yr.
CHILDRESS CREEK WSC	We are not prepared to implement a plan in 2007. Our needs probably need to be addressed around 2010 to 2015. We will however work with Region G and other Bosque County entities in implementing the plan, whatever the date.
JOHNSON COUNTY SUD	An engineering study is currently ongoing to search for alternative sources in the Trinity Basin to meet the future needs of our system in the Trinity Basin.
LEE COUNTY WSC	See comments in Exhibit 9-B.
NORTH CENTRAL TEXAS MWA	The TWDB's State Participation Program is needed to interim ownership of one-half of the additional water supply in excess of the existing customers' long-term needs.
ROUND ROCK	Does not plan on implanting the Lake Granger Augmentation project.
WEST CENTRAL TEXAS MWD	Possible sources of State funding include the State Participation Fund, Drinking Water SRF, TWDB Fund II, Water Infrastructure Fund, and the Rural Water Assistance Fund.

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Exhibit 9-1
TWDB IFR Survey Form

INFRASTRUCTURE FINANCING SURVEY

To Obtain Financing Information from Water Suppliers with Water Needs

Brazos G Regional Water Planning Group

Water Supplier (WUG or WWP)

Recommended Project/Water Management Strategy	Implementation Date	Capital Cost to be Paid by Water Supplier	ID # from DB07
Total Cost of Capital Improvements		$0	

Are you planning to implement the recommended projects/strategies? Yes____ No ____

If "no," please describe how you will meet your future water needs? (Use additional pages if needed.)

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by the Brazos G Regional Water Planning Group, as listed above?
Please indicate:
(1) Funding source(s)[1] by checking the corresponding row(s), and
(2) Percent share of the total cost to be met by each funding source.

Potential Funding Sources	Source to be Used	Percent (%)
Cash Reserves		
Bonds (General Obligation and Contract Revenue)		
Bank Loans		
Federal Government Programs		
State Government Programs; i.e.: TWDB Funding Sources		
Other		
Total (Sum should equal 100 %)		

[1] Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

If state government programs are to be utilized for funding, indicate the programs and the provisions (shares) of those programs. (Attach additional pages if needed.)
(See TWDB web site www.twdb.state.tx.us/Assistance.)

Person Completing this form:

Name	Title	Phone No.

Please Return by October 14, 2005 to
Ms. Teresa Clark
Brazos River Authority
P.O. Box 7555
Waco, TX 76714

Exhibit 9-B
IFR Survey Form Responses

INFRASTRUCTURE FINANCING SURVEY

To Obtain Financing Information from Water Suppliers with Water Needs

Brazos G Regional Water Planning Group

Water Supplier (WUG or WWP) **Abilene**

Recommended Project/Water Management Strategy	Implementation Date	Capital Cost to be Paid by Water Supplier	ID # from DB07
Conservation	2007	$0	G2.1
Water Supply from WCBSOP	2007	$99,027,500	G12.1, G26, G28
Total Cost of Capital Improvements		$99,027,500	

Are you planning to implement the recommended projects/strategies? Yes_xx_ No ____

If "no," please describe how you will meet your future water needs? (Use additional pages if needed.)

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by the Brazos G Regional Water Planning Group, as listed above?
Please indicate:
(1) Funding source(s)[1] by checking the corresponding row(s), and
(2) Percent share of the total cost to be met by each funding source.

Potential Funding Sources	Source to be Used	Percent (%)
Cash Reserves		
Bonds (General Obligation and Contract Revenue)	$40,027,500	
Bank Loans		
Federal Government Programs	$19,000,000	
State Government Programs; i.e.: TWDB Funding Sources	$40,000,000	
Other		
Total (Sum should equal 100 %)	$99,027,500	

[1] Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

If state government programs are to be utilized for funding, indicate the programs and the provisions (shares) of those programs. (Attach additional pages if needed.)
(See TWDB web site www.twdb.state.tx.us/Assistance.)

* State Participation Fund * Water Infrastructure Fund
* Drinking Water SRF * Rural Water Assistance Fund
* TWDB Fund II

Person Completing this form:

Name	Title	Phone No.
Tommy O'Brien	Director Water Utilities	325-676-6416

Please Return by October 21, 2005 to
Ms. Teresa Clark
Brazos River Authority
P.O. Box 7555
Waco, TX 76714

INFRASTRUCTURE FINANCING SURVEY

To Obtain Financing Information from Water Suppliers with Water Needs

Brazos G Regional Water Planning Group

Water Supplier (WUG or WWP) **Johnson County SUD**

Recommended Project/Water Management Strategy	Implementation Date	Capital Cost to be Paid by Water Supplier	ID # from DB07
Conservation	2007	$0	G2.1
Reuse from Trinity River Authority	2025	$79,257,000	G11
Total Cost of Capital Improvements		$79,257,000	

Are you planning to implement the recommended projects/strategies? Yes ✓ No ____

If "no," please describe how you will meet your future water needs? (Use additional pages if needed.)

Engineering study is currently ongoing to search for alternative sources ~~[illegible]~~ in the Trinity Basin to meet the future needs of our system in the Trinity basin.

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by the Brazos G Regional Water Planning Group, as listed above?

Please indicate:

(1) Funding source(s)[1] by checking the corresponding row(s), and

(2) Percent share of the total cost to be met by each funding source.

Potential Funding Sources	Source to be Used	Percent (%)
Cash Reserves		3%
Bonds (General Obligation and Contract Revenue)		47%
Bank Loans		
Federal Government Programs		
State Government Programs; i.e.: TWDB Funding Sources		50%
Other		
Total (Sum should equal 100 %)		

[1] Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

If state government programs are to be utilized for funding, indicate the programs and the provisions (shares) of those programs. (Attach additional pages if needed.)
(See TWDB web site www.twdb.state.tx.us/Assistance.)

To be determined later

Person Completing this form:

Terry Kelley — Name

General Manager — Title

817-645-6646 — Phone No.

Please Return by October 21, 2005 to
Ms. Teresa Clark
Brazos River Authority
P.O. Box 7555
Waco, TX 76714

INFRASTRUCTURE FINANCING SURVEY

To Obtain Financing Information from Water Suppliers with Water Needs

Brazos G Regional Water Planning Group

Water Supplier (WUG or WWP) **Brazos River Authority**

Recommended Project/Water Management Strategy	Implementation Date	Capital Cost to be Paid by Water Supplier	ID # from DB07
BRA System Operation	2007	$221,630,000	HG01BRASYS
Groundwater Development (Carrizo-Wilcox)	2015	$238,641,000	G15.1
BRA System Operation - Lake Granger Augmentation	2045	$303,288,000	G5
Chloride Control Projects (not studied)			
Total Cost of Capital Improvements		$763,559,000	

Are you planning to implement the recommended projects/strategies? **Yes** X* **No** ____

If "no," please describe how you will meet your future water needs? (Use additional pages if needed.)

* See Attached

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by the Brazos G Regional Water Planning Group, as listed above?
Please indicate:
(1) Funding source(s)[1] by checking the corresponding row(s), and
(2) Percent share of the total cost to be met by each funding source.

