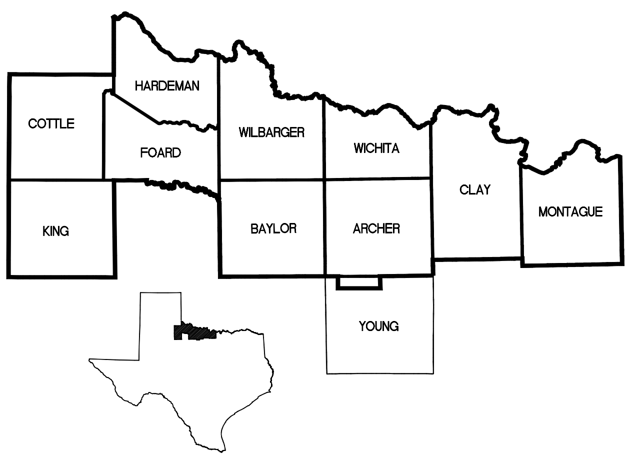
REGION B REGIONAL WATER PLAN

January 2006



Biggs & Mathews, Inc.
Freese and Nichols, Inc.
Alan Plummer Associates, Inc.
Red River Authority of Texas

REGION B

REGIONAL WATER PLAN

Prepared for

Region B Water Planning Group

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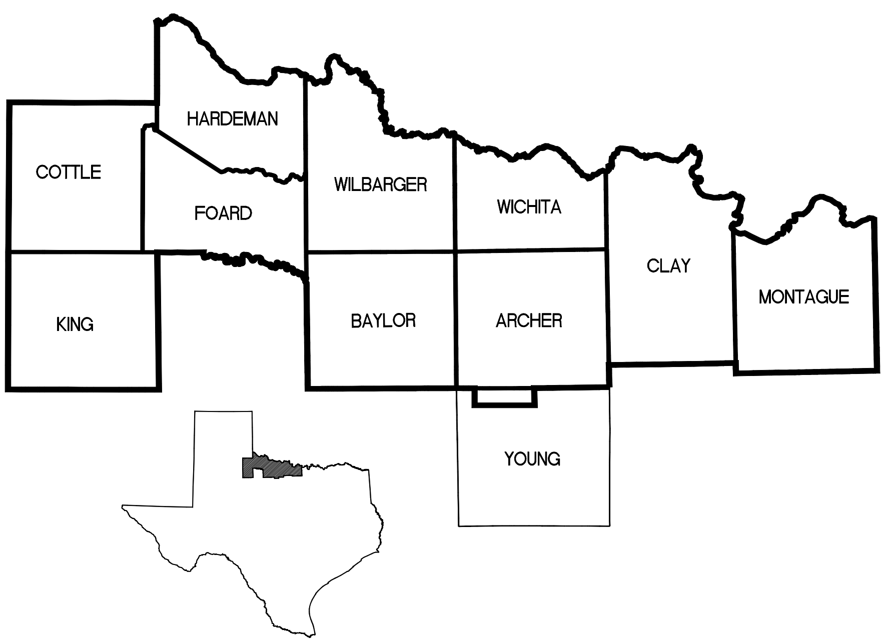

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EXECUTIVE SUMMARY
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REGION B

Introduction

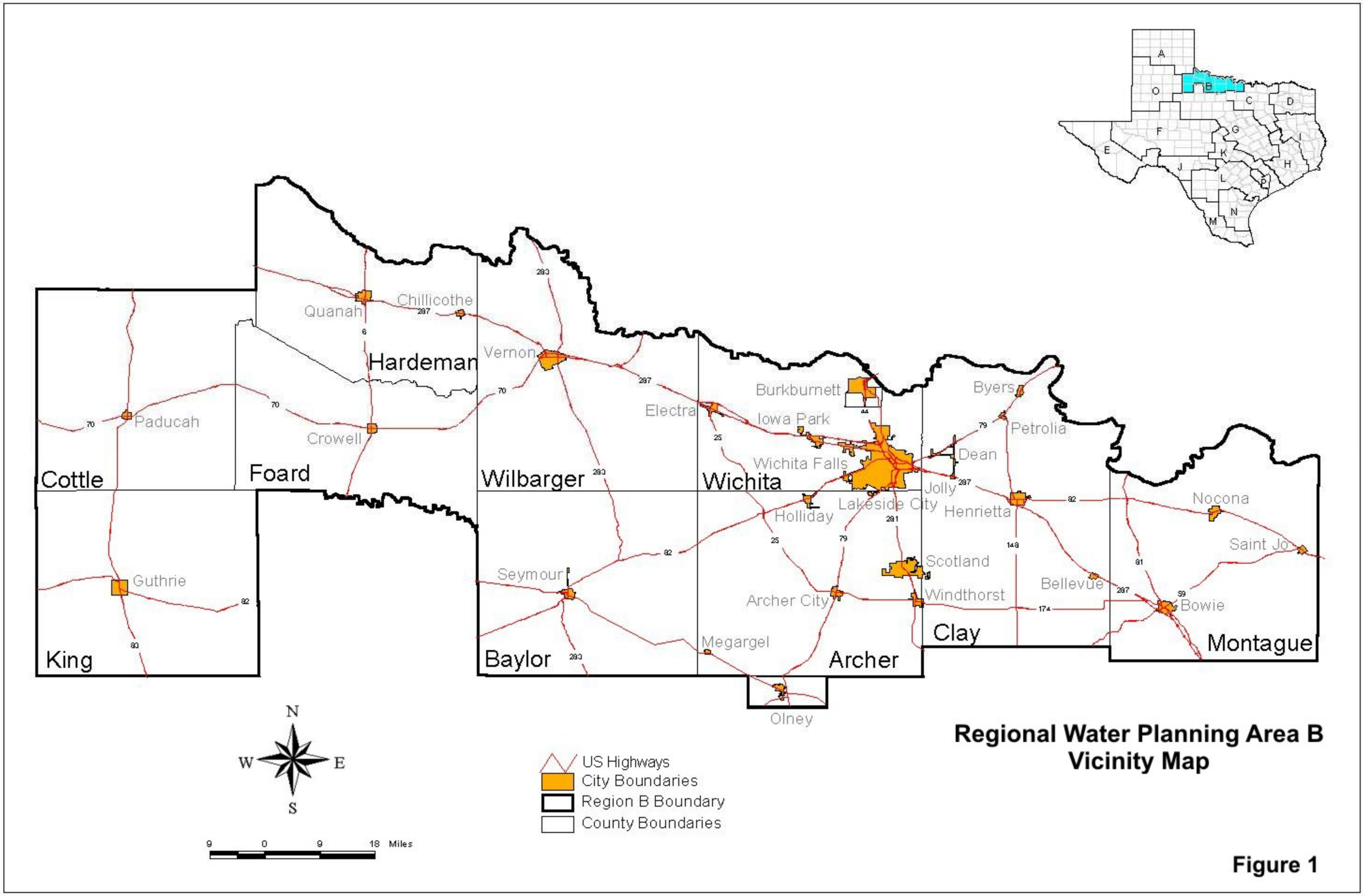
Senate Bill 1 of the 75th Texas Legislature was passed in 1997 to set the process of developing a comprehensive state water plan. To accomplish this task, the state was divided into 16 regional water planning groups. This report describes Region B as designated by Senate Bill 1. Region B is comprised of ten entire counties and a portion of one county in north central Texas. Specifically, those counties are Archer, Baylor, Clay, Cottle, Foard, Hardeman, King, Montague, Wichita, Wilbarger, and the City of Olney in Young County. Figure 1 shows the region, cities, towns, and the counties it encompasses.

Description of Region B

Region B lies mainly in the Red River Basin, however, southern portions of Archer and Clay Counties lie in the Trinity River Basin, and southern portions of Archer, Baylor, and King Counties lie in the Brazos River Basin.

In 2000, the total population of the region was reported to be 201,970, with the largest population center, the City of Wichita Falls, being 104,197 or 52 percent of the total. The second largest city was Vernon with a population of 11,660.

In general, most of the population is concentrated in eastern portions of the region with over one-half located in and around Wichita Falls. The January 1, 2000 estimated population density of the region ranged from a high of 210 persons per square mile (Wichita County) to a low of less than one person per square mile (King County). Regional population is forecasted to increase by approximately 10 percent over the study period. Table ES-1 shows the 1990 census population by county and the corresponding census population in 2000.



Regional Water Planning Area B
Vicinity Map

Figure 1

Table ES-1: County Populations

County	Area (sq. mi)	1990 Population	2000 Population	% Change	Density people/sq.mi.
Archer	910	7,973	8,854	11.0%	10
Baylor	871	4,385	4,093	-6.7%	5
Clay	1,098	10,024	11,006	9.8%	10
Cottle	901	2,247	1,904	-15.3%	2
Foard	707	1,794	1,622	-9.6%	2
Hardeman	695	5,283	4,724	-10.6%	7
King	912	354	356	0.6%	< 1
Montague	931	17,274	19,117	10.7%	21
Wichita	628	122,378	131,664	7.6%	210
Wilbarger	971	15,121	14,676	-2.9%	15
Young	2	3,519	3,396	-3.5%	1617
Average	784	17,305	18,310	5.8%	23

The City of Wichita Falls is the largest demand center in the region. Other demand centers include Seymour, Henrietta, Quanah, Bowie, Nocona, Burkburnett, Electra, Iowa Park, Vernon, Olney, and Archer City. Table ES-2 below shows the population, water use, and gallons per capita per day (GPCD) usage for each center.

Table ES-2: Regional Demand Centers

County	City	2000 Population	2000 Municipal Water Use (Ac-Ft)	Water Use (GPCD)
Archer	Archer City	1,848	232	112
Baylor	Seymour	2,908	554	170
Clay	Henrietta	3,264	526	144
Hardeman	Quanah	3,022	565	167
Montague	Bowie	5,219	824	141
Montague	Nocona	3,198	484	135
Wichita	Burkburnett	10,927	1,273	104
Wichita	Electra	3,168	337	95
Wichita	Iowa Park	6,431	1,232	171
Wichita	Wichita Falls	104,197	21,942	188
Wilbarger	Vernon	11,660	2,795	214
Young	Olney	3,396	609	160

While the population of Region B is only expected to reach near 222,000 by 2060, the Dallas-Fort Worth Metroplex, located just east of the region, is expected to top 9 million. This population could likely impose increasing pressures on water base recreational resources of the Region, as the number of people willing to travel into Region B for recreational purposes increase.

Population and Water Use Projections

The population projections for Region B were determined by the following:

- Using the latest information published by the State Data Center for city populations;
- Surveying the cities, smaller communities, rural water supply corporations, municipal utility districts, and river authorities to determine population based on existing meter counts;
- Using growth trends derived from the surveys based on populations and meter counts from 1990 to 2000.

Table ES-3 shows the population projections for each incorporated city by county and rural areas outside of any incorporated entity (Other Rural).

Table ES-3 – Population Projections

CITY	COUNTY	RIVER BASIN	1990 POP.	2000 POP.	2010 POP.	2020 POP.	2030 POP.	2040 POP.	2050 POP.	2060 POP.
Archer City	Archer	RED	1,784	1,848	2,022	2,200	2,345	2,390	2,307	2,223
Holliday	Archer	RED	1,475	1,632	1,786	1,943	2,071	2,110	2,038	1,963
Lakeside City	Archer	RED	865	984	1,077	1,172	1,249	1,272	1,228	1,183
Seymour	Baylor	BRAZOS	3,185	2,908	2,692	2,569	2,378	2,206	2,089	1,933
Byers	Clay	RED	510	517	534	550	546	524	491	459
Henrietta	Clay	RED	2,896	3,264	3,374	3,470	3,448	3,306	3,103	2,900
Petrolia	Clay	RED	762	782	808	831	826	792	743	695
Paducah	Cottle	RED	1,788	1,498	1,458	1,455	1,384	1,304	1,233	1,193
Crowell	Foard	RED	1,230	1,141	1,137	1,145	1,121	1,081	1,055	1,017
Chillicothe	Hardeman	RED	816	798	796	795	791	786	780	769
Quanah	Hardeman	RED	3,413	3,022	2,981	2,954	2,863	2,746	2,617	2,371
Guthrie	King	RED	150	150	152	144	124	98	77	75
Bowie	Montague	TRINITY	4,990	5,219	5,305	5,389	5,423	5,436	5,440	5,449
Montague	Montague	RED	490	479	470	460	440	421	401	395
Nocona	Montague	RED	2,870	3,198	3,321	3,442	3,491	3,510	3,515	3,528
Saint Jo	Montague	TRINITY	1,048	898	898	898	898	898	898	898
Burkburnett	Wichita	RED	10,145	10,927	11,465	11,949	12,269	12,436	12,553	12,647
Electra	Wichita	RED	3,113	3,168	3,206	3,240	3,263	3,275	3,283	3,290
Iowa Park	Wichita	RED	6,072	6,431	6,678	6,900	7,047	7,124	7,178	7,221
Wichita Falls	Wichita	RED	96,259	104,197	109,663	114,576	117,825	119,525	120,710	121,668
Vernon	Wilbarger	RED	12,001	11,660	12,139	12,655	12,706	12,451	11,844	11,144
Olney	Young	BRAZOS	3,519	3,396	3,429	3,504	3,509	3,469	3,418	3,386
Other Rural			31,514	33,853	35,251	36,677	37,234	37,005	36,214	35,327
Total			**190,895**	**201,970**	**210,642**	**218,918**	**223,251**	**224,165**	**223,215**	**221,734**

The water use for Region B has been divided into several categories for analysis purposes. The various uses analyzed include water for municipal use (MUN), industrial or manufacturing (MFG), power cooling (PWR), mining (MIN), agricultural irrigation (IRR), and livestock watering (STK). Table ES-4 shows the amounts of water predicted to be required for these categories through the year 2060. The water use is shown in acre-feet (Ac-Ft) units with one acre-foot being equivalent to 325,851 gallons of water.

Table ES-4 - Projected Water Use (Acre-Feet)

YEAR	2000	2010	2020	2030	2040	2050	2060
MFG	3,162	3,547	3,755	3,968	4,260	4,524	4,524
PWR	9,841	13,360	17,360	21,360	21,360	21,360	21,360
MIN	1,190	909	845	811	785	792	792
IRR	66,504	99,895	97,702	95,537	93,400	91,292	91,292
STK	10,464	12,489	12,489	12,489	12,489	12,489	12,489
MUN	37,422	40,964	39,655	40,196	39,664	38,962	38,696
TOTAL	128,583	171,164	171,806	174,361	171,958	169,449	169,153

Total water consumption for the region is predicted to remain approximately level from 2010 to 2060.

Evaluation of Current Water Supplies

Water users in the Region B planning area receive surface water from sources in the Brazos, Trinity, and Red River Basins. In addition, groundwater is primarily supplied in Region B by two aquifers, the Seymour and the Blaine.

The Seymour is designated a major aquifer and is found in the central and western portions of the region. It is currently used in Hardeman, Wilbarger, Wichita, Clay, Baylor, Foard, and Cottle Counties. The Blaine is considered a minor aquifer and useable groundwater is limited to the westernmost portion of the region. These aquifers provide a large percentage of available supply in these counties. In addition, the upper portion of the Trinity Aquifer occurs in Montague County in the eastern part of the region. Limited quantities of groundwater are used from the

Trinity for municipal and irrigation uses. There are also other formations within the region that are used for groundwater supply in limited areas. The TWDB identifies these sources as "Undifferentiated Other Aquifer". These formations are not well defined in the literature, but still provide substantial quantities of water in Archer, Clay, Cottle, Montague, and Wichita Counties.

The total amount of supply currently available to Region B is approximately 383,000 acre-feet per year, as shown in Table ES-5. This represents firm supply available to the region. However, the supply that is available to each user is less due to operational and contractual constraints, infrastructure limitations, and water treatment capacities. A comparison of the regional firm supply to the current available supply for the water users is shown in Figure ES-1.

By 2060, the supply to Region B decreases by nearly 70,000 acre-feet per year. This is mostly the results of reduced storage capacities of existing reservoirs due to sediment accumulation. The Lake Kemp and Diversion system was found to have significant reductions in firm yield due to reduced storage capacity, and this system accounts for most of the regional supply reduction.

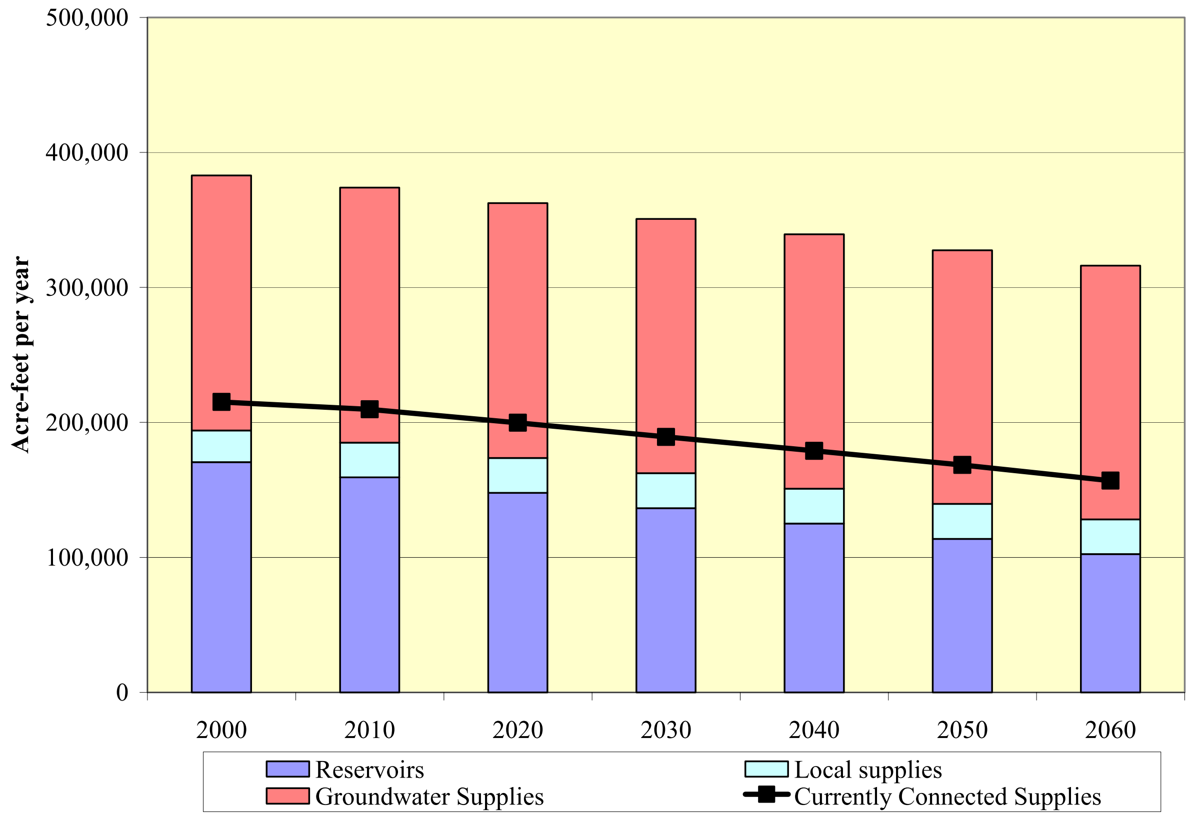
Table ES-5

Summary of Firm Supplies to Region B

	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Reservoirs in Region B	161,580	150,505	139,430	128,355	117,280	106,205	95,128
Reservoirs outside Region B	8,985	8,854	8,723	8,592	8,461	8,330	8,200
Run-of-the-River Supplies	14,666	14,666	14,666	14,666	14,666	14,666	14,666
Local Supplies	9,018	11,316	11,316	11,316	11,316	11,316	11,316
Groundwater Supplies	188,819	188,804	188,804	188,354	188,354	187,952	187,952
Total	**383,068**	**374,145**	**362,939**	**351,283**	**340,077**	**328,469**	**317,262**

Figure ES-1

Comparison of Firm Supplies to Supplies Available to Water Users



Identification, Evaluation, and Selection of Water Management Strategies

A comparison of current supply to demand was performed using projected demands and the allocation of existing supplies developed as evaluated under drought of record conditions. Allocations of existing supplies were based on the most restrictive of current water rights, contracts and available yields for surface water, historical use, and groundwater availability. The allocation process did not directly address water quality issues such as nitrates. Salinity was addressed to some extent by not assigning supplies with known high salinity levels for municipal use. This included most of the Blaine aquifer.

As a region, there is adequate supply to meet the region's needs through 2040. A small shortage begins before 2050, and increases to over 11,000 acre-feet per year by 2060. A comparison of the total regional supply to demand is shown in Figure ES-2

A summary of the projected needs by county are presented in Table ES-6. There are nine water user groups with identified shortages that cannot be met by existing infrastructure and supply. These shortages total 37,124 acre-feet per year by 2060. Of this amount, over 98 percent of the shortage is associated with reduced supplies in the Lake Kemp and Diversion system. Table ES-7 lists the water user groups with projected water shortages.

Figure ES-2 Supply and Demand for Region B

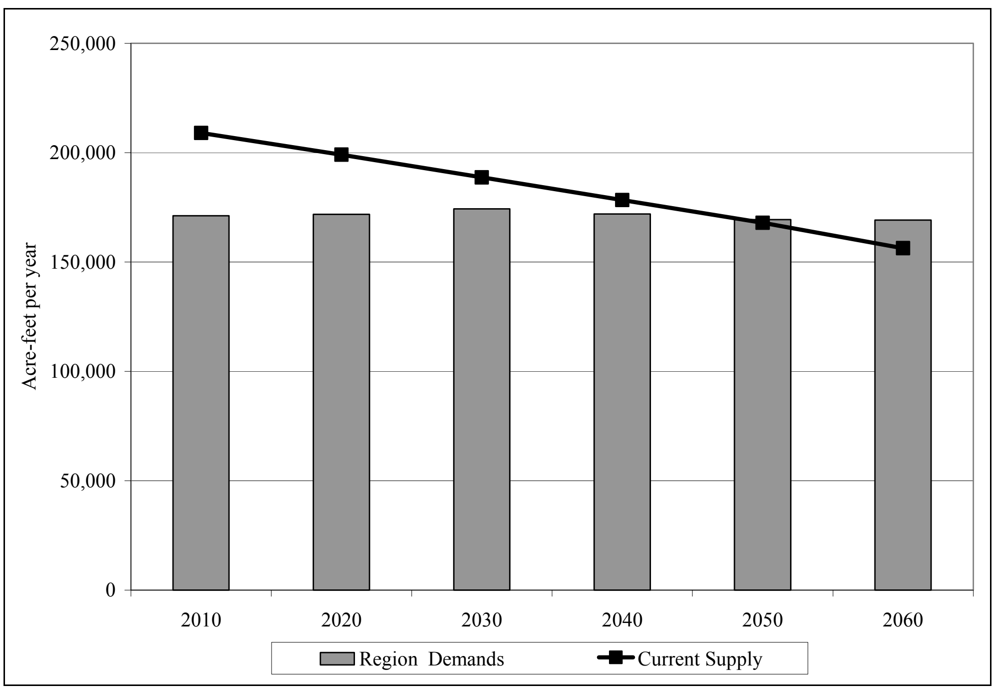


Table ES-6 Comparison of Supply and Demand by County

County	2010	2020	2030	2040	2050	2060
Archer	560	304	-3	-274	-457	-755
Baylor	1,905	2,011	2,115	2,187	2,238	2,284
Clay	639	590	546	595	744	734
Cottle	682	830	978	1,124	1,260	1,269
Foard	546	691	833	975	1,111	1,117
Hardeman	1,191	1,344	1,500	1,646	1,788	1,797
King	377	368	373	387	394	400
Montague	642	587	548	490	446	376
Wichita	14,964	9,437	2,052	-4,506	-11,073	-18,868
Wilbarger	16,759	11,452	5,639	3,847	2,076	-79
Young (P)	254	276	294	314	330	336
Region	**38,520**	**27,891**	**14,876**	**6,785**	**-1,144**	**-11,390**

Table ES-7 Projected Water Shortages for Water User Groups

Water User Group	2010	2020	2030	2040	2050	2060
County-Other - Archer	-162	-126	-161	-187	-142	-136
Irrigation - Archer	-9	-276	-539	-795	-1,046	-1,370
County-Other - Clay	-45	-25	-8	0	0	0
Irrigation - Clay	-7	-121	-224	-314	-392	-513
County-Other - Montague	-133	-184	-197	-206	-194	-197
Mining - Montague	-113	-92	-86	-93	-108	-111
Electra - Wichita	-146	-126	-120	-117	-117	-123
Irrigation - Wichita	-259	-4,674	-9,106	-13,556	-18,025	-23,577
Steam Electric Power - Wilbarger	0	0	-4,132	-6,453	-8,774	-11,097
TOTAL	**-874**	**-5,624**	**-14,574**	**-21,721**	**-28,799**	**-37,124**

While many water user groups were not identified with a shortage, several were found to have little to no supplies above the projected demands. The Region B Regional Water Planning Group recognized that these entities were likely to need to develop new supplies to provide a safe level of water supply. To determine which entities may be impacted, a safe supply was defined as being able to meet the projected demands plus 20 percent of the demand. This was applied only to municipal and manufacturing water user groups. Using these criteria, seven additional water users were identified with safe supply shortages as shown in Table ES-8.

Table ES-8 Water Users with Safe Supply Shortages

	2010	2020	2030	2040	2050	2060
County-Other - Archer	-269	-223	-265	-296	-242	-235
Lakeside City	-3	0	-12	-7	0	0
Byers - Clay	-11	-8	-5	0	0	0
County-Other - Clay	-223	-199	-179	-79	0	0
County-Other - Montague	-394	-458	-475	-486	-470	-475
Electra - Wichita	-261	-236	-228	-223	-222	-228
Iowa Park - Wichita	-110	-96	-103	-114	-124	-142
Wichita Falls - Wichita	0	0	0	0	0	-2,057
Manufacturing - Wilbarger	-170	-181	-194	-217	-241	-241
Vernon - Wilbarger	-354	-395	-423	-410	-366	-181
Bowie - Montague	0	0	0	-31	-73	-134

The City of Wichita Falls is the only wholesale water provider in Region B and is a regional provider for much of the water in Wichita, Archer, and Clay counties. Considering current customer contracts and city demands, Wichita Falls has sufficient supplies to meet the projected firm needs and existing contractual obligations. The City has a projected shortage of 2,057 acre-feet per year to meet safe supply needs. In addition, several current and future customers have requested a total of 1,267 acre-feet per year. A summary of the supply and demand comparison for Wichita Falls is shown in Table ES-9.

Table ES-9 Projected Water Shortages for the City of Wichita Falls

	2010	2020	2030	2040	2050	2060
Total Demand	31,925	30,990	31,879	31,919	31,947	32,111
Total Supplies	45,415	43,364	41,313	39,261	37,210	35,158
Supplies Less Current Customer Demand	13,490	12,374	9,434	7,343	5,264	3,047
Required Safe Supply for Current Customers	36,962	35,847	36,920	36,977	37,017	37,214
Current Customer Safe Supply Surplus/ Shortage	8,453	7,517	4,393	2,284	193	-2,057

Water quality is a significant issue in Region B. Due to limited resources, some user groups are using water of impaired quality or having to install additional treatment systems to utilize existing sources. An implied assumption of the supply analysis is that the quality of existing water supplies is acceptable for the listed use. In other words, water supplies that are currently being used are assumed to continue to be available, regardless of the quality. Senate Bill 1 requires that water quality issues be considered when determining the availability of water during the planning period. For this report, evaluations of source water quality are generally confined to waters used for human consumption. The effect of water quality of Lake Kemp on agricultural use is also reviewed.

The Texas Commission on Environmental Quality (TCEQ) identifies systems that are not compliant with current and proposed primary drinking water standards. This list was reviewed for water users in Region B. Compliance with secondary drinking water standards was not evaluated since the secondary standards do not have the same regulatory and public health implications. Also, compliance with the bacteriological standards (total coliform and fecal coliform) was not evaluated since violations of these standards, when they occur, are typically associated with operational techniques and not the quality of the raw water supply. The water systems in Region B that have existing or potential non-compliances are identified in Table ES-10, along with the parameter of concern.

Table ES-10
Water Systems Not Compliant with Primary Drinking Water Quality Standards

Water System	County	Water Source	CURRENT STANDARD NO_3 MCL = 10 mg/L
Byers	Clay	Seymour Aquifer	X
Charlie WSC	Clay	Seymour Aquifer	X
Lockett Water System	Wilbarger	Seymour Aquifer	X
Hinds-Wildcat Water System	Wilbarger	Seymour Aquifer	X

The TCEQ records indicate that the only primary drinking water standard (other than bacteriological) currently exceeded by water users in Region B is the nitrate criterion. Four water users have water supplies that exceed the MCL for nitrate.

In Region B, water supply needs were identified for three different categories: quantity, quality, and reliability. As shown on Table ES-11, a total of 19 water user groups were identified with one or more of these need categories. Nine water user groups were identified with firm quantity needs. An additional seven water user groups have projected safe supply shortages, and several municipal suppliers were found to have water quality and reliability issues.

Table ES-11

Water Users with Identified Needs

		Water Supply Needs		
User	**County**	**Quantity**	**Quality**	**Reliability**
County Other	Archer	X		
Lakeside City	Archer	X		
Irrigation	Archer	X	X	
County Other	Baylor			X
Seymour	Baylor			X
County Other	Clay	X	X	
Byers	Clay	X	X	
Irrigation	Clay	X	X	
County Other	Montague	X		
Bowie	Montague	X		
Mining	Montague	X		
Electra	Wichita	X		
Irrigation	Wichita	X	X	
Iowa Park	Wichita	X		X
Wichita Falls	Wichita	X		
County Other	Wilbarger		X	
Manufacturing	Wilbarger	X		
Steam Electric Power	Wilbarger	X		
Vernon	Wilbarger	X		

For each of the identified needs, water supply strategies were developed based on discussions with the water user and the Regional Water Planning Group (RWPG) Technical Advisory Committee. In accordance with Senate Bill 1 guidance, the potentially feasible strategies were then evaluated with respect to:

- Quantity, reliability, and cost
- Environmental factors
- Impacts on water resources and other water management strategies
- Impacts on agriculture and natural resources
- Other relevant factors.

As required by Senate Bill 2 (an update to Senate Bill 1), water conservation must be considered when developing water management strategies for water user groups with needs. Generally water conservation was not included in the projected demands for non-municipal water uses in Region B. An expected level of conservation is included in the municipal demand projections due to the natural replacement of inefficient plumbing fixtures with low flow fixtures, as mandated under the State Plumbing Code. For Region B, the total municipal water savings associated with plumbing fixtures is approximately 14.3 percent of the projected demand if no conservation occurred.

Additional conservation savings can potentially be achieved in the region through the implementation of conservation best management practices. It is assumed that entities with low per capita water use will have minimal reductions in water use through conservation. In Region B there are ten municipal water user groups with identified safe supply shortages. Of these entities, Byers, Lakeside City and Montague County-Other have per capita water use below the screening criteria of 140 gallons per person per day.

Conservation strategies appropriate for Region B were evaluated based on the best management practices identified through the State Water Conservation Implementation Task Force. The Task Force identified 21 municipal conservation strategies and 15 strategies for industrial water users. In addition there are new Federal regulations that require new clothes washers to be energy efficient by 2007, which may reduce water use. After review and consideration of these strategies, the recommended municipal conservation package consists of four management practices:

- Public and School Education
- Reduction of Unaccounted for Water through Water Audits
- Water Conservation Pricing
- Passive Clothes Washer Rules

Best management practices not selected include rebate programs, accelerated plumbing fixtures replacements, and specific outdoor watering measures. The benefits of outdoor watering strategies were assumed to be accounted under the public and school education practice. Also, many of the entities in Region B already use restrictions on outdoor watering as a drought management measure. Accelerated fixture replacements do not reduce the ultimate water need, but could delay when the need begins. In Region B, the largest municipal water user, Wichita Falls, has water needs beginning in 2060. No additional savings can be achieved through accelerated implementation of plumbing fixtures. This is also true for rebate programs that simply accelerate the already assumed conservation savings. The likelihood of implementing rebate programs in rural communities is low and previous studies have shown these programs to be relatively costly per acre-foot of water saved.

No industrial conservation strategies were evaluated because there are insufficient data to evaluate these strategies for the manufacturing safe needs in Wilbarger County. For the irrigation and steam electric power needs associated with shortages in Lake Kemp, conservation through reductions in transmission losses in the irrigation canal system will be considered.

A summary of the water savings projected from conservation measures is shown in Table ES-12 and the savings expressed as a percentage of the projected water demands are shown in Table ES-13. Strategies that are required by federal (clothes washer rules) or state (water audits) regulations were assumed to be implemented in accordance with these regulations. Other conservation practices were assumed to be implemented in the decade the entity was found to have a water shortage.

Most of the savings shown in Table ES-12 are associated with the federal clothes washer rules that will require all new clothes washers to be energy efficient by 2007. This strategy assumes that every household that purchases a new clothes washer will reduce its water use by 5.6 gallon per person per day at no additional cost to the water provider; however, it is uncertain as to whether this amount of savings will be realized by the respective entity.

Table ES-12 Total Water Savings Associated with Conservation Strategies[1] (acre-feet per year)

Water User Group	2010	2020	2030	2040	2050	2060
Iowa Park	21	57	68	72	76	80
Electra	10	28	33	34	36	38
Vernon	45	122	144	148	148	146
Wichita Falls	124	533	548	556	562	1,367
Bowie	8	34	34	61	69	72
Byers[2]	1	3	3	3	3	3
Lakeside City[2]	3	9	10	11	11	11
Archer County-Other	7	11	14	16	17	18
Clay County-Other	16	42	45	45	41	39
Montague County-Other[2]	18	78	80	80	81	81

1. It is assumed that there are no savings directly from water audits. Savings are associated with system improvements as the result of water audits.

2. Only conservation savings associated with federal clothes washer rules are estimated for Byers and Montague County-Other because the per capita water use for these entities is less than 140. For Lakeside City, which also has per capita water use less than 140 gpcd, the values shown include savings from federal clothes washer rules and education programs. This is because the Lakeside City school system is shared with Archer County-Other. Benefits from a school education program that is implemented by Archer County-Other may also be realized by Lakeside City.

Table ES-13 Projected Water Savings as Percent of Municipal Demand

Water User Group	2010	2020	2030	2040	2050	2060
Iowa Park	1.72%	4.85%	5.76%	6.14%	6.51%	6.84%
Electra	1.78%	5.17%	6.09%	6.48%	6.85%	7.19%
Vernon	1.67%	4.60%	5.48%	5.86%	6.21%	6.56%
Wichita Falls	0.54%	2.42%	2.40%	2.45%	2.48%	5.98%
Bowie	0.76%	3.43%	3.53%	6.43%	7.30%	7.64%
Byers	0.05%	0.22%	0.22%	0.21%	0.20%	0.18%
Lakeside City	0.58%	1.68%	1.93%	2.07%	2.11%	2.13%
Archer County-Other	1.27%	2.45%	2.78%	3.08%	3.46%	3.77%
Clay County-Other	1.84%	4.87%	5.25%	5.78%	6.77%	7.37%
Montague County-Other	1.76%	7.93%	8.26%	8.45%	8.56%	8.59%

There are fourteen municipal users in Region B that have been identified with water needs relating to quantity, quality, or reliability. These users include Archer County (Other), Baylor WSC, Clay County (Other), Montague County (Other), City of Bowie, City of Byers, City of Electra, City of Iowa Park, City of Lakeside City, City of Vernon, City of Wichita Falls, Charlie WSC, Hinds-Wildcat System, and Lockett Water System.

Based on a comparison of the total regional water supply to demand as shown in the previous Table ES-6, it was determined that there is adequate water supply to meet the needs of Region B as a whole up to the year of 2040. However, by the year 2050, the region is projected to have a supply shortage of 1,144 acre-feet per year and by 2060 the shortage will increase to 11,390 acre-feet per year.

In addition, based on a comparison of the supply to demand of each water user group in Region B, the various water needs were identified and water management strategies were evaluated to meet each need. Though all the strategies may be viable options and should be considered by each affected entity, the following is a listing by county of the preferred water management strategies for each water user group with projected water supply needs.

Archer County

The maximum projected water need for Archer County is 1,678 acre-feet per year. Most of this need (1,370 acre-feet per year) is associated with the irrigation supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Archer Co. (other)	Municipal Conservation	18 [1.]	1.72	2010
	Purchase water from Local Provider	296	5.26	2010
Lakeside City	Municipal Conservation	11	$0	2010
	Purchase water from Wichita Falls	12	1.25	2010
Archer Co. Irrigation	Increase water conservation elevation at Lake Kemp	1096 [1.]	0.01	2010
	Seasonal Conservation Pool (April-Oct.)	274 [1.]	0.01	2020
TOTAL		**1,707**		
ALTERNATE STRATEGIES – NONE IDENTIFIED				

[1]. Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

Baylor County

There are no projected water shortages in Baylor County of Region B, however, an emergency interconnect for Baylor WSC is recommended.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Baylor WSC and City of Seymour	Emergency Interconnect Millers Creek Reservoir	250	$3.80	2010

Clay County

The maximum projected water need for Clay County is 747 acre-feet per year. Most of this need (513 acre-feet per year) is associated with the irrigation supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Clay Co. (other)	Municipal Conservation	39 [1.]	0.78	2010
	Purchase water from Local Provider	223	$4.44	2010
City of Byers	Municipal Conservation	3 [1]	$0	2010
	Purchase water from Dean Dale WSC	11	$2.29	2010
Clay Co. Irrigation	Increase water conservation elevation at Lake Kemp	411 [1.]	$0.01	2010
	Seasonal Conservation Pool (April-Oct.)	102 [1.]	$0.01	2010
Charlie WSC	Nitrate Removal Plant	10	$6.90	2010
TOTAL		**799**		
ALTERNATE STRATEGIES – NONE IDENTIFIED				

[1.] Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

Cottle County

There are no projected water shortages in Cottle County of Region B.

Foard County

There are no projected water shortages in Foard County of Region B.

Hardeman County

There are no projected water shortages in Hardeman County of Region B.

King County

There are no projected water shortages in King County of Region B.

Montague County

The maximum projected water need for Montague County is 733 acre-feet per year. Most of this need (486 acre-feet per year) is associated with a safe need for Montague County (other).