Potential Funding Sources	Source to be Used	Percent (%)
Cash Reserves		2
Bonds (General Obligation and Contract Revenue)		58
Bank Loans		
Federal Government Programs		20
State Government Programs; i.e.: TWDB Funding Sources		20
Other		
Total (Sum should equal 100 %)		100

[1] Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

If state government programs are to be utilized for funding, indicate the programs and the provisions (shares) of those programs. (Attach additional pages if needed.)
(See TWDB web site www.twdb.state.tx.us/Assistance.)
State Participation for excess capacity in regional systems.

Person Completing this form:

Name	Title	Phone No.
David C. Wheelock	Water Services Manager	254-761-3158

Please Return by October 21, 2005 to
Ms. Teresa Clark
Brazos River Authority
P.O. Box 7555
Waco, TX 76714

BRAZOS RIVER AUTHORITY
INFRASTRUCTURE FINANCING SURVEY ATTACHMENT
October 20, 2005

BRA System Operation: BRA is pursuing implementation of this strategy and anticipates receiving its water right permit for System Operation prior to 2010 at a cost of approximately $5 - $7 million. The estimated capital cost of $221,630,000 shown in the Infrastructure Financing Survey for this strategy appears to be a summation of costs for infrastructure related to various intake, transmission, and treatment systems as detailed in Volume II of the Plan. Implementation of these systems and associated costs will be incurred at various points later in the 55-year planning period.

Groundwater Development (Carrizo-Wilcox): The Groundwater Development (Carrizo-Wilcox) project is a potential alternative to the BRA System Operation – Lake Granger Augmentation Project (See attached BRA comments on Initially Prepared Plan). It is unlikely that both projects would be implemented on the scale shown here. BRA is not currently pursuing implementation of this stand-alone project.

BRA System Operation – Lake Granger Augmentation: This project includes development of approximately 30,000 af/year of groundwater to use conjunctively with surface water from Lake Granger. BRA is pursuing implementation.

BRAZOS RIVER AUTHORITY
DETAILED COMMENTS ON JUNE 2005 INITIALLY PREPARED
BRAZOS G REGIONAL WATER PLAN

VOLUME I

SECTION 4A. – DEMAND/SUPPLY COMPARISON

Page 4A-13: Table 4A-6

- Regarding footnote 1 associated with Little River System, suggest listing or referencing another appropriate section of the report that details the future demand of 31,000 acre-feet (who, how much?) associated with the increase from 210,023 in 2040 to 241,023 in 2050.
- Regarding footnote 1 associated with Main Stem/Lower Basin System (Brazos G) suggest listing or referencing another appropriate section of the report that details how much of the projected demands are existing contracts/customers and how much/who are future demands met by BRA System Operations in Region G.
- Regarding footnote 2 associated with Main Stem/Lower Basin System (Region H), suggest final coordination with Region H and BRA to accurately list these demands so that there is consistency between the two plans.

SECTION 4C. – WATER SUPPLY PLANS

Page 4C-250, Section 4C.36.14: Liberty Hill WSC is in discussion with BRA on the possible purchase of water from Lake Stillhouse Hollow and participation in the WCRWL. Suggest coordination with Liberty Hill on adding this source of water as an alternative supply.

Pages 4C-263 & 264, Sections 4C.38.1.1 & 2: Suggest noting that the shortages stated for the Lake Aquilla System are based on a supply/contract amount comparison as opposed to a supply/demand comparison. Also suggest noting that the 2060 supply (yield) value used in the report is based on estimates of sedimentation resulting from a 1995 hydrographic survey of the lake. More recent modeling and hydrographic survey data has indicated lower sedimentation rates, which, if sustained, will result in a greater supply availability from Lake Aquilla. BRA is actively monitoring sedimentation in this reservoir and has participated in programs aimed at reducing the sediment load to the reservoir.

Page 4C-265, Section 4C.38.2.1: Suggest noting here that the shortages stated for the BRA Little River System are based on a supply/contract amount comparison as opposed to a supply/demand comparison, and that they also assume a demand from new contracts of 31,000 acft/yr by 2040 (see related comment above regarding page 4A-13, Table 4-6).

Page 4C-267, Table 4C.38-3: Suggest detailing the new supply resulting from BRA Systems Operation (Lake Granger Conjunctive Use Project) into its surface water (26,127 acft/yr) and groundwater (28,263 acft/yr) components as was done in Table ES-3 in the Executive Summary. Also suggest listing the stand alone Groundwater Development strategy (35,000 afcft/yr) as an alternative as opposed to recommended.

Page 4C-267: Section 4C.38.3.1 – Suggest final coordination with BRA and Region H on values reported as shortages in this section and in Table 4C.38-4 (see related comment above regarding page 4A-13, Table 4-6).

INFRASTRUCTURE FINANCING SURVEY

To Obtain Financing Information from Water Suppliers with Water Needs

Brazos G Regional Water Planning Group

Water Supplier (WUG or WWP) **Cedar Park**

Recommended Project/Water Management Strategy	Implementation Date	Capital Cost to be Paid by Water Supplier	ID # from DB07
Conservation	2007	$0	G2.1
Purchase water from LCRA	2025	$81,748,000	G11.2
Total Cost of Capital Improvements		$81,748,000	

Are you planning to implement the recommended projects/strategies? Yes____ No ✓

If "no," please describe how you will meet your future water needs? (Use additional pages if needed.) The projected shortages in this plan are incorrect for Cedar Park. Cedar Park's projections are for 18,600 ac-ft at full build out. A shortage of only 600 ac-ft

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by the Brazos G Regional Water Planning Group, as listed above?
Please indicate:
(1) Funding source(s)[1] by checking the corresponding row(s), and
(2) Percent share of the total cost to be met by each funding source.

Potential Funding Sources	Source to be Used	Percent (%)
Cash Reserves		
Bonds (General Obligation and Contract Revenue)		
Bank Loans		
Federal Government Programs		
State Government Programs; i.e.: TWDB Funding Sources		
Other		
Total (Sum should equal 100 %)		

[1] Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

If state government programs are to be utilized for funding, indicate the programs and the provisions (shares) of those programs. (Attach additional pages if needed.)
(See TWDB web site www.twdb.state.tx.us/Assistance.)

Person Completing this form:

Name	Title	Phone No.
Kenneth Wheeler	Utility Treatment Mgr.	512-258-4121 ext. 6350

Please Return by October 21, 2005 to
Ms. Teresa Clark
Brazos River Authority
P.O. Box 7555
Waco, TX 76714

INFRASTRUCTURE FINANCING SURVEY

To Obtain Financing Information from Water Suppliers with Water Needs

Brazos G Regional Water Planning Group

Water Supplier (WUG or WWP) **Childress Creek WSC**

Recommended Project/Water Management Strategy	Implementation Date	Capital Cost to be Paid by Water Supplier	ID # from DB07
Purchase water from City of Clifton	2007	$2,299,000	G14.1
Total Cost of Capital Improvements		$2,299,000	

Are you planning to implement the recommended projects/strategies? **Yes** ___ **No** ___

If "no," please describe how you will meet your future water needs? (Use additional pages if needed.) We are not prepared to implement a plan in 2007. Our needs probably need to be addressed around 2010 - 2015. We will however work with Region G and other Bosque County entities in implementing the plan whatever the date.