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Montague Co. (other)	Municipal Conservation	81 [1]	$0	2010
	Develop Additional Groundwater Supplies	486	$1.54	2010
City of Bowie	Municipal Conservation	72 [1.]	$0.71	2010
	Wastewater Reuse	134	$2.80	2040
Montague Co. (Mining)	Purchase water from Local Provider	113	$4.52	2010
TOTAL		**886**		
ALTERNATE STRATEGIES				
Montague Co. (other)	Purchase water from Local Provider	486	$3.75	2010
City of Bowie	Develop Additional Groundwater Supply	134	$3.73	2040
Montague Co. (Mining)	Develop Additional Groundwater Supply	113	$1.54	2010

[1.] Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

Wichita County

The maximum projected water need for Wichita County is 26,745 acre-feet per year. Most of this need (23,577 acre-feet per year) is associated with the irrigation supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
City of Electra	Municipal Conservation	38 [1.]	$1.24	2010
	Purchase Water from Wichita Falls	1,680	$2.48	2010
City of Iowa Park	Municipal Conservation	80 [1.]	$0.83	2010
	Purchase Water from Wichita Falls	1,680	$1.65	2010
City of Wichita Falls	Municipal Conservation	1,367 [1.]	$0.24	2010
	Wastewater Reuse	11,000	$1.76	2020
Wichita Co. Irrigation	Increase water conservation elevation at Lake Kemp	10,000 [1.]	$0.01	2010
	Seasonal Conservation Pool (April-Oct.)	5,000 [1.]	$0.01	2010
	Enclose Canal Laterals in Pipe	8,577	$1.20	2040
TOTAL		**39,422**		

ALTERNATE STRATEGIES				
City of Wichita Falls	Construct Lake Ringgold	27,000	$3.30	2060

[1.] Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

Wilbarger County

The maximum projected water need for Wilbarger County is 11,761 acre-feet per year. Most of this need (11,097 acre-feet per year) is associated with the steam-electric power supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
City of Vernon	Municipal Conservation	146 [1.]	$0.45	2010
	Develop Additional Groundwater Supply	664	$0.94	2010
Lockett Water System	Purchase water from City of Vernon	109	$5.68	2010
Hinds-Wildcat System	Nitrate Removal Plant	40	$3.76	2010
Wilbarger Co. Steam Electric Power	Increase Water Conservation elevation at Lake Kemp	4,193 [1.]	$0.01	2010
	Seasonal Conservation Pool (April – Oct.)	874 [1.]	$0.01	2010
	Enclose Canal Laterals in Pipe	6,023	$1.20	2040
Wilbarger Co. Manufacturing	Purchase water from City of Vernon	241	2.35	2010
TOTAL		**12,297**		
ALTERNATE STRATEGIES				
Lockett Water System	Nitrate Removal Plant	109	1.38	2010
Hinds-Wildcat System	Purchase water from City of Vernon	40	7.21	2010

[1.] Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

Young County

There are no projected water shortages in Young County of Region B.

Impacts of Selected Water Management Strategies on Key Parameters of Water Quality and Impacts of Moving Water from Rural and Agricultural Areas

The Region B Water Planning Group is proposing five preferred water management strategies. Each of the strategies were evaluated and it was determined that none of the proposed strategies are likely to have adverse impacts on water quality within the region. In addition, though some additional agricultural lands may be utilized to develop needed groundwater supplies, the impact on agricultural lands will be minimal.

Consolidated Water Conservation and Drought Management Recommendations

Water conservation is a potentially feasible water savings strategy that can be used to preserve the supplies of existing water resources. Some of the demand projections developed for Senate Bill 1 planning incorporate an expected level of conservation to be implemented over the planning period. For municipal use, the assumed reductions in per capita water use are the result of the implementation of the State Water-Efficiency Plumbing Act. On a regional basis, this is about a 5.4 percent reduction in municipal water use by year 2060 (from a regional per capita use of 165 gallons per person per day to 156 gallons per person per day). Additional municipal water savings may be expected as the federal mandate for energy efficient clothes washing machines takes effect in 2007.

Water conservation and drought management are often a way of life in Region B. With frequent periods of drought, water providers recognize the importance of active management and conservation of local water resources. The Region B Water Planning Group also recognizes that advanced water conservation measures (i.e. savings associated with active conservation measures for municipal and industrial uses) will be implemented by local governing entities or water users as conditions arise. The recommended strategies presented in this plan provide a framework from which water providers can use to develop plans and/or strategies to meet their needs. Region B Planning Group supports the use and consideration of any water conservation strategy deemed appropriate by a water user.

Acknowledging the importance of water conservation to meet future water needs in Region B, this water plan recommends several water conservation strategies for users with identified needs:

- Municipal conservation
- Municipal reuse
- Irrigation conveyance loss reduction

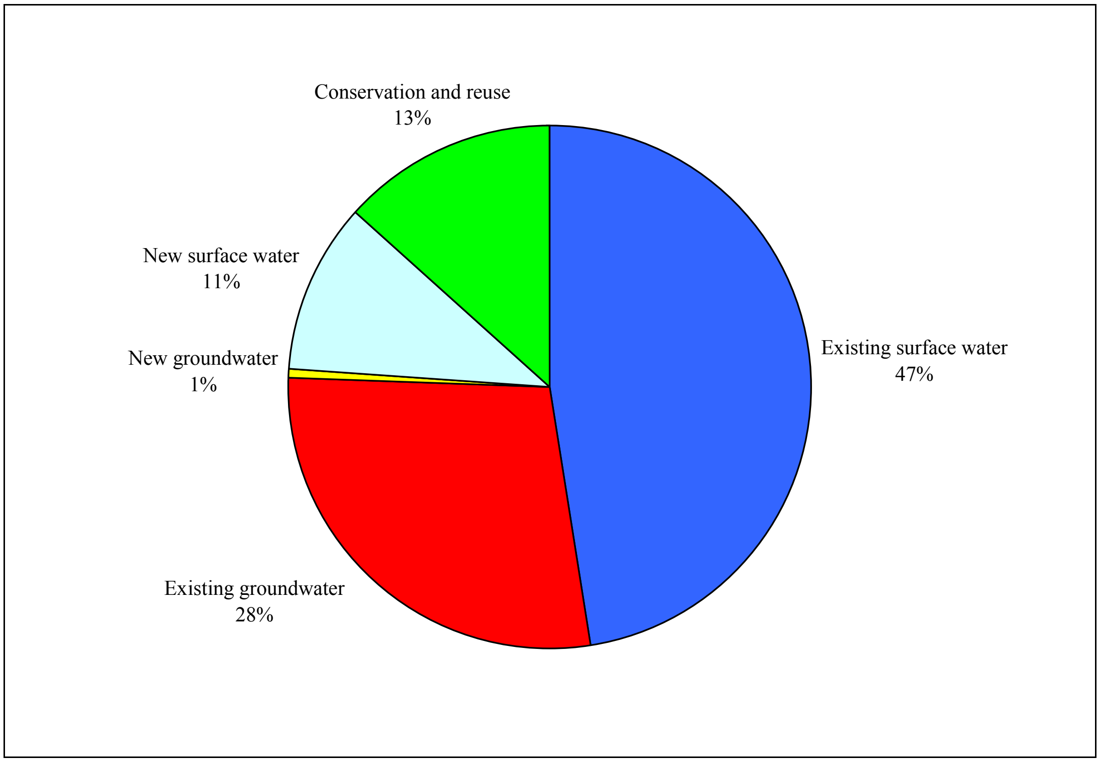
The amount of conservation from each of these strategies is shown in Table ES-14, and represents approximately 54 percent of the total supply from all recommended strategies by 2060. As shown on Figure ES-3, conservation and reuse represent 13 percent of the total amount of water available to Region B in 2060.

Table ES-14: Conservation by Strategy
-Values in Acre-feet per year-

Strategy	2010	2020	2030	2040	2050	2060
Additional Municipal Conservation	252	920	979	1,027	1,043	1,855
Wichita Falls Reuse		11,000	11,000	11,000	11,000	11,000
Bowie Reuse				134	134	134
Lake Kemp Canal Project				14,600	14,600	14,600
Total Conservation	**252**	**11,920**	**11,979**	**26,761**	**26,777**	**27,589**
New Supplies						
Increase conservation elevation at Lake Kemp	25,783	23,766	21,749	19,732	17,715	15,700
Seasonal pool at Lake Kemp	5,000	5,250	5,500	5,750	6,000	6,250
Additional groundwater for Vernon	664	664	664	664	664	664
Additional groundwater for Montague County-Other	394	458	475	486	486	486
Conservation and reuse	252	11,920	11,979	26,761	26,777	27,589
Total – New Supplies[1]	**32,093**	**42,058**	**40,367**	**53,393**	**51,642**	**50,689**
% Conservation	1%	28%	30%	50%	52%	54%

1. New supplies include conservation savings.

Figure ES-3: Water Supplies to Region B in 2060 by Type



Description of How the Regional Water Plan is Consistent with Long-Term Protection of the State's Water Resources, Agricultural Resources, and Natural Resources

The development of viable strategies to meet the demand for water is the primary focus of regional water planning. However, another important goal of water planning is the long-term protection of resources that contribute to water availability, and to the quality of life in the State.

To be consistent with the long-term protection of water resources the Plan must recommend strategies that minimize threats to the region's sources of water over the planning period. The water management strategies were evaluated for threats to water resources. The recommended strategies represent a comprehensive plan for meeting the needs of the region while effectively minimizing threats to water resources.

Agriculture is an important economic cornerstone of Region B. Given the relatively low rainfall, irrigation is a critical aspect of agriculture in the region. The source of most of the region's irrigation is the Lake Kemp/Lake Diversion system, which provides water via a canal system located in Archer, Wichita, and Clay Counties.

Protection of the Lake Kemp/Lake Diversion system has been a central focus of the water planning process for Region B.

Region B contains many natural resources that must be considered in water planning. Natural resources include threatened or endangered species; local, state, and federal parks and public land; and energy/mineral reserves. The Region B Water Plan is consistent with the long-term protection of these resources.

Recommendations Including Unique Ecological Stream Segments, Reservoir Sites, Legislative & Regional Policy Issues

In accordance with 31 TAC 357.7 (a)(9), 31 TAC 357.8, and 31 TAC 357.9, the following recommendations are proposed to facilitate the orderly development, management, and conservation of the water resources available within Region B:

- It is recommended that the Chloride Control Project on the Wichita River and the Pease River be made a regional priority in order to enhance the water quality of Lake Kemp and Lake Diversion, and reclaim those lakes as a viable cost effective short term and long term regional water supply source.
- Based on the results of the Lake Kemp and Lake Arrowhead brush management studies, it is recommended that the State consider providing adequate funding to implement brush management and other land stewardship programs in an attempt to increase watershed yields.
- Region B recommends that no segments be designated as "Unique Stream/River Segments" or "Unique Reservoir Sites" at this time. Pending the results of comprehensive studies and clarification of the significance and impacts of designation, the Regional Water Planning Group may consider designations within the region in the future.

- It is recommended that the state regulatory agencies consider allowing continued long-term use of bottled water programs, and/or providing a waiver for small user groups that can demonstrate they have no reasonable cost-effective means to comply with the current nitrate MCL of 10 mg/L.
- It is recommended that the state fund the development, implementation, and evaluate the necessary management strategies adopted as part of this regional plan. This includes strategies identified to meet a specific need as well as general strategies to increase water supply in the region.
- It is recommended that the Legislature support the grass-roots regional water planning process enacted by Senate Bill 1 and strongly encourages the process be continued with adequate state funding for all planning efforts including administrative activities and data collection.
- It is recommended that the state continue to fund agricultural water use data collection and agricultural water use management/conservation projects.
- Senate Bill 1 requires future projects to be consistent with the approved regional water plan to be eligible for TWDB funding and TCEQ permitting. It is recommended that surface water uses that will not have a significant impact on the region's water supply and water supply projects that do not involve the development of or connection to a new water source should be deemed consistent with the regional water plan even though not specifically recommended in the plan.
- The Region B Planning Group recommends that the state support both federal and state efforts to rehabilitate existing sediment control structures and encourage funding and support for the construction of new structures in watersheds that would have the greatest benefits.
- With regards to conservation it is recommended that the Legislature allow each region to establish realistic, appropriate, and voluntary water conservation goals as opposed to being forced to comply with a state mandated requirement.
- Region B recommends that the gallons per capita per day (gpcd) calculation of water use be based on residential water use only.

CHAPTER 1

REGIONAL WATER PLANNING GROUP B

DESCRIPTION OF REGION

DESCRIPTION OF REGION
TEXAS STATE SENATE BILL 1
REGION B

1.1 Region B Overview

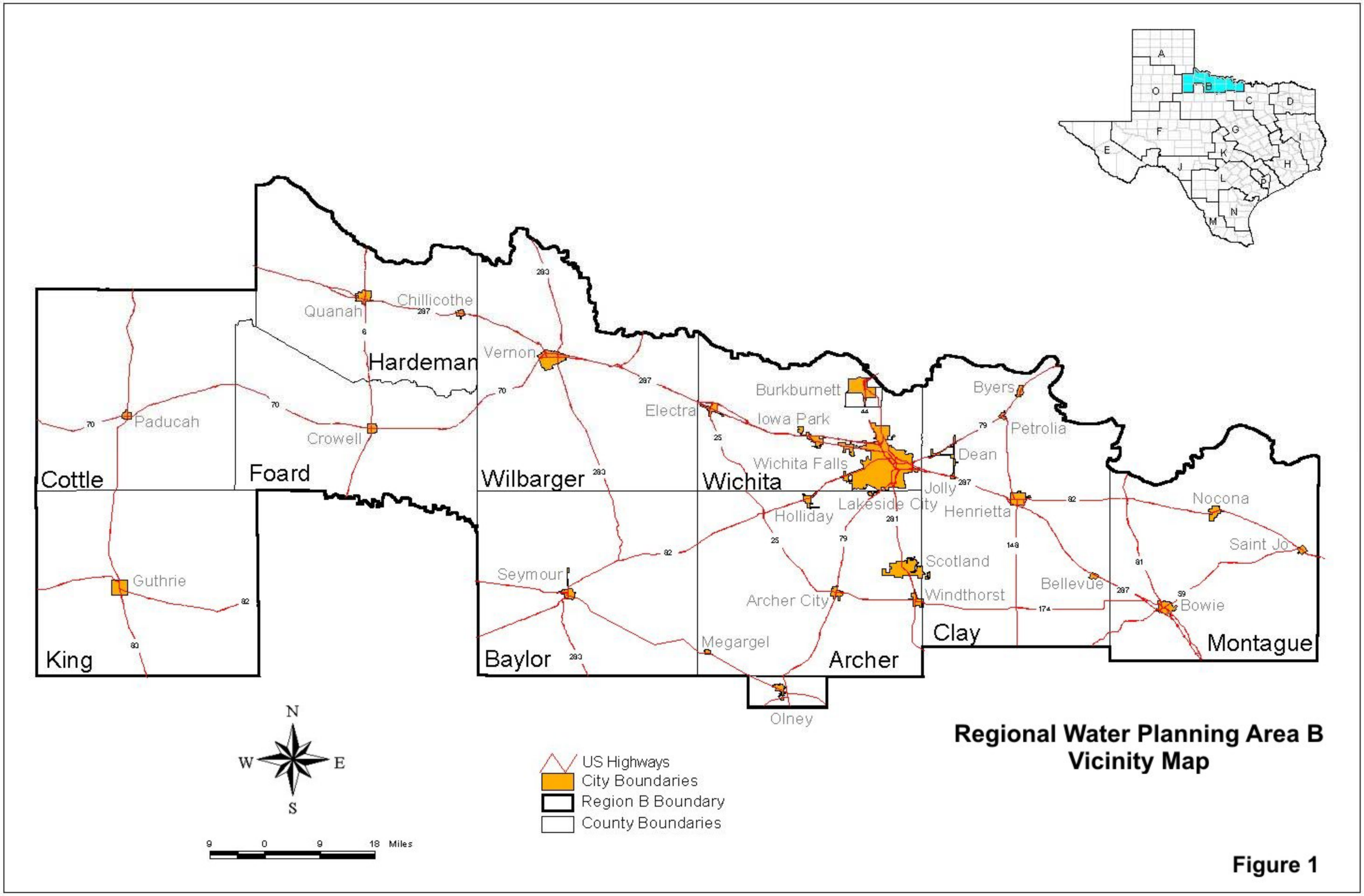
Senate Bill 1 of the 75th Texas Legislature was passed in 1997 to set the process of developing a comprehensive state water plan. To accomplish this task, the state was divided into 16 regional water planning groups. This report describes Region B as designated by Senate Bill 1. Region B is comprised of ten entire counties and a portion of one county in north central Texas. Specifically, those counties are Archer, Baylor, Clay, Cottle, Foard, Hardeman, King, Montague, Wichita, Wilbarger, and the City of Olney in Young County. Figure 1 shows the region, cities, towns, and the counties it encompasses.

Region B lies mainly in the Red River Basin, however, southern portions of Archer and Clay Counties lie in the Trinity River Basin, and southern portions of Archer, Baylor, and King Counties lie in the Brazos River Basin, as shown on the Surface Water Map in Figure 2.

In 2000, the total population of the region was reported to be 201,970, with the largest population center, the City of Wichita Falls, being 104,197 or 52 percent of the total. The second largest city was Vernon with a population of 11,660.

1.2 Population And Demographic Data

In general, most of the population is concentrated in eastern portions of the region with over one-half located in and around Wichita Falls. The January 1, 2000 estimated population density of the region ranged from a high of 210 persons per square mile (Wichita County) to a low of less than one person per square mile (King County). Regional population is forecasted to increase by approximately 10 percent over the study period. The forecasts of projected populations will be examined in more detail in Chapter 2 of this report. Table 1-1 shows the 1990 census population by county and the corresponding census population in 2000. Tables 1-2 through 1-5 give a more in depth breakdown of the regional demographics.



Regional Water Planning Area B
Vicinity Map

Figure 1

Table 1-1: County Populations

County	Area (sq. mi)	1990 Population	2000 Population	% Change	2000 Density people/sq.mi.
Archer	910	7,973	8,854	11.0%	10
Baylor	871	4,385	4,093	-6.7%	5
Clay	1,098	10,024	11,006	9.8%	10
Cottle	901	2,247	1,904	-15.3%	2
Foard	707	1,794	1,622	-9.6%	2
Hardeman	695	5,283	4,724	-10.6%	7
King	912	354	356	0.6%	< 1
Montague	931	17,274	19,117	10.7%	21
Wichita	628	122,378	131,664	7.6%	210
Wilbarger	971	15,121	14,676	-2.9%	15
Average	862	18,683	19,802	6.0%	23

The following tables describe the demography of the region as of the 2000 census.

Table 1-2: 2000 Demographics – Breakdown by Race

	Percentage Of Population That Is…				
County	White	Black	Hispanic	Native	Asian
Archer	95.5%	0.1%	4.9%	0.6%	0.1%
Baylor	91.0%	3.3%	9.3%	0.6%	0.5%
Clay	95.3%	0.4%	3.7%	1.0%	0.1%
Cottle	81.5%	9.9%	18.9%	0.0%	0.0%
Foard	84.2%	3.3%	16.3%	0.6%	0.2%
Hardeman	85.4%	4.8%	14.5%	0.8%	0.3%
King	94.1%	0.0%	9.6%	1.1%	0.0%
Montague	96.0%	0.2%	5.4%	0.7%	0.3%
Wichita	78.8%	10.2%	12.2%	0.9%	1.8%
Wilbarger	79.2%	8.9%	20.5%	0.7%	0.6%
Young	91.1%	1.2%	10.6%	0.6%	0.3%
Average	88.4%	3.8%	11.4%	0.7%	0.4%

Table 1-3: 2000 Demographics – Breakdown by Age

County	Percentage of Population That is Age…							
	<5	5-17	18-24	25-44	45-64	65-74	75-84	85
Archer	6.3	21.9	7.0	27.4	23.5	7.9	4.3	1.7
Baylor	4.9	18.5	5.5	21.4	25.6	12.0	9.0	3.5
Clay	5.8	19.0	6.8	26.4	25.9	9.3	4.8	2.0
Cottle	5.1	18.9	5.7	21.5	23.3	11.0	10.0	4.3
Foard	5.7	20.1	5.8	22.3	22.9	9.7	8.3	5.2
Hardeman	6.5	18.8	7.5	22.6	24.3	9.4	7.6	3.2
King	6.7	27.0	3.7	29.5	22.8	7.9	2.0	0.6
Montague	6.0	18.0	6.8	24.3	25.1	10.0	6.8	2.6
Wichita	7.0	18.2	13.7	29.0	19.5	6.9	4.3	1.5
Wilbarger	6.6	21.3	9.5	24.8	21.6	7.4	5.9	2.8
Young	6.0	19.0	7.0	24.7	23.6	9.9	6.9	2.9

Table 1-4: 2000 Demographics – Breakdown by Income and Education

County	Median Family Income	High School Diploma or Better	Bachelor's Degree or Better	Family Income Below Poverty Level
Archer	$45,984.00	81.1%	15.9%	6.8%
Baylor	$34,583.00	70.1%	12.1%	12.9%
Clay	$41,514.00	80.4%	13.9%	8.1%
Cottle	$33,036.00	66.1%	15.3%	13.7%
Foard	$34,211.00	70.0%	10.5%	9.9%
Hardeman	$33,325.00	70.7%	12.8%	14.6%
King	$36,875.00	78.1%	24.6%	17.9%
Montague	$38,226.00	73.0%	11.3%	10.0%
Wichita	$40,937.00	79.9%	20.0%	10.3%
Wilbarger	$38,685.00	72.2%	17.1%	9.0%
Young	$36,698.00	72.1%	14.4%	12.0%
Average	$37,643.00	74.0%	15.3%	11.4%

Table 1-5: 2000 Demographics – Breakdown by Occupation

County	Percentage of Population That Work In…						
	Management	Service	Sales	Farming	Construction	Production	Unemployed
Archer	30.4%	14.0%	22.1%	3.0%	13.8%	16.7%	2.2%
Baylor	36.3%	17.4%	21.5%	4.6%	11.6%	8.5%	2.4%
Clay	28.7%	13.3%	25.5%	3.8%	11.5%	17.3%	2.2%
Cottle	30.2%	20.5%	20.7%	7.1%	13.0%	8.5%	3.3%
Foard	32.6%	18.7%	16.5%	4.9%	10.6%	16.7%	1.2%
Hardeman	27.2%	21.0%	17.4%	3.9%	12.6%	18.0%	2.5%
King	32.9%	14.1%	20.1%	18.1%	8.7%	6.0%	0.0%
Montague	25.7%	16.8%	21.4%	1.5%	14.1%	20.4%	3.2%
Wichita	28.9%	18.8%	26.4%	0.4%	10.0%	15.6%	3.3%
Wilbarger	28.3%	22.8%	22.0%	1.7%	8.4%	16.8%	2.2%
Young	26.3%	16.2%	24.2%	1.6%	13.3%	18.3%	3.0%
Average	29.8%	17.6%	21.6%	4.6%	11.6%	14.8%	2.3%

1.3 Water Use Demand Centers

The City of Wichita Falls is the largest demand center in the region. Other demand centers include Seymour, Henrietta, Quanah, Bowie, Nocona, Burkburnett, Electra, Iowa Park, Vernon, Olney, and Archer City. Table 1-6 below shows the population of these demand centers and also the gallons per capita per day (GPCD) usage for each center.

Table 1-6: Regional Demand Centers

County	City	2000 Population	2000 Municipal Water Use (Ac-Ft)	Water Use (GPCD)
Archer	Archer City	1,848	232	112
Baylor	Seymour	2,908	554	170
Clay	Henrietta	3,264	526	144
Hardeman	Quanah	3,022	565	167
Montague	Bowie	5,219	824	141
Montague	Nocona	3,198	484	135
Wichita	Burkburnett	10,927	1,273	104
Wichita	Electra	3,168	337	95
Wichita	Iowa Park	6,431	1,232	171
Wichita	Wichita Falls	104,197	21,942	188
Wilbarger	Vernon	11,660	2,795	214
Young	Olney	3,396	609	160

While the population of Region B is only expected to reach near 222,000 by 2060, the Dallas-Fort Worth Metroplex, located just east of the region, is expected to top 9 million. This population could likely impose increasing pressures on the water base recreational resources of the region, as the number of people willing to travel into Region B for recreational purposes increases.

1.4 Water Supply and Use

Water providers have continuously strived to develop the water resources in Region B so that they can deliver potable water to the people, irrigation water to the farmers and ranchers, and water to promote industrial and economic growth. In 1901, the dam at Lake Wichita in Wichita County was completed, signifying the beginning of 90 years of water management for recreation, irrigation, and human consumption for north central Texas. In 1924, the dam at Lake Kemp was completed, making it one of the largest man-made lakes in the world. The lake was originally designed for flood prevention and water supply, however, soon after construction, it was determined that its water was too saline to drink. This led to the discovery of natural salt-water springs in Foard, King, and Knox Counties which have caused the water in the Big Wichita and Pease Rivers to be very difficult to treat for human consumption; consequently it is only used for irrigation and steam electric power purposes today. This natural phenomenon has prompted the Red River Authority to initiate the Wichita River Basin Chloride Control Project on the Big Wichita River. By building brine lakes and low-flow dams, the amount of dissolved solids and chlorides in the water has been reduced. As a result, water from Lake Kemp may be utilized for other uses. In fact, the City of Wichita Falls is currently constructing a 10 MGD reverse osmosis (R.O.) plant to treat Lake Kemp water and supplement their current water supply. There are 10 significant lakes and 4 major streams that are used for water supply in the region. Figure 2 - "Surface Water Map" shows the location of the major surface water sources in Region B. Charts 1 through 12 depict the average monthly and average annual streamflows at various USGS gauging stations which are shown on Figure 2. (NOTE: The site number shown for each chart represents the USGS gauging station shown on Figure 2.)

Table 1-7 shows the Year 2000 firm yield for each significant lake in Region B.

Table 1-7: Year 2000 Firm Yields for Lakes in Region B

Water Source	Basin	Lake Firm Yield (ac-ft)	Conservation Capacity (ac-ft)
Lake Kemp/Diversion	Red River	100,650	205,160
Lake Kickapoo/Arrowhead	Red River	50,830	323,430
Amon Carter Lake	Trinity	2,210	27,876
Lake Electra	Red River	470	5,606
Lake Nocona	Red River	1,260	21,819
Olney Lake	Red River	961	6,165
Santa Rosa Lake	Red River	3,075	8,245
North Fork Buffalo Cr.	Red River	840	14,378
Lake Pauline	Red River	1,284	3,297

In addition to the lakes listed in the previous table, some municipalities and water supply corporations obtain their raw water from wells.

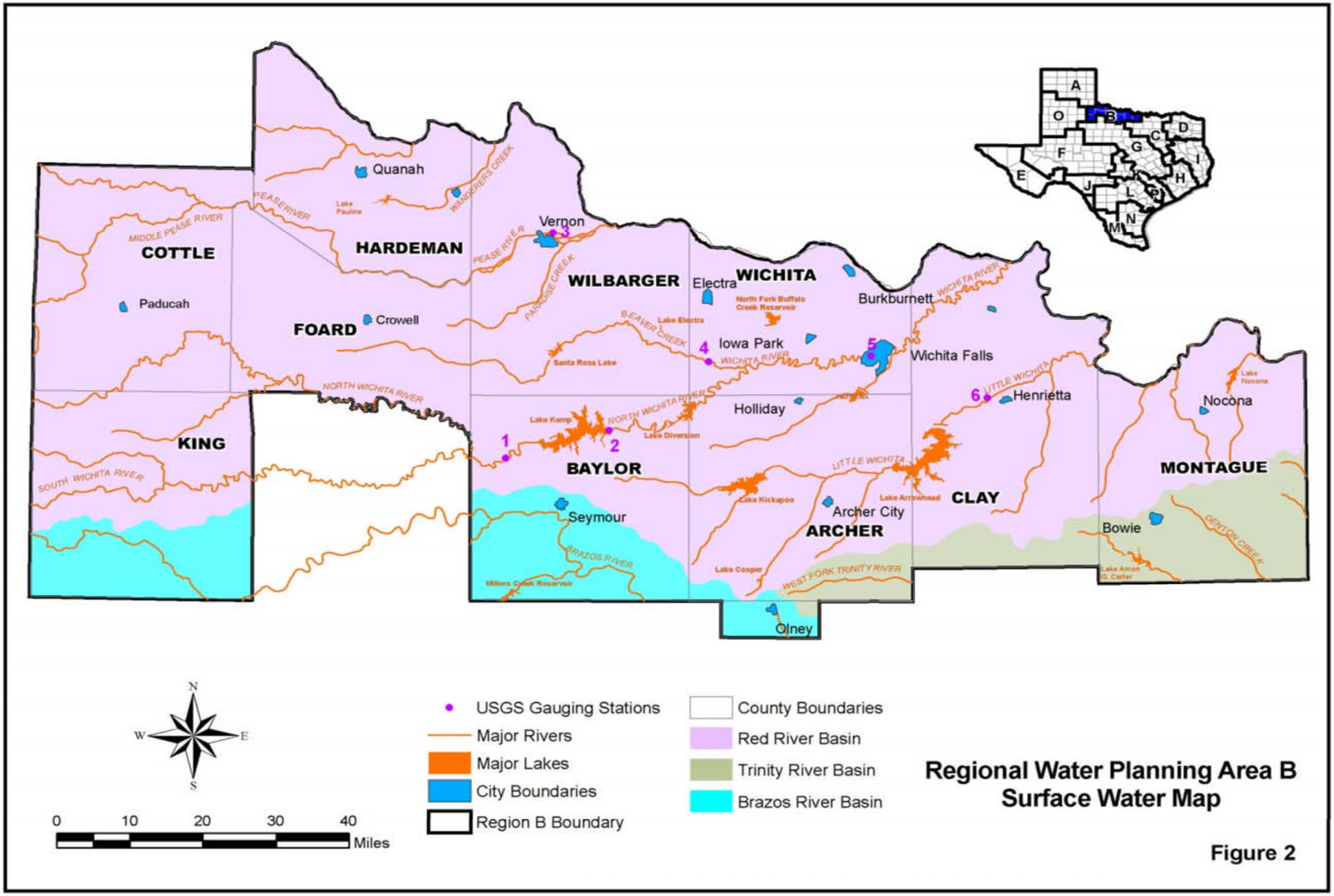

COTTLE
HARDEMAN
WILBARGER
WICHITA
FOARD
KING
BAYLOR
ARCHER
CLAY
MONTAGUE
Quanah
Vernon
Paducah
Crowell
Electra
Burkburnett
Iowa Park
Wichita Falls
Holliday
Henrietta
Nocona
Seymour
Archer City
Bowie
Olney
MIDDLE PEASE RIVER
PEASE RIVER
WANDERERS CREEK
PARADISE CREEK
BEAVER CREEK
WICHITA RIVER
NORTH WICHITA RIVER
SOUTH WICHITA RIVER
LITTLE WICHITA
BRAZOS RIVER
WEST FORK TRINITY RIVER
DENTON CREEK
Lake Kemp
Lake Diversion
Santa Rosa Lake
Lake Electra
North Fork Buffalo Creek Reservoir
Lake Kickapoo
Lake Arrowhead
Lake Cooper
Millers Creek Reservoir
Lake Nocona
Lake Amon G. Carter
1
2
3
4
5
6
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
N
S
E
W
0
10
20
30
40
Miles
USGS Gauging Stations
Major Rivers
Major Lakes
City Boundaries
Region B Boundary
County Boundaries
Red River Basin
Trinity River Basin
Brazos River Basin
Regional Water Planning Area B
Surface Water Map
Figure 2

Chart-1: Streamflow Data – Site 1

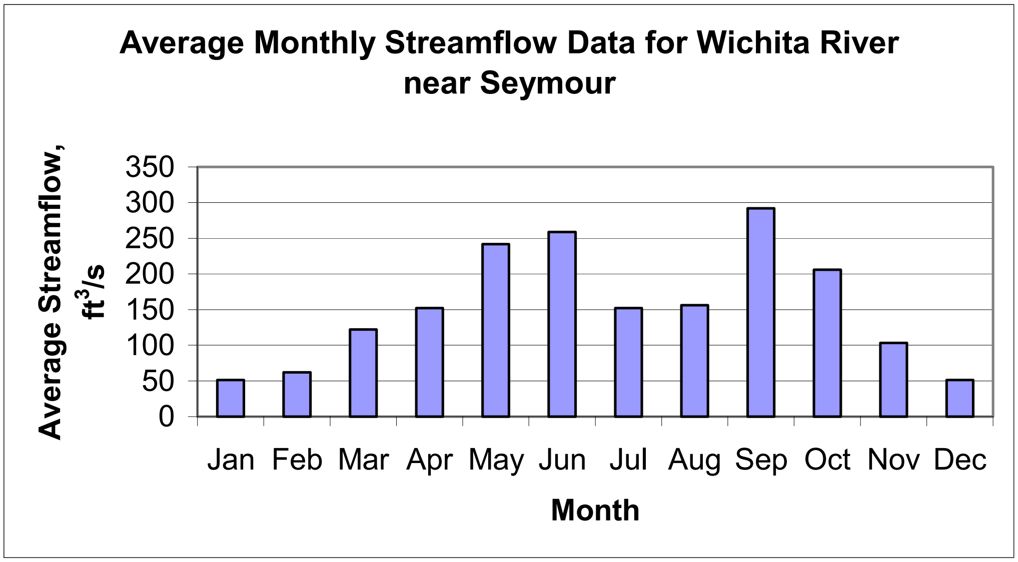
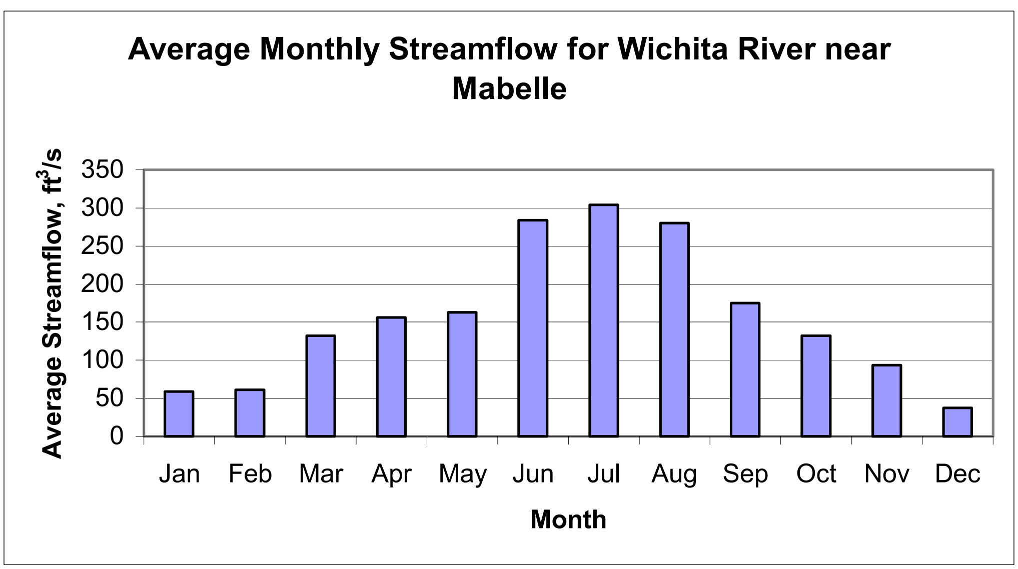


Chart-2: Streamflow Data – Site 2



Note: Streamflows at this site are influenced by releases from Lake Kemp for irrigation and industrial diversions.