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by the Brazos G Regional Water Planning Group, as listed above?
Please indicate:
(1) Funding source(s)[1] by checking the corresponding row(s), and
(2) Percent share of the total cost to be met by each funding source.

Potential Funding Sources	Source to be Used	Percent (%)
Cash Reserves	as available	10 %
Bonds (General Obligation and Contract Revenue)		
Bank Loans		
Federal Government Programs		
– State Government Programs; i.e.: TWDB Funding Sources		90 %
Other		
Total (Sum should equal 100 %)		100 %

[1] Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

If state government programs are to be utilized for funding, indicate the programs and the provisions (shares) of those programs. (Attach additional pages if needed.)
(See TWDB web site www.twdb.state.tx.us/Assistance.)

We will use any state program available to us.

Person Completing this form:

Name	Title	Phone No.
Calvin Rueter	President	254.675.2603

Please Return by October 21, 2005 to
Ms. Teresa Clark
Brazos River Authority
P.O. Box 7555
Waco, TX 76714

Lee County Water Supply Corp.
P.O. Box 8
1598 South Leon St
Giddings, TX 78942
Office 979-542-6213
Fax 979-542-7014

November 1, 2005

Ms. Teresa Clark
Brazos River Authority

Lee County Water Supply Corp. sincerely apologizes for our tardiness with this form, how ever I believe the information we will provide you with will be of some consequent.

Lee County WSC began a study in early 1999 on the development of the Carrizo-Wilcox, after our P.E.R. (Preliminary Engineering Report) and other studies necessary for funding through the USDA-RD, we began construction on this project finishing in 2003.
In the later part of 2003 Lee County WSC began production of these wells, sense this time all production from the Queen City has been discontinued.
At this time approximately 84.6% of our entire production comes from the Carrizo-Wilcox Aquifer with 15.6% coming from the Sparta.
At any given time Lee County WSC can serve its entire CCN with water from the Carrizo-Wilcox due to some good foresight by those in charge of this project.
We here at Lee County WSC are reporting our monthly water levels to the Lost Pines Ground Water District as to better manage the Aquifer.

Respectfully;
Lee County Water supply Corp.

Wade B. Dane
Assistant Manager

INFRASTRUCTURE FINANCING SURVEY

To Obtain Financing Information from Water Suppliers with Water Needs

Brazos G Regional Water Planning Group

Water Supplier (WUG or WWP) **Lee County WSC**

Recommended Project/Water Management Strategy	Implementation Date	Capital Cost to be Paid by Water Supplier	ID # from DB07
Carrizo-Wilcox Aquifer Development	2007	$1,762,000	G15.1
Carrizo-Wilcox Aquifer Development "Wells"	2003	1,271,099	
Plant Facilities	2003	1,911,702	
Total Cost of Capital Improvements		3,182,801	
Total Cost of Capital Improvements		$1,762,000	

Are you planning to implement the recommended projects/strategies? **Yes**____ **No** x

If "no," please describe how you will meet your future water needs? (Use additional pages if needed.) See letter attached.

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by the Brazos G Regional Water Planning Group, as listed above?
Please indicate:
(1) Funding source(s)[1] by checking the corresponding row(s), and
(2) Percent share of the total cost to be met by each funding source.

Potential Funding Sources	Source to be Used	Percent (%)
Cash Reserves		
Bonds (General Obligation and Contract Revenue)		
Bank Loans		
Federal Government Programs	USDA-RD	100%
State Government Programs; i.e.: TWDB Funding Sources		
Other		
Total (Sum should equal 100 %)		100%

[1] Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

If state government programs are to be utilized for funding, indicate the programs and the provisions (shares) of those programs. (Attach additional pages if needed.)
(See TWDB web site www.twdb.state.tx.us/Assistance.)

Person Completing this form:

Name: [signature] Title: Asst. Mgr. Phone No.: 979-542-6213

Please Return by October 21, 2005 to
Ms. Teresa Clark
Brazos River Authority
P.O. Box 7555

INFRASTRUCTURE FINANCING SURVEY

To Obtain Financing Information from Water Suppliers with Water Needs

Brazos G Regional Water Planning Group

Water Supplier (WUG or WWP) **North Central Texas MWA**

Recommended Project/Water Management Strategy	Implementation Date	Capital Cost to be Paid by Water Supplier	ID # from DB07
Lake Creek Diversion w/ a Priority Calls Agreement with BRA	2007	$18,222,000	G28
Total Cost of Capital Improvements		$18,222,000	

Are you planning to implement the recommended projects/strategies? **Yes** X **No** ____

If "no," please describe how you will meet your future water needs? (Use additional pages if needed.)

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by the Brazos G Regional Water Planning Group, as listed above?
Please indicate:
(1) Funding source(s)[1] by checking the corresponding row(s), and
(2) Percent share of the total cost to be met by each funding source.

Potential Funding Sources	Source to be Used	Percent (%)
Cash Reserves	Exist. Cust.	5
Bonds (General Obligation and Contract Revenue)	New Cust.	36
Bank Loans		
Federal Government Programs	Grants	23
State Government Programs; i.e.: TWDB Funding Sources	Participation	36
Other (Devine Intervention)		
Total (Sum should equal 100 %)		100

[1] **Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.**

If state government programs are to be utilized for funding, indicate the programs and the provisions (shares) of those programs. (Attach additional pages if needed.)
(See TWDB web site www.twdb.state.tx.us/Assistance.)

The TWDB's State Participation Program is needed for interim ownership of one-half of the additional water supply in excess of the existing customers long-term needs.

Person Completing this form:

Name	Title	Phone No.
Dolan Moore	Gen. Mgr.	(940)422-4051

Please Return by October 21, 2005 to
Ms. Teresa Clark
Brazos River Authority
P.O. Box 7555
Waco, TX 76714

INFRASTRUCTURE FINANCING SURVEY

To Obtain Financing Information from Water Suppliers with Water Needs

Brazos G Regional Water Planning Group

Water Supplier (WUG or WWP) **Palo Pinto County MWD #1**

Recommended Project/Water Management Strategy	Implementation Date	Capital Cost to be Paid by Water Supplier	ID # from DB07
Lake Palo Pinto Off-Channel Reservoir	2035	$19,314,000	G13.5
Total Cost of Capital Improvements		$19,314,000	

Are you planning to implement the recommended projects/strategies? Yes X No ____

If "no," please describe how you will meet your future water needs? (Use additional pages if needed.)

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by the Brazos G Regional Water Planning Group, as listed above?
Please indicate:
(1) Funding source(s)[1] by checking the corresponding row(s), and
(2) Percent share of the total cost to be met by each funding source.

Potential Funding Sources	Source to be Used	Percent (%)
Cash Reserves	X	22
Bonds (General Obligation and Contract Revenue)	X	78
Bank Loans		
Federal Government Programs		
State Government Programs; i.e.: TWDB Funding Sources		
Other		
Total (Sum should equal 100 %)		100

[1] Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

If state government programs are to be utilized for funding, indicate the programs and the provisions (shares) of those programs. (Attach additional pages if needed.)
(See TWDB web site www.twdb.state.tx.us/Assistance.)

Person Completing this form:

Name	Title	Phone No.
Scott Blasor	Secretary	(940)328-7712

Please Return by October 21, 2005 to
Ms. Teresa Clark
Brazos River Authority
P.O. Box 7555
Waco, TX 76714

INFRASTRUCTURE FINANCING SURVEY

To Obtain Financing Information from Water Suppliers with Water Needs

Brazos G Regional Water Planning Group

Water Supplier (WUG or WWP) **Round Rock**

Recommended Project/Water Management Strategy	Implementation Date	Capital Cost to be Paid by Water Supplier	ID # from DB07
Conservation	2007	$0	G2.1
Reuse	2007	$6,369,000	G3
LCRA/BRA Alliance	2015	$101,336,000	G11.2
BRA System Operation - Lake Granger Augmentation	2045	$83,642,581	G5
Total Cost of Capital Improvements		$191,347,581	

Are you planning to implement the recommended projects/strategies? **Yes____** **No ____**

If "no," please describe how you will meet your future water needs? (Use additional pages if needed.)

LCRA/ BRA Alliance - Yes
Lake Granger Augmentation - No

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by the Brazos G Regional Water Planning Group, as listed above?
Please indicate:
(1) Funding source(s)[1] by checking the corresponding row(s), and
(2) Percent share of the total cost to be met by each funding source.

Potential Funding Sources	Source to be Used	Percent (%)
Cash Reserves		
Bonds (General Obligation and Contract Revenue)	X	75%
Bank Loans		
Federal Government Programs		
State Government Programs; i.e.: TWDB Funding Sources	X	10%
Other Impact Fees	X	15%
Total (Sum should equal 100 %)		100%

[1] **Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.**

If state government programs are to be utilized for funding, indicate the programs and the provisions (shares) of those programs. (Attach additional pages if needed.)
(See TWDB web site www.twdb.state.tx.us/Assistance.)

Person Completing this form:

Tom Clark — Director of Utilities — 512-341-3146

Name **Title** **Phone No.**

Please Return by October 21, 2005 to
Ms. Teresa Clark
Brazos River Authority
P.O. Box 7555
Waco, TX 76714

INFRASTRUCTURE FINANCING SURVEY

To Obtain Financing Information from Water Suppliers with Water Needs

Brazos G Regional Water Planning Group

Water Supplier (WUG or WWP) **West Central Texas MWD**

Recommended Project/Water Management Strategy	Implementation Date	Capital Cost to be Paid by Water Supplier	ID # from DB07
West Central Brazos System Optimization Plan	2007	$99,027,500	G12.1, G26, G28
Total Cost of Capital Improvements		$99,027,500	

Are you planning to implement the recommended projects/strategies? Yes ✓ No ___

If "no," please describe how you will meet your future water needs? (Use additional pages if needed.)

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by the Brazos G Regional Water Planning Group, as listed above?
Please indicate:
(1) Funding source(s)[1] by checking the corresponding row(s), and
(2) Percent share of the total cost to be met by each funding source.

Potential Funding Sources	Source to be Used	Percent (%)
Cash Reserves		
Bonds (General Obligation and Contract Revenue)	$40,027,500	
Bank Loans		
Federal Government Programs	$19,000,000	
State Government Programs; i.e.: TWDB Funding Sources	$40,000,000	
Other		
Total (Sum should equal 100 %)	$99,027,500	

[1] Funding source refers to the initial capital funds needed to construct or implement a project, not the means of paying off loans or bonds used for the construction or implementation.

If state government programs are to be utilized for funding, indicate the programs and the provisions (shares) of those programs. (Attach additional pages if needed.)
(See TWDB web site www.twdb.state.tx.us/Assistance.)

State Participation Fund, Water Infrastructure Fund, Drinking Water SRF, Rural Water Assistance Fund, TWDB Fund II

Person Completing this form:

Name	Title	Phone No.
[signature]	CFO/Assistant General Manager	325-673-8254

Please Return by October 21, 2005 to
Ms. Teresa Clark
Brazos River Authority
P.O. Box 7555
Waco, TX 76714

Section 10
Adoption of Plan
[31 TAC §357.11-12]

10.1 Public Participation

The Brazos G Regional Water Planning Group (BGRWPG) provided considerable opportunity for the public to participate in the planning process. Notices and meeting agendas were posted prior to each meeting in accordance with State law, and these and other meeting materials were posted on the BGRWPG website (www.brazosgwater.org) as they became available prior to each meeting. The public was invited to speak during public comment periods during each planning group and committee meeting. In addition, stakeholders were often invited to participate in planning group and committee meetings (as formal items of the meeting agenda) to present information to the planning group that was pertinent to issues the planning group was considering. These groups included the Lost Pines Groundwater Conservation District, City of College Station, West Central Texas Municipal Water District, City of Waco, Brazos River Authority, National Wildlife Federation, Palo Pinto County Municipal Water District No. 1, Texas Parks and Wildlife Department, Texas Water Development Board, Texas General Land Office, Sierra Club, Texas Water Conservation Association Reuse Committee, Lake Alan Henry Water Supply District, Walnut Creek Mining Company, San Antonio Water System, Stuart Henry, attorney, City of Mineral Wells, and H20 Partners.

In addition to regular planning group and committee meetings, the BGRWPG held several public hearings to obtain input concerning amendments to the 2001 Brazos G Regional Water Plan and for other items as required by regional water planning rules.

10.2 Brazos G Regional Water Planning Group Website (www.brazosgwater.org)

The BGRWPG has directed its consultant to maintain a website where meeting notices, agendas, and presentation materials may be viewed by the public. In addition to meeting materials, the 2001 and 2006 planning documents are posted for public viewing and download. The website offers other features including member contact information, planning area maps, planning data, and audio transcripts of all meetings held since August 2004.

10.3 Coordination with Water User Groups and Wholesale Water Providers

The BGRWPG requested comments from all water user groups, county judges, and councils of governments in the region on the draft population and water demand projections developed by the TWDB. Draft plans for each water user group and wholesale water provider were provided to each water user group, wholesale water provider, council of governments, and county judge in the region. The BGRWPG held three sub-regional meetings in April 2005 to solicit comments on the draft plans prior to development of the Initially Prepared Plan. These meetings were held in Abilene on April 12, 2005 (Upper Subregion), in Waco on April 13, 2005 (Middle Subregion), and in Bryan on April 14, 2005 (Lower Subregion). The 2006 Initially Prepared Plan was provided to all county libraries and county clerks, and posted on the Brazos G website for public review and comment.