Chart-3: Streamflow Data – Site 3

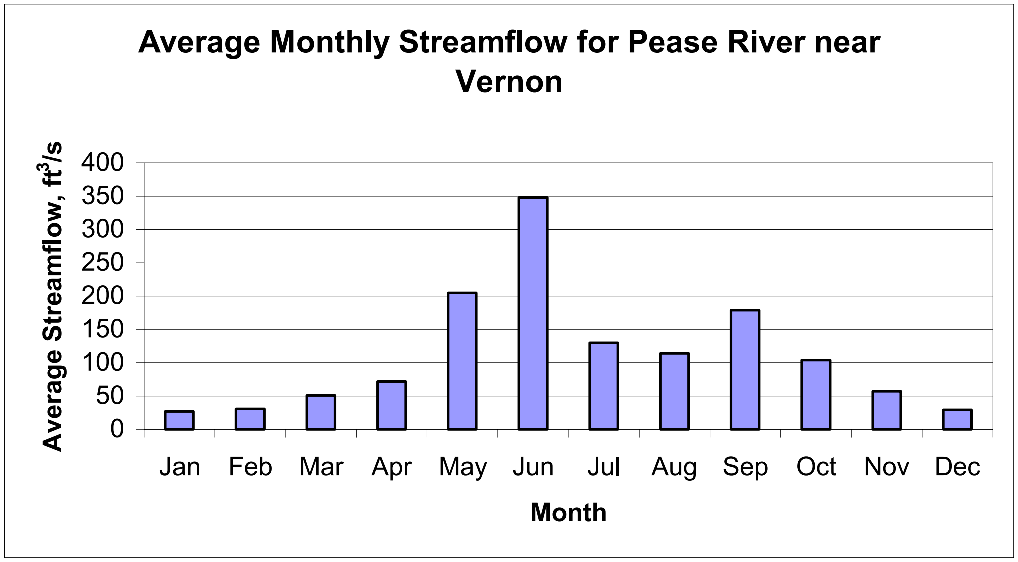


Chart-4: Streamflow Data – Site 4

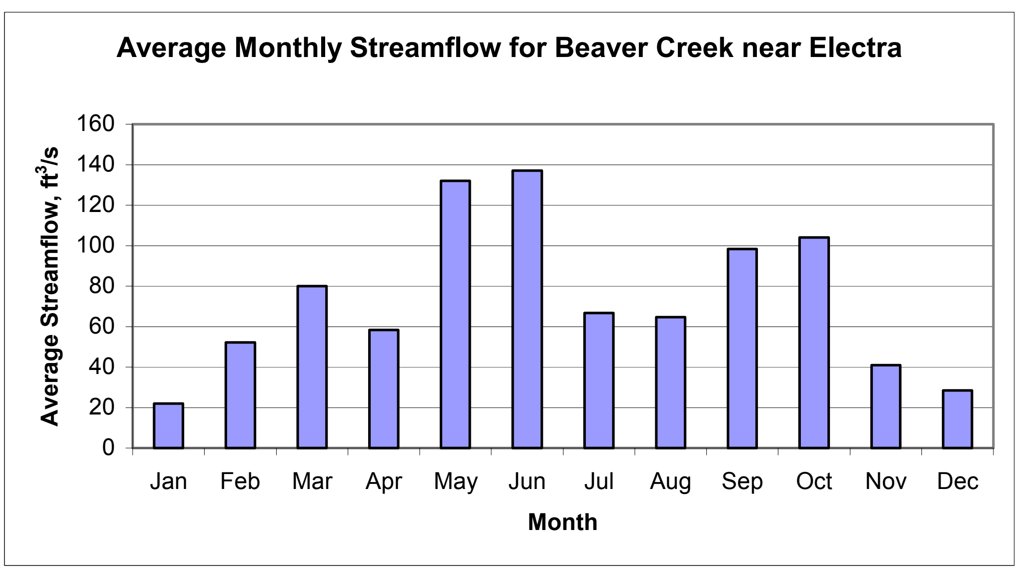


Chart-5: Streamflow Data – Site 5

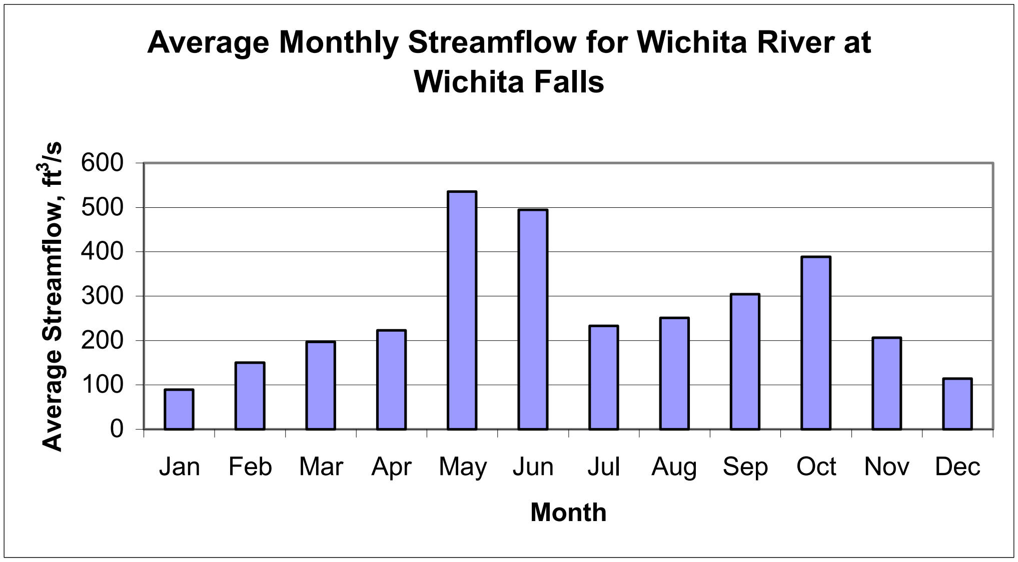


Chart-6: Streamflow Data – Site 6

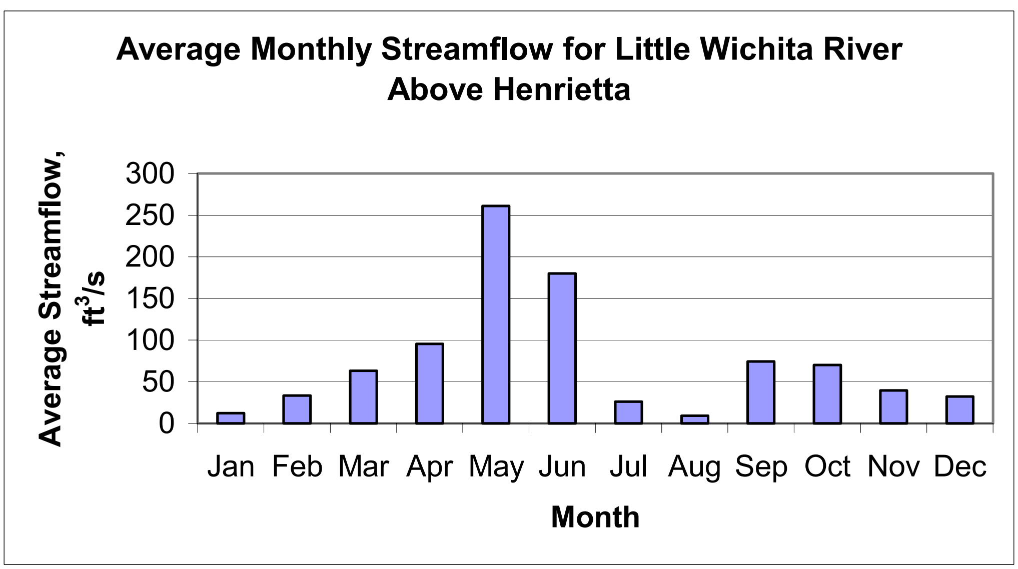


Chart-7: Streamflow Data – Site 1

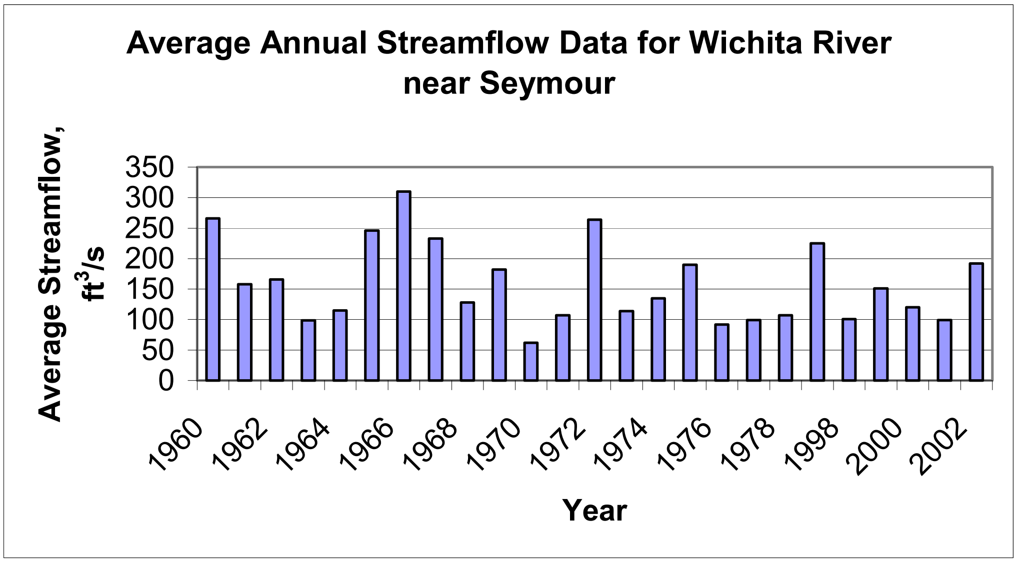


Chart-8: Streamflow Data – Site 2

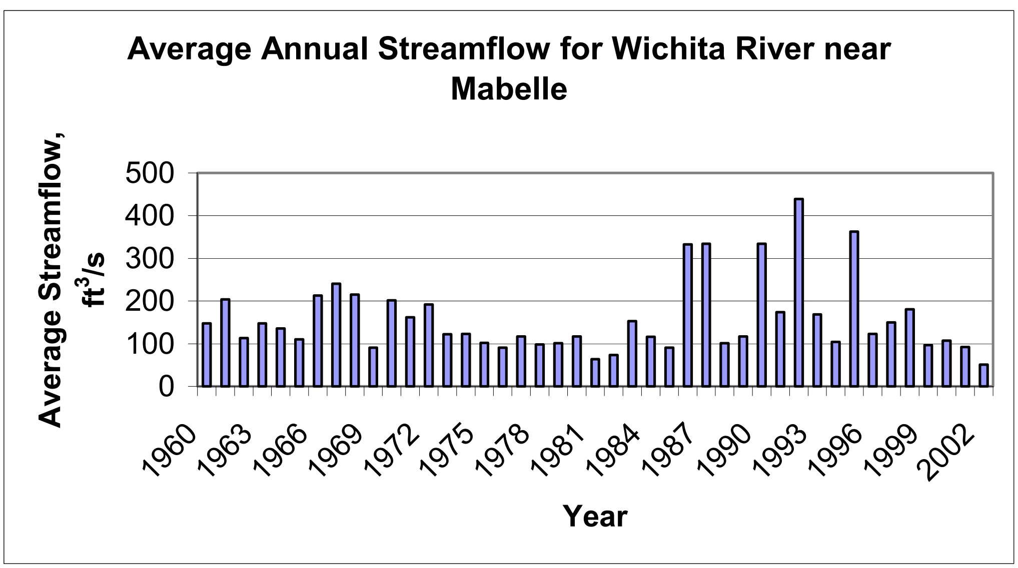


Chart-9: Streamflow Data – Site 3

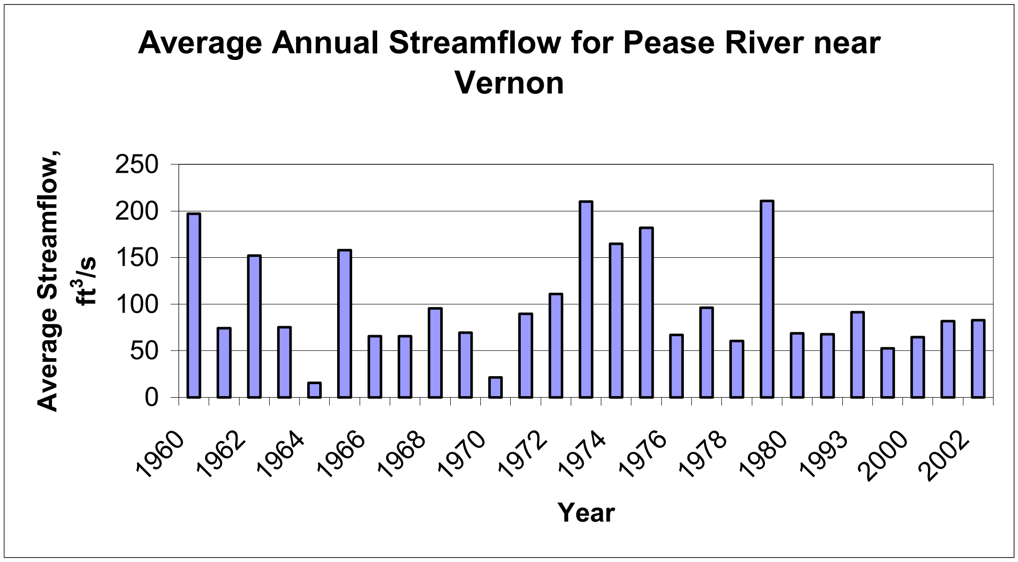


Chart-10: Streamflow Data – Site 4

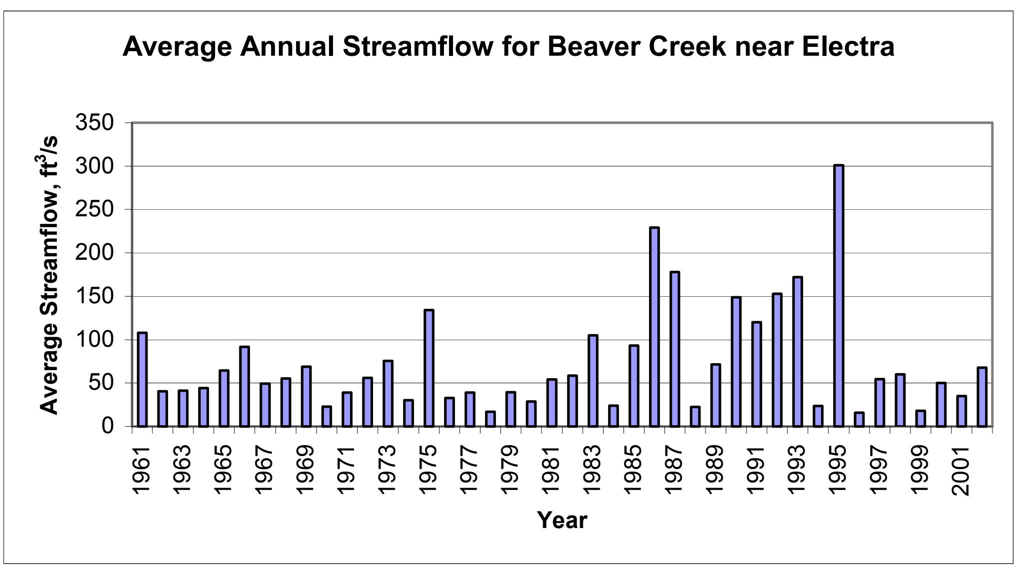


Chart-11: Streamflow Data – Site 5

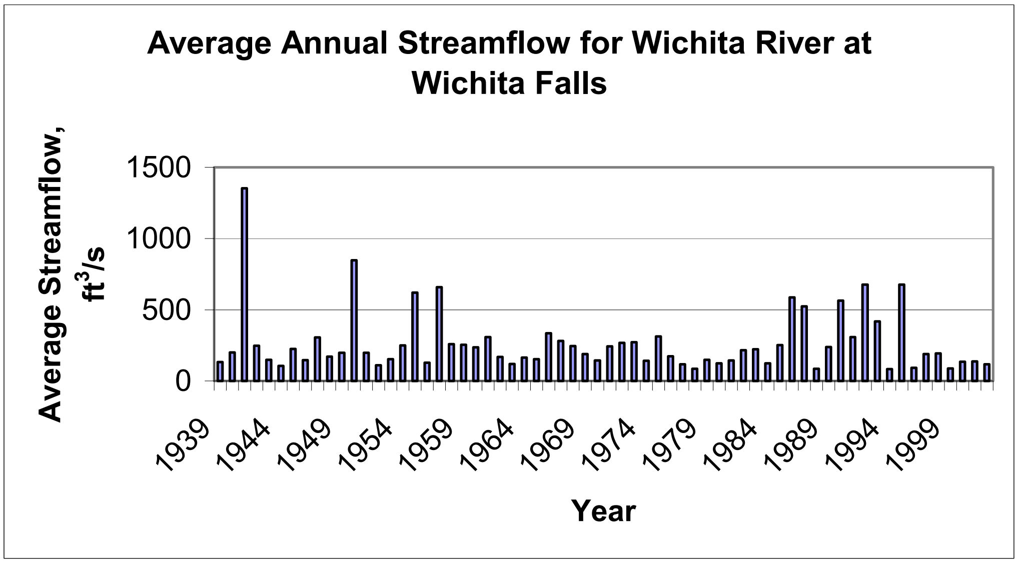
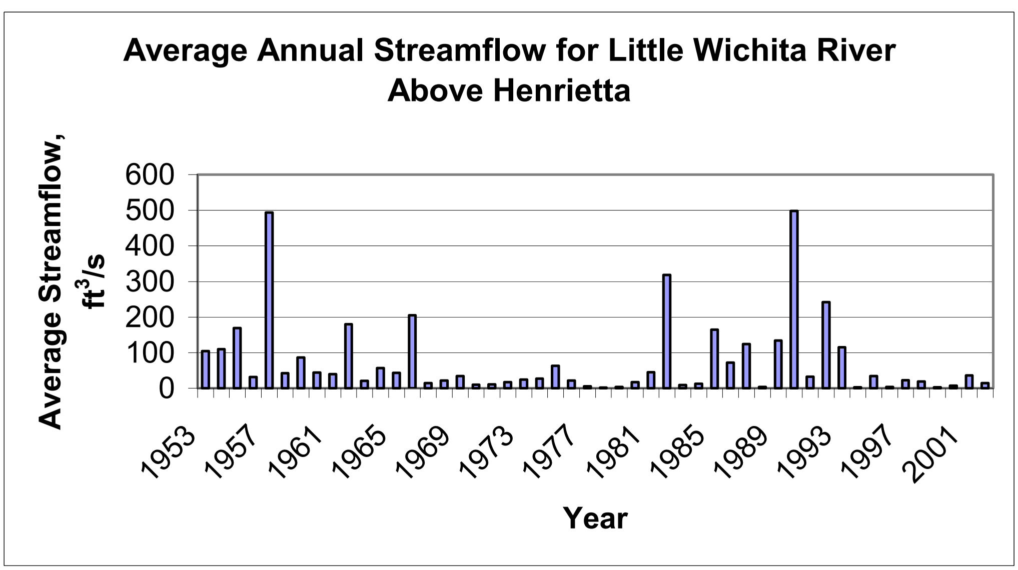


Chart-12: Streamflow Data – Site 6



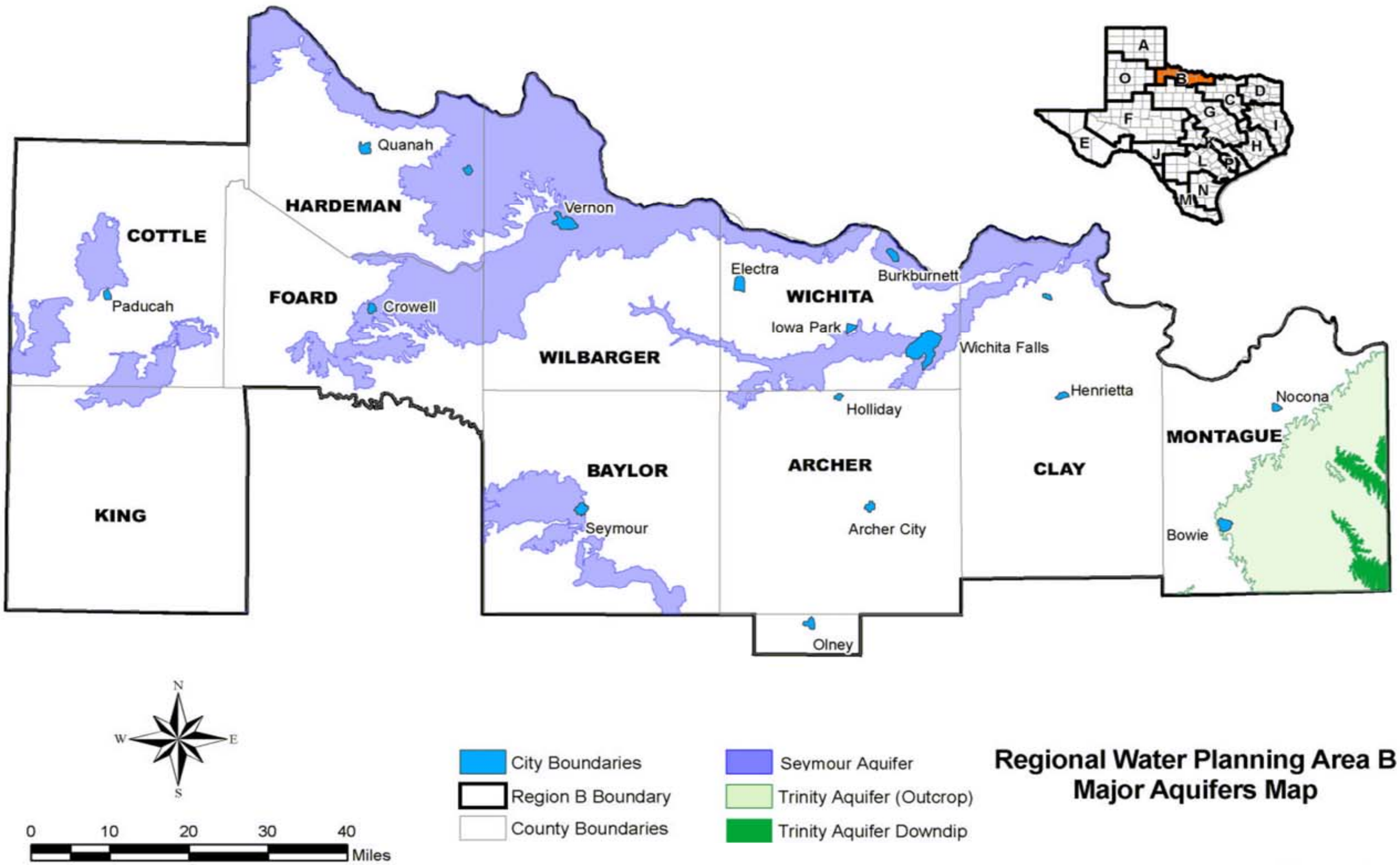
There are two major aquifers (Seymour and Trinity) and one minor aquifer (Blaine) in Region B. The Seymour Aquifer, found in the western portions of the region, is utilized for irrigation purposes in addition to being pumped for municipal use by the cities of Vernon, Burkburnett, Electra, and Seymour.

Extreme northern reaches of one of the state's most expansive aquifers, the Trinity Aquifer, lies in eastern and southern Montague County, the easternmost county in Region B. Water from this area of the aquifer is used mainly for irrigation purposes, due to its relatively low well yield. Figure 3 shows the location of the major aquifers within Region B.

Figure 4 shows the location of the only minor aquifer in Region B, known as the Blaine Aquifer. The Blaine Aquifer is found only in Cottle, Foard, Hardeman, and King Counties of Region B, and the large majority of the water pumped from this aquifer is used for agricultural purposes. The water pumped from this aquifer is high in dissolved solids from natural halite dissolution. In addition to the natural contamination, significant pollutants are also present in the aquifer as a result of human activities, such as oil and gas production and agriculture.

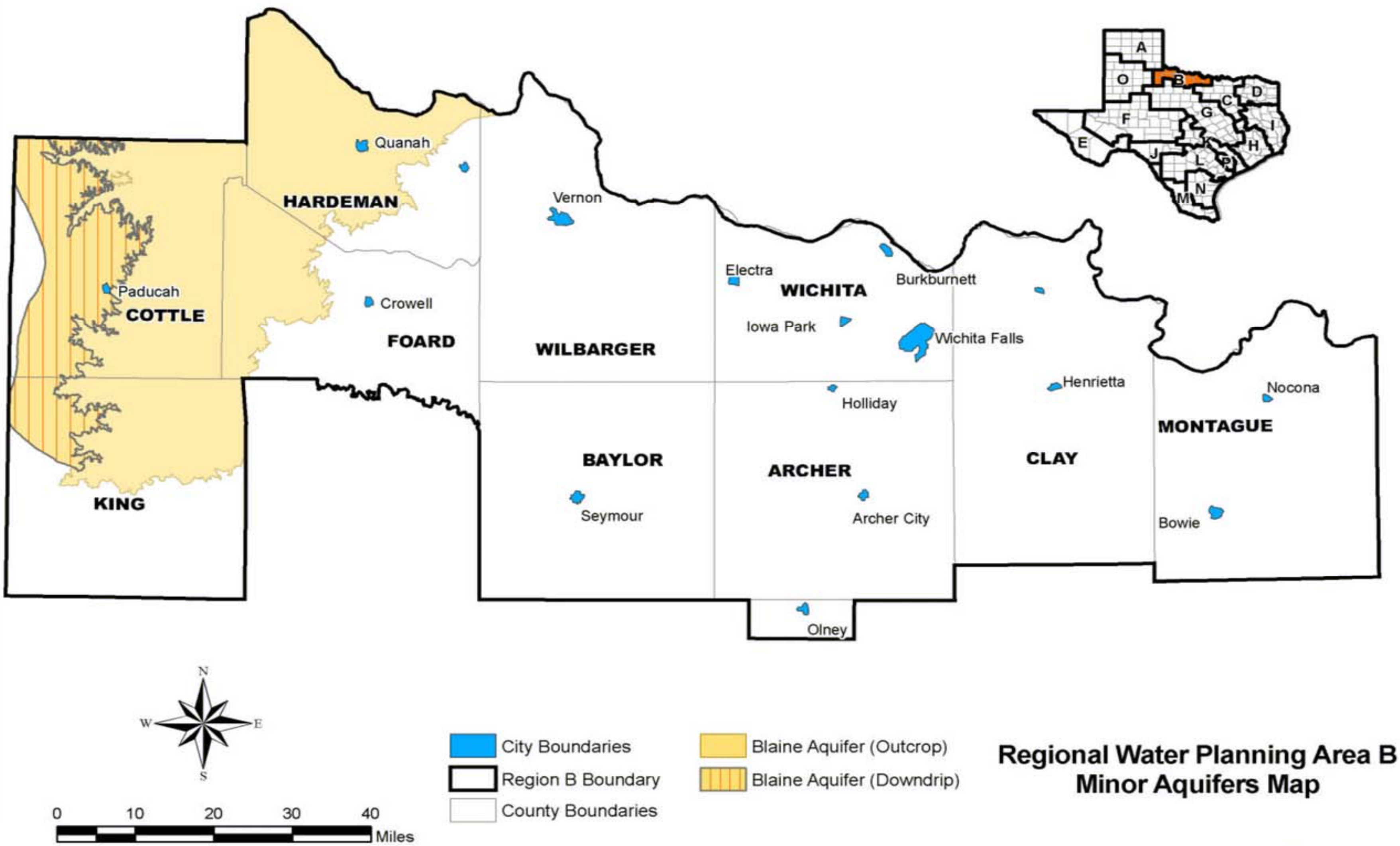
At one time, nearly 150 natural springs and seeps across the area were known to exist within Region B. While some continue to produce water today, many of these springs have dried up over time due to over-pumping of the groundwater for municipal, agriculture, industrial, and mining use. A few small producing springs feed natural ponds and creeks that are habitat for many plants and animals. It should be recognized that any future development of underground sources of water, as well as the overuse of existing surface water supplies, may cause a decline in the viability of existing springs.

Agriculture irrigation is the main component of regional water use, accounting for approximately 60 percent of all water used. Irrigation water is currently provided from Lakes Kemp and Diversion in unlined canals by the Wichita County Water Improvement District #2, the major irrigation provider in the region. A significant amount of irrigation is also provided from groundwater. Irrigation use in the region is expected to decline to 54 percent of the total use throughout the study period as more efficient pumping, irrigation techniques, and equipment are implemented across the region. Municipal use is expected to remain relatively constant due to conservation, while steam-electric use is expected to increase from 9,841 acre-feet (ac-ft) in the year 2000 to 21,360 ac-ft in the year 2060. The overall water use in the region is projected to remain relatively constant throughout the study period. Figure 5 shows the actual water used by category for Region B in 1990 and 2000. The 2060 projections are taken from Chapter 2 of this report.



Regional Water Planning Area B
Major Aquifers Map

Figure 3



Regional Water Planning Area B
Minor Aquifers Map

Figure 4

Figure 5

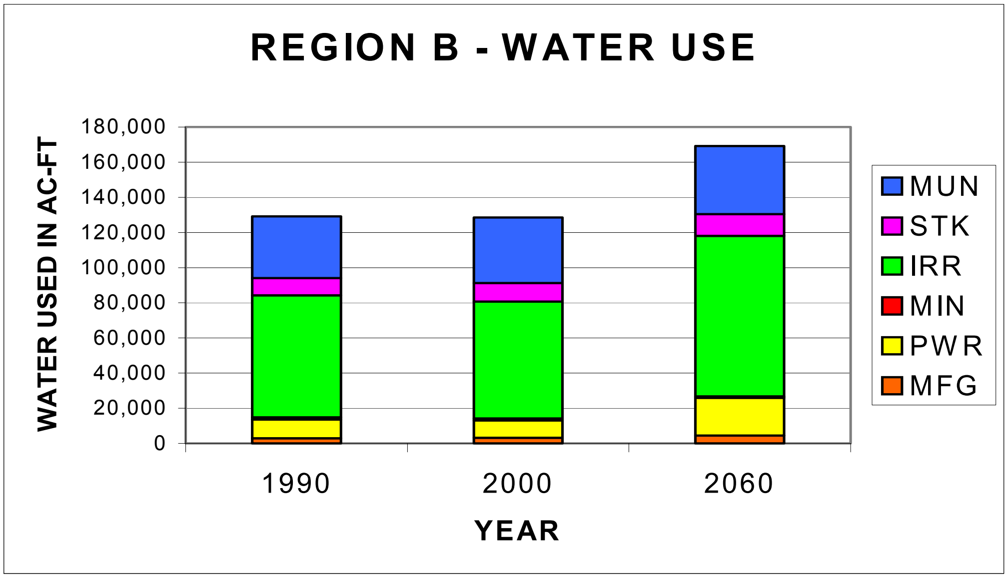


Table 1-8 shows the water rights holders of Region B and their permitted and actual usage.

Table 1-8: Surface Water Rights Holders and Their Usage

Rights Holder	Water Supply	Permitted Use (ac-ft)	Reported Use		
			1999	2000	2001
A.L. Rhodes	Little Wichita River	3,600	NR	NR	NR
City of Bowie	Amon G. Carter	5,000	750	983	NR
Peba Oil & Gas Co.	Red River	1,600	Abandoned 9/3/99		
N. Montague Co. MWA	Lake Nocona	1,260	689	517	522
Red River Authority	South Wichita River	8,780	4,094	3,039	3,406
Lonnie D. Allsup	Trib. Of Wichita River	2,150	360	360	NR
City of Wichita Falls	Lake Wichita	7,961	0	0	0
Wichita County WID #2	Ls. Kemp & Diversion	193,000	52,216	54,562	71,741
W.T. Waggoner Estate	Ls. Santa Rosa & Wharton	3,070	101	96	86
City of Electra	Lake Electra	1,400	306	174	102
City of Wichita Falls	Lake Kickapoo	40,000	6,170	6,717	11,813
City of Olney	Ls. Olney & Cooper	1,260	556	146	666
City of Wichita Falls	Lake Arrowhead	45,000	23,762	19,750	12,948
City of Wichita Falls	Little Wichita River	2,352	0	0	0
City of Henrietta	Little Wichita River	1,560	694	556	638
American Electric Power	Lake Pauline	3,616	31	983	495

A more detailed analysis of water use and water use projections is presented in Chapters 2 and 3 of this report.

1.5 Climate Data

The best way to describe the weather of Region B is volatile. It has the ability to change from one extreme to another in a short period of time. Annual precipitation can also vary greatly from year to year. The average annual rainfall for the region is 27.4 inches; however, the extremes range from 47 inches in 1919 to 12 inches in 1896. Table 1-9 shows monthly averages and records for the Wichita Falls area and Table 1-10 lists temperatures and rainfall for each county in the region.

Table 1-9: Monthly Averages and Records for Wichita Falls

Monthly Avg's	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High Temp.	52.1	58.1	67.2	75.5	83.5	91.7	97.2	95.8	87.5	77.1	63.7	54.5
Low Temp.	28.9	33.4	41.1	49.3	59.3	67.8	72.4	71.3	63.7	52.4	40.1	31.3
Precipitation	1.12	2.39	2.27	2.62	3.92	3.69	1.58	2.39	3.19	3.11	1.62	1.68
Monthly Rec's	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
High Temp.	87	93	100	102	110	117	114	113	111	102	89	88
Low Temp.	-12	-8	6	24	36	50	54	53	38	21	14	-7
Snowfall	9.8	9.0	9.7	1.0	0.0	0.0	0.0	0.0	0.0	1.0	6.3	7.0
Rainfall	2.25	2.97	3.60	3.87	5.12	5.36	3.10	4.52	6.19	4.00	3.15	3.12

Table 1-10: Temperature Extremes and Average Rainfall

	Temperature (of)		Annual
	Jan. Mean Min.	July Mean Max.	Rainfall (in)
Archer	29	98	29.3
Baylor	26	97	27.3
Clay	26	97	31.9
Cottle	25	96	22.3
Young	26	96	30.6
Foard	24	97	23.9
Hardeman	23	97	24.5
King	24	98	23.8
Montague	31	96	32.9
Wichita	29	97	28.8
Wilbarger	25	97	25.7

The region is obviously drier in the western areas and has more rainfall in eastern and southern counties.

Since 1930, the entire state has experienced seven major droughts. Two of these droughts have occurred in the past six years, in 1998 and 2002. It has been predicted that between 15 and 30 percent of Texas farmers will quit the business this year due to recent droughts. This fact is particularly significant for Region B since agriculture is a major contributor to the economy of the region.

1.6 Economic Aspects of Region B

The three main components of the region's economy are farming, ranching, and mineral production.

The Texas Railroad Commission reports that Region B has nearly 30,000 producing oil wells and over 650 gas wells. Table 1-11 provides a tabulation by county of the current oil and gas wells.

Table 1-11: Number of Oil and Gas Wells

County	Oil Wells	Gas Wells
Archer	5,886	0
Baylor	422	2
Clay	2,094	76
Cottle	60	68
Foard	152	89
Hardeman	311	1
King	872	50
Montague	2,847	49
Wichita	10,699	3
Wilbarger	1,869	2
Young	4,480	323
Total	29,692	663

The service infrastructure is also strong. Some of the services offered throughout Region B include agribusiness, oilfield service, grain, fiber, and food processing. Wichita County, the most populous county in the region, is the retail trade center for a large area. Sheppard Air Force Base and medical services also are big contributors to the economy of Wichita County. The region boasts a variety of manufacturing. Some areas of manufacturing include oilfield equipment, clothing, building products, plastics, electronics, wood products, and aircraft equipment.

1.7 Land Use

Region B includes some of the largest ranches in the state, including the Waggoner Ranch in Wilbarger County and the Four Sixes Ranch in King County. It has over 1 million acres of croplands and over 3 million acres of open range. Table 1-12 shows land use percentages for each county in the region (data for Montague County was unavailable). Percentages under the heading of "Conservation" represent lands that had previously been croplands, but have been converted to the Conservation Reserve Program. The Conservation Reserve Program, or CRP, subsidizes farmers and landowners to convert highly erodible farmland to permanent grassland for a period of ten years.

Table 1-12: Percentage of Land Use by County

County	Crops	Federal	Conservation	Pasture	Range	Urban	Water	Transportation
Archer	16.2%	<0.1%	1.0%	1.6%	77.0%	0.9%	2.2%	1.1%
Baylor	29.0%	-	1.6%	1.7%	61.2%	0.7%	4.9%	0.8%
Clay	19.3%	-	0.6%	6.1%	67.9%	1.6%	3.1%	1.5%
Cottle	14.7%	-	12.7%	0.9%	65.3%	0.3%	2.1%	0.6%
Foard	21.2%	-	14.9%	-	62.4%	-	0.6%	0.9%
Hardeman	37.5%	-	15.4%	0.4%	42.2%	1.2%	1.7%	1.6%
King	9.7%	-	2.3%	0.4%	86.4%	0.0%	0.5%	0.6%
Montague	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Wichita	40.5%	1.1%	1.5%	3.8%	38.7%	9.9%	1.5%	3.0%
Wilbarger	37.2%	-	7.3%	6.7%	46.6%	<0.1%	0.9%	1.3%
Young	30.6%	-	0.8%	2.7%	61.0%	1.6%	2.1%	1.3%

Typical crops in Region B include cotton, coastal bermuda, wheat, alfalfa, peanuts, grain sorghum, watermelons, pecans, peaches, and other various fruits. Cattle for beef and dairy production is the major component of the livestock industry, with sheep, swine, and equine also present.

1.8 Navigable Waterways

Navigable waters of the United States are those waters that are subject to the ebb and flow of the tide and/or presently being used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. Navigable waters include lakes and other on-channel impoundments of navigable rivers.

Based on information from the U.S. Army Corps of Engineers there are no navigable waters within Region B.

1.9 Ecology and Wildlife

Most of Region B lies in the area known as the "Rolling Plains" with the exception of Montague County, which lies in the "Oakwoods and Prairies" area. The Texas Parks and Wildlife Department describes the "Rolling Plains" region as a "gently rolling plain of mesquite and short grass savanna." The open range is generally characterized by its mesquite brush, prairie grasses, and sandstone outcroppings, Cottonwood, hackberry, and saltcedar brush can be found near most rivers and streams. This vegetation is important to the survival of both resident and migratory birds. It is evident by the widespread mesquite, however, that over-grazing, soil erosion, and the lowering of the groundwater table have all contributed to the decline of the native grasslands. The topography of the region gently slopes to the east and southeast. The Red River and its major tributaries drain most of the region; however, extreme southern reaches of the region are drained by tributaries of the Brazos and Trinity Rivers.

The Texas Parks and Wildlife Department uses freshwater mussels as water quality indicators because they are usually the first organisms to show their sensitivity to changes in aquatic quality. Recent surveys have determined that 52 separate species of mussels have declined[1]. Another organism used to indicate water quality is the minnow. Since 1950, minnows native to the Big Wichita River System have also shown serious declines. These native minnows include the plains minnow, the silver chub, and several varieties of shiner. The plains minnow is commonly used in support of a significant commercial baitfish industry. The decline of these organisms indicates poor water conservation and management. Runoff and scouring flows have increased with broad increases in over-grazing, highway development, and general land clearing. Scouring flows can cause excessive sedimentation, thus eliminating the natural habitats of these organisms.

The “Rolling Plains” region of Texas is not usually thought of as an area rich in wetland habitats. However, the region is actually very important to both migrating and wintering waterfowl. In fact many species of migrating shorebirds, raptors, and other birds stop over in the region to feed and rest on the available wetlands.

There are over 40 species of water-dependent reptiles, amphibians, and mammals that live in the study area. Some of these include minks, muskrats, beavers, snakes, turtles, salamanders, and frogs. Fish species present in the study area include drum, carp, buffalo, bluegill, sunfish, largemouth, white, spotted, and striped bass; white crappie; flathead, blue, and channel catfish. Lake Kemp supports a striped bass fishery. Some endangered species are also present across the region. Table 1-13 lists the endangered and threatened species present in the region.

Copper Breaks State Park, located 12 miles south of Quanah in Hardeman County contains 1,889 acres, and a 70 acre lake. The park has abundant wildlife, and according to the 1998 Texas Almanac, is home for part of the official Texas Longhorn herd.

Table 1-13: Region B - Endangered/Threatened Species

SPECIES	STATE STATUS	FEDERAL STATUS
Reddish Egret	Threatened	
American Peregrine Falcon	Endangered	Endangered
Arctic Peregrine Falcon	Threatened	Endangered
Whooping Crane	Endangered	Endangered
Bald Eagle	Threatened	Threatened
Brown Pelican	Endangered	Endangered
White-Faced Ibis	Threatened	-
Interior Least Tern	Endangered	Endangered
Black-capped Vireo	Endangered	Endangered
Shovelnose Sturgeon	Threatened	-
Texas Kangaroo Rat	Threatened	-
Black-footed Ferret	Endangered	Endangered
Brazos Water Snake	Threatened	-
Texas Horned Lizard	Threatened	-

1.10 Summary of Existing Local or Regional Water Plans

In April 1999, surveys were sent to the water providers of Region B to determine, among other things, if they possessed a water conservation plan or a local or regional water plan. Table 1-14 lists the results of those surveys.

Table 1-14: 1999 Survey Results Regarding Water Plans (Municipal Providers)

Water Provider	Existing Drought Contingency Plan?	Existing Water Conservation Plan?	Existing Local or Regional Water Plan?	Special Concerns of the Provider
Archer County MUD	Y	Y	N	Supply
Arrowhead Lake Water System	Y	Y	N	
Arrowhead Ranch Estates Water System	Y	Y	N	
Baylor County WSC	N	N	N	Nitrates
Box Community Water System	N	N	N	
City of Archer City	N	N	N	
City of Bowie	Y	Y	N	
City of Burkburnett	N	N	N	Nitrates
City of Byers	N	N	N	Nitrates
City of Charlie	N	N	N	Nitrates
City of Crowell	Y	N	N	Nitrates
City of Dumont	N	N	N	
City of Electra	N	Y	N	Nitrates
City of Henrietta	Y	Y	Y	
City of Holliday	N	N	N	
City of Iowa Park	N	N	N	
City of Lakeside City	N	N	N	Storage
City of Megargel	Y	N	N	
City of Nocona	N	N	N	
City of Nocona Hills	N	Y	Y	Nitrates
City of Olney	N	Y	N	Storage
City of Paducah	N	N	N	
City of Petrolia	N	N	N	
City of Pleasant Valley	N	N	N	
City of Quanah	N	N	N	
City of Saint Jo	Y	Y	N	
City of Scotland	Y	N	N	
City of Seymour	N	N	N	Nitrates
City of Sunset	N	N	N	Storage
City of Vernon	Y	Y	Y	Nitrates
City of Wichita Falls	Y	Y	Y	
Dean Dale WSC	Y	Y	N	
Farmers Valley Water System	Y	Y	N	
Foard County Water System	Y	Y	N	
Forestburg WSC	N	N	N	
Goodlett Water System	Y	Y	N	
Hinds Water System	Y	Y	N	
Horseshoe Bend WSC	N	N	N	
Lockett Water System	Y	Y	N	
Medicine Mound Water System	Y	Y	N	
Northside WSC	Y	Y	Y	Nitrates
Quanah NE Water System	Y	Y	N	
Ringgold Water System	Y	Y	N	
South Quanah Water System	Y	Y	N	
Wichita Valley WSC	N	N	N	
Windthorst WSC	N	N	N	

The table shows that as of May 1, 1999 most providers did not have a drought contingency or water conservation plan that met the new requirements of Senate Bill 1. However, as a part of the Senate Bill 1 planning efforts, most entities developed the plans as required.

1.11 Summary of Recommendations in the 2002 State Water Plan

The 2002 State Water Plan indicated few water supply shortages for entities in Region B. The main recommendations in the plan are for the development of additional groundwater for the cities of Vernon and Electra, and for Wichita Falls to develop a treatment system for water from Lake Kemp and utilize wastewater reuse. Also, the heavily dissolved solid and chloride concentrations in the western portions of the region are preventing the full utilization of the available water resources. To reduce this, it was recommended that the Wichita River Basin Chloride Control Project, sponsored by the Red River Authority of Texas, continue to be funded and operated.

1.12 Identification of Known Threats to Agriculture or Natural Resources

Excessive concentrations of total dissolved solids, sulfate, and chloride are a general problem in most streams of the Red River Basin under low flow conditions. The high salt concentrations are caused, in large part, by the presence of salt water springs, seeps, and gypsum outcrops. Salt water springs are generally located in the western portion of the (Red River) basin in the upper reaches of the Wichita River, the North and South Forks of the Pease River, and the Little Red, which is a tributary to the Prairie Dog Town Fork of the Red River. Gypsum outcrops are found in the area ranging westward from Wichita County to the High Plains Caprock Escarpment.