10.4 Coordination with Other Planning Regions

Coordination with other planning regions was accomplished primarily through the technical consultants, who coordinated data and shared information that was later reported to the planning groups.

10.5 Brazos G Regional Water Planning Group Meetings

The BGRWPG held 69 public meetings during the 2006 planning cycle, including regular meetings of the full planning group; periodic meetings of the Executive, Scope of Work, and Finance Committees; periodic meetings of the Groundwater Availability, Surface Water Availability, and Water Policy Workgroups; and public hearings to receive public comments concerning revisions to the 2001 Brazos G Regional Water Plan, changes to the scope of work for developing the 2006 Brazos G Regional Water Plan, and the identification of potentially feasible water management strategies.

10.6 Public Hearing and BGRWPG Responses to Public Comments on Initially Prepared Plan

10.6.1 Oral Comments

The BGRWPG held a public hearing on August 17, 2005 to receive comments concerning the Initially Prepared 2006 Brazos G Regional Water Plan. Eight members of the public provided oral comments to the planning group concerning various aspects of the plan.

Written comments were received from seven of those individuals or from the organizations they represent that mirror or expand upon their oral comments. Responses to comments from those individuals are addressed with the written comments. The oral comments received can be heard from the audio transcripts on the BGRWPG website (www.brazosgwater.org).

Table 10-1. Individuals Providing Oral Comments Concerning the 2006 Initially Prepared Plan

Commenter	*Representing*	*Comments*	*Brazos G Response to Comments*
Michele Gangnes	Neighbors for Neighbors	See written comments.	See response to written comments.
Sidney Youngblood	Bell-Milam Land and Water Rights Association	See written comments from Bell-Milam Land and Water Rights Association.	See response to written comments.
Nick Roberts	Self and Bell-Milam Land and Water Rights Association	See written comments from Bell-Milam Land and Water Rights Association.	See response to written comments.
James Burks	44 Farms and Sherwood Properties	See written comments from Bell-Milam Land and Water Rights Association.	See response to written comments.
David Bell	West Central Texas Municipal Water District	See written comments.	See response to written comments.
Dr. Robert Kier	Lost Pines Groundwater Conservation District	See written comments from Lost Pines Groundwater Conservation District.	See response to written comments.
Ken Monroe	Self and Possum Kingdom Lake residents	Requested more timely information concerning the impacts of BRA's proposed System Operation on Possum Kingdom Lake levels.	This request is best made to the Brazos River Authority concerning operations of Possum Kingdom Reservoir under the proposed System Operation.
Susan Kaderka	National Wildlife Federation	See joint written comments from National Wildlife Federation, Environmental Defense and Sierra Club.	See response to written comments.

10.6.2 Written Comments

Following the August 17, 2005 public hearing, written public comments were received by the planning group through October 17, 2005. Additional comments were received from the Texas Water Development Board and the Texas Parks and Wildlife Department. No comments were received from federal agencies. The following section summarizes the public comments received and the responses of the BGRWPG. Comments are shown in *italics*, with the response from the BGRWPG following in regular type. When comments are numbered, the number refers to comment numbers in the written comments received. Copies of written comments received are included in Appendix P.

Commenter — National Wildlife Federation / Environmental Defense / Sierra Club (Letter)

Various generalized comments A-E. Please see comment letter.

The recommendations lettered A-E would require substantial modification of the plan and a deviation from the direction the RWPG has taken.

1. *Environmental flows should be acknowledged as a category of water demand.*

Environmental flows are not designated as a type of water use by the TWDB. Definitive quantification of such demands has not yet been done for streams in the Brazos G Area, except for new water rights issued since the 1980's, which contain instream flow provisions. Any such designation in the Brazos G Plan would imply that the BGRWPG recommends that existing water right holders without instream flow provisions curtail use to maintain environmental flows.

2. *Note in Table 2-4 that projected per capita water use rates are before any additional water conservation beyond the 1991 State Water Efficient Plumbing Fixtures Act.*

Text on page 2-13 describes the assumptions in the projected water use rates; no modification is necessary.

3. *Asks for clarification of last column of Table 2-4.*

The column correction states that the reduction between 2010 and 2060 is due to the 1991 Water Efficient Plumbing Fixtures Act. It does not state that it is a portion of the reduction. Inspection of the data will show that the reduction listed is the total reduction. No modification is necessary.

4. *A large decline in water demand for Abilene from 2000 to 2010 is shown in Table 2-5.*

This decline is because the water demands were corrected by the TWDB, except for the year 2000 values. The year 2000 values were not corrected by the TWDB. A footnote at the bottom of Table 2-4 explains the dramatic reductions in per capita use. A similar footnote has been added to Table 2-5.

6. *Wastewater effluent discharges (return flows) in Table 3.2-1 reflect assumed large volumes of reuse that are not reflected in recommended water management strategies.*

The return flows used in the Brazos G WAM were developed in order to provide a conservative estimate of water available to existing water rights, future appropriations, and environmental flows, without resorting to the default TWDB assumption of 100% reuse. The return flows are not intended to be used in a drop-by-drop mass balance of water whereby any wastewater flows not discharged to the stream are accounted for expressly in recommended water management strategies. They are solely used to determine a realistic, yet conservative estimate of surface water availability.

7. *Management plans and definitions for evaluating groundwater availability are inferred, but should be explicitly stated.*

The BGRWPG did not adopt any specific management plans or definitions, but evaluated previous estimates of groundwater availability using Groundwater Availability Models (GAMs) when available, or other data when GAMs were not. GAMs were used by the BGRWPG to evaluate different levels of pumpage, and qualitative judgments were made by the members of the planning group that the effects of the availability were acceptable. This process is described in Section 3.4.1 and Appendix B.

8. *Drought management is not included as a water management strategy as required by Texas Water Code Requirements.*

The BGRWPG considered drought management as a water management strategy and rejected it for the reasons stated in Section 4B.1.7.

9. *The method for applying water conservation as a water management strategy makes it difficult to quantify the amount of savings attributable to pro-active water conservation as opposed to those savings realized by the 1991 Water Efficient Plumbing Fixtures Act.*

The methodology is clearly described how potential water conservation savings were determined. Many combinations of programs could be used to meet conservation goals, and those used in the plan to compute conservation savings and costs provide adequate examples of reasonable goals for a variety of programs without specifying specific programs for specific water user groups. The section will be updated to specifically list those BMPs identified by the Water Conservation Task Force. In addition, an additional table will be added showing for those entities for which conservation is recommended, the differentiation between 1991 Plumbing Act savings and the additional savings recommended by the BGRWPG.

10 & 11. The BGRWPG should have been more aggressive in adopting water conservation goals.

Additional water conservation goals beyond those recommended by the BGRWPG are difficult to quantify, both in actual water savings and costs. The expected savings and costs are reasonable and do represent significant water savings throughout the region.

12. The Initially Prepared Plan provides for WUGs' needs as though the amount supplied through conservation were not real. The final plan should reflect a confidence and an expectation that water conservation will actually be employed to meet WUGs' future water needs.