The excessive amounts of dissolved solids and chlorides in the water present problems to managers, planners, and others concerned with water treatment for municipal use. For this reason, the quality of the available water supply is as much an issue as the quantity for Region B. Water consumers of all kinds, whether municipal, industrial, or agricultural, desire water that is less saline; however, these conditions have existed for many years, and the plants and animals that live with them have adapted well. The Red River Authority of Texas is sponsoring a federal chloride control project to control the natural chloride level in the Red River Basin by impounding high chloride waters from the natural brine springs.

There is limited recent information available with regards to groundwater levels and drawdown data within the region. However, historical use indicates that with the exception of Wilbarger County, much of the groundwater is not fully developed or not currently being used. Therefore, it is anticipated that additional groundwater can be developed to meet the projected water demands through the planning period with no known threats to agriculture or natural resources.

1.13 Water Providers in Region B

Water is provided in Region B by a number of entities. The cities provide most of the water in the region with the City of Wichita Falls providing the majority of the water. Other major providers include the Red River Authority of Texas and the Greenbelt Water Authority. The following Table 1-15 shows a comprehensive listing of the water providers and the municipal use for the year 2000. A more detailed discussion of water use is presented in Chapter 2 of this report. It should be noted that these use figures do not include water for irrigation, manufacturing, electrical power, livestock, or mining.

Table 1-15: Water Providers and Users in Region B

USER	COUNTY	RIVER BASIN	2000 Water Use AF/YR
Archer City	Archer	RED	232
Holliday	Archer	RED	245
Lakeside City	Archer	RED	125
Seymour	Baylor	BRAZOS	554
Byers	Clay	RED	69
Henrietta	Clay	RED	526
Petrolia	Clay	RED	93
Paducah	Cottle	RED	247
Crowell	Foard	RED	250
Chillicothe	Hardeman	RED	151
Quanah	Hardeman	RED	565
Guthrie	King	RED	77
Bowie	Montague	TRINITY	824
Montague	Montague	RED	55
Nocona	Montague	RED	484
Saint Jo	Montague	TRINITY	210
Burkburnett	Wichita	RED	1,273
Electra	Wichita	RED	337
Iowa Park	Wichita	RED	1,232
Wichita Falls	Wichita	RED	21,942
Vernon	Wilbarger	RED	2,795
Olney	Young	BRAZOS	609
Other Rural			5,185
TOTAL			38,080

USER Other Rural	COUNTY	RIVER BASIN	2000 Water Use AF/YR
Baylor WSC	Archer	RED	18
Archer Co. MUD #1	Archer	RED	138
Megargel	Archer	RED	46
Scotland	Archer	RED	224
Windthorst WSC	Archer	RED	351
Wichita Valley WSC	Archer	RED	184
Archer Co. Other	Archer	RED	33
Archer Co. Other	Archer	TRINITY	24
Archer Co. Other	Archer	BRAZOS	36
Baylor WSC	Baylor	BRAZOS	190
Baylor Co. Other	Baylor	RED	22
Baylor Co. Other	Baylor	BRAZOS	90
Bellevue	Clay	RED	41
Bluegrove WSC	Clay	RED	7
Charlie WSC	Clay	RED	10
Dean Dale WSC	Clay	RED	217
Arrowhead Lake Water System	Clay	RED	95
Arrowhead Ranch Water System	Clay	RED	89
Friberg-Cooper WSC	Clay	RED	78
Clay Co. Other	Clay	RED	517
Clay Co. Other	Clay	TRINITY	68
King-Cottle WSC	Cottle	RED	75
Cottle Co. Other	Cottle	RED	6
Foard Co. WSD	Foard	RED	49
Margaret WSD	Foard	RED	17
Thalia WSC	Foard	RED	34
Foard Co. Other	Foard	RED	22

USER Other Rural	COUNTY	RIVER BASIN	2000 Water Use AF/YR
Goodlet Water System	Hardeman	RED	17
Medicine Mound Water System	Hardeman	RED	19
Quanah NE Water System	Hardeman	RED	59
S Quanah Water System	Hardeman	RED	19
Hardeman Co. Other	Hardeman	RED	74
King-Cottle WSC	King	RED	17
Dumont Water System	King	RED	30
King Co. Other	King	RED	2
King Co. Other	King	BRAZOS	3
Forestburg	Montague	RED	24
Montague Water System	Montague	RED	32
Nocona Hills WSC	Montague	RED	96
Oak Shores Water System	Montague	RED	5
Sunset Water System	Montague	RED	20
Ringgold WSC	Montague	RED	24
Montague Co. Other	Montague	RED	201
Montague Co. Other	Montague	TRINITY	796
Friberg Cooper WSC	Wichita	RED	92
Horseshoe Bend Water System	Wichita	RED	14
Pleasant Valley	Wichita	RED	101
Wichita Valley WSC	Wichita	RED	186
Dean Dale WSC	Wichita	RED	117
Box Com. Water System	Wilbarger	RED	19
Farmers Valley Water System	Wilbarger	RED	23
Harrold WSC	Wilbarger	RED	29
Hinds Com Water System	Wilbarger	RED	26
Lockett Water System	Wilbarger	RED	95
Northside WSC	Wilbarger	RED	37
Odell Water System	Wilbarger	RED	16
Oklaunion WSC	Wilbarger	RED	40
Wilbarger Co. Other	Wilbarger	RED	188
Young Co. Other	Young	BRAZOS	82
Young Co. Other	Young	TRINITY	1

1.14 Wholesale Water Providers

Each regional water planning group is required to designate its "Wholesale Water Providers" (WWP). According to the rules, a WWP is any person or entity, including river authorities and irrigation districts, which have contracts to sell more than 1,000 acre-feet of water wholesale in any one year during the five years immediately preceding the adoption of the last Regional Water Plan.

The only "Wholesale Water Provider" in Region B is the City of Wichita Falls.

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CHAPTER 2

REGIONAL WATER PLANNING GROUP B

POPULATION AND WATER USE PROJECTIONS

POPULATION AND WATER USE PROJECTIONS

TEXAS STATE SENATE BILL 1

REGION B

2.1 Region B Overview

The eleven North Central Texas counties of Region B contain only one city with a population larger than 100,000, which is Wichita Falls. The other communities are smaller and more rural in nature with incomes that are dependent on agriculture and, to a lesser extent, the oil industry. Consequently, the population for the region is projected to have only a moderate increase for the next sixty years from 201,970 people in 2000 to 221,734 in 2060, or 9.8 percent. Tables A-1 through A-4, in Attachment 2-1, summarize all of the population projections for the region through the year 2060 as adopted by the Regional Water Planning Group (RWPG). These projections were made by using the 1996 through 2000 population information as provided by the Texas State Data Center in conjunction with questionnaires mailed to every water provider in the region.

Per capita municipal water use is predicted to gradually decline over the planning period from 165 gallons per capita per day (gpcd) in 2000 to 156 gpcd in 2060 based on water use and population projections. According to the 2002 Texas Water Plan published by the Texas Water Development Board, the use for the entire state was shown to be 168 gpcd in 1990 with an increase to 181 gpcd in 2000. In 2050 the statewide use is predicted to decline to 157 gpcd. Region B's water use is currently in-line with the statewide average and is expected to decline in the future as predicted with the average. In the more densely populated areas where new construction is progressing at a faster pace than some rural areas, more water conserving measures can be implemented by requiring the newer plumbing fixtures and maintaining tighter controls on overall water use. Tables A-5 through A-9, in Attachment 2-1, summarize the projected water demands through the year 2060 as adopted by the RWPG with all revisions being approved by the Texas Water Development Board.

2.2 Population Growth

The Region B projected total population growth is shown in Figure 2-1. The projections were determined by:

- Using the latest information published by the State Data Center for city populations;
- Surveying the cities, smaller communities, rural water supply corporations, municipal utility districts, and river authorities to determine population based on existing meter counts;
- Using growth trends derived from the surveys based on populations and meter counts from 1990 to 2000.

Figure 2-1

Projected Population for Region B

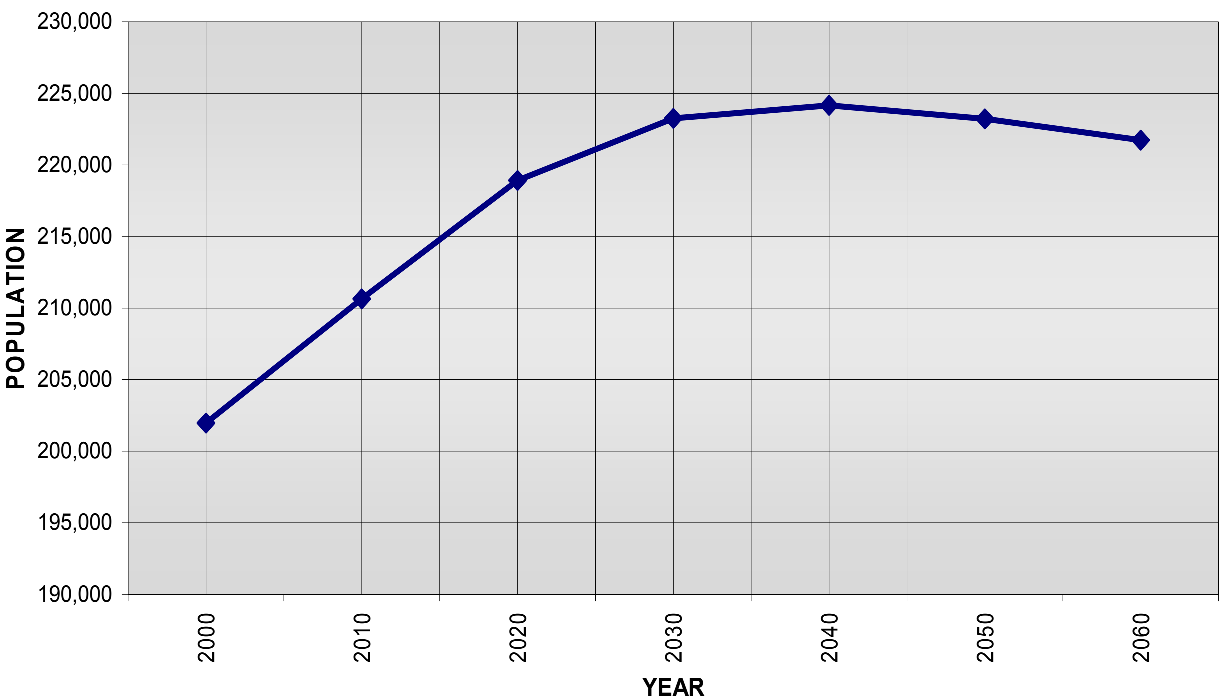


Table 2-1 - Projected Population Data Points

YEAR	2000	2010	2020	2030	2040	2050	2060
POPULATION	201,970	210,642	218,918	223,251	224,165	223,215	221,734

The city with the highest projected growth rate is Wichita Falls. It is expected to grow by approximately 17 percent in the next sixty years for several reasons. Recently the city annexed additional property north and west of town. The Allred Prison has expanded and Midwestern State University student population has increased in recent years. Other towns that may experience some growth include Lakeside City, Henrietta, Burkburnett, Iowa Park, and Vernon.

2.3 Water Uses

2.3.1 Total Region B Use

The water use for Region B has been divided into several categories for analysis purposes. The various uses analyzed include water for municipal use (MUN), industrial or manufacturing (MFG), power cooling (PWR), mining (MIN), agricultural irrigation (IRR), and livestock watering (STK). Figure 2-2 shows the amounts of water predicted to be required for these categories through the year 2060. The water use is shown in acre-feet (ac-ft) units with one acre-foot being equivalent to 325,851 gallons of water.

Figure 2-2

Projected Water Use for Region B

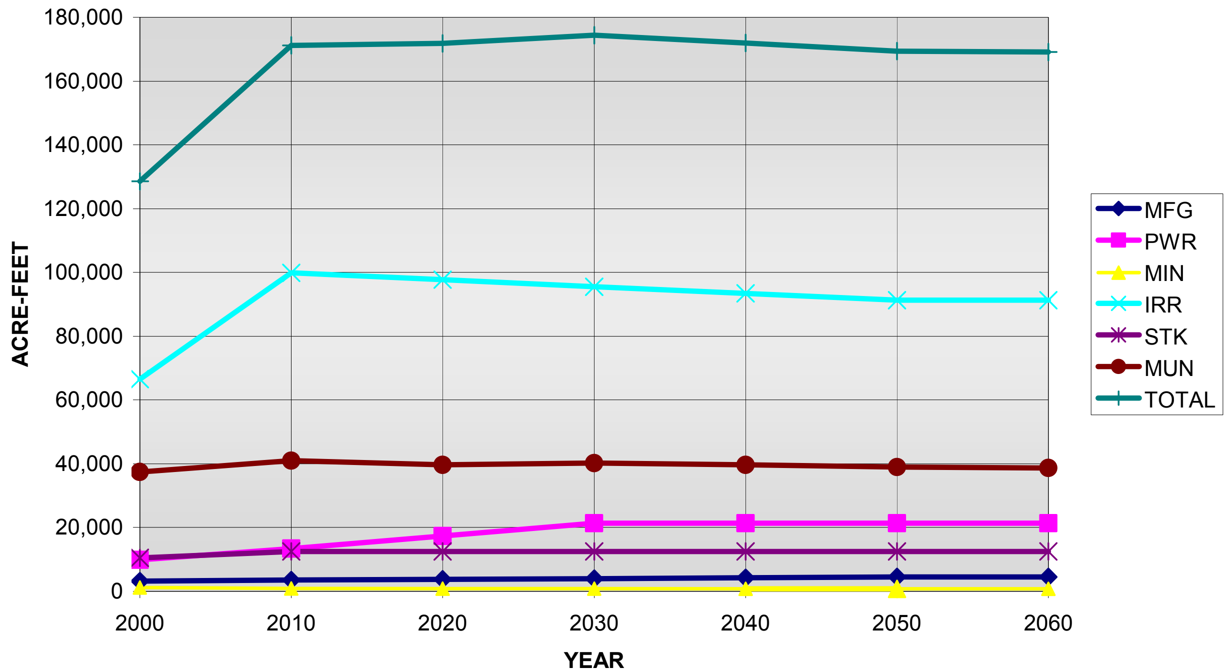


Table 2-2 - Projected Water Use Data Points (Acre-Feet)

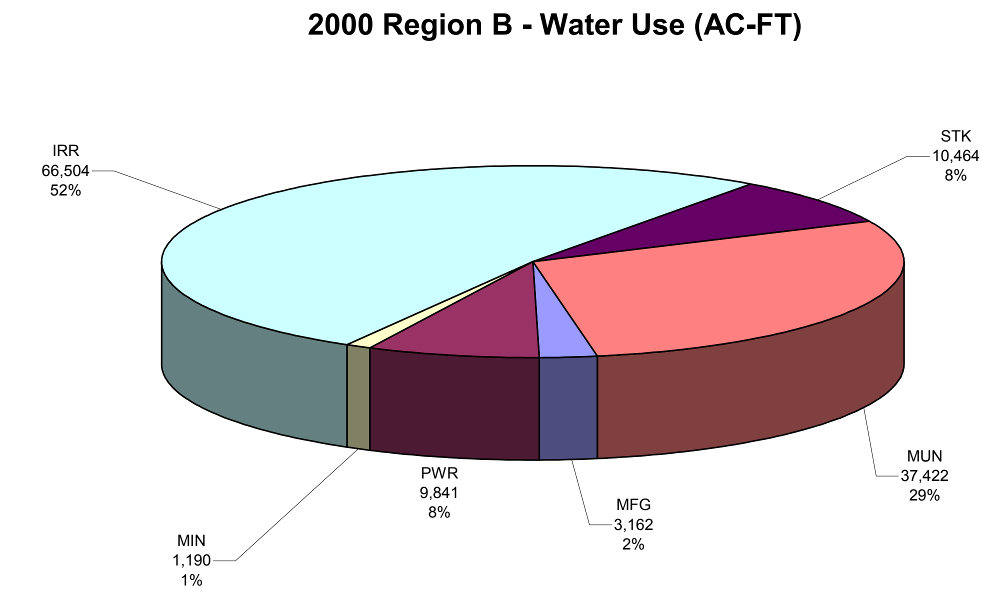
YEAR	2000	2010	2020	2030	2040	2050	2060
MFG	3,162	3,547	3,755	3,968	4,260	4,524	4,524
PWR	9,841	13,360	17,360	21,360	21,360	21,360	21,360
MIN	1,190	909	845	811	785	792	792
IRR	66,504	99,895	97,702	95,537	93,400	91,292	91,292
STK	10,464	12,489	12,489	12,489	12,489	12,489	12,489
MUN	37,422	40,964	39,655	40,196	39,664	38,962	38,696
TOTAL	128,583	171,164	171,806	174,361	171,958	169,419	169,153

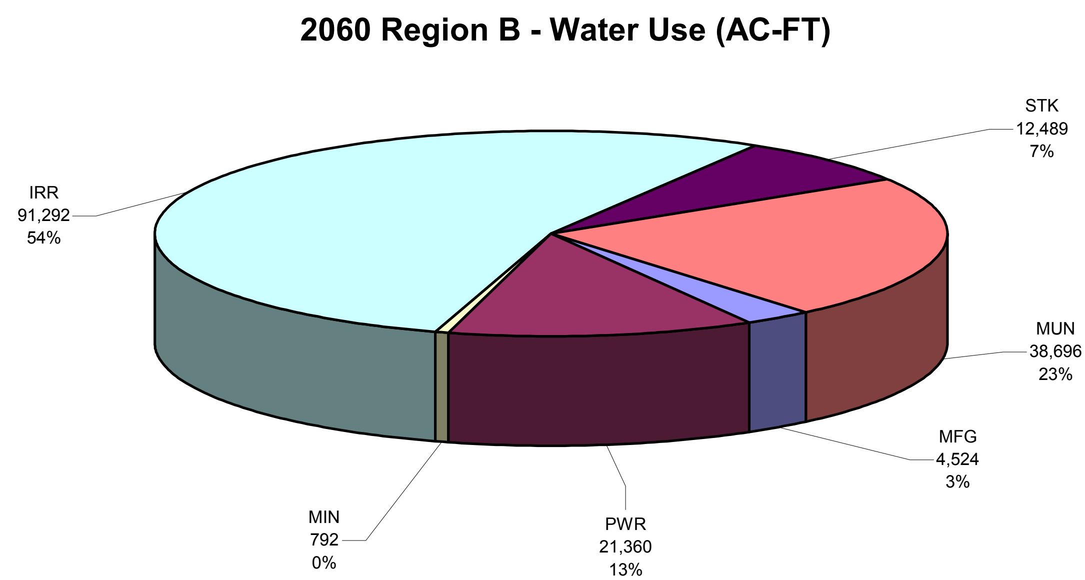
Total water consumption for the region is predicted to remain approximately level from 2010 to 2060. Figure 2-3 compares the water uses of 2000 to the projected water uses for 2060.

The two scenarios in Figure 2-3 show that the composition of water use for this region is not anticipated to change much.

Figure 2-3

Composition of Past and Projected Region B Water Use





2.3.2 Municipal Water Use

Municipal water use is defined by the TWDB as residential and commercial water use. Residential use includes single and multi-family household water use. Commercial use includes water used by business establishments, public offices, and institutions, but does not include industrial water use. Residential and commercial water uses are categorized together because they are similar types of uses, for example, each category uses water primarily for drinking, cleaning, sanitation, cooling and landscape watering.

Water use data were compiled for the water users of the region through research of records at the TWDB, the TCEQ, and through questionnaires sent to the providers of municipal water.

The total municipal water use for Region B is shown to decline from 40,964 ac-ft in the year 2010 to 38,696 ac-ft in 2060 in spite of a population increase of nearly 10 percent. The decrease is anticipated because, as previously mentioned, the per capita water use is expected to decrease over the next sixty years. Decreases in water use are expected due to water savings from more efficient plumbing fixtures as required by the State Plumbing Code.

2.3.3 Manufacturing Water Use

Manufacturing, or industrial, water use has been defined as water used in the production process of manufactured products, including water used by employees for drinking and sanitation purposes. Water use for manufacturing products (MFG) in Region B is a small percentage, approximately 3 percent, of the overall water use in this region.

The majority of the MFG water use is in Wichita County by the industrial facilities in and around Wichita Falls. Over 66 percent of the MFG water for the region is consumed in Wichita County. Wilbarger, Hardeman, and Montague Counties also have facilities that require water in the MFG category. The top six MFG facilities in Wichita County include: Vetrotex America, PPG Industries, Stanley Proto Tools, Howmet Corporation, Wichita Falls Castings, and Tranter Inc. Wilbarger County has Rhodia Inc. and Wright Brand Foods as the major industrial users for that area. There are numerous other small industrial users in Region B.

Based on the increasing trend of water required for MFG in Region B, an increase from 3,162 ac-ft in 2000 to 4,524 ac-ft in 2060 has been projected, for a 38 percent increase in this category. Figure 2-4 shows the projections for manufacturing water use in Region B.

Region B will probably have some growth in the number of industrial facilities that locate in the area. The anticipated growth can be attributed to reasonable land prices, a good labor market, and above average power and water resources.

Figure 2-4

Projected Industrial Water Use for Region B

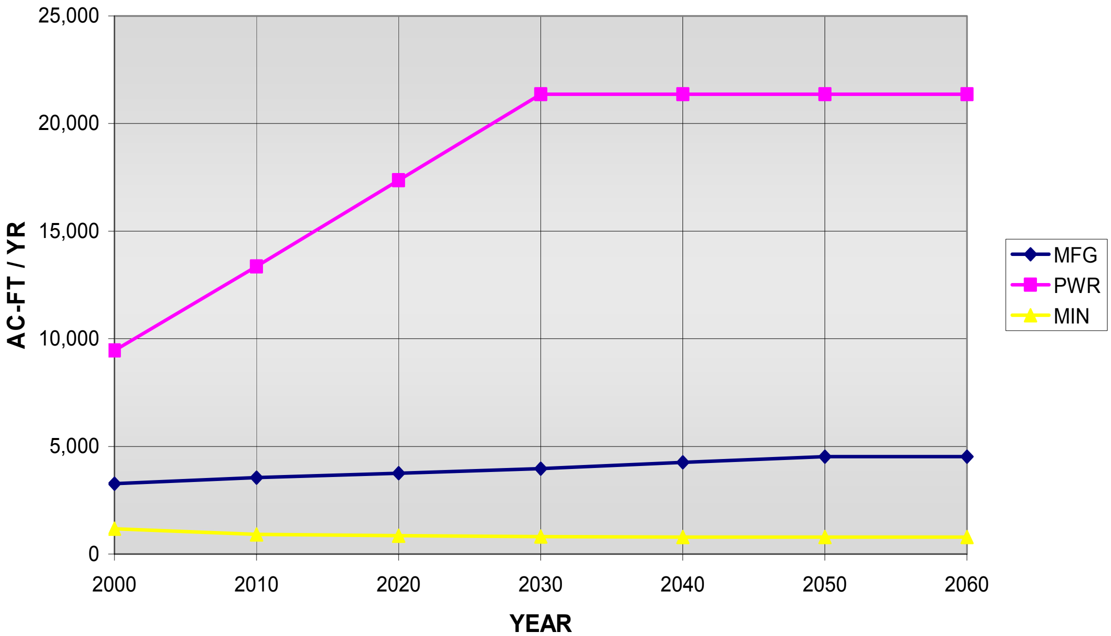


Table 2-3 - Projected Industrial Water Use Data Points

YEAR	2000	2010	2020	2030	2040	2050	2060
MFG	3,162	3,547	3,755	3,968	4,260	4,524	4,524
PWR	9,841	13,360	17,360	21,360	21,360	21,360	21,360
MIN	1,190	909	845	811	785	792	792

2.3.4 Steam-Electric Power Generation

The total water use required for steam-electric power generation for Region B was 9,841 ac-ft in the year 2000 and is expected to grow to 21,360 ac-ft in the year 2060. American Electric Power (AEP) currently has power producing plants in Wilbarger and Hardeman Counties and there is a small cogeneration plant in Wichita Falls associated with the Vetrotex America manufacturing facility. With possible future expansion of the AEP facilities, the water used in this category is expected to increase over the sixty year planning period. The percentage of water used for power generation in Region B will increase from eight percent in 2000 to 13 percent in 2060. The projections for water use for steam-electric power generation are also shown in Figure 2-4.

2.3.5 Mining Water Use

The oil and gas industry has played a large role in the history and development of the North Central Texas area and is essentially the only "mining" activity in the region. Fresh water has been used in the past to drill wells and in some cases to water flood oil fields. However, as the fields in this area are mature and will not see much more development, water required for production will decline as well. Based on current status of the oil industry and recent trends in water required for mining in this region, a decrease from 1,190 ac-ft required in the year 2000 to 792 ac-ft in the year 2060 is projected and is shown in Figure 2-4.

2.3.6 Agricultural Irrigation Water Use

The largest water use in Region B is irrigated agriculture. Irrigated crops in the region include cotton, wheat, peanuts, alfalfa, hay-pasture, vegetables, orchards, and others. The total acreage irrigated varies from year to year depending on weather, crop price, government programs, and other factors. Agricultural irrigation use accounted for approximately 52 percent of the water used in 2000 and is projected to be 54 percent of all the water used in 2060. Figure 2-5 shows the projected agricultural irrigation water use.

A portion of the water used for irrigation in Region B is from groundwater, but the majority of the water used is surface water, which is delivered through unlined open canals and distribution laterals. The existing canal system is known to have large water losses due to overflows out the end of many of the laterals. These water losses have been included in the water required for irrigation.

Figure 2-5

Projected Agricultural Water Use for Region B

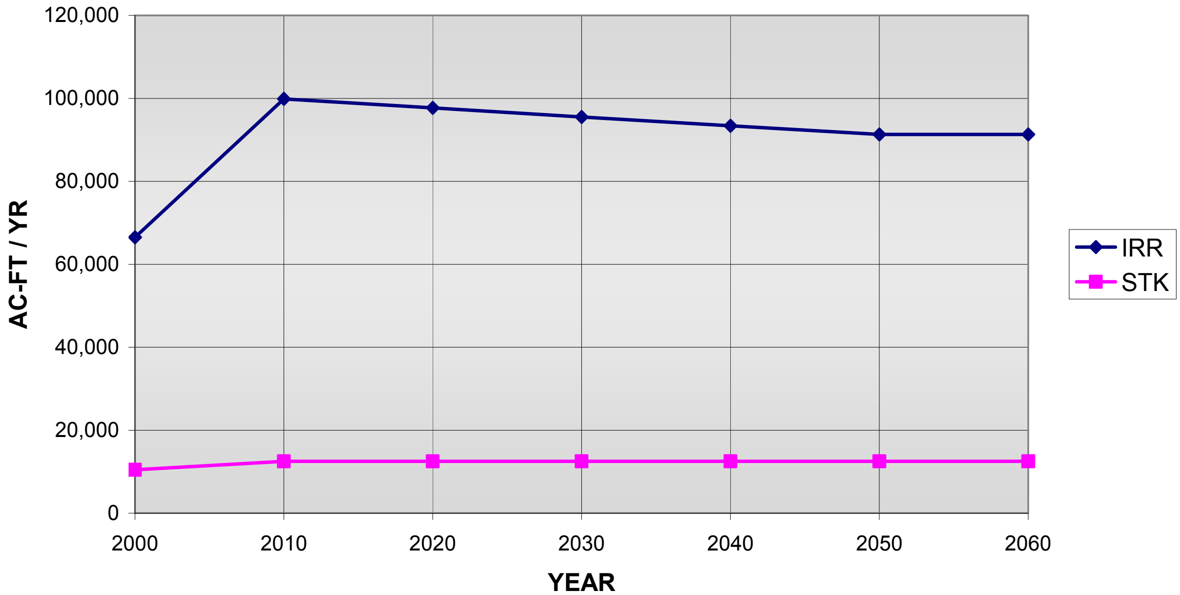


Table 2-4 - Projected Agricultural Water Use Data Points

YEAR	2000	2010	2020	2030	2040	2050	2060
IRR	66,504	99,895	97,702	95,537	93,400	91,292	91,292
STK	10,464	12,489	12,489	12,489	12,489	12,489	12,489

2.3.7 Livestock Watering

Livestock production is an important part of the economy in Region B. In 2000, the total water used in the region for livestock was 10,464 ac-ft, and the use is projected slightly increase through 2060. The livestock water use projections are shown in Figure 2-5.

2.3.8 Wholesale Water Providers

The only Wholesale Water Provider (WWP) in Region B is the City of Wichita Falls. Shown in Table 2-5 below are the demands for 2010 through 2060 on the Wichita Falls system.

Table 2-5 – Wichita Falls Wholesale Water Demand

CUSTOMERS	Contract (MGD)	Demands (Acre-Feet per Year)					
		2010	2020	2030	2040	2050	2060
Wichita Falls		23,049	22,015	22,810	22,743	22,700	22,874
Archer City	0.60	336	336	336	336	336	336
Archer Co. Mud #1	0.15	84	84	84	84	84	84
Holliday		249	258	266	267	255	246
Lakeside City	0.35	196	196	196	196	196	196
Scotland	0.25	140	140	140	140	140	140
Windthorst WSC	0.75	420	420	420	420	420	420
Dean Dale WSC (Clay County)	0.825	292	286	280	271	263	253
Red River Authority	0.75	420	420	420	420	420	420
Burkburnett	3.30	1,850	1,850	1,850	1,850	1,850	1,850
Dean Dale WSC (Wichita County)	(above)	170	176	182	191	199	209
Friberg Cooper WSC	0.25	140	140	140	140	140	140
Iowa Park	2.00	1,121	1,121	1,121	1,121	1,121	1,121
Pleasant Valley		100	95	93	91	90	89
Wichita Valley WSC	1.25	701	701	701	701	701	701
Olney	1.00	561	561	561	561	561	561
Manufacturing		1,736	1,831	1,919	2,027	2,111	2,111
Steam Electric		360	360	360	360	360	360
Total Demand		**31,925**	**30,990**	**31,879**	**31,919**	**31,947**	**32,111**

2.3.9 Region B Water Plan

This chapter has been updated in accordance with the Texas Water Development Board requirements and all updated population and water use projections were adopted by the Region B RWPG in 2003.

ATTACHMENT 2-1

REGIONAL WATER PLANNING GROUP B

POPULATION TABLES A-1 THROUGH A-4
WATER USE TABLES A-5 THROUGH A-9

REGION B WATER PLAN UPDATE
TABLE A-1
PROJECTED TOTAL POPULATION OF REGION B

CITY	COUNTY	RIVER BASIN	1990 POP.	2000 POP.	2010 POP.	2020 POP.	2030 POP.	2040 POP.	2050 POP.	2060 POP.
Archer City	Archer	RED	1,784	1,848	2,022	2,200	2,345	2,390	2,307	2,223
Holliday	Archer	RED	1,475	1,632	1,786	1,943	2,071	2,110	2,038	1,963
Lakeside City	Archer	RED	865	984	1,077	1,172	1,249	1,272	1,228	1,183
Seymour	Baylor	BRAZOS	3,185	2,908	2,692	2,569	2,378	2,206	2,089	1,933
Byers	Clay	RED	510	517	534	550	546	524	491	459
Henrietta	Clay	RED	2,896	3,264	3,374	3,470	3,448	3,306	3,103	2,900
Petrolia	Clay	RED	762	782	808	831	826	792	743	695
Paducah	Cottle	RED	1,788	1,498	1,458	1,455	1,384	1,304	1,233	1,193
Crowell	Foard	RED	1,230	1,141	1,137	1,145	1,121	1,081	1,055	1,017
Chillicothe	Hardeman	RED	816	798	796	795	791	786	780	769
Quanah	Hardeman	RED	3,413	3,022	2,981	2,954	2,863	2,746	2,617	2,371
Guthrie	King	RED	150	150	152	144	124	98	77	75
Bowie	Montague	TRINITY	4,990	5,219	5,305	5,389	5,423	5,436	5,440	5,449
Montague	Montague	RED	490	479	470	460	440	421	401	395
Nocona	Montague	RED	2,870	3,198	3,321	3,442	3,491	3,510	3,515	3,528
Saint Jo	Montague	TRINITY	1,048	898	898	898	898	898	898	898
Burkburnett	Wichita	RED	10,145	10,927	11,465	11,949	12,269	12,436	12,553	12,647
Electra	Wichita	RED	3,113	3,168	3,206	3,240	3,263	3,275	3,283	3,290
Iowa Park	Wichita	RED	6,072	6,431	6,678	6,900	7,047	7,124	7,178	7,221
Wichita Falls	Wichita	RED	96,259	104,197	109,663	114,576	117,825	119,525	120,710	121,668
Vernon	Wilbarger	RED	12,001	11,660	12,139	12,655	12,706	12,451	11,844	11,144
Olney	Young	BRAZOS	3,519	3,396	3,429	3,504	3,509	3,469	3,418	3,386
Other Rural			31,514	33,853	35,251	36,677	37,234	37,005	36,214	35,327
Total			**190,895**	**201,970**	**210,642**	**218,918**	**223,251**	**224,165**	**223,215**	**221,734**

REGION B WATER PLAN UPDATE
TABLE A-2
PROJECTED "COUNTY OTHER" POPULATION OF REGION B

CITY	COUNTY	RIVER BASIN	1990 POP.	2000 POP.	2010 POP.	2020 POP.	2030 POP.	2040 POP.	2050 POP.	2060 POP.
Baylor WSC	Archer	RED	76	93	103	113	120	130	140	140
Archer Co. MUD #1	Archer	RED	500	727	944	1,000	1,035	1,035	1,035	1,025
Megargel	Archer	RED	223	226	300	300	300	300	244	225
Scotland	Archer	RED	500	600	714	714	815	815	765	700
Windthorst WSC	Archer	RED	800	1,157	1,266	1,378	1,468	1,496	1,444	1,392
Wichita Valley WSC	Archer	RED	1,050	2,736	2,994	3,258	3,472	3,538	3,416	3,291
Archer Co. Other	Archer	RED	650	200	140	150	250	300	200	180
Archer Co. Other	Archer	TRINITY	25	100	80	60	102	137	137	135
Archer Co. Other	Archer	BRAZOS	25	76	100	64	100	100	100	100
County Total			**3,849**	**5,915**	**6,641**	**7,037**	**7,662**	**7,851**	**7,481**	**7,188**
Baylor WSC	Baylor	BRAZOS	474	830	880	920	960	970	980	990
Baylor Co. Other	Baylor	RED	219	106	50	50	50	50	50	50
Baylor Co. Other	Baylor	BRAZOS	507	249	243	196	146	127	111	93
County Total			**1,200**	**1,185**	**1,173**	**1,166**	**1,156**	**1,147**	**1,141**	**1,133**
Bellevue	Clay	RED	349	349	349	349	320	310	300	300
Blue Grove WSC	Clay	RED	95	95	95	95	90	85	80	80
Charlie WSC	Clay	RED	80	90	90	90	90	90	90	90
Dean Dale WSC	Clay	RED	1,988	2,081	2,151	2,212	2,199	2,108	1,978	1,849
Arrowhead Lake System	Clay	RED	713	712	712	711	710	709	709	710
Arrowhead Ranch System	Clay	RED	568	588	608	613	618	623	633	635
Windthorst WSC	Clay	RED		220	227	234	232	223	209	195
Friberg-Cooper WSC	Clay	RED	234	244	254	260	260	260	260	260
Clay Co. Other	Clay	RED	1,265	1,617	1,712	1,809	1,817	1,664	1,441	1,208
Clay Co. Other	Clay	TRINITY	564	447	462	475	472	453	425	397
County Total			**5,856**	**6,443**	**6,660**	**6,848**	**6,808**	**6,525**	**6,125**	**5,724**
King-Cottle WSC	Cottle	RED	422	376	369	368	360	345	332	325
Cottle Co. Other	Cottle	RED	37	30	30	30	25	25	25	25
County Total			**459**	**406**	**399**	**398**	**385**	**370**	**357**	**350**
Foard Co. System	Foard	RED	100	105	105	105	105	105	105	100
Margaret System	Foard	RED	90	85	85	85	80	75	70	65
Thalia WSC	Foard	RED	195	190	190	190	185	180	175	170
Foard Co. Other	Foard	RED	179	101	97	105	93	66	52	32
County Total			**564**	**481**	**477**	**485**	**463**	**426**	**402**	**367**

REGION B WATER PLAN UPDATE
TABLE A-3
PROJECTED "COUNTY OTHER" POPULATION OF REGION B

CITY	COUNTY	RIVER BASIN	1990 POP.	2000 POP.	2010 POP.	2020 POP.	2030 POP.	2040 POP.	2050 POP.	2060 POP.
Goodlett System	Hardeman	RED	103	101	100	100	100	100	100	95
Medicine Mound System	Hardeman	RED	100	111	106	106	106	106	106	100
Quanah NE System	Hardeman	RED	208	207	207	207	207	207	207	200
S Quanah System	Hardeman	RED	70	75	75	75	75	75	75	70
Hardeman Co. Other	Hardeman	RED	573	410	400	389	354	309	259	187
County Total			**1,054**	**904**	**888**	**877**	**842**	**797**	**747**	**652**
King-Cottle WSC	King	RED	110	110	115	120	120	120	125	125
Dumont System	King	RED	60	60	70	85	85	85	85	85
King Co. Other	King	RED	12	16	28	55	85	76	72	37
King Co. Other	King	BRAZOS	22	20	20	20	10	10	10	10
County Total			**204**	**206**	**233**	**280**	**300**	**291**	**292**	**257**
Forestburg	Montague	TRINITY	141	160	170	180	185	190	195	200
Montague System	Montague	RED	393	400	400	400	410	410	420	425
Nocona Hills WSC	Montague	RED	607	800	1,200	1,300	1,400	1,500	1,600	1,700
Oak Shores System	Montague	RED	300	400	500	500	600	600	700	700
Sunset System	Montague	TRINITY	335	400	400	450	450	450	500	500
Ringgold WSC	Montague	RED	215	300	300	350	350	350	350	350
Montague Co. Other	Montague	RED	1,896	1,552	1,290	1,295	1,202	1,203	1,204	1,204
Montague Co. Other	Montague	TRINITY	3,989	3,786	3,771	4,122	3,953	3,867	3,817	3,862
County Total			**7,876**	**7,798**	**8,032**	**8,597**	**8,550**	**8,570**	**8,786**	**8,941**
Friberg Cooper WSC	Wichita	RED	336	346	360	370	380	380	380	380
Horseshoe Bend System	Wichita	RED	70	70	70	70	70	70	70	70
Pleasant Valley	Wichita	RED	435	460	480	480	480	480	480	480
Wichita Valley WSC	Wichita	RED	3,032	2,764	3,159	3,514	3,749	3,872	3,958	4,027
Dean Dale WSC	Wichita	RED	497	1,121	1,248	1,362	1,438	1,478	1,506	1,528
Wichita Co. Other	Wichita	RED	2,419	2,180	1,729	1,344	1,085	955	863	791
County Total			**6,789**	**6,941**	**7,046**	**7,140**	**7,202**	**7,235**	**7,257**	**7,276**
Box Com. System	Wilbarger	RED	143	143	142	142	142	142	142	150
Farmers Valley System	Wilbarger	RED	103	102	102	101	101	100	100	110
Harrold WSC	Wilbarger	RED	222	222	222	222	222	222	222	225
Hinds Com. System	Wilbarger	RED	128	128	127	127	127	127	127	135
Lockett System	Wilbarger	RED	585	596	603	603	603	603	603	615
Northside WSC	Wilbarger	RED	138	138	138	138	138	138	138	145
Odell System	Wilbarger	RED	106	110	110	110	110	110	110	115
Oklaunion WSC	Wilbarger	RED	320	320	320	320	320	320	320	325
Wilbarger Co. Other	Wilbarger	RED	1,375	1,257	1,376	1,510	1,524	1,459	1,302	1,063
County Total			**3,120**	**3,016**	**3,140**	**3,273**	**3,287**	**3,221**	**3,064**	**2,883**

REGION B WATER PLAN UPDATE
TABLE A-4
PROJECTED "COUNTY OTHER" POPULATION OF REGION B

CITY	COUNTY	RIVER BASIN	1990 POP.	2000 POP.	2010 POP.	2020 POP.	2030 POP.	2040 POP.	2050 POP.	2060 POP.
Young Co. Other	Young	BRAZOS	537	552	557	570	570	564	556	550
Young Co. Other	Young	TRINITY	6	6	5	6	9	8	6	6
County Total			**543**	**558**	**562**	**576**	**579**	**572**	**562**	**556**

TABLE A-5
PROJECTED TOTAL WATER USE OF REGION B
PLAN UPDATE

USER	COUNTY	RIVER BASIN	DATA CAT.	2000 Water Use AF/YR	2010 DEMAND AF/YR	2020 DEMAND AF/YR	2030 DEMAND AF/YR	2040 DEMAND AF/YR	2050 DEMAND AF/YR	2060 DEMAND AF/YR
Archer City	Archer	RED	MUN	232	333	343	356	357	341	328
Holliday	Archer	RED	MUN	245	249	258	266	267	255	246
Lakeside City	Archer	RED	MUN	125	166	163	173	169	161	155
Seymour	Baylor	BRAZOS	MUN	554	611	548	504	460	432	387
Byers	Clay	RED	MUN	69	83	81	78	73	64	64
Henrietta	Clay	RED	MUN	526	720	701	677	638	592	553
Petrolia	Clay	RED	MUN	93	95	92	90	84	73	73
Paducah	Cottle	RED	MUN	247	316	300	277	256	239	232
Crowell	Foard	RED	MUN	250	277	264	252	241	233	224
Chillicothe	Hardeman	RED	MUN	151	117	109	106	102	100	98
Quanah	Hardeman	RED	MUN	565	543	510	491	453	426	386
Guthrie	King	RED	MUN	77	68	65	56	44	35	34
Bowie	Montague	TRINITY	MUN	824	1,027	987	966	952	941	943
Montague	Montague	RED	MUN	55	47	46	44	42	40	39
Nocona	Montague	RED	MUN	484	693	681	671	664	657	660
Saint Jo	Montague	TRINITY	MUN	210	99	101	98	97	96	96
Burkburnett	Wichita	RED	MUN	1,273	1,843	1,820	1,816	1,809	1,806	1,819
Electra	Wichita	RED	MUN	337	575	550	539	531	526	527
Iowa Park	Wichita	RED	MUN	1,232	1,210	1,184	1,176	1,169	1,163	1,170
Wichita Falls	Wichita	RED	MUN	21,942	23,049	22,015	22,810	22,743	22,700	22,874
Vernon	Wilbarger	RED	MUN	2,795	2,671	2,659	2,627	2,519	2,383	2,229
Olney	Young	BRAZOS	MUN	609	707	685	667	647	631	625
Other Rural				5,508	5,465	5,493	5,456	5,347	5,068	4,934
TOTAL				**37,422**	**40,964**	**39,655**	**40,196**	**39,664**	**38,962**	**38,696**

TABLE A-6
PROJECTED "COUNTY OTHER" WATER USE OF REGION B
PLAN UPDATE

USER	COUNTY	RIVER BASIN	DATA CAT.	2000 Water Use AF/YR	2010 DEMAND AF/YR	2020 DEMAND AF/YR	2030 DEMAND AF/YR	2040 DEMAND AF/YR	2050 DEMAND AF/YR	2060 DEMAND AF/YR
Baylor WSC	Archer	RED	MUN	18	21	21	21	21	21	21
Archer Co. MUD #1	Archer	RED	MUN	138	150	150	151	149	147	146
Megargel	Archer	RED	MUN	46	42	40	39	39	31	32
Scotland	Archer	RED	MUN	224	226	214	208	237	216	212
Windthorst WSC	Archer	RED	MUN	351	198	205	203	202	199	196
Wichita Valley WSC	Archer	RED	MUN	184	347	356	351	343	329	316
Archer Co. Other	Archer	RED	MUN	33	24	22	37	42	28	25
Archer Co. Other	Archer	TRINITY	MUN	24	20	8	10	14	14	14
Archer Co. Other	Archer	BRAZOS	MUN	36	30	10	33	23	23	23
COUNTY TOTAL				**1,210**	**1,058**	**1,026**	**1,053**	**1,070**	**1,008**	**985**
Baylor WSC	Baylor	BRAZOS	MUN	190	187	190	190	190	190	192
Baylor Co. - Other	Baylor	RED	MUN	22	17	15	13	13	12	12
Baylor Co. - Other	Baylor	BRAZOS	MUN	90	73	59	26	23	20	17
COUNTY TOTAL				**302**	**277**	**264**	**229**	**226**	**222**	**221**
Bellevue	Clay	RED	MUN	41	38	38	38	38	38	38
Bluegrove WSC	Clay	RED	MUN	7	7	7	7	7	7	7
Charlie WSC	Clay	RED	MUN	10	10	9	9	9	9	9
Dean Dale WSC	Clay	RED	MUN	217	230	224	218	206	199	192
Windthorst WSC	Clay	RED	MUN	67	36	35	32	30	29	27
Arrowhead Lake System	Clay	RED	MUN	95	90	85	83	81	80	81
Arrowhead Ranch System	Clay	RED	MUN	89	87	84	82	81	81	83
Friberg-Cooper WSC	Clay	RED	MUN	78	81	83	83	83	83	83
Clay Co. Other	Clay	RED	MUN	508	532	534	525	467	317	251
Clay Co. Other	Clay	TRINITY	MUN	68	69	63	66	50	47	44
COUNTY TOTAL				**1,180**	**1,180**	**1,162**	**1,143**	**1,052**	**890**	**815**
King-Cottle WSC	Cottle	RED	MUN	75	74	74	72	69	67	65
Cottle Co. Other	Cottle	RED	MUN	6	5	2	4	4	4	4
COUNTY TOTAL				**81**	**79**	**76**	**76**	**73**	**71**	**69**
Foard Co. System	Foard	RED	MUN	49	47	44	43	42	42	40
Margaret System	Foard	RED	MUN	17	17	17	16	15	14	13
Thalia WSC	Foard	RED	MUN	34	34	34	33	32	31	30
Foard Co. Other	Foard	RED	MUN	22	18	19	18	13	10	6
COUNTY TOTAL				**122**	**116**	**114**	**110**	**102**	**97**	**89**

TABLE A-7
PROJECTED "COUNTY OTHER" WATER USE OF REGION B
PLAN UPDATE

USER	COUNTY	RIVER BASIN	DATA CAT.	2000 Water Use AF/YR	2010 DEMAND AF/YR	2020 DEMAND AF/YR	2030 DEMAND AF/YR	2040 DEMAND AF/YR	2050 DEMAND AF/YR	2060 DEMAND AF/YR
Goodlett System	Hardeman	RED	MUN	17	16	15	14	13	13	12
Medicine Mound System	Hardeman	RED	MUN	19	17	16	15	15	15	14
Quanah NE System	Hardeman	RED	MUN	59	56	53	51	50	50	49
S Quanah System	Hardeman	RED	MUN	19	18	17	16	16	16	15
Hardeman Co. Other	Hardeman	RED	MUN	74	65	63	57	50	42	30
COUNTY TOTAL				**188**	**172**	**164**	**153**	**144**	**136**	**120**
King-Cottle WSC	King	RED	MUN	17	17	18	18	18	19	19
Dumont System	King	RED	MUN	30	35	43	43	43	43	43
King Co. Other	King	RED	MUN	2	4	8	13	11	11	6
King Co. Other	King	BRAZOS	MUN	3	3	3	1	1	1	1
COUNTY TOTAL				**52**	**59**	**72**	**75**	**73**	**74**	**69**
Forestburg	Montague	RED	MUN	24	26	27	28	29	30	31
Montague WSC	Montague	RED	MUN	32	32	32	33	33	34	35
Nocona Hills WSC	Montague	RED	MUN	96	144	156	168	180	192	204
Oak Shores System	Montague	RED	MUN	5	6	6	7	7	9	9
Sunset System	Montague	RED	MUN	20	20	22	22	22	25	25
Ringgold WSC	Montague	RED	MUN	24	24	25	25	25	25	25
Montague Co. Other	Montague	RED	MUN	201	167	168	156	156	156	156
Montague Co. Other	Montague	TRINITY	MUN	796	735	797	811	815	795	792
COUNTY TOTAL				**1198**	**1,154**	**1,233**	**1,250**	**1,267**	**1,266**	**1,277**
Friberg Cooper WSC	Wichita	RED	MUN	92	110	119	119	119	119	119
Horseshoe Bend System	Wichita	RED	MUN	14	14	14	14	14	14	14
Pleasant Valley	Wichita	RED	MUN	101	100	95	93	91	90	90
Wichita Valley WSC	Wichita	RED	MUN	186	366	385	378	375	381	386
Dean Dale WSC	Wichita	RED	MUN	117	134	138	142	145	151	158
Wichita Co. Other	Wichita	RED	MUN	109	164	185	53	44	25	13
COUNTY TOTAL				**619**	**807**	**809**	**799**	**788**	**780**	**780**
Box Com. System	Wilbarger	RED	MUN	19	18	17	17	16	16	17
Farmers Valley System	Wilbarger	RED	MUN	23	22	21	20	19	19	21
Harold WSC	Wilbarger	RED	MUN	29	28	27	27	26	26	28
Hinds Com. System	Wilbarger	RED	MUN	26	25	23	23	22	22	25
Lockett System	Wilbarger	RED	MUN	95	91	87	84	83	82	85
Northside WSC	Wilbarger	RED	MUN	37	35	33	32	32	31	35
Odell System	Wilbarger	RED	MUN	16	15	15	14	14	14	17
Oklaunion WSC	Wilbarger	RED	MUN	40	39	37	35	35	35	38
Wilbarger Co. Other	Wilbarger	RED	MUN	188	206	226	229	219	195	160
COUNTY TOTAL				**473**	**479**	**486**	**481**	**466**	**440**	**426**
Young Co. Other	Young	BRAZOS	MUN	82	83	86	86	85	83	82
Young Co. Other	Young	TRINITY	MUN	1	1	1	1	1	1	1
COUNTY TOTAL				**83**	**84**	**87**	**87**	**86**	**84**	**83**
GRAND TOTAL (COUNTY OTHER)				**5,508**	**5,465**	**5,493**	**5,456**	**5,347**	**5,068**	**4,934**

TABLE A-8
PROJECTED "COUNTY OTHER" WATER USE OF REGION B
PLAN UPDATE

COUNTY	RIVER BASIN	DATA CAT.	2000 Water Use AF/YR	2010 DEMAND AF/YR	2020 DEMAND AF/YR	2030 DEMAND AF/YR	2040 DEMAND AF/YR	2050 DEMAND AF/YR	2060 DEMAND AF/YR
ARCHER	RED	MFG	0	0	0	0	0	0	0
ARCHER	RED	PWR	0	0	0	0	0	0	0
ARCHER	RED	MIN	0	0	0	0	0	0	0
ARCHER	RED	IRR	1,971	3,500	3,400	3,300	3,200	3,100	3,100
ARCHER	RED	STK	2,165	2,277	2,277	2,277	2,277	2,277	2,277
ARCHER	TRINITY	MFG	0	0	0	0	0	0	0
ARCHER	TRINITY	PWR	0	0	0	0	0	0	0
ARCHER	TRINITY	MIN	0	0	0	0	0	0	0
ARCHER	TRINITY	IRR	0	0	0	0	0	0	0
ARCHER	TRINITY	STK	284	298	298	298	298	298	298
ARCHER	BRAZOS	MFG	0	0	0	0	0	0	0
ARCHER	BRAZOS	PWR	0	0	0	0	0	0	0
ARCHER	BRAZOS	MIN	0	0	0	0	0	0	0
ARCHER	BRAZOS	IRR	0	0	0	0	0	0	0
ARCHER	BRAZOS	STK	129	136	136	136	136	136	136
BAYLOR	RED	MFG	0	0	0	0	0	0	0
BAYLOR	RED	PWR	0	0	0	0	0	0	0
BAYLOR	RED	MIN	0	0	0	0	0	0	0
BAYLOR	RED	IRR	213	198	193	187	181	176	176
BAYLOR	RED	STK	629	600	600	600	600	600	600
BAYLOR	BRAZOS	MFG	0	0	0	0	0	0	0
BAYLOR	BRAZOS	PWR	0	0	0	0	0	0	0
BAYLOR	BRAZOS	MIN	39	21	10	5	0	0	0
BAYLOR	BRAZOS	IRR	523	487	473	459	445	431	431
BAYLOR	BRAZOS	STK	370	353	353	353	353	353	353
CLAY	RED	MFG	0	0	0	0	0	0	0
CLAY	RED	PWR	0	0	0	0	0	0	0
CLAY	RED	MIN	306	219	195	180	176	176	176
CLAY	RED	IRR	1,993	3,900	3,800	3,700	3,600	3,500	3,500
CLAY	RED	STK	1,741	1,972	1,972	1,972	1,972	1,972	1,972
CLAY	TRINITY	MFG	0	0	0	0	0	0	0
CLAY	TRINITY	PWR	0	0	0	0	0	0	0
CLAY	TRINITY	MIN	4	3	3	4	4	4	4
CLAY	TRINITY	IRR	0	0	0	0	0	0	0
CLAY	TRINITY	STK	194	219	219	219	219	219	219
COTTLE	RED	MFG	0	0	0	0	0	0	0
COTTLE	RED	PWR	0	0	0	0	0	0	0
COTTLE	RED	MIN	25	25	27	28	30	30	30
COTTLE	RED	IRR	4,434	4,301	4,172	4,047	3,925	3,808	3,808
COTTLE	RED	STK	387	387	387	387	387	387	387
FOARD	RED	MFG	0	0	0	0	0	0	0
FOARD	RED	PWR	0	0	0	0	0	0	0
FOARD	RED	MIN	22	24	24	25	26	27	27
FOARD	RED	IRR	3,889	4,829	4,684	4,543	4,407	4,275	4,275
FOARD	RED	STK	279	289	289	289	289	289	289
HARDEMAN	RED	MFG	23	374	398	424	452	480	480
HARDEMAN	RED	PWR	879	1,000	1,000	1,000	1,000	1,000	1,000
HARDEMAN	RED	MIN	111	3	3	2	2	2	2
HARDEMAN	RED	IRR	5,330	4,849	4,704	4,563	4,426	4,293	4,293
HARDEMAN	RED	STK	480	480	480	480	480	480	480

TABLE A-9
PROJECTED "COUNTY OTHER" WATER USE OF REGION B
PLAN UPDATE

COUNTY	RIVER BASIN	DATA CAT.	2000 Water Use AF/YR	2010 DEMAND AF/YR	2020 DEMAND AF/YR	2030 DEMAND AF/YR	2040 DEMAND AF/YR	2050 DEMAND AF/YR	2060 DEMAND AF/YR
KING	RED	MFG	0	0	0	0	0	0	0
KING	RED	PWR	0	0	0	0	0	0	0
KING	RED	MIN	0	0	0	0	0	0	0
KING	RED	IRR	20	20	20	20	20	20	20
KING	RED	STK	244	486	486	486	486	486	486
KING	BRAZOS	MFG	0	0	0	0	0	0	0
KING	BRAZOS	PWR	0	0	0	0	0	0	0
KING	BRAZOS	MIN	0	0	0	0	0	0	0
KING	BRAZOS	IRR	0	0	0	0	0	0	0
KING	BRAZOS	STK	143	285	285	285	285	285	285
MONTAGUE	RED	MFG	6	9	12	15	19	24	24
MONTAGUE	RED	PWR	0	0	0	0	0	0	0
MONTAGUE	RED	MIN	609	491	467	459	463	476	476
MONTAGUE	RED	IRR	12	59	59	59	59	59	59
MONTAGUE	RED	STK	856	1,054	1,054	1,054	1,054	1,054	1,054
MONTAGUE	TRINITY	MFG	0	0	0	0	0	0	0
MONTAGUE	TRINITY	PWR	0	0	0	0	0	0	0
MONTAGUE	TRINITY	MIN	18	14	14	14	14	14	14
MONTAGUE	TRINITY	IRR	48	238	238	238	238	238	238
MONTAGUE	TRINITY	STK	645	796	796	796	796	796	796
WICHITA	RED	MFG	2,292	2,315	2,441	2,558	2,702	2,814	2,814
WICHITA	RED	PWR	262	360	360	360	360	360	360
WICHITA	RED	MIN	29	86	78	70	46	39	39
WICHITA	RED	IRR	19,556	59,000	58,000	57,000	56,000	55,000	55,000
WICHITA	RED	STK	740	740	740	740	740	740	740
WILBARGER	RED	MFG	841	849	904	971	1,087	1,206	1,206
WILBARGER	RED	PWR	8,700	12,000	16,000	20,000	20,000	20,000	20,000
WILBARGER	RED	MIN	28	23	24	24	24	24	24
WILBARGER	RED	IRR	28,527	18,499	17,944	17,406	16,884	16,377	16,377
WILBARGER	RED	STK	1,066	1,797	1,797	1,797	1,797	1,797	1,797
YOUNG	BRAZOS	MFG	0	0	0	0	0	0	0
YOUNG	BRAZOS	PWR	0	0	0	0	0	0	0
YOUNG	BRAZOS	MIN	0	0	0	0	0	0	0
YOUNG	BRAZOS	IRR	0	10	10	10	10	10	10
YOUNG	BRAZOS	STK	0	300	300	300	300	300	300
YOUNG	TRINITY	MFG	0	0	0	0	0	0	0
YOUNG	TRINITY	PWR	0	0	0	0	0	0	0
YOUNG	TRINITY	MIN	0	0	0	0	0	0	0
YOUNG	TRINITY	IRR	0	5	5	5	5	5	5
YOUNG	TRINITY	STK	0	20	20	20	20	20	20

CHAPTER 3

REGIONAL WATER PLANNING GROUP B

EVALUATION OF CURRENT WATER SUPPLIES

EVALUATION OF CURRENT WATER SUPPLIES
TEXAS STATE SENATE BILL 1
REGION B

Under Senate Bill 1 planning guidelines, each region is to identify currently available water supplies to the region by source and user. The supplies available by source are based on the water available during drought of record conditions. For surface water reservoirs, this is the equivalent of firm yield supply or permitted amount (whichever is lower). For diversions directly from a stream or river (run-of-the-river), this is the minimum supply available in a year over the historical record. Groundwater supplies are defined by availability by county and aquifer. Generally, groundwater supply is the supply available with acceptable long-term impacts to water levels. These impacts may vary with users and locations.

In addition to surface water and groundwater supplies, there are available supplies from reuse and local supplies. The available supply from reuse is based on permitted authorizations and facilities. Current reuse in Region B is negligible and limited to municipal irrigation. Local supplies generally include stock ponds for livestock.

3.1 Existing Surface Water Supply

Water users in the Region B planning area receive surface water from sources in the Brazos, Trinity and Red River Basins. In accordance with the Texas Water Development Board's (TWDB) established procedures, the surface water supplies for the 2006 regional water plans are determined using the TCEQ-approved Water Availability Models (WAM). Water Availability Models have been completed for each of the major river basins in Texas. The Water Availability Models were developed for the purpose of reviewing and granting new surface water rights permits. The assumptions in the Water Availability Models are based on the legal interpretation of water rights and in some cases do not accurately reflect current operations. For planning purposes, adjustments were made to the Water Availability Models to better reflect current and future surface water conditions in the region.

Generally, changes to the Water Availability Models included:

- Assessment of reservoir sedimentation rates and calculation of area-capacity conditions for current (2000) and future (2060) conditions (See Section 3.1.2)
- Inclusion of system operation of the Lake Kemp/Lake Diversion system
- Other corrections

Table 3.1 summarizes the currently available surface water supplies by reservoir source in Region B in ac-ft per year. Run-of-the-river supplies and local surface water supplies are presented in Table 3.2. The Water Availability Models were also used to determine the run of the river supplies. Local supplies shown in Table 3.2 are the historical surface water use for livestock or mining reported by the TWDB. It is assumed that these estimates represent available surface water from stock ponds, which are not required to have a water right and are not included in the WAMs. Brief descriptions of reservoirs in the region are included in Section 3.1.1. Water rights associated with run-of-the-river supplies are discussed in Section 3.1.5.

Special water resources are designated by the TWDB and include surface water resources that are located in one region and used in whole or in part in another region. No special water resource is located within Region B, but Greenbelt Lake, which is located in the Panhandle Planning Area (Region A), is designated as a special resource. This lake provides water to several municipalities in the western part of Region B. A description of the lake is included in Section 3.1.1.

Table 3.1
Currently Available Surface Water Supplies – Reservoirs
(ac-ft per year)

	Basin	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
WATER SUPPLY SYSTEMS								
Lake Kemp/ Diversion System	Red	100,650	90,417	80,184	69,951	59,718	49,485	39,250
Wichita System								
Kickapoo	Red	20,130	19,901	19,672	19,443	19,214	18,985	18,758
Arrowhead	Red	30,700	30,197	29,694	29,191	28,688	28,185	27,680
TOTAL	*Red*	*50,830*	*50,098*	*49,366*	*48,634*	*47,902*	*47,170*	*46,438*
Subtotal		**151,480**	**140,515**	**129,550**	**118,585**	**107,620**	**96,655**	**85,688**
RESERVOIRS IN REGION B								
Lake Amon Carter	Trinity	2,210	2,108	2,006	1,904	1,802	1,700	1,600
Lake Electra	Red	470	462	454	446	438	430	420
North Fork Buffalo Creek Reservoir	Red	840	840	840	840	840	840	840
Santa Rosa Lake	Red	3,075	3,075	3,075	3,075	3,075	3,075	3,075
Lake Pauline	Red	1,284	1,284	1,284	1,284	1,284	1,284	1,284
Lake Cooper/Olney	Red	961	961	961	961	961	961	961
Lake Nocona	Red	1,260	1,260	1,260	1,260	1,260	1,260	1,260
Subtotal		**10,100**	**9,990**	**9,880**	**9,770**	**9,660**	**9,550**	**9,440**
RESERVOIRS OUTSIDE REGION B								
Greenbelt Reservoir	Red	8,985	8,854	8,723	8,592	8,461	8,330	8,200
TOTAL		**170,565**	**159,359**	**148,153**	**136,947**	**125,741**	**114,535**	**103,328**

Table 3-2
Summary of Local Surface Water Supplies for Region B
(ac-ft per year)

	Use	County	Basin	2000	2010	2020	2030	2040	2050	2060
LOCAL RUN-OF-THE-RIVER SUPPLIES										
Run-of-the-River	Irrigation	Archer	Red	7	7	7	7	7	7	7
Run-of-the-River	Irrigation	Baylor	Red	0	0	0	0	0	0	0
Run-of-the-River	Irrigation	Baylor	Brazos	17	17	17	17	17	17	17
Run-of-the-River	Irrigation	Clay	Red	1,809	1,809	1,809	1,809	1,809	1,809	1,809
Run-of-the-River	Irrigation	Cottle	Red	11	11	11	11	11	11	11
Run-of-the-River	Irrigation	Hardeman	Red	116	116	116	116	116	116	116
Run-of-the-River	Irrigation	Montague	Red	47	47	47	47	47	47	47
Run-of-the-River	Irrigation	Wichita	Red	325	325	325	325	325	325	325
Run-of-the-River WCWID #2	Irrigation	Wichita	Red	8,850	8,850	8,850	8,850	8,850	8,850	8,850
Run-of-the-River	Irrigation	Wilbarger	Red	779	779	779	779	779	779	779
Run-of-the-River - Archer City Lake	Municipal -	Archer	Red	314	314	314	314	314	314	314
Run-of-the-River - Petrolia	Municipal -	Clay	Red	67	67	67	67	67	67	67
Run-of-the-River – Henrietta	Municipal	Clay	Red	1,499	1,499	1,499	1,499	1,499	1,499	1,499
Run-of-the-River - Iowa Park/Gordon	Municipal -	Wichita	Red	538	538	538	538	538	538	538
Run-of-the-River	Municipal	Wilbarger	Red	115	115	115	115	115	115	115
Run-of-the-River	Industrial	Clay	Red	141	141	141	141	141	141	141
Run-of-the-River	Mining	Clay	Red	1	1	1	1	1	1	1
Run-of-the-River	Mining	Wilbarger	Red	30	30	30	30	30	30	30
Subtotal				**14,666**	**14,666**	**14,666**	**14,666**	**14,666**	**14,666**	**14,666**

Table 3-2 (continued)

	Use	County	Basin	2000	2010	2020	2030	2040	2050	2060
Local Supply	Livestock[1]	Archer	Red	1948	2,049	2,049	2,049	2,049	2,049	2,049
Local Supply	Livestock	Archer	Brazos	116	122	122	122	122	122	122
Local Supply	Livestock	Archer	Trinity	256	268	268	268	268	268	268
Local Supply	Livestock	Baylor	Red	566	566	566	566	566	566	566
Local Supply	Livestock	Baylor	Brazos	333	333	333	333	333	333	333
Local Supply	Livestock	Clay	Red	1567	1,784	1,784	1,784	1,784	1,784	1,784
Local Supply	Livestock	Clay	Trinity	175	198	198	198	198	198	198
Local Supply	Livestock	Cottle	Red	449	449	449	449	449	449	449
Local Supply	Livestock	Foard	Red	251	251	251	251	251	251	251
Local Supply	Livestock	Hardeman	Red	288	288	288	288	288	288	288
Local Supply	Livestock	King	Red	219	437	437	437	437	437	437
Local Supply	Livestock	King	Brazos	129	257	257	257	257	257	257
Local Supply	Livestock	Montague	Red	770	949	949	949	949	949	949
Local Supply	Livestock	Montague	Trinity	581	716	716	716	716	716	716
Local Supply	Livestock	Wichita	Red	404	704	704	704	704	704	704
Local Supply	Livestock	Wilbarger	Red	959	1,617	1,617	1,617	1,617	1,617	1,617
Local Supply	Livestock	Young	Brazos	0	301	301	301	301	301	301
Local Supply	Livestock	Young	Trinity	0	20	20	20	20	20	20
Local Supply	Mining	Hardeman	Red	7	7	7	7	7	7	7
Subtotal				**9,018**	**11,316**	**11,316**	**11,316**	**11,316**	**11,316**	**11,316**

[1] TWDB historical livestock surface water use. Year 2000 supplies are the reported usage in year 2000 by the TWDB.

3.1.1 Existing Water Supply Reservoirs

Greenbelt Lake

Greenbelt Lake is located in the Panhandle Planning Area (Region A), but water from the lake is used to supply several cities in Region B. The lake is owned and operated by the Greenbelt Municipal and Industrial Water Authority, and is located on the Salt Fork of the Red River in Donley County near the City of Clarendon. Construction of Greenbelt Lake was completed in 1968, and the lake had an initial conservation capacity of 60,400 ac-ft. Greenbelt Municipal and Industrial Water Authority has a diversion right of 12,000 ac-ft per year from the lake to provide municipal, industrial, mining, and irrigation water supply. The firm yield of the reservoir in year 2000 is estimated to be 8,985 ac-ft per year.

Lake Pauline

Lake Pauline is located on the upper reaches of Wanderers Creek near Quanah in Hardeman County. The dam was completed in 1928 and the reservoir had a reported conservation capacity of 4,137 ac-ft in 1968 (Bisset, 1999). Lake Pauline is owned and operated by American Electric Power. The lake is permitted for 3,616 ac-ft per year of consumptive use, which includes 3,000 ac-ft per year of diversions from Groesbeck Creek. Its primary use was for cooling water for the Lake Pauline power plant. This plant has recently been moth-balled and is not operating at this time. The estimated firm yield for Lake Pauline with diversions from Groesbeck Creek is 1,284 ac-ft per year.

Lakes Kemp and Diversion

Lake Kemp is located on the Wichita River, immediately upstream of State Highway 183 in Baylor County. The original storage was estimated at 268,000 ac-ft. Lake Diversion was constructed approximately 20 miles downstream of Lake Kemp for secondary storage with a capacity of 40,000 ac-ft. The reservoir lies in both Archer and Baylor Counties.

Lake Diversion is operated in conjunction with Lake Kemp to provide water supply for municipal, industrial, irrigation, mining, and recreational purposes. The City of Wichita Falls and

Wichita County Improvement District No. 2 own the water rights in Lake Kemp and Lake Diversion. Water released from Lake Kemp travels to Lake Diversion for distribution. Irrigation water is diverted into canal systems.

Due to high salinity loads in the tributaries that flow to Lake Kemp, most of the water use from Lake Kemp historically has been limited to irrigation and industrial purposes. The City of Wichita Falls is completing a reverse osmosis water treatment plant and infrastructure to utilize water from Lake Kemp for municipal purposes. This project is expected to be operational by 2006.

To improve the water quality of the Wichita River, the Red River Authority sponsors a chloride control project that diverts saline water from the South Wichita River above Lake Kemp to Truscott Brine Reservoir in Knox County. Recent evaluations of the effectiveness of the project found these diversions reduce the total chloride load to Lake Kemp by approximately 25 percent. This results in a lower flow-weighted chloride concentration in the reservoir. However, there still is a significant chloride load to the reservoir system from the North and Middle Wichita Rivers. Future proposed low flow diversions from these tributaries should further reduce the chloride loading into Lake Kemp.

The yield of Lake Kemp and Lake Diversion was evaluated as a system with releases made to Lake Diversion when the water elevation at Lake Diversion drops to 1049.5 feet msl. The total permitted diversion for the system is 193,000 ac-ft per year. The water right allows the District to divert a portion of the irrigation right (16,660 ac-ft per year) directly from the Wichita River for irrigation purposes. This portion of the water right was evaluated as a run of the river supply and is not part of the firm yield of the system. Under these assumptions, the projected yield of the Lake Kemp/Lake Diversion System in 2000 was 100,650 ac-ft per year.

Santa Rosa Lake

Santa Rosa Lake is located in Wilbarger County on Beaver Creek. It was constructed in 1929 by the Waggoner Estate for irrigation and had an original capacity of 15,755 ac-ft. Current use is for livestock and irrigation. It is permitted for 3,075 ac-ft per year, but recent historical use is much lower. According to a representative of the Waggoner Estate, the lake went totally dry in 1971. Recent reported use from the lake is approximately 100 to 300 ac-ft per year. The Red River Basin Water Availability Model shows a firm yield of in excess of its permitted diversion. However, in light of historical performance, Santa Rosa Lake has little reliable supply, and is not considered a major water supply source for planning purposes.

Lake Electra

Lake Electra is located on Camp Creek near the City of Electra in Wichita County. It is owned and operated by the City of Electra and has a diversion right of 600 ac-ft per year for municipal use. At normal pool elevation (1,111 feet MSL), the storage capacity of Lake Electra is 5,626 ac-ft. However, due to the relatively small drainage area (14.5 square miles), the lake is usually below its normal pool elevation. Previous reports indicate the lake may never have completely filled since construction was completed in 1950. The WAM shows the firm yield of Lake Electra is 470 ac-ft per year.

Over the past eight years Lake Electra has experienced continued low lake levels and may be in a critical drought. To supplement Lake Electra, the City has a permit to divert up to 800 ac-ft per year from Beaver Creek for emergency municipal use. This right has been used on occasion, but there is no permanent diversion structure or transmission line. A review of available flows in Beaver Creek indicates that during some years there is very little flow during the hot dry months. In 1984, the total flow during the dry spring and summer months was less than 800 ac-ft. Also, Beaver Creek has a higher salinity level than Lake Electra. Large diversions from Beaver Creek may require additional treatment, which is currently undesirable. During a drought, diversions from Beaver Creek will be minimal because of the water quality and low flow conditions. To fully utilize this emergency right, diversions from Beaver Creek must be planned over the year. Since there is no existing diversion system in place and this water is only available for emergencies, it is assumed that this supply is currently not available to Electra.

North Fork Buffalo Creek Reservoir

The North Fork Buffalo Creek Reservoir was constructed in 1964 to provide additional water for the City of Iowa Park. The dam is located below the confluence of North Fork Buffalo Creek and Lost Creek in Wichita County. The reservoir had an original storage capacity of 15,400 ac-ft with a drainage area of 33 square miles. The current permitted water right for the reservoir is 840 ac-ft per year. North Fork Buffalo Creek Reservoir is owned and operated by the City of Iowa Park.

North Fork Buffalo Creek Reservoir is currently in drought of record conditions. During 2004, the content in the reservoir dropped to less than 400 ac-ft, which is approximately 2 percent of its conservation storage. The City stopped using water from North Fork Buffalo Creek and is purchasing water from the City of Wichita Falls. Previous studies, as well as the Red River WAM report, firm yield estimates at about 2,000 ac-ft per year. Based on the current performance of the lake, the firm yield is most likely much less. Additional studies of the yield of North Fork Buffalo Creek Reservoir were conducted under current and assumed future conditions. This study found that if the drought extends through 2007 and the reservoir refills, the reliable firm supply from North Fork Buffalo Creek Reservoir would be approximately 750 ac-ft per year. If the drought were to extend beyond 2007, the yield would be less. However, the reliable supply from North Fork Buffalo Creek Reservoir cannot be determined accurately until the drought is over and the reservoir has refilled. For this plan, it is assumed that the firm supply available from North Fork Buffalo Creek Reservoir is the permitted amount of 840 ac-ft per year. Further discussion of the additional yield study is included in Attachment 3-1.

Wichita System

The Wichita System consists of Lake Kickapoo and Lake Arrowhead. These lakes are owned and operated by the City of Wichita Falls for municipal and industrial supply. Water from the lakes is transported to Wichita Falls' water treatment plants for treatment and distribution. Some raw water is sold directly to wholesale customers. A brief description of each lake follows:

Lake Kickapoo

Lake Kickapoo was built by the City of Wichita Falls in 1946 for municipal water supply with an initial conservation storage capacity of 106,000 ac-ft. The reservoir is located on the North Fork of the Little Wichita River in Archer County. It is owned and operated by the City of Wichita Falls. The diversion rights from the lake total 41,720 ac-ft per year.

Lake Arrowhead

Lake Arrowhead was built in 1966 by the City of Wichita Falls for municipal, industrial and recreational use. The lake is located on Little Wichita River in Clay County, about 12 miles southeast of Wichita Falls. The lake is owned and operated by the City of Wichita Falls. The diversion rights from Lake Arrowhead total 45,000 ac-ft per year; however, the maximum diversion from both Lake Arrowhead and Kickapoo cannot exceed 65,000 ac-ft per year. This water right condition was considered in the evaluation of the system yield. The firm yield of the Wichita System in 2000 was estimated at 50,830 ac-ft per year.

Lakes Olney and Cooper

Lakes Olney and Cooper are a twin-lake system located on Mesquite Creek in Archer County. Lake Olney dam was constructed in 1935 to provide municipal water for the City of Olney. In 1953 the dam for Lake Cooper was built for additional storage. Collectively, the lakes have a conservation storage capacity of 6,650 ac-ft, with diversion rights of 1,260 ac-ft per year. The firm yield of these lakes is estimated at 961 ac-ft per year.

Lake Nocona

Lake Nocona is a 25,400 acre-foot reservoir located on Farmers Creek in Montague County, approximately eight miles northeast of the City of Nocona. Construction was completed in 1960 to provide municipal water supply to the City of Nocona. The lake is owned and operated by the North Montague County Water Supply District. The original permit for Lake Nocona allowed the diversion and use of 4,500 ac-ft per year for municipal, industrial, and mining purposes. In 1984, the final determination of water rights for the Middle Red River segment of the Red River Basin reduced the authorized diversion to 645 ac-ft per year for municipal use only. Subsequent studies reported the firm yield of the reservoir to be 1,260 ac-ft per year through year 2030

(F&N, 1986). The water right permit for diversions from Lake Nocona was amended in 1987 to 1,260 ac-ft per year for municipal, irrigation, and recreational uses. The reported firm yield for Lake Nocona using the Red River WAM greatly exceeded the permitted amount. For this plan, the firm supply from Lake Nocona is 1,260 ac-ft per year.

Amon G. Carter

Lake Amon G. Carter is located on Big Sandy Creek in Montague County, about six miles south of the City of Bowie. The lake was originally constructed in 1956 and enlarged in 1979. It has a current storage capacity of 28,600 ac-ft and an estimated firm yield of 2,210 ac-ft per year. The lake is owned and operated by the City of Bowie for water supply. The existing water right permit allows for a diversion of 5,000 ac-ft per year for municipal, industrial, and mining water use.

Miller's Creek Reservoir

Miller's Creek Reservoir is located about seven miles southeast of Bomarton, in the Brazos River Basin. The dam was constructed in 1977 on Miller's Creek in Baylor County, and the reservoir extends southwest into Throckmorton County. It is owned and operated by the North Central Texas MWA. It has a permitted diversion of 5,000 ac-ft per year for municipal, industrial, and mining uses. Water from this reservoir is currently used exclusively in the Brazos G Region. The yield for Miller's Creek Reservoir was determined by the Brazos G Region. Under safe yield analysis, the Brazos G reports a reliable supply of 583 ac-ft per year in 2010, reducing to little to no reliable supply by 2060.

Other Lakes and Reservoirs in the Region

Lake Wichita

Lake Wichita is located south of the City of Wichita Falls and lies in Archer and Wichita Counties. It was constructed in 1901 on Holliday Creek for irrigation and municipal use, but little water has been used for municipal purposes since Lake Kickapoo water supply became available. Presently, Lake Wichita is used for recreational purposes only.

Lake Iowa Park

Lake Iowa Park is located on Stevens Creek, northwest of the City of Iowa Park, and has been a source of water for the City of Iowa Park since 1949. The lake has a storage capacity of 2,565 ac-ft and the water right permit allows a diversion of 500 ac-ft per year for municipal use. The lake has recently experienced severe drought conditions and was nearly dry in years 2000 and 2004.

3.1.2 Sedimentation and Impacts to Reservoir Yields

Sediment production rates in Region B vary considerably due to land use, soil types, and topography. Wind erosion is quite active across the rolling prairies and cultivated fields. The USGS and U.S. Soil Conservation Services have compiled much of the sedimentation data available for reservoirs in Region B. Lakes Kickapoo, Arrowhead, and Nocona have recently published volumetric surveys, which were used to estimate sedimentation rates. Estimates of sedimentation rates for the other lakes were developed from several sources. For sedimentation rates developed from the Texas Board of Water Engineers Report 5912, the effects of SCS structures and development were considered. Estimates of reservoir capacities for years 2000 and 2060, based on the reservoir's drainage area and sedimentation rate, are presented in Table 3-3. Since the yield of a reservoir is affected by the reservoir's area-capacity relationship, high sedimentation rates will reduce the reservoir's storage capacity and firm yield. The projected reservoir yields over the planning period are shown in Table 3-1.