Water conservation savings are largely voluntary in nature and cannot be mandated by the planning group for a water user group to adopt, nor can most be quantitatively defined with any confidence or assurance of accuracy. TWDB rules allow for planning for more than projected shortages (needs), because water demand projections often lag actual demands due to unexpected growth, and often water user groups will voluntarily discontinue an existing supply source that is adequate to meet some demands in favor of a new source that is cheaper, more reliable, or provides better quality water. Water utilities need excess supply capacity to be able to respond to unanticipated future conditions. The BGRWPG is not in the position of mandating limits on development of future projects, especially when savings due to conservation measures are often speculative.

13. Conservation savings should reflect Federal clothes washer efficiency standards, for which a 5.6 gpcd projected reduction in water use will result. The Region B IPP includes this assumption.

The Region B IPP assumed water savings of 5.6 gpcd was taken from a 1999 study of 37 households in Seattle, WA, where water efficient washers were installed in the homes and monitored. The 5.6 gpcd cited is for each washer replaced in a single-family residence. Actual savings for all customers of a water user group would be less, and depend upon the percentage of replacement over time. The BGRWPG has adopted a conservation savings target of 21 gpcd. Any combination of the Best Management Practices available could be used to meet the 21 gpcd goals, not just those used to estimate the reasonable target.

14 & 15. Statements regarding impacts of reuse strategies are inconsistent between Tables 4B.3.1.1, 4B.3-12, and tables for individual water management strategies.

The statements are not inconsistent; overall, reuse will tend to have minimal impacts to the environment, but could possibly have high local impacts depending greatly on local situations. Local impacts are site-specific, and would require detailed studies for each stream reach that are beyond the scope of this plan.

16. Changes in streamflow are not quantitatively reported, as required by TWDB rules.

The reuse strategies, overall, will not provide changes in streamflow below baseline conditions. Baseline streamflow conditions already assume a level of reuse greater than the individual water management strategies.

17. Changes in flow due to the BRA's System Operation water management strategy are not evaluated at a sufficient number of locations.

The water supplied from the BRA's proposed System Operation strategy was included at each of the proposed WUG diversion locations to determine the cumulative effects of the total plan, as shown in Section 7.1. Any remaining Brazos G supply from the strategy was assumed to be diverted at Hempstead for purposes of evaluating the cumulative effects of the plan.

18. Many of the studied reservoirs would satisfy no specific water demands. The majority of the water available from the BRA's System strategy would be allotted to Region H.

Yes, both statements are true.

19. Table 4B.12-1 does not note that costs are for raw water at the reservoir, not treated water delivered.

A note has been made on the table.

20. Evaluations of instream flow effects of new reservoirs are insufficient.

The requested analyses are beyond the scope of the plan, and would be completed if a project were pursued by a local entity as part of the permitting and authorization process.

21. Statements regarding the effects of Little River Reservoir on the instream biological community are unsubstantiated.

The statements were made using the best professional judgment of the consultant team, given the resources available for evaluation.

22 & 23. The environmental and implementation issues assessment for Carrizo-Wilcox Aquifer development are insufficient.

The anticipated pumping from the two strategies is less than the water estimated to be available; therefore the water level declines from the two strategies are less than what would be caused by withdrawing water at the full availability estimates. Information to that effect will be included in the report sections.

24. Conservation savings may have been double counted for WUGs for which conservation is planned.

No double counting of conservation savings occurred.

25. *City of Killen projected water use exceeds 140 gpcd after 2000, but conservation is not recommended as a water management strategy.*

Conservation has been added as a recommended water management strategy for the City of Killeen.

26. *Conservation is not listed as a water management strategy for the City of Marlin (which has no projected shortages), despite Brushy Creek Reservoir being recommended as a water management strategy.*

Conservation has been included as a recommended water management strategy for the City of Marlin.

27. *Proposed savings from additional water conservation beyond the default 1991 Water Efficient Plumbing Fixtures Act savings should be shown.*

Agreed. A table and discussion will be added.

28. *Commenter disagrees over how drought management is considered.*

The BGRWPG stands by the statements made. To not meet demands is antithetical to water supply planning. While drought management is vital, it should be utilized to extend supplies to safeguard for times when a drought of record might be exceeded. Including drought demand management as a water management strategy leaves no room for error when severe droughts do occur.

29. *The cumulative effects analysis does not fully show the effects of the plan on streamflows. A comparison to current streamflows should at least be made, in addition to the baseline run.*

The current comparison demonstrates the effects of the plan, considering that current water rights are allowed to use water as they are fully authorized and entitled to do. A comparison to current conditions (using TCEQ's WAM Run 8) would demonstrate changes that could occur in the future, but would not demonstrate the effects of just the plan. Changes in streamflow shown by comparison to current conditions would be due in part to full utilization of existing water rights. The BGRWPG will add an additional comparison to the TCEQ's WAM Run 8 (current conditions), and will also add text stating that those changes are not due solely to the strategies in the plan.

30. *Mid-region locations for diversion of the unused BRA System Operations supply are not shown; the only location is at Hempstead.*

No mid-region diverter has been identified, beyond those already noted as potential recipients of the BRA System water. It is more likely that the majority of the unused Brazos G portion of the supply would be diverted in the lower basin.

31. Biological significance of streamflow changes are not shown.

Biological significance of streamflow changes would require extensive study beyond the scope of this plan, and would require that daily, rather than monthly, flows be evaluated for a full understanding of instream flow effects.

32. Stating (Section 7.2.1) that water level declines in an aquifer will be less than a certain amount does not provide assurance of protection of the State's natural resources.

The statements in the section are appropriate and will stand.

Commenter — Johnson County SUD (Meeting with consultant, provided a marked plan section)

Recommends that the Bethany WSC acquire future supplies from Johnson County SUD, rather than Fort Worth.

The plan will be modified as requested.

Commenter — Fort Hood (Letter)

Year 2000 per capita water use is listed incorrectly on Table 2-4.

The table will be corrected with a water use rate of 197 gpcd.

Projected population does not agree with information supplied by Fort Hood.

Fort Hood supplied the requested revisions to the population projections too late in the planning process for the TWDB to make the revisions.

Per capita water use rates are too high, and should be listed no higher than 197 gpcd.

When the Fort Hood population projections could not be revised, we utilized the projections supplied by Fort Hood to calculate revised water demands, which included both personnel living on-base and those commuting onto the base from the surrounding area. Based upon the data provided by Fort Hood, personnel living off-base constitute approximately 49 percent of the total personnel (military, dependents, contract and civilian) associated with the base. We utilized a per capita use rate for the on-base personnel equal to the regional average of 145 gpcd, and then assigned the remainder of the base's 197 gpcd to the off-base personnel (52 gpcd). A total water demand was projected using these use rates for the projected on- and off-base personnel. These water demand projections were used to determine the total water demands for the base. The projected per capita use rates were then back-calculated by dividing by the TWDB's lower population projections. This results in a higher apparent gpcd, but ensures that the base's water demands are accounted for correctly. The base and the TWDB both agreed to this methodology in a series of emails and telephone conversations in February, March, and June of 2005. A footnote to Table 2-4 will be made noting that on-base personnel were assumed to use 145 gpcd and that off-base personnel raise the use rates to those shown in the table, since they are not accounted for in the population of the base.