Table 3-3: Estimated Sedimentation Rates and Projected Capacities

Reservoir	Drainage Area (sq mi)	Sediment Rate (af/yr/sq mi)	Year of Initial Capacity	Capacities (Ac-ft)			Source (sediment rate)
				Initial	2000	2060	
Lake Pauline	42.6	0.68	1971	4,137	3,297	1,559	TBWE 1959
Lake Kemp	2,086	1.13	1973[1]	268,000	205,160	65,506	F&N 1976
Santa Rosa Lake	334	0.14	1929	15,755	8,245	5,434	Espey,2002
Lake Electra	14.5	0.69	1998[2]	5,626	5,606	5,006	TBWE 1959
North Fork Buffalo Creek	33	0.86	1964	15,400	14,378	12,676	TBWE 1959
Lake Kickapoo	275	1.325	1946	106,400	86,280	64,417	TWDB, 2001
Lake Arrowhead	832	0.98	1966	262,100	237,150	185,974	TWDB 2001
Olney/Cooper	12.3	0.68	1935/1953	6,650	6,165	5,663	TBWE 1959
Lake Nocona	94	0.48	1961	25,400	21,819	19,112	TWDB, 2002
Amon Carter	101	0.51	1980[3]	28,589	27,876	24,772	HDR 1979

1. Revised construction was completed in 1973. At that time, COE re-surveyed the lake.
2. 1998 area-capacity data. Previous survey conducted in 1987 indicated much larger capacity. This difference is currently being investigated.
3. Enlargement of Lake Amon Carter was completed in 1980 and area-capacity was determined at that time

As shown on Table 3-3, highly erodible soils in Region B that contribute to the accumulation of sediment result in significant impacts to reservoir storage capacities. This is especially noted for Lake Kemp that has a large drainage area and high sedimentation rate. The estimated 2060 storage capacity is approximately 30 percent of the estimated capacity in year 2000 and 24 percent of the capacity in 1973. Wichita County Water Improvement District No. 2 and the Corps of Engineers are planning an updated volumetric survey for Lake Kemp and are waiting for the reservoir to fill above the conservation level to conduct the survey.

3.1.3 Reservoir Water Rights

Water rights for reservoirs located in Region B are summarized on Table 3-4. Comparisons of rights to firm yields indicate that water rights for several of the reservoirs in Region B exceed firm yield. For Lake Kemp, the 2000 firm yield was approximately 57 percent of the permitted right. By 2060, the projected yield of the Lake Kemp system is only 22 percent of the permitted diversion. Presently, water from Lake Kemp is used only for irrigation and industrial uses, with occasional emergency municipal use. As Wichita Falls begins using water from Lake Kemp and industrial demands increase, the total demand on this resource will likely exceed the available supplies during drought of record conditions.

A summary of the existing known contracts by reservoir is presented on Table 3-5. With the exception of the City of Wichita Falls, the primary water right holders are not included on Table 3-5.

Table 3-4: Summary of Reservoir Water Rights

Reservoir	Water Right No.	Priority Date	Holder	Water Right Amount (ac-ft/year)						2000 Yield (ac-ft/yr)
				Mun	Ind	Irr	Mining	Rec	Total	
Greenbelt	5233	8/11/58	Greenbelt MIWA	14,530	500	250	750		16,030	8,985
Pauline/ Groesbeck	5230	6/27/14 3/5/45	American Electric Power		3,600	16		0	3,616	1,284
Kemp/ Diversion	5123	10/2/20	Wichita Co WID #2 Wichita Falls	25,150	40,000	103,340[1]	2,000	5,850	176,340[1]	100,650
Santa Rosa	5124	6/30/26	W.T. Waggoner Estate			3,075			3,075	3,075
Electra	5128 5128	3/29/49 2/25/74	City of Electra Emergency supply	600 800					600 800	470 0
Kickapoo	5144	6/21/44	Wichita Falls	40,000					40,000	50,830
Arrowhead	5150	6/20/62	Wichita Falls	45,000					45,000	
Olney/ Cooper	5146	3/26/53	City of Olney	1,260					1,260	910
N.F. Buffalo Creek	5131	9/19/62	City of Iowa Park	840					840	840
Iowa Park/ Lake Gordon	5132 5133	8/3/49 11/22/38	City of Iowa Park	500 300					800	538
Nocona	4879	10/9/58	North Montague Co. WSD	1,080		100		80	1,260	1,260
Amon Carter	3320	7/12/54	City of Bowie	3,500	1,300		200		5,000	2,210

Mun – Municipal Use Ind – Industrial Use Irr – Irrigation Use Rec – Recreational Use

1. Water right 5123 includes a diversion of 16,660 ac-ft per year directly from the river for irrigation. This portion of the right is not included in this table. The total permitted diversion for irrigation by the Wichita County WID #2 is 120,000 ac-ft per year. The total permitted diversion for water right 5123 is 193,000 ac-ft per year.

Source: Texas Commission on Environmental Quality, Water Rights Database, 2004.

Table 3-5: Summary of Existing Water Supply Contracts in Region B

Source Name	Contract Holder	Contract Amount		Comment
		MGD	AF/YR	
Greenbelt	Crowell		273	No Contract Amount – 2000 Historical Use
Greenbelt	Quanah		598	No Contract Amount – 2000 Historical Use
Greenbelt	Red River Authority		260	No Contract Amount – 2000 Historical Use
Kemp/Diversion	American Electric Power		20,000	Contract
Kemp/Diversion	TPW Dundee Fish Hatchery		2,200	
Nocona	Nocona Hills Owners Assoc		246	Contract
Wichita System	Archer City	0.6		Contract – Lake Kickapoo
Wichita System	Archer County MUD #1	0.15		Contract, No Expiration Date
Wichita System	Burkburnett	3.3		Contract
Wichita System	Dean Dale WSC	0.825		Contract, No Expiration Date
Wichita System	Friberg-Cooper WSC	0.25		
Wichita System	Henrietta			Wichita Falls must meet Henrietta's senior water right
Wichita System	Holliday		294	No Contract Amount – 2000 Demands
Wichita System	Iowa Park	2.0		
Wichita System	Lakeside City	0.35		
Wichita System	Olney	1.0		Contract – Lake Kickapoo
Wichita System	Pleasant Valley		121	No Contract Amount – 2000 Demands
Wichita System	Red River Authority	0.75		
Wichita System	Scotland	0.25		
Wichita System	Sheppard AFB			Part of Wichita Falls 2000 Demands
Wichita System	Wichita Falls		21,943	2000 Demands
Wichita System	Wichita Valley WSC	1.25		
Wichita System	Windthorst WSC	0.75		

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3.1.4 Run-of-the-River Supplies

Portions of three river basins are located in Region B. The Red River and its tributaries represent the largest river system, flowing across the central and northern areas of the region. The Brazos River flows through the southern portion of King and Baylor Counties, and the upper tributaries of the Trinity River lie in southwest Montague County.

The Red River forms the northern boundary of Region B and flows eastward along the Texas – Oklahoma border. Tributaries within the region include the Pease River, Wichita River, and Little Wichita River. High concentrations of total dissolved solids, sulfate, and chloride are concerns for the upper reaches of these streams during low flow conditions. Naturally occurring salt springs, seeps, and gypsum outcrops are found in the area westward of Wichita County to the High Plains Caprock Escarpment in the Panhandle Region Planning Area. As a result water from these rivers in Cottle, Foard, King, Hardeman, and parts of Baylor and Wilbarger Counties is generally not used or is restricted to irrigation use only. The quality of the water gradually improves downstream toward the eastern portion of the region.

Existing run-of-the river water rights for the Red River system in Region B are shown on Table 3-6 and include major rights on the Red River in Clay County, Little Wichita River, Wichita River and Beaver Creek. Beaver Creek is a tributary to the Wichita River, and flows eastward from Foard County to the Wichita River in Wichita County. Groesbeck Creek, which has a large water right associated with Lake Pauline, is addressed with this reservoir. Generally, rights associated with reservoirs and unnamed tributaries or smaller rivers and streams that have no reliable water supply are not included on Table 3-6.

The total available supplies from the run-of-the-river diversions are shown on Table 3-2. These supplies were determined using the Water Availability Models and represent the minimum diversion in a year over the historical record in the respective model.

Table 3-6: Run of the River Water Rights

Water Right	County	Permitted Amount (af/yr)	Use	Owner
Red River				
5143	Clay	200	Irrigation	Joe J. Parker
Little Wichita River				
4268	Clay	3,600	Irrigation	A.L. Rhodes
5147	Archer	30	Irrigation	Joy Graham
5152	Clay	1,560	Municipal	City of Henrietta
5153	Clay	50	Irrigation	Clay County Country Club Inc.
5154	Clay	15	Irrigation	Johnnie H. Shaw
Wichita River				
4433	Wichita	300	Irrigation	Alvin & Nana Robertson
5123	Wichita	16,660	Irrigation	WCWID #2
5135	Clay	357	Irrigation	Eagle Farms, Inc.
5136	Clay	200	Irrigation	Joe L. Hale Estate
5138	Clay	55	Irrigation	M.E. McBride
5139	Clay	30	Irrigation	Bob Brown
5140	Clay	270	Industrial	Red River Feed Yard, Inc.
5152A	Wichita	2,352	Recreation	City of Wichita Falls
5530	Wichita	32	Irrigation	Joe L. Burton
Beaver Creek				
5125	Wilbarger	675	Irrigation	W.T. Waggoner Estate
5126	Wilbarger	60	Municipal	W.T. Waggoner Estate
5127	Wilbarger	85	Municipal, Mining	W.T. Waggoner Estate
5129	Wichita	404	Irrigation	Harry L. Mitchell
5393	Wichita	450	Irrigation	James Brockriede
5128[1]	Wilbarger	800	Municipal	City of Electra
Groesbeck Creek				
5225	Hardeman	96	Irrigation	Hunter Brothers
5226	Hardeman	60	Irrigation	FW Howard Jr.
5227	Hardeman	100	Irrigation	FW Howard Jr. & Wife
5228	Hardeman	63	Irrigation	BJ Howard & Wife
5231	Hardeman	41	Irrigation	Garland Welborn
Antelope Creek				
5130	Wichita	40	Irrigation	Hulen J. Cook Jr. Et Al
Big Mineral Creek				
5113	Wilbarger	150	Irrigation	James David Belew & Wife
Sherwood				
5238	Wilbarger	160	Irrigation	Joyce Virginia Chapman

Table 3.6 (Continued)

Water Right	County	Permitted Amount (af/yr)	Use	Owner
Devils Creek				
5112	Hardeman	45	Irrigation	Texas Parks & Wildlife Dept.
Armand Bayou				
5230	Hardeman	16	Irrigation	AEP Texas North Company
Belknap				
4874	Clay	30	Irrigation	Herschel H. Studdard
4875	Montague	133	Irrigation	Clarice Benton Whiteside
Frog Creek				
5142	Clay	200	Irrigation	Joe J. Parker
Long Creek				
5109	Clay	200	Irrigation	A D Hanna
Mesquite Creek				
5146	Archer	35	Irrigation	City of Olney
Deep Draw				
5605	Montague	100	Irrigation	Jerry D. Nunneley
Pease Creek				
5111	Cottle	23	Irrigation	John E. Isbell Jr. & Wife

1. This water right is associated with Lake Electra. It is a right to divert water from Beaver Creek to Lake Electra for emergency municipal use.

Source: Texas Commission on Environmental Quality, Water Rights Database, 2004.

3.2 Groundwater Supplies

3.2.1 General Description

Groundwater is primarily supplied in Region B by two aquifers, the Seymour and the Blaine. The Seymour is designated a major aquifer and is found in the central and western portions of the region. It is currently used in Hardeman, Wilbarger, Wichita, Clay, Baylor, Foard, and Cottle Counties. The Blaine is considered a minor aquifer and useable groundwater is limited to the westernmost portion of the region. These aquifers provide a large percentage of available supply in these counties. In addition, the upper portion of the Trinity Aquifer occurs in Montague County in the eastern part of the region. Limited quantities of groundwater are used from the Trinity for municipal and irrigation uses. There are also other formations within the region that are used for groundwater supply in limited areas. The TWDB identifies these sources as "Undifferentiated Other Aquifers". These formations are not well defined in the literature, but still provide substantial quantities of water in Archer, Clay, Cottle, Montague, and Wichita Counties. For purposes of this report, the groundwater availability for "Other Aquifers" will be determined from the reported historical use.

Seymour Aquifer

The Seymour Formation consists of isolated areas of alluvium that vary in saturated thickness from less than 10 feet to over 80 feet. This aquifer is relatively shallow and exists under water table conditions in most of its extent. Artesian conditions can occur where the water-bearing zone is overlain by clay. The upper portion of the Seymour consists of fine-grained and cemented sediments. The basal portion of the formation has greater permeability and produces greater volumes of water. Yields of wells typically range from 100 gpm to 1,300 gpm, depending on the saturated thickness, and average about 300 gpm.

Recharge to the Seymour is largely due to direct infiltration of precipitation over the outcrop area. Surface streams adjoining the outcrop are at elevations lower than the water levels in the Seymour Aquifer and do not contribute to recharge. Other possible sources of recharge include infiltration from irrigation or upward leakage of water from underlying Permian formations, but these amounts are insignificant.

Natural discharge from the Seymour occurs through seeps and springs, evapotranspiration, and leakage to the Permian. It is estimated that a large part of the Seymour's total natural discharge is from evapotranspiration from plants and is considerably larger than discharges to seeps and springs (TWDB Report 337, 1992).

Water quality of the Seymour is variable throughout the region, and generally ranges from fresh to slightly saline. Brine pollution from earlier oil activities and excessive pumping has caused localized concentrations of minerals in the alluvium, limiting the full utilization of the water resource. In addition, high nitrate concentrations occur in the groundwater over a wide area. These nitrate concentrations are often due to agricultural practices, and can be attributed to nitrogen fertilizer or leaching from areas formerly covered by nitrogen fixing vegetation such as grasses or mesquite groves. Other sources of nitrate include organic matter from poorly functioning septic systems, infiltration of animal wastes or naturally occurring sources.

Blaine Aquifer

The Blaine Formation extends in a narrow outcrop band from Wheeler to King Counties. Groundwater occurs in numerous solution channels and caverns in beds of gypsum and anhydrite. In most places the aquifer exists under water table conditions, but it is also artesian where overlain by the Dog Creek Shale. Saturated thickness of the aquifer approaches 300 feet in its northern extent, and is generally less in the Region B area. Well yields vary considerably from one location to another due to the nature of solution channels. It is common for dry holes to be found adjacent to wells of moderate to high yield. The average well yield is 400 gpm.

The primary source of recharge to the Blaine Aquifer is precipitation that falls on the High Plains Escarpment to the west and the Blaine outcrop area. The solution openings and fractures in the gypsum provide access for water to percolate downward. The Blaine Aquifer may also receive some recharge from the overlying Dog Creek Shale.

Water in the Blaine Aquifer generally moves eastward through the solution channels, dissolving mineral deposits along the way, and discharging to low topographic areas. The dissolved solids concentrations in the aquifer increase with depth and generally range from 1,000 to over 10,000 mg/l. Due to the high mineral content, the TWDB has limited the extent of the Blaine Aquifer to areas with water less than 10,000 mg/l of dissolved solids.

Natural salt springs and seeps from the Blaine formation contribute to increased salinity of surface water. Due to the high mineral content, the Blaine Aquifer has been used primarily for irrigation of salt tolerant crops.

Trinity Aquifer

The Trinity Group consists of three formations, the Travis Peak, Glen Rose, and Paluxy. In the northern part of its extent, the Glen Rose thins out and the Travis Peak and Paluxy coalesce into a single geologic unit known as the Antlers Formation. In Region B, the Trinity Group outcrops in the eastern portion of Montague County. The thickness of the Trinity Aquifer ranges from less than 10 feet to 600 feet. Water table conditions occur in outcrop area, while artesian conditions exist in the downdip formation. Well yields in the Trinity Aquifer range from moderate to low. The effective recharge for the entire Trinity Aquifer as determined by TDWR is 1.5 percent of the mean annual precipitation over the outcrop area (TDWR, 1982).

Limited amounts of good quality water can be obtained from the Trinity in Montague County. Groundwater is generally used for municipal, mining, irrigation, and livestock purposes. Water level declines have been recorded in heavily pumped areas to the south and southeast of Montague County.

Springs in Region B

The most recent effort to document major springs in Texas was published in 1981 (Brune, 1981). This work identified six major springs in Region B that are listed in Table 3-7. Some of these springs had historical significance as water supplies for nomadic Indians and western travelers. None of these springs are currently used for water supply, and at least one is no longer flowing.

Table 3-7
Major Springs in Region B

County	Spring	Location	Status
Baylor	Buffalo Springs	three miles west of Seymour	Flow at 25 gpm in 1969
Clay	Buffalo Springs	At Buffalo Springs	Uncertain
Montague	Barrel Springs		No longer flowing
Wichita	China Springs	two miles west of Haynesville	Brackish water flow at 100 gpm in 1970
Wilbarger	Doans Springs	one mile northwest of Doans	Flowing in 1970. Impounded in a recreational lake.
	Condon Springs	three miles northwest of Vernon	Flowing in 1969

3.2.2 Groundwater Availability and Recharge

The average annual groundwater availability is the amount of water that could be reasonably developed from the aquifer. It is comprised of the annual effective recharge plus the amount of water that can be recovered annually from storage over a specified period without causing excessive drawdown or irreversible harm, such as subsidence or water quality deterioration.

As part of Senate Bill 1 the TWDB initiated a comprehensive groundwater availability modeling program to assist groundwater conservation districts and regional water planning groups in determining available groundwater supplies. The groundwater availability models (GAM) for the Northern Trinity, Seymour, and Blaine Aquifers were published in late 2004. These models use a three-dimensional groundwater flow model (Modflow) to estimate aquifer response to stresses placed on the system (such as well pumping). The groundwater model for the Seymour and Blaine formation was released by the TWDB in November 2004. This was after the analyses of supplies for the region was completed. A review of the results of the Seymour Groundwater Availability Model found that the available supplies from this source were consistent with the supplies determined for the 2006 plan, and no further analyses were conducted. The Northern Trinity Aquifer GAM was released in August 2004. This model was used to estimate water availability from the Trinity Aquifer in Montague County.

The supplies from the Seymour and Blaine Aquifers were determined using previous studies. As part of the 1997 State Water Plan, the TWDB evaluated the groundwater availability for the major and minor aquifers of the state. Previous publications and water well data were used to derive annual groundwater availability. Effective recharge was determined by applying a percentage of the mean annual precipitation upon the aquifer's outcrop area. For the Seymour, the TWDB used a conservative estimate of five percent of the average annual precipitation for the entire Seymour formation. This percentage was generally based on the low flow analyses used in the groundwater studies of Baylor and Jones Counties (TDWR Report 238, 1979). In addition, an estimated annual amount recoverable from storage was determined based on using 75 percent of the total storage over the 57-year period from 1974 through 2030. After 2030, it was assumed no water would be available from storage, limiting availability to recharge.

Reviews of previous groundwater publications found a range of reportable recharge rates and availability estimates for the Seymour Aquifer. The Baylor Study (TDWR, 1978) indicated an effective recharge rate of ten percent of the average annual precipitation for the year 1969. However, groundwater availability was limited in some areas due to thin saturated thickness and high loss to evapotranspiration. The Baylor Study also did not include mining of groundwater from storage due to the nature of the near surface aquifer (i.e., did not want to create abnormally low water levels.) More recently, a study by Woodward Clyde for the City of Vernon estimated the recharge to the Seymour in the Odell-Lockett area in Wilbarger County to be approximately 15 percent of the average rainfall (Woodward-Clyde, 1998).

This higher estimate of recharge appears to be limited to specific areas and cannot be applied over the regional aquifer. Also, it is unrealistic to expect that all aquifer recharge will be available for development. The TWDB estimate of five to seven percent of the annual precipitation is a reasonable estimate of effective recharge for the Seymour, and is appropriate for regional water planning purposes. However, since the Seymour Aquifer is a near-surface unconfined aquifer and is sensitive to recharge and withdrawals, mining of the aquifer may adversely affect the water supply. Therefore, for this plan, the mining of storage is not included in the groundwater availability estimates for the Seymour.

For the Blaine Aquifer, comparisons of declines of water levels and pumpage were used to estimate effective recharge. In Hardeman County, Maderak (TDWR, 1972) determined the effective recharge to the Blaine to be between five and seven percent of the average annual precipitation. The TWDB used a conservative estimate of five percent for water availability planning. No recoverable storage from the Blaine Aquifer was included in the availability estimates. For the Blaine, the groundwater estimates include water with total dissolved solids (TDS) up to 10,000 mg/l. For the other aquifers in the region, the availability estimates were limited to water containing less than 3,000 mg/l of dissolved solids.

The TWDB methodology for groundwater availability for the Blaine Aquifer is appropriate for this planning effort. However, the Blaine Aquifer has a large amount of groundwater with moderate to high salinity. As a result much of the water from this formation is not used in the region. Therefore, the groundwater availability from the Blaine is broken down by TDS level. Based on historical water quality data, there is little to no water available for municipal purposes. (Small amounts of water from the Blaine Aquifer are currently being used for municipal purposes in areas with limited water resources.) Water with TDS levels between 1,000 and 3,000 mg/l is appropriate for irrigation, livestock, mining, and some industrial uses. Water with TDS levels greater than 3,000 mg/l may be available with treatment or irrigation of salt tolerant crops.

The effective recharge for the Trinity Aquifer within the Brazos, Trinity, and Red River Basins was determined by the trough method (TDWR Report 238, 1979). Using this method, it was determined that approximately 1.5 percent of the annual precipitation over the outcrop area is available for development as effective recharge. In addition, the TWDB estimated that 1 million ac-ft of water could be withdrawn from artesian storage within the Trinity. However, much of the Trinity Aquifer within Montague County is not artesian and the water availability from this portion of the aquifer may differ. Since the outcrop area is used to recharge the downdip portion of the aquifer, a direct application of effective recharge over the outcrop area is not appropriate to determine groundwater availability.

Groundwater availabilities for the Seymour and Blaine Aquifers were re-calculated as five percent of the mean annual rainfall over the outcrop area, using historical precipitation data and the delineation of recharge areas. The availability estimates for the Trinity were determined from the 2004 Northern Trinity/Woodbine Aquifer GAM (Harden, 2004). Assuming an average drawdown of 30 feet or less over the 50-year analysis period, the groundwater availability from the Trinity Aquifer in Montague County is nearly 2,700 ac-ft per year. This availability is similar to previous estimates reported in the 2001 Regional Water Plan. A summary of groundwater availability by aquifer and county is presented in Table 3-8. Table 3-9 shows the availability in the Blaine Aquifer by concentration of TDS.

Table 3-8: Groundwater Availability – Region B

County Name	Basin	Aquifer Name	Groundwater Availability (af/yr)	Effective Recharge Rate (in/yr)
Baylor	Brazos	Seymour	8,205	1.35
Baylor	Red	Seymour	1,485	1.35
Baylor	*Total*	*Seymour*	*9,690*	*1.35*
Clay	Red	Seymour	7,870	1.39
Cottle	Red	Seymour	8,410	1.11
Cottle	Red	Blaine	27,100	1.01
Foard	Red	Seymour	12,130	1.23
Foard	Red	Blaine	15,390	1.19
Hardeman	Red	Seymour	15,390	1.18
Hardeman	Red	Blaine	23,770	0.92
King	Red	Blaine	17,590	1.10
Montague	Red	Trinity	239	0.51
Montague	Trinity	Trinity	2,443	0.51
Montague	*Total*	*Trinity*	*2,682*	*0.51*
Wichita	Red	Seymour	13,920	1.38
Wilbarger	Red	Seymour	30,500	1.28

Table 3-9: Availability in Blaine Aquifer by TDS

County	Basin	Groundwater Availability (af/yr)			
		Total	*TDS (mg/l):*		
			1,000 - 3,000	*3,000 - 10,000*	*>10,000*
Cottle	Red	27,100	6,494	18,153	2,453
Foard	Red	15,390	10,945	4,445	0
Hardeman	Red	23,770	13,601	10,169	0
King	Red	17,590	3,706	13,884	0

As shown on the above tables, there are large quantities of water available in the Seymour and Blaine Aquifers, and limited quantities in the Trinity Aquifer. However, the water in the Blaine is unsuitable for municipal use without additional treatment, and only a portion is readily available for other uses. Water quality issues associated with the Seymour Aquifer (nitrates and TDS) also limit the usefulness of this resource. Historical use indicates that with the exception of Wilbarger County, much of the groundwater is not fully developed or not currently being used. A comparison of the 1999 historical use and groundwater availability estimates is shown on Table 3-10.

Table 3-10: Groundwater Historical Use

County	Aquifer	Availability (af/yr)	Historical Use-1999 (af/yr)
Baylor	Seymour	9,690	2,467
Clay	Seymour	7,870	923
Cottle	Seymour	8,410	27
Cottle	Blaine	27,100	7,403
Foard	Seymour	12,130	5,267
Foard	Blaine	15,390	24
Hardeman	Seymour	15,390	149
Hardeman	Blaine	23,770	5,350
King	Blaine	17,590	269
Montague	Trinity	2,682	430
Wichita	Seymour	13,920	3,107
Wilbarger	Seymour	30,500	36,716

Source: TWDB, historical groundwater pumpage data, 2004.

The groundwater availability for "Other Aquifer" was based on historical use. A summary of supplies from this source is shown in Table 3-11.

Table 3-11
Supplies from Other Aquifers in Region B

County	Basin	Groundwater Availability (ac-ft/yr)
Archer	Red	335
Archer	Brazos	43
Archer	Trinity	50
Clay	Red	734
Clay	Trinity	118
Cottle	Red	836
King	Red	179
King	Brazos	66
Montague	Red	654
Montague	Trinity	603
Wilbarger	Red	658

Note: Region B also receives 86 ac-ft per year of groundwater from Dickens County in Region O.

3.2.3 Reliability of Local Supplies

Many of the local cities and communities in Region B rely on groundwater for all or a portion of their municipal supply. Those communities that use groundwater exclusively include the cities of Vernon, Seymour, Paducah, Saint Jo, and Montague. The cities of Electra, Burkburnett, and Chillicothe use a combination of groundwater and surface water. Also, several water supply corporations use groundwater to supply rural areas. Based on surveys of the water users in Region B, some of these users are experiencing lower water table elevations, nitrate contamination, and/or salt water intrusion of their groundwater supplies. Nitrate contamination is a particular concern in the Seymour Aquifer.

3.2.4 Groundwater Conservation Districts

There are two groundwater conservation districts located in Region B. The Rolling Plains Groundwater Conservation District covers Baylor, Knox, and Haskell Counties. Only Baylor County is in Region B, which uses water from the Seymour Aquifer. The Tri-County Groundwater Conservation District covers Foard and Hardeman Counties in the northwestern part of Region B. Both the Blaine and Seymour Aquifers are present in these two counties. The groundwater management plan for Tri-County Groundwater District was recently approved by the TWDB in August 2005.

3.3 Inter-Basin Transfers and Inter-Region Transfers

There is only one known inter-basin transfer in Region B. This is from Lake Kickapoo in the Red River Basin to the City of Olney in the Brazos Basin. The City of Olney has a contract with the City of Wichita Falls to provide one MGD of water during peak demands. Most years this additional supply is not used or minimally used.

Inter-regional transfers occur from the Panhandle Planning Area to Region B through the Greenbelt Municipal and Industrial Water Authority. In addition, a small amount of groundwater from Dickens County in Region O is supplied to Guthrie in King County. There are no other existing inter-regional transfers.

3.4 System Operations and Reliability

The analysis for current surface water supplies within the region is based on the firm yield of the reservoirs. This approach is required by the Senate Bill 1 regulations, but it is often not reflective of how reservoir yields have been determined in other planning efforts. Firm yield analyses determine the amount of water that is available on an annual basis during a repeat of historical drought of record conditions assuming all the water in the reservoir is available for use. This means that the reservoir content will approach zero sometime during the drought period if the firm yield is used. This analysis is also based on the historical rainfall and runoff for each reservoir. Experts at the University of Arizona's Climate Assessment Project for the Southwest recently indicated that Texas might be heading into a significant dry period. Since 1995 climatic patterns have shifted, bringing warmer drier weather to the Southern United States. This phenomenon called the Pacific Decadal Oscillation usually lasts 20 to 30 years (San Antonio Express News, 2/7/00). If this happens, then the region may be entering a new drought period that may surpass the historical drought of record and the firm yield may overestimate the available water supply. However, it is still too early to assess the impact of this weather shift.

Based on these concerns and the uncertainties inherent with the yield analyses, the available water supply for the region may be less than shown on Table 3-1. For these reasons, most water supply systems will not allow their reservoir contents to drop to very low levels without utilizing alternative supplies and implementing drought contingency measures. Many cities within Region B have initiated drought contingency measures in the past decade in response to continuing dropping reservoir levels and are actively considering alternative water sources.

To provide a more conservative estimate of the available surface water supply within the region, safe yield analyses were conducted for the municipal reservoirs in Region B. The safe yield analysis utilizes the same historical hydrology as the firm yield analysis, but assumes that a one-year supply of water is reserved in the reservoir at all times. This analysis has been commonly used for water resource planning in this region in the past. However, the one-year reserve amount may still be less than the preferred minimum operating content. For the City of Wichita Falls, severe drought contingency measures are initiated when the content of the Wichita System drops below 40 percent (137,000 ac-ft), which is much greater than a one-year reserve. Using the Water Availability Models, the safe yields for reservoirs in Region B are shown on Table 3-12.

Table 3-12
Summary of Safe Yield Analyses

Reservoir	2000	2010	2020	2030	2040	2050	2060
Wichita System	36,700	35,743	34,786	33,829	32,872	31,915	30,959
Lake Electra	230	225	220	215	210	205	200
North Fork Buffalo Creek [1]	700	690	680	670	660	650	640
Amon Carter	1,650	1,589	1,528	1,467	1,406	1,345	1,285
Olney/ Cooper	770	770	770	770	770	770	770
Greenbelt	7,470	7,331	7,192	7,053	6,914	6,775	6,635

1. North Fork Buffalo Creek Reservoir is in drought of record conditions. The safe yield of this reservoir may be less than shown in Table 3-12. Attachment 3-1 discusses the potential impacts of continuing drought on the yield of North Fork Buffalo Creek Reservoir.

3.5 Allocation of Existing Supplies

3.5.1 Water User Groups

To assess the projected water shortages in the region, the currently available supplies were allocated to each water user. Surface water allocations are based on current water rights, contracts, available yields, and current infrastructure capacities, accounting for the most restraining limitation. Groundwater allocations are based on current developed well fields, considering aquifer limits and availability. Surface water use reported to TWDB for livestock watering was assumed supplied by on farm stock ponds.

The supplies to each water user are shown in the Water User Group Summary Tables in Appendix A. A summary of the currently available supplies by county is presented in Table 3-13.

Table 3-13
Summary of Currently Available Supplies by County

County	2000	2010	2020	2030	2040	2050	2060
Archer	10,998	8,577	8,205	7,856	7,500	7,119	6,771
Baylor	4,452	4,452	4,452	4,452	4,452	4,452	4,452
Clay	8,818	9,008	8,784	8,571	8,369	8,182	8,049
Cottle	5,788	5,790	5,792	5,793	5,795	5,795	5,795
Foard	6,038	6,081	6,066	6,052	6,040	6,032	6,021
Hardeman	8,349	8,729	8,712	8,719	8,705	8,705	8,656
King	946	1,295	1,296	1,295	1,295	1,294	1,294
Montague	6,176	6,429	6,368	6,307	6,246	6,185	6,125
Wichita	109,981	104,866	97,376	89,867	82,338	74,830	67,242
Wilbarger	52,419	53,077	51,266	48,945	46,624	44,303	41,980
Young (P)	1,043	1,379	1,379	1,379	1,379	1,379	1,379
TOTAL	**215,009**	**209,684**	**199,697**	**189,237**	**178,743**	**168,275**	**157,763**

3.5.2 Wholesale Water Providers

There is one wholesale water provider in Region B: the city of Wichita Falls. The city currently receives water from two primary sources: Lake Arrowhead and Lake Kickapoo. Wichita Falls also receives water from Lake Kemp when water levels in Lakes Kickapoo and Arrowhead are low. The city is completing a reverse osmosis water treatment plant, which will enable the city to treat and use up to 10 mgd of water from Lake Kemp. Wichita Falls also has water rights for Lake Wichita, but this lake is currently used only for recreational purposes. The total available supply to Wichita Falls is shown in Table 3-14.

Table 3-14
Available Supply to Wichita Falls (ac-ft/yr)

Safe Yield[1]	2000	2010	2020	2030	2040	2050	2060
Kickapoo	14,210	13,668	13,126	12,584	12,042	11,500	10,959
Arrowhead	22,490	22,075	21,660	21,245	20,830	20,415	20,000
Wichita System	**36,700**	**35,743**	**34,786**	**33,829**	**32,872**	**31,915**	**30,959**
		0	0	0	0	0	
Kemp Municipal[2]	10,766	9,672	8,578	7,484	6,389	5,295	4,199
Total – Wichita Falls	**47,466**	**45,415**	**43,364**	**41,313**	**39,261**	**37,210**	**35,158**

1. Safe yield was calculated for the Wichita System.
2. Proportional firm yield supply was used for Lake Kemp, with an assumed treatment loss of 25 percent.

3.6 Summary of Currently Available Supplies

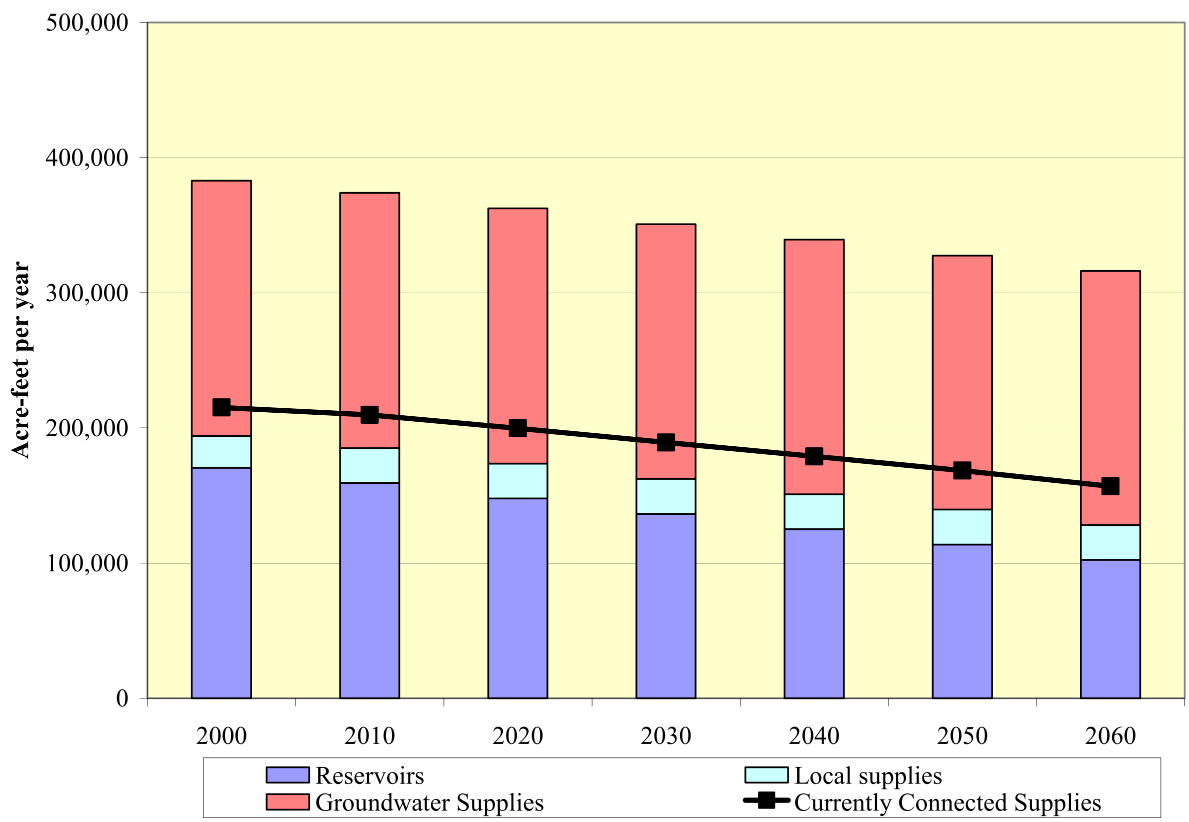
The total amount of supply currently available to Region B is approximately 383,000 ac-ft per year, as shown on Table 3-15. This represents firm supply available to the region. However, the supply that is available to each user is less due to operational and contractual constraints, infrastructure limitations, and water treatment capacities. A comparison of the regional firm supply to the total currently available supply to the water users is shown on Figure 3-1.

By 2060, the supply to Region B decreases by nearly 66,000 ac-ft per year. This is mostly due to the reduced storage capacities of existing reservoirs due to sediment accumulation. The Lakes Kemp and Diversion system were found to have significant reductions in firm yield due to reduced storage capacity, and this system accounts for most of the regional supply reduction.

Table 3-15
Summary of Firm Supplies to Region B

	2000	2010	2020	2030	2040	2050	2060
Reservoirs in Region B	161,580	150,505	139,430	128,355	117,280	106,205	95,128
Reservoirs outside Region B	8,985	8,854	8,723	8,592	8,461	8,330	8,200
Run-of-the-River Supplies	14,666	14,666	14,666	14,666	14,666	14,666	14,666
Local Supplies	9,018	11,316	11,316	11,316	11,316	11,316	11,316
Groundwater Supplies	188,819	188,804	188,804	188,354	188,354	187,952	187,952
Total	**383,068**	**374,145**	**362,939**	**351,283**	**340,077**	**328,469**	**317,262**

Figure 3-1
Comparison of Firm Supplies to Supplies Available to Water Users



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ATTACHMENT 3-1

REGIONAL WATER PLANNING GROUP B

EVALUATION OF WATER SUPPLY FROM NORTH FORK CREEK RESERVOIR

ATTACHMENT 3-1

EVALUATION OF WATER SUPPLY FROM NORTH FORK CREEK RESERVOIR

North Fork Buffalo Creek Reservoir is a primary source of water for the City of Iowa Park. This reservoir was completed in 1964 with a conservation storage capacity of 15,400 ac-ft, and has a permitted diversion of 840 ac-ft per year. In October 2003 the content of North Fork Buffalo Creek Reservoir dropped to less than 200 ac-ft and the city subsequently stopped using water from the reservoir. Presently the reservoir content has increased slightly, but the city has continued to rely on purchasing water from the City of Wichita Falls rather than its local lake.

Review of previous studies and historical records indicate that inflows developed for the Red River Water Availability Model (WAM) may be overestimated based on historical content of the reservoir. Previous studies, as well as the Red River WAM, report firm yield estimates at about 2,000 ac-ft per year. Historical diversions from the reservoir are considerably less than 2,000 ac-ft per year and current content is nearly empty. Based on these observations and the continuing drought in the region, the Region B Water Planning Group re-evaluated the firm and safe yields of North Fork Buffalo Creek Reservoir using newly developed inflows specific for the reservoir. This study also assessed the impacts of the on-going drought on the available supply and reservoir content.

The supply analysis found that North Fork Buffalo Creek Reservoir is still in drought-of-record conditions. This means that the reliable yield of the reservoir cannot be determined accurately until the drought is over and the reservoir has refilled. The study did confirm that the reservoir cannot continue to be used at the same diversion amounts as in the past. Several predictive scenarios were evaluated to assess the potential impacts of a continuing drought. This included assessments of the reservoir response over a short-term two-year period and a longer five-year period. Assuming the drought extends through 2007 and the reservoir refills, the reliable firm supply from North Fork Buffalo Creek would be approximately 750 ac-ft per year. The safe supply is estimated at 340 ac-ft year. Given the reservoir's initial storage as of June 2005 (800 ac-ft), the reservoir will likely be able to supply 200 ac-ft per year without a shortage over the next five years. If the region receives average to above average rainfall, this amount will probably be greater. These estimates are considerably less than the historical diversions from the reservoir.

A brief description of the technical data developed for the supply analysis and the findings is presented below.

Runoff

The firm yield analysis used hydrology developed for the reservoir from January 1940 to June 2005. Estimates of historical runoff in the North Buffalo Creek Reservoir were derived from mass balance analyses and by using double mass correlation with inflows in Lake Kemp. The preferred method for estimating runoff is by mass balance because it is obtained from direct measurements at the reservoir. Mass balance computations estimate the runoff for each month based on change of the storage content, evaporation losses, diversions, and releases. Mass balance was used for years after 1986, when historical data from the reservoir are available.

For the years in which records of historical content are not available or the years before the construction of the reservoir, runoff was estimated through correlation with adjusted gaged flows in nearby gaging stations or known runoff in near reservoirs. A correlation was established by a comparison between the runoff in the North Fork Buffalo Creek watershed computed by mass balance at the reservoir and the flows estimated at another location during years when both series have available records. The alternative series of data analyzed for estimating runoff into North Buffalo Creek Reservoir include:

1. Inflows in Lake Kemp, either computed by mass balance or calculated by the Corps of Engineers, Tulsa District.
2. Incremental flow in the Wichita River basin between the gages of Wichita River near Mabelle, Beaver Creek near Electra, and Wichita River at Wichita Falls.
3. Gaged flow at the Beaver Creek near Electra.
4. Adjusted gaged flow in the Little Wichita at Archer City (below Lake Kickapoo).

Comparison between the known inflow by mass balance and these series included double mass curves, scatter plots, and correlation coefficients. The analysis determined that the inflow in Lake Kemp is the best source to estimate the runoff into North Buffalo Creek Reservoir. The following relationship was established:

$$\text{Runoff North Buffalo Creek Reservoir} = 0.0195 \times \text{Inflow Lake Kemp}$$

For the period from 1940 to 1959, inflows in Lake Kemp were obtained from a 1964 Hydrology Memorandum elaborated by the Corps of Engineers. For the period of 1960 to 1985, inflows into Lake Kemp were calculated with mass balance using known historical content, releases, diversions, and evaporation loss.

Evaporation

Monthly net evaporation rates were calculated with data obtained from the Texas Water Development Board, which contain gross evaporation and precipitation depths for one-degree quadrangles in the state. The evaporation in North Buffalo Creek Reservoir was calculated as a weighted average of net evaporation based on the distance to the center of the four nearest quadrangles. Data from the TWDB are available through 2002.

For the years 2003 through 2005, net evaporation was calculated from data provided by the Tulsa District of Corps of Engineers on Lake Kemp and Waurika Lake. Waurika Lake is located in Oklahoma, eight miles north of Clay County and 43 miles northeast of North Buffalo Creek Reservoir. The net evaporation rate in North Buffalo Creek Reservoir was calculated as the weighted average by distance of the net evaporation in Lake Kemp and Lake Waurika.

Area-Capacity

North Buffalo Creek Reservoir was completed in November 1964 with an initial conservation storage of 15,400 ac-ft. As part of the evaluation of surface water supplies for Region B, Freese and Nichols estimated that the conservation capacity in 2000 has been reduced to 14,380 ac-ft due to sedimentation. The capacity will be further reduced to 12,680 ac-ft by 2060. A discussion of the estimated sedimentation rates for reservoirs in Region B is included in Section 3.1.2 of the Regional Water Plan. The yield analysis presented here assumed a conservation storage of 14,380 ac-ft (2000 conditions).

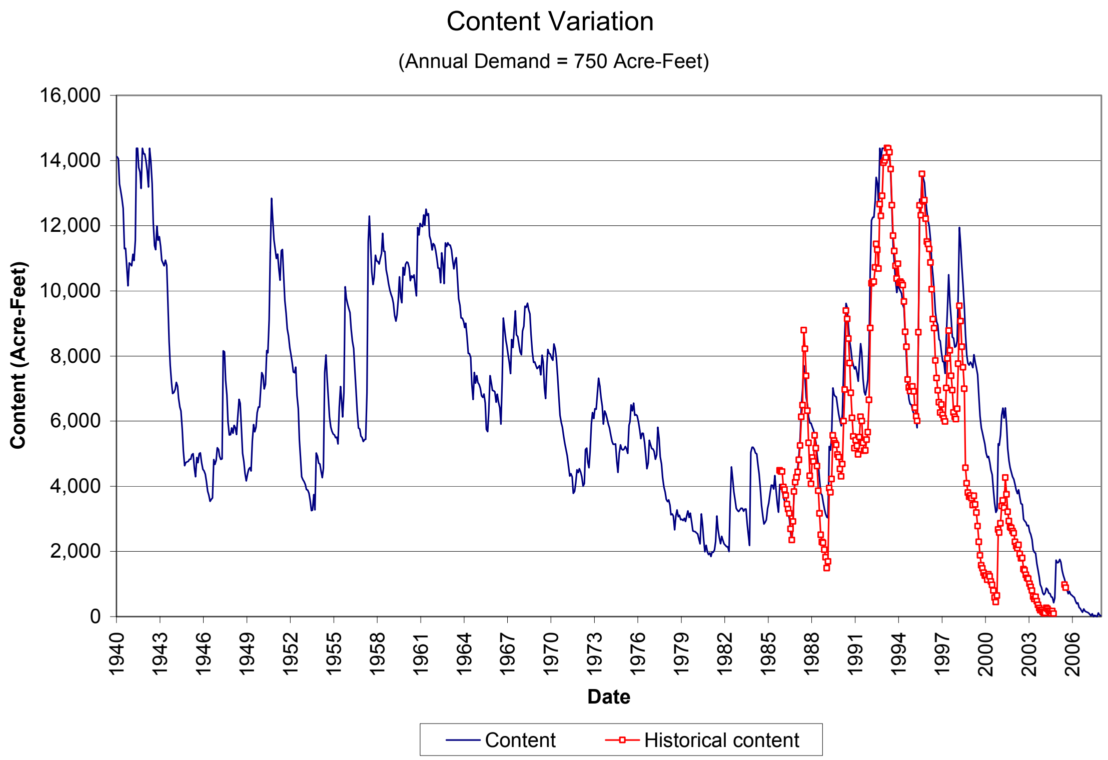
Firm and Safe Yields

Firm yield analysis were developed using the hydrologic period from January 1940 through June 2005. Firm yield is defined as the maximum water supply that can be withdrawn from a reservoir without causing the reservoir to be emptied, assuming a repetition of a hydrologic period. Safe yield is the maximum diversion that would leave at least one-year supply in storage.

The firm yield was estimated to be 1,100 ac-ft per year, and the safe yield was 630 ac-ft per year. However, the minimum storage content occurs in January 2004, shortly before the simulations ends. The firm and safe yields could be lower if the drought continues.

In order to estimate the yields assuming an extension of the current drought through 2007, the hydrology of 1956 was appended twice to the simulation record. Any other hydrologic year could be appended, but this year was chosen because it is a good indicator of low inflow conditions. 1956 was the final year of the drought of the 1950's and the annual runoff was slightly lower than during 2002 and 2003. The firm yield using this assumed extended drought is 750 ac-ft per year and the safe yield is 340 ac-ft per year. The reservoir content for the predictive firm yield analysis is shown on Figure 1. Historical content is also shown for comparison. As shown on Figure 1, the minimum content of the reservoir occurs at the end of the simulation period, which means that continued drought will impact the reliable supply from the reservoir. The firm yield of North Buffalo Creek Reservoir cannot be truly estimated using historical records until runoff is high enough to produce spills.

Figure 1
North Fork Buffalo Creek Reservoir – Predictive Content



Assessment of the On-Going Drought on Water Supply

With the current on-going drought and the low content of the North Fork Buffalo Creek Reservoir, the ability of the reservoir to meet future water supply demands is uncertain. To assess the probability of the reservoir response under different hydrologic conditions, a sequence of reservoir operation analyses were evaluated for a five-year period. Each scenario contains a 5-year hydrologic sequence obtained from historical records and starts with the storage recorded at the end of June 2005. The first scenario simulates the hydrologic period July 1940-June 1945, with a content of 800 ac-ft. The second simulation covers the period July 1941 to June 1946, and so on through June 2005. In total 61 scenarios are simulated. Statistical parameters are obtained from all scenarios to assess the reliability of water supply from the reservoir conditioned upon very low initial levels of storage.

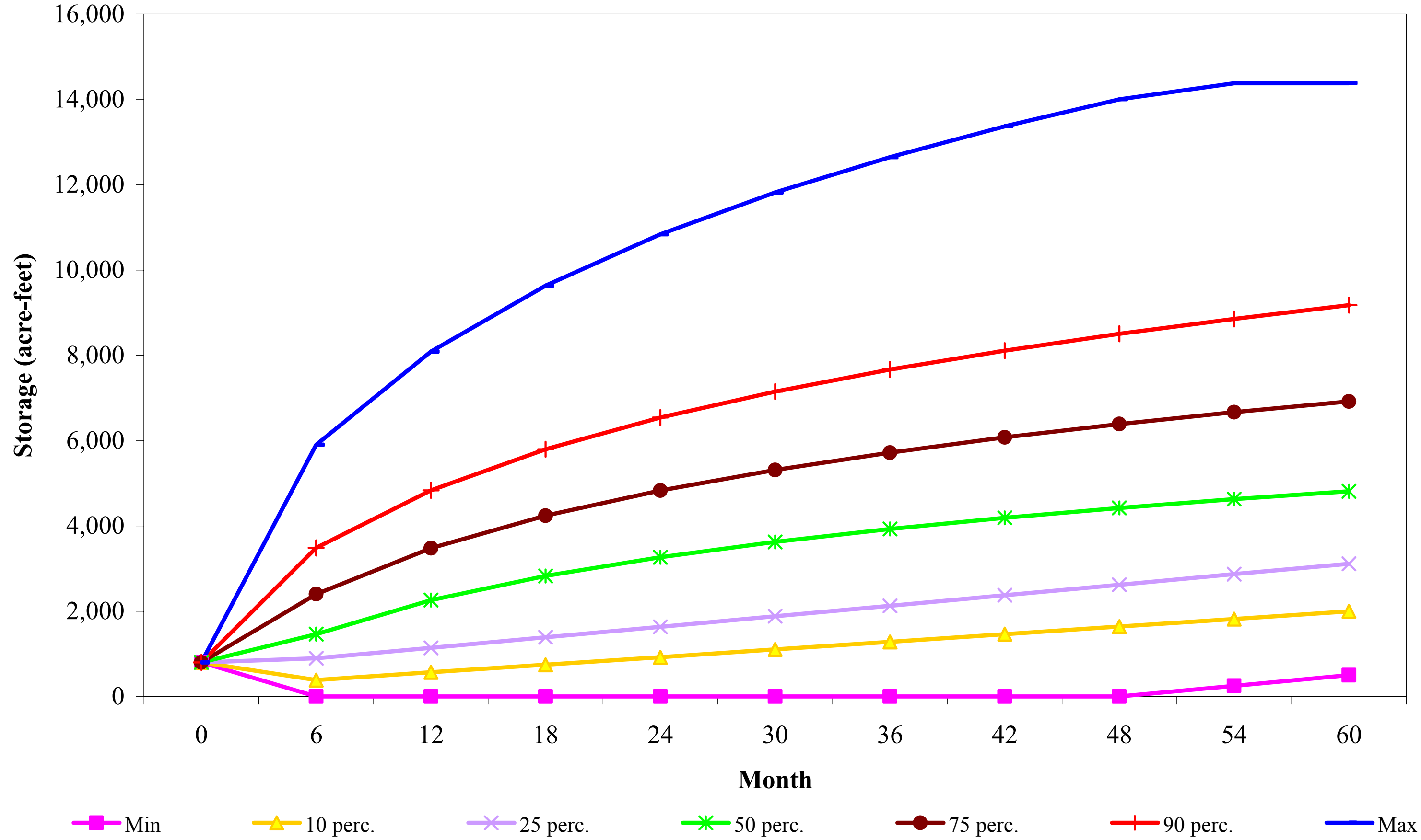
Results of the 61 scenarios show that given the storage of 800 ac-ft (recorded at the end of June 2005), an annual diversion of 200 ac-ft per year would likely be supplied without shortage for the next 5 years. If the diversion increases, the probability of having a shortage increases as shown in Table 1. Figure 2 shows the statistics for reservoir storage assuming the annual diversion of the permitted amount of 840 ac-ft.

Table 1
Percentage of Scenarios with at Least One Shortage for Different Levels of Diversion

Annual Diversion	Percentage of sequences with at least one month of shortage
1,000	23.0%
900	19.7%
800	13.1%
700	6.6%
600	6.6%
500	4.9%
400	4.9%
300	1.6%
<200	0.0%

Figure 2
North Fork Buffalo Creek Reservoir

Percentiles for Storage for the Next 5 year for a Diversion of 840 acre-feet per year
(Statistics from 61 possible scenarios)



CHAPTER 4

REGIONAL WATER PLANNING GROUP B

IDENTIFICATION, EVALUATION, AND SELECTION OF WATER MANAGEMENT STRATEGIES

IDENTIFICATION, EVALUATION, AND SELECTION OF WATER MANAGEMENT STRATEGIES
TEXAS STATE SENATE BILL 1
REGION B

4.1 Comparison of Supply and Demand

A comparison of current supply to demand was performed using the projected demands developed in Chapter 2 and the allocation of existing supplies developed in Chapter 3 as evaluated under drought of record conditions. As discussed in Chapter 3, allocations of existing supplies were based on the most restrictive of current water rights, contracts, and available yields for surface water and historical use and groundwater availability for groundwater. The allocation process did not directly address water quality issues such as nitrates. Salinity was addressed to some extent by not assigning supplies with known high salinity levels for municipal use. This included most of the Blaine Aquifer. Further discussion of water quality issues and the effect on supply is presented in Section 4.3.

As a region, there is adequate supply to meet the region's needs through 2040. A small shortage begins before 2050, and increases to over 11,000 ac-ft per year by 2060. A comparison of the total regional supply to demand is shown on Figure 4-1. Comparisons for the three largest water use types, irrigation, municipal, and steam electric power are shown on Figures 4-2 through 4-4.

A summary of the projected needs by county are presented in Table 4-1. The comparison of supply versus demands by user group for Region B is presented in the Water User Group Summary Tables in Appendix A. There are nine water user groups with identified shortages that cannot be met by existing infrastructure and supply. These shortages total 37,124 ac-ft per year by 2060. Of this amount, over 98 percent of the shortage is associated with reduced supplies in the Lakes Kemp and Diversion system. Table 4-2 lists the water user groups with projected water shortages.

Figure 4-1 Supply and Demand for Region B

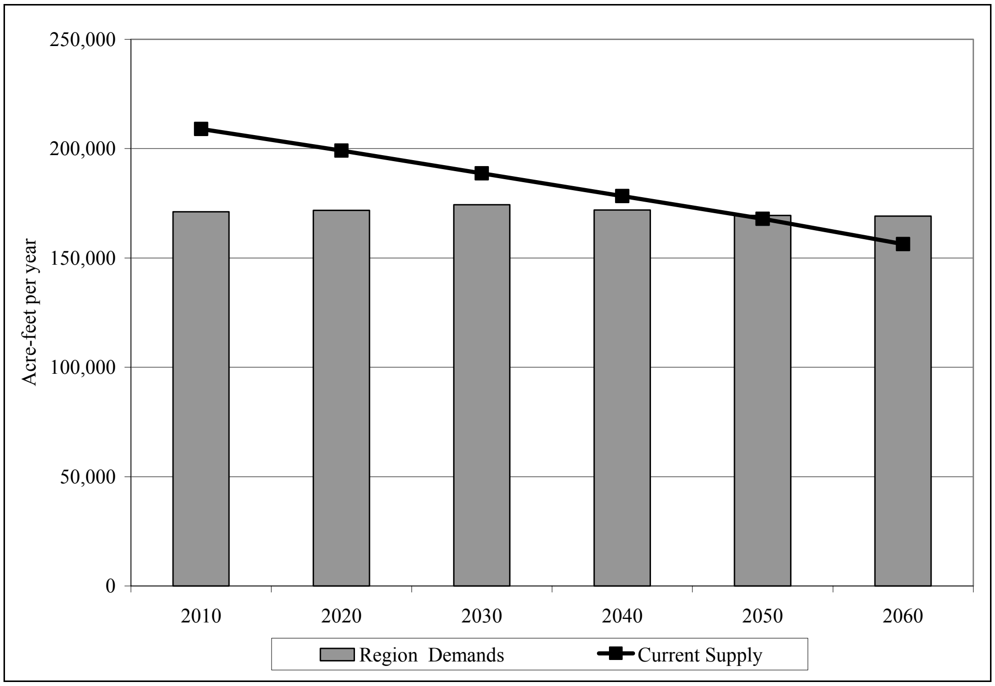


Figure 4-2 Irrigation Supply and Demand for Region B

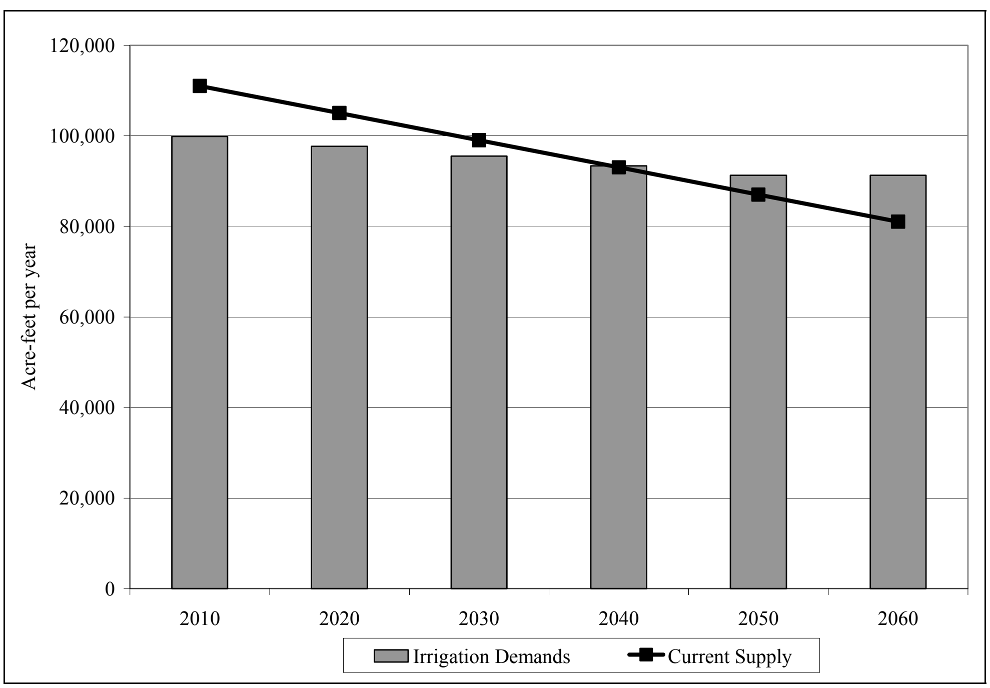


Figure 4-3 Municipal Supply and Demand for Region B

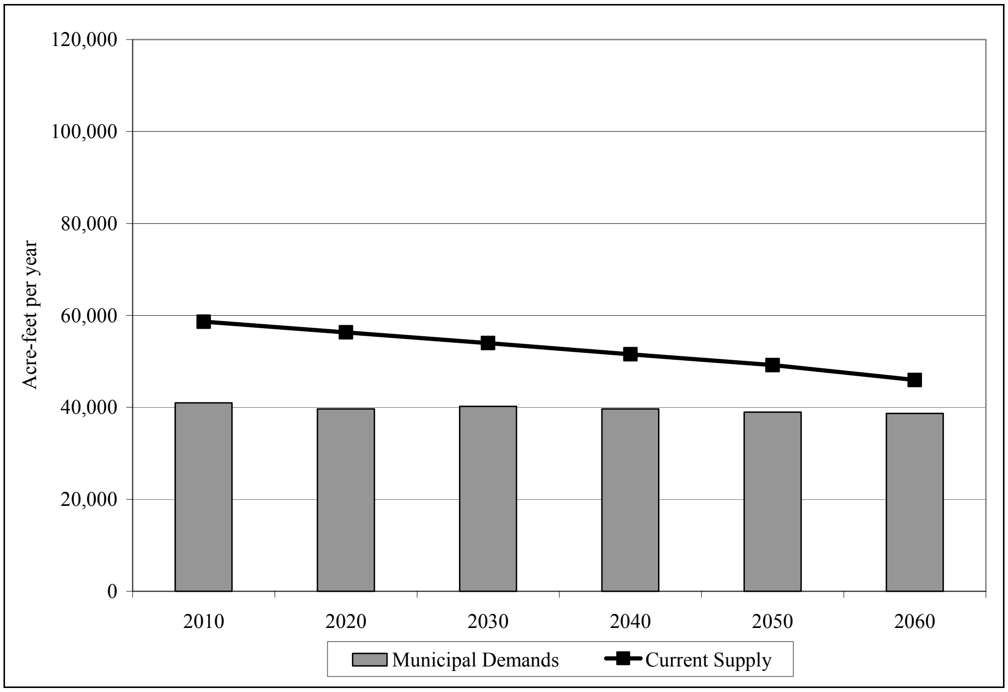


Figure 4-4 Steam Electric Power Supply and Demand for Region B

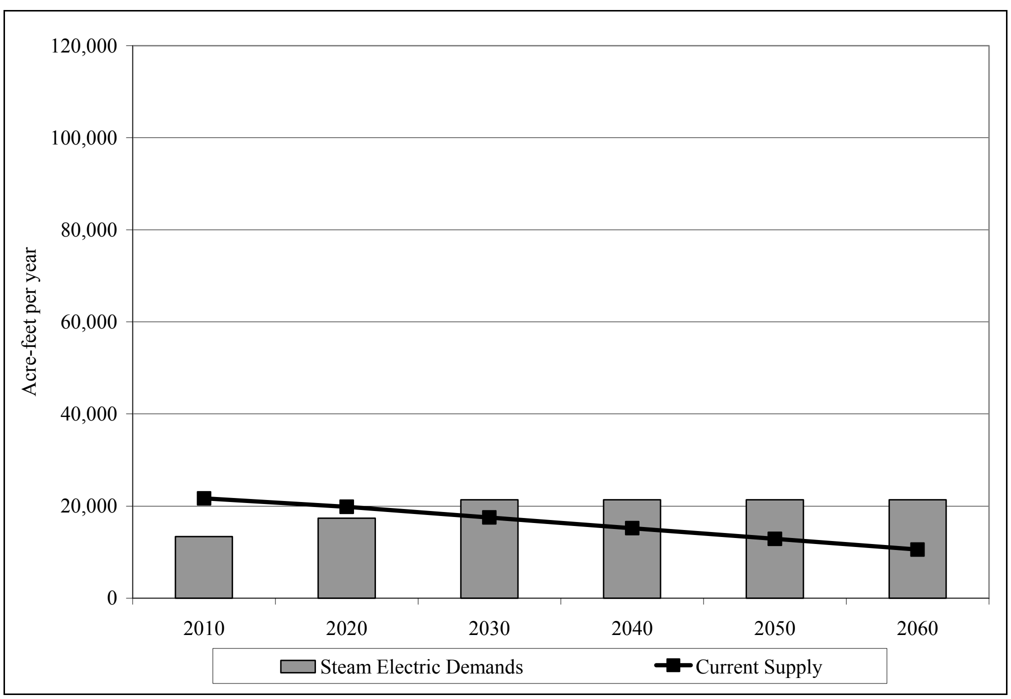


Table 4-1 Comparison of Supply and Demand by County

County	2010	2020	2030	2040	2050	2060
Archer	560	304	-3	-274	-457	-755
Baylor	1,905	2,011	2,115	2,187	2,238	2,284
Clay	639	590	546	595	744	734
Cottle	682	830	978	1,124	1,260	1,269
Foard	546	691	833	975	1,111	1,117
Hardeman	1,191	1,344	1,500	1,646	1,788	1,797
King	377	368	373	387	394	400
Montague	642	587	548	490	446	376
Wichita	14,964	9,437	2,052	-4,506	-11,073	-18,868
Wilbarger	16,759	11,452	5,639	3,847	2,076	-79
Young (P)	254	276	294	314	330	336
Region	**38,520**	**27,891**	**14,876**	**6,785**	**-1,144**	**-11,390**

Table 4-2 Projected Water Shortages for Water User Groups

Water User Group	2010	2020	2030	2040	2050	2060
County-Other - Archer	-162	-126	-161	-187	-142	-136
Irrigation - Archer	-9	-276	-539	-795	-1,046	-1,370
County-Other - Clay	-45	-25	-8	0	0	0
Irrigation - Clay	-7	-121	-224	-314	-392	-513
County-Other - Montague	-133	-184	-197	-206	-194	-197
Mining - Montague	-113	-92	-86	-93	-108	-111
Electra - Wichita	-146	-126	-120	-117	-117	-123
Irrigation - Wichita	-259	-4,674	-9,106	-13,556	-18,025	-23,577
Steam Electric Power - Wilbarger	0	0	-4,132	-6,453	-8,774	-11,097
TOTAL	**-874**	**-5,624**	**-14,574**	**-21,721**	**-28,799**	**-37,124**

4.1.1 Evaluation of Safe Supply

While many water user groups were not identified with a shortage, several were found to have little to no supplies above the projected demands. The Region B Regional Water Planning Group recognized that these entities were likely to need to develop new supplies to provide a safe level of supply. To determine which entities may be impacted, a safe supply was defined as being able to meet the projected demands plus 20 percent of the demand. This was applied only to municipal and manufacturing water user groups. Using these criteria, seven additional water users were identified with safe supply shortages.

Table 4-3 Water Users with Safe Supply Shortages

	2010	2020	2030	2040	2050	2060
County-Other - Archer	-269	-223	-265	-296	-242	-235
Lakeside City	-3	0	-12	-7	0	0
Byers - Clay	-11	-8	-5	0	0	0
County-Other - Clay	-223	-199	-179	-79	0	0
County-Other - Montague	-394	-458	-475	-486	-470	-475
Electra - Wichita	-261	-236	-228	-223	-222	-228
Iowa Park - Wichita	-110	-96	-103	-114	-124	-142
Wichita Falls - Wichita	0	0	0	0	0	-2,057
Manufacturing - Wilbarger	-170	-181	-194	-217	-241	-241
Vernon - Wilbarger	-354	-395	-423	-410	-366	-181
Bowie - Montague	0	0	0	-31	-73	-134

4.1.2 Comparison of Supply and Demand for Wholesale Water Providers

The City of Wichita Falls is the only wholesale water provider in Region B. It is a regional provider for much of the water in Wichita, Archer, and Clay Counties. Considering current customer contracts and city demands, Wichita Falls has sufficient supplies to meet the projected firm needs and existing contractual obligations. The city has a projected shortage of 2,057 ac-ft per year to meet safe supply needs. In addition, both current and future customers have requested a total of 1,267 ac-ft per year. A summary of the supply and demand comparison for Wichita Falls is shown in Table 4-4. A more detailed analysis is included in Appendix A.

Table 4-4 Projected Water Shortages for the City of Wichita Falls

	2010	2020	2030	2040	2050	2060
Total Demand	31,925	30,990	31,879	31,919	31,947	32,111
Total Supplies	45,415	43,364	41,313	39,261	37,210	35,158
Supplies Less Current Customer Demand	13,490	12,374	9,434	7,343	5,264	3,047
Required Safe Supply for Customers	36,962	35,847	36,920	36,977	37,017	37,214
Customer Safe Supply Surplus/ Shortage	8,453	7,517	4,393	2,284	193	-2,057

4.1.3 Effect of Water Quality on Supply

Water quality is a significant issue in Region B. Due to limited resources, some user groups are using water of impaired quality or having to install additional treatment systems to utilize existing sources. An implied assumption of the supply analysis is that the quality of existing water supplies is acceptable for the listed use. In other words, water supplies that are currently being used are assumed to continue to be available, regardless of the quality. Senate Bill 1 requires that water quality issues be considered when determining the availability of water during the planning period. For this report, evaluations of source water quality are generally confined to waters used for human consumption. The effect of water quality of Lake Kemp on agricultural use is also reviewed.

Municipal Water Systems with Existing or Potential Quality Concerns

To determine whether the quality of specific sources of supply imposes a potential limitation on their use, the quality of the major sources of supply was compared to current and proposed drinking water standards. Pursuant to the Federal Safe Drinking Water Act, the U.S. Environmental Protection Agency (EPA) has adopted maximum contaminant levels (MCLs) for a list of organic and inorganic contaminants of drinking water. This list constitutes the primary drinking water standards, and water used for human consumption is to comply with the MCLs established by this list. The list of primary drinking water standards has recently been revised by EPA to include the addition of MCLs for contaminants not previously listed and the lowering of MCLs for other regulated contaminants (e.g., arsenic).

The Texas Commission on Environmental Quality (TCEQ) identifies systems that are not compliant with current and proposed primary drinking water standards. This list was reviewed for water users in Region B. Compliance with secondary drinking water standards was not evaluated since the secondary standards do not have the same regulatory and public health implications. Also, compliance with the bacteriological standards (total coliform and fecal coliform) was not evaluated since violations of these standards, when they occur, are typically associated with operational techniques and not the quality of the raw water supply. The water systems in Region B that have existing or potential non-compliances are identified in Table 4-5, along with the parameter of concern.

Table 4-5
Water Systems Not Compliant with Primary Drinking Water Quality Standards

Water System	County	Water Source	CURRENT STANDARD NO_3 MCL = 10 mg/L
Byers	Clay	Seymour Aquifer	X
Charlie WSC	Clay	Seymour Aquifer	X
Lockett Water System	Wilbarger	Seymour Aquifer	X
Hinds-Wildcat Water System	Wilbarger	Seymour Aquifer	X

The TCEQ records indicate that the only primary drinking water standard (other than bacteriological) currently exceeded by water users in Region B is the nitrate criterion. Four water users have water supplies that exceed the MCL for nitrate. During the last planning cycle there were concerns that several systems that may not comply with EPA's revised drinking water standard for arsenic. This was in part due to the uncertainty of the recommended maximum concentration for the revised standard. Since then the EPA set the new arsenic standard at 0.010 mg/L. At this level, there are no known water quality concerns for arsenic for Region B water providers. The current arsenic standard of 0.05 mg/L is in effect through January 22, 2006. After that date, the revised standard for arsenic will be 0.010 mg/L. These standards were adopted by the TCEQ in December 2004.

Nitrate Concerns

The nitrate MCL is 10 mg/L. Consumption of water with nitrate levels in excess of 10 mg/L by infants can cause methemoglobinemia or "blue baby syndrome", a potentially fatal condition. Additionally, pregnant women are urged not to drink water with a high concentration of nitrates because of the potential health effects on the unborn fetus.

In Region B, moderate to high nitrate levels are found in water from the Seymour Aquifer. These concentrations are partly attributed to agricultural activities in the area. Long-standing practices associated with fertilizing crops are believed to have caused an increase in nitrates in the groundwater. Not all water produced from the Seymour Aquifer has excessive nitrates, but the water users shown in Table 4-5 have historically exhibited nitrate concentrations that range from slightly above the MCL of 10 mg/L to over 25 mg/L, in some cases.

Removal of nitrates from water can be expensive. Reverse osmosis or a comparable advanced membrane technique is required. Nitrates can also be reduced by blending the water with another water source with low nitrate levels, if such a source is available and otherwise of acceptable quality. The TCEQ currently is urging all water systems in the region using water with high nitrate levels to reduce the nitrate concentration by treatment, by blending, or by securing an alternate source of water. Deadlines for these water users to achieve the drinking water standard for nitrate have not been set. However, it can be expected that the TCEQ will continue to work toward achieving this goal and may eventually set deadlines for compliance.

According to the most recent water demand projections, the municipal water use for the water users in Table 4-5 is estimated to be approximately 215 ac-ft in the year 2010. This is a significant decrease from previous demand estimates for the municipal water use of source waters containing high concentrations of nitrates. In part, the decrease in projected demand is the result of cities such as Burkburnett, Electra, Seymour, and Vernon installing new water treatment technologies that are highly effective in the removal of nitrates and chlorides. Other potential alternatives include contracting to obtain water from other suppliers or a different raw water source.

Salinity Concerns for Lake Kemp and Diversion Lake

Waters in the Wichita River Basin have historically exhibited high dissolved solids and chloride concentrations. Previous studies, dating back to 1957, have documented that the salt concentrations in the area significantly limit the use of these waters for municipal, industrial, and irrigation purposes.

The U.S. Army Corps of Engineers (USACE) determined that an average of over 3,600 tons per day of chloride was being discharged to the Red River system from natural and man-made sources. A project, known as the Chloride Control Project, has been designed to reduce the amount of salt contamination from eight of the Red River Basin's natural salt sources; three of which lie within the Wichita River Basin. To date, only one of the proposed chloride control facilities has been constructed and is operational. This low-flow dam structure on the South Wichita River (within the Lake Kemp drainage basin) retains low flows that are high in salts, and diverts them via a pump station and pipeline to Truscott Brine Reservoir. Low-flow diversion dams are also planned for the Middle and North Wichita Rivers. When constructed, high chloride water that would normally flow to Lake Kemp and Lake Diversion would be diverted to Truscott Brine Reservoir.

Recent water quality data of the Lakes Kemp/Diversion system indicate that chloride levels have reduced since completion of the first chloride control project, but they still limit the water use. The primary uses impacted by the lakes' salt content are potable water supplies and irrigation. Water quality criteria established pursuant to the Safe Drinking Water Act considers high salt content aesthetically undesirable, and is regulated under the secondary drinking water standards. Chloride, sulfate, and total dissolved solids concentrations are subject to the secondary standards. The TCEQ established criteria for these parameters that are somewhat higher than EPA criteria, and water systems in Texas are subject to the state criteria. Both the TCEQ and EPA standards and typical Lake Kemp levels for these parameters are presented in Table 4-6.

Table 4-6
Secondary Drinking Water Standards and Salinity Levels for Lake Kemp

Parameter	TCEQ Criteria	EPA Criteria	Lake Kemp/Diversion Typical concentration
Chloride (mg/L)	300	250	800 – 1,200
Sulfate (mg/L)	300	250	550 - 800
Total Dissolved Solids (mg/L)	1,000	500	2,000 – 3,500

It is sometimes possible to use water with salt concentrations that exceed the drinking water criteria by blending it with waters with lower salt content. This practice has been used in the Wichita River Basin, but is often limited to emergency use only. At the present time, a blend containing less than 25 percent of the waters from Lake Kemp or Diversion Lake is typically necessary if TCEQ criteria are to be achieved. This obviously limits the extent to which waters from these reservoirs can be used for potable supply without advanced treatment.

The salinity of irrigation water from Lake Kemp can also limit the crops to which it can be applied. There are several systems for classifying the salinity of waters that characterize the suitability of the water for various types of crops. One classification system developed by the U.S. Department of Agriculture (USDA) in 1954 identifies four classes of water, based on the chloride concentration of the water, and describes the suitability of each class for irrigation. The classes and their corresponding description of suitability are as follows:

Class I – Low Salinity Water (Chloride < 250 mg/L)
Water is considered excellent to good and suitable for most plants growing on most soils with little likelihood that soil salinity will develop.

Class II – Medium Salinity Water (Chloride > 250 mg/L, but < 750 mg/L)
Water can be used if a moderate amount of leaching occurs. Plants with moderate salt tolerance can be grown in most cases without special practices for salinity control.

Class III – High Salinity Water (Chloride > 750 mg/L, but < 2,150 mg/L)
Water cannot be used on soils with restricted drainage. Even with adequate drainage, special management for salinity control may be required, and plants with good salt tolerance should be selected.

Class IV – Very High Salinity (Chloride > 2,150 mg/L)
Water is not suitable for irrigation under ordinary conditions, but may be used occasionally under very special circumstances. Only very salt tolerant crops should be selected.

The water in Lake Kemp and Diversion Lake is generally Class III. Therefore, its use for irrigation is limited to plants with high salt tolerance. The USDA Plant Sciences Group has performed research on the salt tolerance of various herbaceous crops, and examples of salt tolerant crops include cotton, barley, sugar beet, Bermuda grass, and asparagus.

4.1.4 System Limitations

In addition to water supply and water quality issues, system limitations were identified for the municipalities within the region. System limitations include water treatment plant design capacity, major water transmission pipelines, and associated pumping facilities. Distribution systems and storage facilities within a community were not addressed.

Municipal water systems are typically designed for peak flow conditions. The water supply analysis presented in Section 4.1 considered average day conditions and did not address limitations associated with peak demands. To assess limitations associated with treatment capacities for the municipalities in Region B, a peaking factor was applied to the average day demands developed in Chapter 2. Several of the larger municipalities provided this peaking factor based on historical use and these are shown on Table 4-7. For those users without a known peaking factor, a factor of 2 was assumed.

Water treatment plant capacities for surface water treatment were obtained from a TCEQ database. Transmission pipeline capacities were estimated from pipe diameters and average flow velocities. The water users provided the pumping capacities for the major transmission systems. Water treatment plant capacities were evaluated for all users who receive treated water from that system. For example, for the City of Wichita Falls, the sum of the peak demands for all treated water customers was compared to the city’s water treatment plant’s capacity. In addition to the physical system limitations, a comparison of available supply to peak demands was made for those entities with a contract that specified a peak demand limit (e.g., City of Wichita Falls customers).

Table 4-7 Peak Day Demands

Water User Group	Average Day Treated System Demands (MGD)	Peaking Factor[1]	Peak Day Demand (MGD)	Treatment Plant Capacity (MGD)
Archer City	0.32		0.64	1.08
Seymour	0.79		1.58	3
Byers	0.07		0.14	0.24
Henrietta	0.64	2	1.28	1.66
Petrolia	0.08		0.16	0.29
Paducah	0.28		0.56	1.91
Chillicothe	0.1		0.2	0.45
Bowie	1.13	2.25	2.54	4.60
Nocona	1	1.66	1.66	2.45
Saint Jo	0.09		0.18	0.39
Burkburnett	2.1	1.7	3.57	4.10
Electra	0.51		1.02	2.23
Iowa Park	0.75		1.5	1.66
Wichita Falls	25.26	2.25	56.84	57.57
Vernon	3.26		6.52	7.1
Olney	0.63	1.87	1.18	1.72

1. For those cities without a given peaking factor, a factor of 2 was assumed.

As shown on Table 4-7, the municipalities in Region B appear to have sufficient capacities to transport and treat peak demands. The City of Wichita Falls is currently expanding their treatment capacity by 20 mgd to serve additional customers that have requested treated water. Included in this 20 mgd expansion is the 10 mgd reverse osmosis facility that will be used to treat water from Lake Kemp. In addition, several municipal water user groups are evaluating alternative supplies to increase the reliability of their water sources. This includes the Cities of Iowa Park and Seymour and Baylor WSC.

Iowa Park is seeking to install an alternate transmission line and increase the water supply from Wichita Falls to provide the ability to use only treated water from Wichita Falls. The City of Seymour and Baylor WSC use groundwater from the Seymour Aquifer and share a water treatment plant. These entities are considering an emergency interconnection to Millers Creek Reservoir that would provide water on an emergency basis during drought or other catastrophic event.

4.1.5 Summary of Needs

In Region B, water supply needs were identified for three different categories: quantity, quality, and reliability. As shown on Table 4-8, a total of 19 water user groups were identified with one or more of these need categories. Nine water user groups were identified with firm quantity needs. An additional seven water user groups have projected safe supply shortages, and several municipal suppliers were found to have water quality and reliability issues.