Fort Hood does not wish to supply the City of Gatesville with any water from its water right.

The City of Gatesville concurs. Gatesville will be shown as increasing its supply from Lake Belton through an expanded BRA contract.

Commenter — Acton MUD (Letter)

Projected population for areas served by the MUD is too low. Revised population and water demand projections are provided.

Population projections cannot be changed at this late date to accommodate the request. Increasing Acton MUD's population would require reducing population projections elsewhere in the region so as to maintain regional totals.

Commenter — ALCOA (Letter)

Requested revisions to mining demands in Lee and Milam Counties, based upon Railroad Commission of Texas requirements for continued mine reclamation activities.

Mining demands in the plan will be modified in Lee County to 5,450 acft/yr in years 2010-2040, and in Milam County to 4,000 acft/yr in years 2010-2030, 3,000 acft/yr in 2040, and 1,500 acft/yr in 2050-2060 to more accurately reflect ongoing mining activities and requirements of the Railroad Commission of Texas. The BGRWPG will recommend to the TWDB that these demands be changed.

Commenter — Bell-Milam Land and Water Rights Association (Letter and oral comments from associated parties)

Expresses opposition to the Little River Reservoir and all its various configurations.

The Little River Reservoir is not a recommended water management strategy in the 2006 Brazos G Plan; however the off-channel configuration was selected by the Region H Planning Group as a recommended strategy starting in 2050.

Commenter — Brazos River Authority (Letter)

Section 4A, Table 4A-6 – Suggestions to add additional information regarding Little River System demands, Main Stem/Lower Basin demands, and additional coordination with Region H regarding demands in Region H.

The requested revisions to the table will be made. We will coordinate with Region H to verify and finalize the Region H demands to ensure consistency between the two regional water plans.

Page 4C-250 – Liberty Hill WSC will likely obtain additional supply from BRA (Lake Stillhouse Hollow), and not LCRA (Lake Travis).

Liberty Hill WSC has made a similar comment. The water supply plan for Liberty Hill WSC will be modified to reflect additional supply from BRA and a release of the current supply contracted for out of Lake Travis.

Pages 4C-263 & 264 – Suggests adding clarification regarding supplies and demands for Lake Aquilla System.

The information will be clarified as requested.

Page 4C-265 – Suggests adding clarification regarding projected shortages to the Little River System.

The information will be clarified as requested.

Page 4C-267 – Suggests adding clarification to the Lake Granger Augmentation by listing groundwater and surface water components separately.

The information will be clarified as requested.

Page 4C-267 – Requests listing the stand-alone groundwater development strategy as an alternative instead of recommended water management strategy.

The water management strategy will be included as an alternative, not recommended, strategy.

4C-267 – Suggests final coordination with BRA and Region H regarding shortages shown for the lower basin.

The BGRWPG has directed its consultant to coordinate with Region H and BRA to verify and finalize lower basin demands.

4C-272 – Suggests noting that more recent data have indicated lower sedimentation rates for Lake Aquilla than utilized for the plan.

The information has been clarified as requested.

4B.6 – Requests changing statement that BRA has little uncommitted water at Lake Granbury.

The information has been clarified as requested.

Commenter — Liberty Hill WSC (Letter)

Requests changing strategy for Liberty Hill from Lake Travis to Lake Stillhouse Hollow. The BRA has made a similar request.

The recommended water management strategy has been changed for Liberty Hill WSC.

Commenter — Camp Creek Water Company (Letter)

Notes that Camp Creek Lake and surrounding homes would be inundated by Millican Reservoir.

The consultant has not verified this statement. However, Millican Reservoir is not a recommended water management strategy. Furthermore, any entity pursuing Millican Reservoir would be required to address issues such as these.

Commenter — Cities of Bryan and College Station (Letter)

Requests that language similar to that adopted for the 2001 Plan amendment regarding BRA System Operations and return flows be also included in the 2006 Plan.

The language will be added to the plan at the appropriate locations.

Requests language be added as a third footnote to Table 3.2-1 stating that the cities of Bryan and College Station have filed application with TCEQ to reuse their current and future effluent.

The footnote will be added as requested.

Commenter — City of Temple (Letter)

1.a. The permitted amount shown in Appendix D should equal the supply shown in Appendix C.

The values shown in Appendices C and D represent different totals. The permitted amount stated in Appendix D (35,804), is the total of the water rights owned by Temple. The total supply shown in Appendix C (approximately 37,500 acre-feet per year) is the actual amount of water estimated to be available for diversion by Temple through the drought of record, and is based on WAM results and water contracts/agreements with the BRA.

1.b. Reported use in Appendix D are inaccurate.

The reported use in Appendix D are from the TWDB database, which is known to have some errors. The Appendix D table will be corrected.

2. Reported water use in Table 2-5 for year 2000 should be 21,234 acft/yr.

The value in Table 2-5 will be corrected.

Commenter — Post Oak Savannah GCD, Clearwater UWCD, and Lost Pines GCD (Separate Letters)

All three letters request that the plans for use of the Carrizo-Wilcox Aquifer in Region L by the San Antonio Water System (SAWS) from Lee and Milam counties be dropped, in response to the cancellation of the water supply contract between SAWS and Alcoa.

All references to the contract between SAWS and Alcoa will be removed from the plan.

Commenter — Eugene Pollard, Private Citizen, College Station (e-mail)

Recommends that free public access points to rivers be allowed to remain open.

Public access to rivers is beyond the scope of regional water planning and the BGRWPG has opted not to develop a water policy recommendation.

Commenter — FHLM WSC (Letter)

Requests that recommended strategies for water user groups to which FHLM WSC supplies water be changed from City of Waco and/or BRA System Operations to Carrizo-Wilcox supplies and expanded use of the Trinity.

Note that FHLM WSC has not been identified as a water user group or a wholesale water provider. Carrizo-Wilcox Aquifer development will be added as an potential strategy for Chalk Bluff WSC, Gholson WSC, City of Mart, and City of Riesel, but not expanded use of the Trinity. The Trinity Aquifer is currently being overdrafted and cannot sustain expanded use. Brazos G will direct its consultant to coordinate with FHLM and include a Carrizo-Wilcox strategy as requested.

Commenter — Lambshead Land and Cattle Company (Letter)

Requests that 4,000 acft/yr of irrigation demand be added to Throckmorton County.

The Brazos G consultant has discussed this request with TWDB staff, and they are agreeable because Throckmorton County currently shows zero irrigation demand, provided that the ranch provides sufficient documentation to support their request. The Brazos G consultant will coordinate with the ranch and the TWDB, and the requested demand revision will be added to the plan.

Commenter — Neighbors for Neighbors (Michelle Gangnes) (Oral — See Transcript)

Requests that groundwater availability estimate from the Carrizo-Wilcox Aquifer in Lee County be revised to 7,500 acft/yr.

The BGRWPG has confirmed its previous estimates and will make no change.

Commenter — Patricia McCain, Private Citizen, Bryan (Letter)

Notes that "illegal changing of creeks and sloughs by private landowners has caused environmental damages."

Alteration of watercourses is a regulatory issue and outside the scope of regional water planning and the BGRWPG has opted not to develop a water policy recommendation.

Commenter — Texas Mining and Reclamation Association (Letter)

Comments that the BRA System Operations strategy, if permitted by the TCEQ in its current form, would compromise the efforts of entities involved with mining reclamation to maintain surface water ponds and lakes as required by the Railroad Commission of Texas by appropriating surface water that is needed to maintain storage in these water bodies. Requests *that language be added to the description of the BRA System Operations option that would promote protection of future mining reclamation efforts*

Language will be added to the plan as follows:

"Consideration of water rights permits, including the need for water for specific purposes, and conditions of the permits, is the responsibility of TCEQ, not the regional water planning process. However, the BGRWPG assumes that any water appropriated by water right permits associated with this water management strategy will not impair the capability to impound and store water in surface water bodies such as sedimentation ponds, end lakes and other environmental features associated with mining and mining reclamation activities, when such are required by the Railroad Commission of Texas and other regulatory entities. This assumption is applicable only to runoff originating within the watershed that drains directly to each water body, and is not applicable to diversions from rivers or streams to maintain storage in the water bodies. Diversions of water from those water bodies for any reason are also specifically excluded from this assumption."

Commenter — Lost Pines GCD (Letter)

Comments that Table 3.4-3 (page 3-45) notes that water level declines ("drawdowns") are not shown.

These are shown in Appendix B. A reference to Appendix B will be made in the table to aid the reader.

Supplies to Manville WSC from the Carrizo-Wilcox Aquifer are not shown appropriately.

Manville's current supply from the Carrizo-Wilcox Aquifer is 2,396 acft/yr out of a total supply of 4,348 acft/yr (55%). Manville's current supplies are sufficient to meet the WSC's projected water demands through the 2060 planning horizon. No additional supplies from the Carrizo-Wilcox Aquifer appear to be necessary and the plan does not recommend or imply them.

Carrizo-Wilcox Aquifer supply is the target source to meet future demands in Williamson County, and currently contracted but unused supplies from the LCRA (Lake Travis) are not utilized.

This statement is not true. The plan makes full use of available LCRA supply to meet the majority of the future demand in Williamson County through the BRA/LCRA Alliance (25,000 acft), existing contracts with Leandar and Cedar Park (6,400 and 18,000 acft), and additional supplies not yet contracted for from the LCRA (26,200 acft), for a total supply from the LCRA into Williamson County of 75,600 acft/yr. Augmentation of Lake Granger's yield with Carrizo-Wilcox Aquifer supply is targeted for 2050 and later, and may not be fully utilized until much later than that.

The footnote on Table 3.4-4, page 3-50 regarding Lost Pine's revision to its groundwater availability estimate for Lee County in its management plan is untrue and incorrect.

The footnote is not a blatant misstatement, as claimed by the reviewer. However, it will be modified to the following to further clarify the reasons for the revision by Lost Pines GCD.

"The Lost Pines GCD originally estimated the Lee County groundwater availability from the Carrizo-Wilcox to be equal to recharge in Lee County, as determined by the Central Carrizo-Wilcox GAM, which is 7,500 acft/yr. This availability estimate was changed by the district to 46,458 acft/yr for the appearance of eliminating the apparent conflict with the 2001 Brazos G Regional Water Plan in order to obtain a determination of administrative completeness from the TWDB. This change was made under protest to the TWDB and to the BGRWPG."

Commenter — Texas Parks and Wildlife(Letter)

Comments received are fairly general in nature and do not recommend specific revisions to the plan.

No revisions to the plan are necessary to consider, based upon the comments.

Commenter — West Central Texas Municipal Water District (Oral — See Transcript)

The WCTMWD recommends the BGRWPG to adopt a water policy recommendation that would allow planning groups to consider alternative future growth rates higher than the TWDB projections and consider additional water projects to meet those alternative projections.

The BGRWPG has not opted to adopt a policy statement to that effect.

10.7 TWDB Comments on Initially Prepared Plan and BGRWPG Responses

The following section summarizes the comments received from the TWDB and the responses of the BGRWPG.

1. Provide information on the plan's impacts on navigation.

The plan has little or no impact to navigation, as the Brazos River and tributaries are not used for commercial navigation and none of the strategies would significantly impact non-commercial navigation activities. Add additional information to Section 1.

2. Report supply information for WWPs by category of use, by county and river basin.

Data showing WWP supplies by source are shown in Tables 4A-6 through 4A-20. These data are further broken down in the DB07 database tables.

3. Include groundwater supply estimates for each decade from 2010 to 2060 (Page 3-41).

This section describes groundwater availability, which may or may not be actual supply depending upon well capacities installed in each county. The availability estimates are constant for each decade. Actual groundwater supplies are tabled in Appendix C by county, but are not differentiated by source aquifer. Additional columns will be added to Table 3.4-2 showing projected supplies in years 2010 and 2060. Other decades are shown in the DB07 database tables.

4. *Please clarify statement (Page 3-40, text and Table 3.4-1) in text stating that "availability estimates are not developed for undifferentiated aquifers…"*

The statement is incorrect and will be removed from the text.

5 & 6. Text/table numeric disagreements noted.

Corrected.

7. *Provide information on the sedimentation data update and its effects on Lake Mexia.*

The information is included in Appendix M.

8. *Provide results of [various] studies for Millican Reservoir.*

As Millican Reservoir was not included as a recommended strategy, these studies were not completed in order to conserve State funds. HDR (and Brazos G) will not invoice costs associated with these studies.

9, 10, & 11. Text/table numeric disagreements noted.

Corrected.

12. *Complete Chapter 10, Adoption of Plan*

This will be completed prior to submittal of final plan to the TWDB.

13, 15, & 16. Various text or figure improvements suggested.

Corrected or accepted.

14. *Add description of groundwater quality issues in the region.*

Adding this information in a form that would provide useful information is beyond the scope of the regional plan. Groundwater quality varies substantially within each of the aquifers in the region, and considerable detail would be needed to adequately address the issue sufficiently for it to add any value to the plan. The level of detail required to address the issue adequately for all of the aquifer systems in the region is beyond the scope of the plan. Any attempt to address the issue in the plan would be superficial, and likely misleading to the reader.

17. *Change the reference on Fig. 4B.4-1 to Fig. 4B.4-2.*

The figure is referenced correctly as it is.

18. Fig. 4B.7-4 is referenced incorrectly.

Corrected.

19. Consider adding "implementation issues" discussion to Palo Pinto Creek Off-channel Reservoir evaluation.

A discussion of implementation issues will be added.

10.8 Final Plan Adoption

On November 16, 2005, the BGRWPG reviewed and responded to the written comments received. The final plan was adopted by unanimous vote of the members present pending completion of the changes noted in response to comments received.

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