Table 4-8

Water Users with Identified Needs

		Water Supply Needs		
User	**County**	**Quantity**	**Quality**	**Reliability**
County Other	Archer	X		
Lakeside City	Archer	X		
Irrigation	Archer	X	X	
County Other	Baylor			X
Seymour	Baylor			X
County Other	Clay	X	X	
Byers	Clay	X	X	
Irrigation	Clay	X	X	
County Other	Montague	X		
Bowie	Montague	X		
Mining	Montague	X		
Electra	Wichita	X		
Irrigation	Wichita	X	X	
Iowa Park	Wichita	X		X
Wichita Falls	Wichita	X		
County Other	Wilbarger		X	
Manufacturing	Wilbarger	X		
Steam Electric Power	Wilbarger	X		
Vernon	Wilbarger	X		

4.1.6 Economic Impacts of Not Meeting Needs

Section 357.7(4) of the rules for implementing Texas Senate Bill 1 requires regional water planning groups to evaluate the social and economic impacts of projected water shortages (i.e., "unmet water needs") as part of the planning process. The rules contain provisions that direct the Texas Water Development Board (TWDB) to provide technical assistance to complete socioeconomic impact assessments. In response to requests from regional planning groups, staff of the TWDB's Office of Water Resources Planning designed and conducted analyses to evaluate socioeconomic impacts of unmet water needs. This evaluation report is included in Attachment 4-3. The results of the study indicated that Region B would suffer significant losses if drought of records conditions return and water supplies are not developed. If such conditions occurred, 2010 lost income to residents could total $4.18 million and 52 jobs would be lost.

In addition, state and local governments could lose roughly $240,000 in tax receipts. If conditions occurred in 2060, models showed income losses of $4.35 million, job losses of 64 and nearly $250,000 worth of state and local taxes lost.

Thus, if water shortages lasted for three years in Region B, total losses could easily exceed $12 million.

4.2 Identification and Evaluation of Water Management Strategies to Meet Needs

4.2.1 Evaluation Procedures

Each water user group with a need analyzed how they might best meet their needs and various potentially feasible water management strategies were developed by the consultants for consideration and priority ranking by the water user groups and the Regional Water Planning Group (RWPG) Technical Advisory Committee. Following approval by the Technical Advisory Committee, all potentially feasible strategies were presented to and approved by the entire RWPG. In accordance with Senate Bill 1 guidance, each of the potentially feasible strategies were then evaluated with respect to:

- Quantity, reliability and cost
- Environmental factors
- Impacts on water resources and other water management strategies
- Impacts on agriculture and natural resources
- Other relevant factors.

The other considerations listed in TAC 357.7(a), such as inter-basin transfers and third party impacts due to voluntary redistribution of water, were not specifically reviewed because they were not applicable to strategies identified for Region B needs.

The definition of quantity is the amount of water the strategy would provide to the respective user group in ac-ft per year. This amount is considered with respect to the user's projected safe supply needs. Reliability is an assessment of the availability of the specified water quantity to the user over time. If the quantity of water is available to the user all the time, then the strategy has a high reliability. If the quantity of water is contingent on other factors, then reliability will be lower. The assessment of cost for each strategy is expressed in dollars for water delivered and treated for the end user requirements in ac-ft per year. Calculations of these costs follow Senate Bill 1 guidelines for cost considerations, and identify capital and annual costs by decade. Project capital costs are based on second quarter 2002 price levels, and include construction costs, engineering, land acquisition, mitigation, right-of-way, contingencies, and other project costs. Annual costs include power costs associated with transmission, water treatment costs, water purchase (if applicable), operation and maintenance, and other project-specific costs. For Region B projects, all debt service was calculated over 20 years at a six percent interest rate, except for Lake Ringgold and the Chloride Control projects, which were calculated over 40 years.

Potential impacts to sensitive environmental factors were considered for each strategy. Such sensitive environmental factors included wetlands, threatened, and endangered species, unique wildlife habitats, effects on environmental water needs, and cultural resources. In an attempt to quantify the impact of each strategy, existing environmental reports were reviewed in addition to cursory environmental surveys in the area of the proposed project. Based on the above stated environmental factors, each strategy was evaluated as to whether the strategy would create a low impact, moderate impact, or high impact. If a strategy is selected, a more detailed environmental evaluation may be required.

The impact on water resources considers the effects of the strategy on water quantity, quality, and use of the water resource. A water management strategy may have a positive or negative effect on a water resource. This review also evaluated whether the strategy would impact the water quantity and quality of other water management strategies identified.

A water management strategy could potentially impact agricultural production or local natural resources. Impacts to agriculture may include reduction in agricultural acreage, reduced water supply for irrigation, or impact to water quality as it affects crop production. Some strategies may actually improve agricultural production. The impacts to natural resources may consider inundation of parklands, impacts to exploitable natural resources (such as mining), recreational use of a natural resource, and other strategy-specific factors.

Other relevant factors include regulatory requirements, political and local issues, public support, time requirements to implement the strategy, recreational impacts of the strategy, and other socio-economic benefits or impacts.

Strategies for Region B were developed to provide water of sufficient quantity and quality that is acceptable for its end use. As shown on Tables 4-5 and 4-6, water quality is a concern for several water sources in Region B. Water quality issues affect water use options and treatment requirements. For the evaluations of the strategies, it was assumed that the final water product would meet existing state water quality requirements for the specified use. For example, a strategy that provides water for municipal supply would meet existing drinking water standards, while water used for mining may have a lower quality. Strategies that improve water quality of other existing supplies, such as chloride control projects, were also considered.

A summary of the evaluation of the potentially feasible strategies in Region B is presented in Attachment 4-1 at the end of this chapter. The associated costs for each strategy are presented in Attachment 4-2.

4.2.2 Conservation

As required by Senate Bill 2, water conservation must be considered when developing water management strategies for water user groups with needs. Generally water conservation was not included in the projected demands for non-municipal water uses in Region B. An expected level of conservation is included in the municipal demand projections due to the natural replacement of inefficient plumbing fixtures with low flow fixtures, as mandated under the State Plumbing Code. For Region B, the total municipal water savings associated with plumbing fixtures is approximately 14.3 percent of the projected demand if no conservation occurred.

Additional conservation savings can potentially be achieved in the region through the implementation of conservation best management practices. It is assumed that entities with low per capita water use will have minimal reductions in water use through conservation. In Region B there are ten municipal water user groups with identified safe supply shortages. Of these entities, Byers, Lakeside City, and Montague County-Other have per capita water use below the screening criteria of 140 gallons per person per day. Municipal conservation strategies, with the exception of passive strategies, will not be evaluated for these user groups. Water savings from passive management strategies should occur without additional cost or effort from the water user.

Conservation strategies appropriate for Region B were evaluated based on the best management practices identified through the State Water Conservation Implementation Task Force. The Task Force identified 21 municipal conservation strategies and 15 strategies for industrial water users. In addition there are new federal regulations that require new clothes washers to be energy efficient by 2007, which may reduce water use. After review and consideration of these strategies, the recommended municipal conservation package consists of four management practices:

- Public and School Education
- Reduction of Unaccounted for Water through Water Audits
- Water Conservation Pricing
- Federal Clothes Washer Rules

Best management practices not selected include rebate programs, accelerated plumbing fixtures replacements, and specific outdoor watering measures. The benefits of outdoor watering strategies were assumed to be accounted under the public and school education practice. Also, many of the entities in Region B already use restrictions on outdoor watering as a drought management measure. Accelerated fixture replacements do not reduce the ultimate water need, but could delay when the need begins. In Region B, the largest municipal water user, Wichita Falls, has water needs beginning in 2060. No additional savings can be achieved through accelerated implementation of plumbing fixtures. This is also true for rebate programs that simply accelerate the already assumed conservation savings. The likelihood of implementing rebate programs in rural communities is low and previous studies have shown these programs to be relatively costly per ac-ft of water saved.

No industrial conservation strategies were evaluated because there is insufficient data to evaluate these strategies for the manufacturing safe needs in Wilbarger County. Where possible, reuse will be considered as a strategy for this need. For the irrigation and steam electric power needs associated with shortages in Lake Kemp, conservation through reductions in transmission losses in the irrigation canal system will be considered. This strategy is discussed in Section 4.2.5.

A summary of the water savings projected from conservation measures is shown in Table 4-9. The savings expressed as a percentage of the projected water demands are shown in Table 4-10. Strategies that are required by federal (clothes washer rules) or state (water audits) regulations were assumed to be implemented in accordance with these regulations. Other conservation practices were assumed to be implemented in the decade the entity was found to have a water shortage. A more detailed discussion of the conservation savings and costs is included in Attachment 4-5.

Most of the savings shown in Table 4-9 are associated with the federal clothes washer rules that will require all new clothes washers to be energy efficient by 2007. This strategy assumes that every household that purchases a new clothes washer will reduce its water use by 5.6 gallon per person per day at no additional cost to the water provider; however, it is uncertain as to whether this amount of savings will be realized by the respective entity. This strategy was evaluated for all user groups with an identified firm or safe need.

Table 4-9 Total Water Savings Associated with Conservation Strategies[1] (ac-ft per year)

Water User Group	2010	2020	2030	2040	2050	2060
Iowa Park	21	57	68	72	76	80
Electra	10	28	33	34	36	38
Vernon	45	122	144	148	148	146
Wichita Falls	124	533	548	556	562	1,367
Bowie	8	34	34	61	69	72
Byers[2]	1	3	3	3	3	3
Lakeside City[2]	3	9	10	11	11	11
Archer County-Other	7	11	14	16	17	18
Clay County-Other	16	42	45	45	41	39
Montague County-Other[2]	18	78	80	80	81	81

1. It is assumed that there are no savings directly from water audits. Savings are associated with system improvements as the result of water audits.

2. Only conservation savings associated with federal clothes washer rules are estimated for Byers and Montague County-Other because the per capita water use for these entities is less than 140. For Lakeside City, which also has per capita water use less than 140 gpcd, the values shown include savings from federal clothes washer rules and education programs. This is because the Lakeside City school system is shared with Archer County-Other. Benefits from a school education program that is implemented by Archer County-Other may also be realized by Lakeside City.

Table 4-10 Projected Water Savings as Percent of Municipal Demand

Water User Group	2010	2020	2030	2040	2050	2060
Iowa Park	1.72%	4.85%	5.76%	6.14%	6.51%	6.84%
Electra	1.78%	5.17%	6.09%	6.48%	6.85%	7.19%
Vernon	1.67%	4.60%	5.48%	5.86%	6.21%	6.56%
Wichita Falls	0.54%	2.42%	2.40%	2.45%	2.48%	5.98%
Bowie	0.76%	3.43%	3.53%	6.43%	7.30%	7.64%
Byers	0.05%	0.22%	0.22%	0.21%	0.20%	0.18%
Lakeside City	0.58%	1.68%	1.93%	2.07%	2.11%	2.13%
Archer County-Other	1.27%	2.45%	2.78%	3.08%	3.46%	3.77%
Clay County-Other	1.84%	4.87%	5.25%	5.78%	6.77%	7.37%
Montague County-Other	1.76%	7.93%	8.26%	8.45%	8.56%	8.59%

The projected annual costs and cost per 1,000 gallons of water saved are shown in Table 4-11.

Table 4-11
Projected Costs for Municipal Water Conservation Strategies

Water User Group	Total Annual Costs					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Iowa Park	$15,436	$21,550	$21,550	$21,550	$21,550	$21,550
Electra	$10,712	$15,263	$15,263	$15,263	$15,263	$15,263
Vernon	$15,436	$21,550	$21,550	$21,550	$21,550	$21,550
Wichita Falls	$1,187	$1,187	$1,187	$1,187	$1,187	$108,711
Bowie	$436	$436	$436	$16,550	$16,550	$16,550
Byers	$0	$0	$0	$0	$0	$0
Lakeside City	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
Archer County-Other	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Clay County-Other	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Montague County-Other	$0	$0	$0	$0	$0	$0
	Cost per 1,000 Gallons of Water Conserved					
Iowa Park	$2.28	$1.15	$0.98	$0.92	$0.87	$0.83
Electra	$3.22	$1.65	$1.43	$1.36	$1.30	$1.24
Vernon	$1.06	$0.54	$0.46	$0.45	$0.45	$0.45
Wichita Falls	$0.03	$0.01	$0.01	$0.01	$0.01	$0.24
Bowie	$0.17	$0.04	$0.04	$0.83	$0.74	$0.71
Byers	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Lakeside City	$4.59	$1.66	$1.48	$1.39	$1.38	$1.37
Archer County-Other	$4.70	$2.70	$2.22	$1.90	$1.85	$1.72
Clay County-Other	$1.87	$0.72	$0.68	$0.69	$0.74	$0.78
Montague County-Other	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

4.2.3 Municipal Water Strategies

There are 14 municipal users in Region B that have been identified with water needs relating to quantity, quality, or reliability. These users include Archer County (Other), Baylor WSC, Clay County (Other), Montague County (Other), City of Bowie, City of Byers, City of Electra, City of Iowa Park, City of Lakeside City, City of Vernon, City of Wichita Falls, Charlie WSC, Hinds-Wildcat System, and Lockett Water System.

Potentially feasible water strategies were identified for each water user with needs along with their associated costs. Detailed cost estimates for each strategy are shown in Attachment 4-2.

Archer County (Other)

Archer County (Other) includes all areas within the county that are outside the service area of incorporated cities with population greater than 500 people or any other local water service provider.

Based on Tables 4-2 and 4-3, a water supply shortage is projected for Archer County (Other). Therefore, potentially feasible strategies were evaluated to meet a maximum firm supply of 187 ac-ft per year and a maximum safe supply of 296 ac-ft per year. These maximum shortages are projected by the year 2040.

With no known dependable groundwater supply in Archer County, the only potentially feasible strategy considered, in addition to conservation, was additional supply from an existing local provider. Depending on the demand location, the local provider would be one of the five current water user groups within Archer County or a smaller water provider that is included in the County-Other category.

For planning purposes it was assumed that as a minimum the local providers system would require an upgrade of approximately 10,000 LF of 6" line in addition to the costs of purchasing the additional required volume of treated water.

Quantity, Reliability, and Cost

A safe supply of 296 ac-ft per year can be made available from several of the current local providers within Archer County which have an excess supply of treated water throughout the planning period. The reliability of this source would be good in that the water purchased would be through a contractual obligation from a dependable local provider. For planning purposes, it is assumed that 30 percent of the needed supply would be obtained from Archer City Lake and the remainder would come from Wichita Falls sources.

As shown in the detailed cost estimates provided in Attachment 4-2, the capital costs for this strategy is $342,500 with an annual cost of $507,500 and an annual cost of water delivered per ac-ft of $1,715.

Environmental Impacts

Environmental impacts would be minimal assuming that the pipeline could be installed generally along public roads. There could likely be some creek crossings along the pipeline route; however, there are no major issues that are readily apparent at this level of study. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

The impacts to other resources and strategies with this project would be indirect. In order for the local providers to provide the required water to other portions of the county, the local provider would first have the water to sell. That may require the local provider to purchase additional water from an entity like the City of Wichita Falls or Archer City prior to entering into a contract to meet the additional water demand.

Impacts on Agricultural and Natural Resources

With the only anticipated construction being water line improvements along public roads, only minimal agricultural and natural resources impacts are anticipated.

Other Relevant Factors

No other relevant factors regarding this strategy have been identified at this time.

Clay County (Other)

Clay County (Other) includes all areas within the county that are outside the service area of incorporated cities or any other local water service provider.

Based on Tables 4-2 and 4-3, a water supply shortage is projected for Clay County (Other). Therefore, potentially feasible strategies were evaluated to meet a maximum firm supply of 45 ac-ft per year and a maximum safe supply of 223 ac-ft per year. These maximum shortages are projected by the year 2010.

With a very limited groundwater supply in Clay County, the only potentially feasible strategy considered, in addition to conservation, was additional supply from an existing local provider.

Depending on the demand location, the local provider would be one of the five current water user groups within Clay County or one of the five smaller water providers that are included in the County-Other category.

For planning purposes it was assumed that as a minimum the local providers system would require an upgrade of approximately 10,000 LF of 6" line in addition to the costs of purchasing the additional required volume of treated water.

Quantity, Reliability, and Cost

A safe supply of 223 ac-ft per year can be made available from several of the current local providers within Clay County, which have an excess supply of treated water throughout the planning period. The reliability of this source would be good in that the water purchased would be through a contractual obligation from a dependable local provider. For planning purposes, it is assumed that all of this supply would be obtained from Wichita Falls sources.

As shown in the detailed cost estimates provided in Attachment 4-2, the capital costs for this strategy are $342,500 with an annual cost of $322,500 and an annual cost of water delivered per ac-ft of $1,446.

Environmental Impacts

Environmental impacts would be minimal assuming that the pipeline could be installed generally along public roads. There could likely be some creek crossings along the pipeline route, however there are no major issues that are readily apparent at this level of study. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

The impacts to other resources and strategies with this project would be indirect. In order for the local providers to provide the required water to other portions of the county, the local provider would first have the water to sell. That may require the local provider to purchase additional water from an entity like the City of Wichita Falls prior to entering into a contract to meet the additional water demand.

Impacts on Agricultural and Natural Resources

With the only anticipated construction being water line improvements along public roads only minimal agricultural and natural resources impacts are anticipated.

Other Relevant Factors

No other relevant factors regarding this strategy have been identified at this time.

Montague County (Other)

Montague County (Other) includes all areas within the county that are outside the service area of incorporated cities or any other local water service provider.

Based on Tables 4-2 and 4-3, a water supply shortage is projected for Montague County (Other). Therefore, potentially feasible strategies were evaluated to meet a maximum firm supply of 206 ac-ft per year and a maximum safe supply of 486 ac-ft per year. These maximum shortages are projected by the year 2040. Therefore, two potentially feasible strategies were considered for Montague County (Other).

One option would be to develop additional groundwater supplies in the county. To meet the required demand utilizing groundwater, it is anticipated that approximately six wells would need to be drilled in addition to ground storage, pumping facilities, and 10,000 LF of 6" transmission line.

A second option would be to provide additional supply from an existing local provider. Depending on the demand location, the local provider would be one of the three current water user groups within Montague County or smaller water suppliers that are included in the County-Other category. For planning purposes it was assumed that as a minimum the local providers systems would require an upgrade of approximately 10,000 LF of 6" line in addition to the costs of purchasing the additional required volume of treated water.

Quantity, Reliability, and Cost

A safe supply of 486 ac-ft per year can be provided by developing additional groundwater supply wells or by purchasing additional water from an existing local provider.

It is anticipated that the supply reliability from the local provider might be better than the groundwater supply since water levels tend to decline over time. For planning purposes, it is assumed that approximately 20 percent of new supply would come from the Trinity Aquifer, 40 percent from Lake Nocona and 40 percent from the City of Bowie.

As shown in the detailed cost estimate provided in Attachment 4-2, the capital costs for the additional groundwater supply is $1,710,000 with an annual cost of $244,000 and an annual cost of water delivered per ac-ft of $502.

In comparison, the capital cost for additional water from a local provider is $409,000 with an annual cost of $591,500 and an annual cost of water delivered per ac-ft of $1,217.

Environmental Impacts

Environmental impacts would be minimal for both strategies, assuming that the pipeline could be installed generally along public roads. There could likely be some creek crossings along the route, however, there are no major issues with either strategy that are readily apparent. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

With regards to developing an additional groundwater supply there would be a low impact on the existing water resources and no impact on other water management strategies.

The impacts to other resources and strategies with regards to additional water from a local provider would be indirect. In order for the local providers to provide the required water to other portions of the county the local provider must first have the water to sell. That may require the local provider to purchase additional water from an entity like the City of Bowie, City of Nocona or the City of Saint Jo prior to entering into a contract to meet the additional water demand.

Impacts on Agricultural and Natural Resources

In developing a groundwater supply well field, there is a potential that a small portion of agricultural land could be impacted. However, we believe the impact would be minimal.

With the local provider strategy and the only anticipated construction being the water line improvements along public roads, only minimal agricultural and natural resource impacts are anticipated.

Other Relevant Factors

No other relevant factors regarding either strategy have been identified at this time.

City of Bowie

The City of Bowie has a population of 5,219 and is located in the southwest portion of Montague County. The city currently utilizes Lake Amon Carter for its water supply and it is anticipated that this source will provide for an adequate firm supply through the year 2060.

However, based on Table 4-3, a safe water shortage is projected for the City of Bowie beginning in the year 2040. Therefore, potentially feasible strategies were evaluated to meet a maximum safe supply of 134 ac-ft per year projected for the year 2060.

In addition to conservation, two potentially feasible strategies were considered for the City of Bowie.

One option would be to develop groundwater supplies in the county. To meet the required demand utilizing groundwater it is anticipated that two wells would need to be drilled in addition to ground storage, pumping facilities and 10,000 LF of six inch transmission line.

A second option would be the reuse of treated wastewater. Currently the city discharges approximately 672 ac-ft per year of treated wastewater from their existing plant. With enhanced treatment and approximately 5,280 feet of conveyance pipe, this water could be reused by the city to meet current and future water demands.

Quantity, Reliability, and Cost

A safe supply of 134 ac-ft per year can be provided by developing groundwater supply wells or by constructing the appropriate treatment and conveyance facilities for wastewater reuse.

It is anticipated that the supply reliability from the wastewater reuse would be better than the groundwater supply since water levels tend to decline over time. In addition, there is some concern by the city with mixing groundwater and surface water.

As shown in the detailed cost estimate provided in Attachment 4-2, the capital costs for the additional groundwater supply is $1,367,000 with an annual cost of $163,200 and an annual cost of water delivered per ac-ft of $1,218.

In comparison, the capital cost for additional water from wastewater reuse is $895,000 with an annual cost of $122,000 and an annual cost of water delivered per ac-ft of $911.

Environmental Impacts

Environmental impacts would be minimal for both strategies, assuming that the pipeline could be installed generally along public roads. There could likely be some creek crossings along the route, however, there are no major issues with either strategy that are readily apparent. With regards to the wastewater reuse system, the treatment facility and pump station would both be located at the existing wastewater treatment plant. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

Development of an additional groundwater supply would be a low impact on the existing water resources and no impact on other water management strategies.

The wastewater reuse option would have a low to moderate impact on the receiving stream of the plant in that a portion of the effluent would be diverted.

Impact on Agriculture and Natural Resources

In developing a ground water supply there is a potential that a small portion of agricultural land could be impacted. However, it is anticipated that it would be minimal.

With the wastewater reuse option the impact would be minimal in that the pipeline would be installed along public roads and the treatment facilities would be located at the existing plant. Also, though some of the wastewater flow would be diverted, the impact would be minimal.

Other Relevant Factors

There are no other known relevant factors relating to the groundwater option, however, there could be an issue with public acceptance of a wastewater reuse system if perception prevails regarding health and safety concerns of utilizing wastewater.

City of Byers

The City of Byers has a population of 517 and is located in the far northern portion of Clay County. The city currently purchases treated surface water from Dean Dale WSC to supplement their groundwater supply. The treated water supply is also used to blend with groundwater to meet nitrate standards. It is anticipated that their current supply well provides for an adequate firm supply through the year 2060.

However, based on Table 4-3, a safe water supply shortage is projected for Byers by the year 2010. Therefore, potentially feasible strategies were evaluated to meet a maximum safe supply shortage of 11 ac-ft per year.

Since Byers has a water usage below 140 gpcd, only conservation associated with the Federal Clothes Washer Standards was considered as a strategy. With the relatively small amount of water needed the only strategy evaluated for Byers was to purchase additional treated water from Dean Dale WSC. Dean Dale has adequate line and pumping facilities and is capable of meeting the necessary safe supply requirement.

Quantity, Reliability, and Cost

A safe supply of 11 ac-ft per year can be provided by purchasing the additional water from Dean Dale WSC. If necessary, Dean Dale has sufficient supply from the City of Wichita Falls to meet this additional demand. The additional treated water would also be used to blend with groundwater to meet water quality needs.

As shown in the detailed cost estimate provided in Attachment 4-2, there are no required capital expenditures for this strategy. However, with the purchase of water, the annual cost is estimated at $8,200 and the cost of water delivered per ac-ft is $746.

Impacts on Agricultural and Natural Resource

With there being no construction required and utilizing existing water conveyance facilities, only minimal agricultural and natural resources impacts are anticipated.

Environmental Impacts

With no construction required for this strategy there are no environmental impacts. (See Attachment 4-1).

City of Electra

The City of Electra has a population of 3,168 and is located in the western portion of Wichita County. The city currently utilizes both surface water from Lake Electra and also groundwater from the Seymour Aquifer. Approximately 60 percent of the water supply is derived from the lake and the remaining 40 percent is supplied from groundwater. Due to high nitrate levels in the groundwater, the city maintains and operates its own Reverse Osmosis treatment plant. However, with the recent drought, the City of Electra has frequently experienced a serious shortage of water.

Based on Tables 4-2 and 4-3 a maximum firm supply shortage of 146 ac-ft per year and a maximum safe supply shortage of 261 ac-ft per year is projected for Electra in the year 2010.

Therefore in addition to conservation, the only potentially feasible strategy evaluated for the City of Electra was to purchase treated water from the City of Wichita Falls. After a thorough investigation of their limited options, the city officials have determined that purchasing water from the City of Wichita Falls is their only viable option for a long term reliable source of water supply. The city has requested 840 ac-ft per year from the City of Wichita Falls (1.5 mgd). It is likely that this supply would be delivered part way through a new treated water pipeline that the City of Iowa Park is planning to construct from Wichita Falls. In the short-term, however, the city will continue to develop their groundwater supply as required.

Approximately 115,000 LF of 16" water transmission line and two pump stations will be required to convey the necessary water from Wichita Falls to the City of Electra.

Quantity, Reliability, and Cost

A safe supply of 261 ac-ft per year can be made available from the City of Wichita Falls which has an excess supply of treated water. The reliability of this source would be good in that the water purchased would be through a contractual obligation from Wichita Falls. As shown in the detailed cost estimates provided in Attachment 4-2, the capital costs for this strategy is $7,500,000 with an annual cost of $1,358,000 and an annual cost of water delivered per ac-ft of $808.

Environmental Impacts

Environmental impacts would be minimal assuming that the pipeline could be installed generally along public roads. There could likely be some creek crossings along the pipeline route, however, there are no major issues that are readily apparent at this level of study. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

The impacts to other resources and strategies with this project would be indirect in that the City of Wichita Falls would be utilizing their existing supply to provide for the City of Electra.

Impacts on Agricultural and Natural Resources

With the only anticipated construction being water line improvements along public roads, only minimal agricultural and natural resources impacts are anticipated.

Other Relevant Factors

No other relevant factors regarding this strategy have been identified at this time.

City of Iowa Park

The City of Iowa Park has a population of 6,431 and is located in the central portion of Wichita County. The city currently utilizes surface water from North Fork Buffalo Creek Lake and Lake Iowa Park, in addition to purchasing treated water from the City of Wichita Falls. With the recent drought, the City of Iowa Park lakes went dry and the city was totally dependant on Wichita Falls for water. The city intends to discontinue using water from Lake Iowa Park in the future.

Based on Table 4-3 a maximum safe supply shortage of 142 ac-ft per year is projected for Iowa Park in the year 2060.

Therefore in addition to conservation, the only potentially feasible strategy evaluated for the City of Iowa Park was to purchase additional treated water from the City of Wichita Falls. After a thorough investigation of their limited options, the city officials have determined that purchasing water from the City of Wichita Falls is their only viable option for a long term reliable source of water supply. The city has requested an additional 280 ac-ft per year (0.5 mgd) of treated water from the city of Wichita Falls.

Approximately 35,000 LF of 16" water transmission line will be required to convey the necessary water from Wichita Falls to the City of Iowa Park.

Quantity, Reliability, and Cost

A safe supply of 142 ac-ft per year can be made available from the City of Wichita Falls which has an excess supply of treated water. The reliability of this source would be good in that the water purchased would be through a contractual obligation. As shown in the detailed cost estimates provided in Attachment 4-2, the capital costs for this strategy are $2,210,000 with an annual cost of $903,000 and an annual cost of water delivered per ac-ft of $538.

Environmental Impacts

Environmental impacts would be minimal assuming that the pipeline could be installed generally along public roads. There could likely be some creek crossings along the pipeline route, however, there are no major issues that are readily apparent at this level of study. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

The impacts to other resources and strategies with this project would be indirect in that the City of Wichita Falls would be utilizing existing supply to provide for the City of Iowa Park.

Impacts on Agricultural and Natural Resources

With the only anticipated construction being water line improvements along public roads, only minimal agricultural and natural resources impacts are anticipated.

Other Relevant Factors

No other relevant factors regarding this strategy have been identified at this time.

City of Lakeside City

The City of Lakeside City has a population of 984 and is located in the northern portion of Archer County. The city currently purchases treated surface water from the City of Wichita Falls which is their source of water supply. It is anticipated that their current supply will provide for an adequate firm supply through the year 2060.

However, based on Table 4-3, a safe water supply shortage is projected for Lakeside City by the year 2010. Therefore, potentially feasible strategies were evaluated to meet a maximum safe supply shortage of 12 ac-ft per year.

Since Lakeside City has a water usage below 140 gpcd, conservation savings are limited. With the relatively small amount of water needed, the only strategy evaluated for Lakeside City was to purchase additional treated water from Wichita Falls. Wichita Falls has adequate line and pumping facilities and is capable of meeting the necessary safe supply requirement.

Quantity, Reliability, and Cost

A safe supply of 12 acre feet per year can be provided by purchasing the additional water from the City of Wichita Falls to meet this additional demand.

As shown in the detailed cost estimate provided in Attachment 4-2, there are no required capital expenditures for this strategy. However, with the purchase of water, the annual cost is estimated at $4,887 and the cost of water delivered per ac-ft is $407.

Impacts on Agricultural and Natural Resources

With there being no construction required and utilizing existing water conveyance facilities, only minimal agricultural and natural resources impacts are anticipated.

Environmental Impacts

With no construction required for this strategy there are no environmental impacts. (See Attachment 4-1).

City of Vernon

The City of Vernon has a population of 11,660 and is located in western Wilbarger County. Vernon currently uses groundwater from two principal well fields which are both located approximately 13 miles north of the city. Over the past few years Vernon has completed an ion-exchange treatment plant to address the high nitrate content in their existing water supply.

In addition, they have recently purchased approximately 220 acres of land to develop additional groundwater supplies for the future. It is anticipated that the City of Vernon's current supply will provide for an adequate firm supply through the year 2060.

However, based on Table 4-3, a safe supply shortage is projected for Vernon by the year 2010. A safe supply shortage was also projected for Manufacturing in Wilbarger County, which is provided by the City of Vernon. It is assumed that the city will continue to provide water for manufacturing in Wilbarger County. Therefore, potentially feasible strategies were evaluated to meet a maximum safe supply shortage of 423 ac-ft per year for the City of Vernon and the safe supply shortage for manufacturing. The estimated total new supply needed is 664 ac-ft per year.

Having conferred with the City of Vernon officials, in addition to conservation, the only strategy evaluated for Vernon was to develop additional groundwater supply wells and continue to utilize their nitrate removal treatment facility. To meet the safe supply shortage would be required to drill two additional wells and install approximately 25,000 LF of transmission line to the treatment plant. Water sold to manufacturing may not require nitrate treatment.

Quantity, Reliability, and Cost

A total supply of 664 ac-ft per year can be provided by developing and treating additional groundwater supplies. As shown in the detailed cost estimate provided in Attachment 4-2, the capital costs for the additional supply is $1,355,500 with an annual cost of $203,200 and an annual cost of water delivered per ac-ft of $306.

Environmental Impacts

The environmental impact would be low because the pipeline route would follow existing public roads. (See Attachment 4-1).

Impacts on Water Resources and Other Management Strategies

The impact on Water Resources would be minimal and there are no other strategies that would be affected.

Impacts on Agriculture and Natural Resources

Threats to agriculture would be low since the well field has not historically been used for farming.

Other Relevant Factors

With the City of Vernon already using groundwater, this additional supply would compliment their existing system.

City of Wichita Falls

The City of Wichita Falls is located in the southeastern portion of Wichita County and has a current population of 104,197. It is the largest city in a radius of about 100 miles, and the nearby communities and towns share economic and cultural ties to Wichita Falls.

The service area of Wichita Falls is approximately 65 percent of the entire Region B population and the municipal water demand on the Wichita Falls system accounts for approximately 65 percent of the total Region B municipal demand. With the majority of the municipal demand being dependent on the City of Wichita Falls for the next 50 years, it is imperative that management strategies be identified and evaluated to increase the system reliability. To provide for a more conservative estimate of the available surface water supply in Region B a safe yield analysis was conducted for each of the three existing surface water supply reservoirs. This analysis utilizes the same historical hydrology as firm yield, but assumes that a one-year supply of water is reserved at all times. The results of the safe yield analysis for the Wichita Falls surface water supply for the years 2010 to 2060 were estimated at 45,481 and 35,158 ac-ft per year respectively.

Based on the calculated safe supply less the current customer demand, and as shown in Table 4-3, the City of Wichita Falls is projected to have a 2,057 ac-ft per year safe supply shortage in the year 2060. This does not include any additional customer demands that are anticipated within the next three to five years.

Therefore, after consultation with the City of Wichita Falls and the Region B Technical Advisory Committee, two potentially feasible strategies were evaluated to provide the City of Wichita Falls with an additional source of supply.

A Wastewater Reuse system could be constructed that would utilize approximately 11,000 ac-ft per year (10 MGD) of processed and treated effluent for irrigation purposes or mixed with the existing raw water supply at the secondary reservoir.

A second alternative for additional water supply would be to construct a new lake approximately 40 miles northeast of Wichita Falls near the town of Ringgold to provide an additional 27,000 ac-ft per year (24.5 MGD)

Quantity, Reliability, and Cost

Currently the City of Wichita Falls operates and maintains a wastewater treatment plant that discharges approximately 14,300 ac-ft per year (13 MGD) of very high quality treated effluent into the Wichita River for use downstream by other entities. This water would be a very reliable source for the city, and could be utilized to decrease the irrigation and industrial demands on the system, and/or to increase the municipal water by 11,000 ac-ft per year (10 MGD). To produce 10 MGD of reusable water, this alternative would require advanced treatment at the River Road Wastewater Treatment Plant (RRWWTP) including denitrification, microfiltration, and ultraviolet (UV) disinfection. In addition, a 30-inch pipeline and 10 MGD pump station will be required to convey the water to the secondary reservoir at the Jasper WTP.

With regards to the new lake strategy, the City of Wichita Falls identified a potential reservoir site approximately 40 miles northeast of Wichita Falls, near the town of Ringgold. The site would be on the Little Wichita River and previous studies have concluded that, if constructed approximately 27,000 ac-ft per year (24.5 MGD) of water could be made available for municipal use. An evaluation of Lake Ringgold using the Red River WAM found the yield to be 33,000 ac-ft per year, which assumes instream flow releases using the Consensus Method. This is more than previously estimated. For planning purposes, it is assumed that Lake Ringgold would be able to provide 27,000 ac-ft per year of firm supply. The safe yield is estimated at 24,000 ac-ft per year.

This reservoir would be in the same drainage basin as Lake Arrowhead and Lake Kickapoo so it is anticipated that the water quality would be very similar to the existing reservoirs. The reliability of this water supply would be good, however, with the location of the Ringgold site being downstream and in the same drainage basin as the two existing lakes, the Ringgold Reservoir could be adversely affected during periods of extended drought.

Of the 17,000 acres of land needed for the reservoir site, the city currently owns approximately 5,000 acres. Along with purchasing the remaining lands for the site, additional facilities including a lake intake structure, pump station facilities, and 40 miles of 54" transmission line would be required to convey 27,000 ac-ft per year (24.5 MGD) of raw water into existing treatment facilities in Wichita Falls. As shown in the detailed cost estimate provided in Attachment 4-2, the total capital costs for the wastewater reuse project is $48,700,000 with an annual cost of $6,321,000 and an annual cost of water delivered per ac-ft of $575.

For the construction of the Lake Ringgold Reservoir, the total capital cost is $319,746,000 with an annual cost of $29,015,500 and an annual cost of water delivered per ac-ft of $1,075.

<u>Environmental Factors</u>

The wastewater reuse alternative would have low to moderate impacts on the environment since the pipeline route could be routed along the Holliday Creek Flood Control Project. In addition, the pump station would be located at the existing wastewater plant in an area of minimal impact. (See Attachment 4-1).

The Lake Ringgold alternative would have a moderate impact on the environment with the inundation of nearly 15,000 acres of existing pasture land. In addition, pump stations and the pipeline into the city should be located in areas of low to moderate impact. (See Attachment 4-1).

Impact on Water Resources and Other Management Strategies

The wastewater reuse alternative would have a low to moderate impact on the Wichita River in that the wastewater effluent would no longer be discharging into the river. During drought conditions this could cause a noticeable effect on the quantity and perhaps the quality of water in the Wichita River immediately downstream from the wastewater plant.

The Lake Ringgold alternative would have a high impact on the water resources of the city in that an additional 275,000 ac-ft of reservoir storage would be created, while increasing the water supply to Wichita Falls by 27,000 ac-ft per year.

Though this alternative is the most expensive strategy, it would likely delay the need for the wastewater reuse project and/or the Lake Kemp/Diversion project beyond the year 2060.

Impacts on Agriculture and Natural Resources

The wastewater reuse alternative would have a low impact on agriculture in that the location for the reuse facility would likely be at an existing site. However, the impact on natural resources is anticipated to be moderate to high in that wastewater flows would be diverted from the existing discharge stream.

The Lake Ringgold alternative would have a moderate to high impact on both agriculture and natural resources in that approximately 17,100 acres of agriculture land could be required for the site and approximately 1,150 acres of wetlands could be impacted.

Other Relevant Factors

Public acceptance of the wastewater reuse may become an issue if perception prevails that properly treated wastewater effluent is a questionable source of raw water supply for the city due to unfounded health concerns or other misconceptions. In addition, this alternative will require a modification to the wastewater discharge permit which could take one to two years.

The construction of Lake Ringgold would require the city to obtain a permit from the state to impound water from the Little Wichita River.

Charlie Water Supply Corporation

Charlie Water Supply Corporation is a small water system located in the northern portion of Clay County near the Red River that serves a population of approximately 90. The system currently utilizes a groundwater supply that will be adequate through 2060, however the nitrate levels in the water exceed state standards.

The only potentially feasible strategy evaluated for this user was to construct a nitrate removal treatment plant. The plant would be designed to provide 10 ac-ft per year of potable water that meets minimum state requirements.

Quantity, Reliability, and Cost

Constructing a nitrate removal plant would provide for 10 ac-ft per year for very reliable and good quality of water that meets minimum state standards.

As shown in the detailed cost estimate provided in Attachment 4-2, the capital costs for this strategy are $165,000 with an annual cost of $22,500 and an annual cost of water delivered per ac-ft of $2,250.

Environmental Factors

The environmental impacts would be low because there will be no discharge of the brine wastewater stream. Also, the salt concentration of the waste stream should not be very high. (See Attachment 4-1).

Impacts on Water Resources and other Water Management Strategies

There should be no water resource impacts since no additional water is used from the Aquifer. The nitrate removal system improves the water quality of the supply from the Aquifer.

Impacts on Agriculture and Natural Resources

Impacts to agriculture should be low. A minimum of one acre of existing agricultural land would need to be purchased for the treatment plant and evaporation pond. No additional water would be pumped from the Aquifer. Therefore, there should be no additional impacts to agricultural supply.

Other Relevant Factors

This strategy could be implemented between two and five years. The permitting and regulatory requirements are expected to be moderate. The water treatment plant would require approval from TCEQ and the system would require a no discharge wastewater permit. A NPDES storm water permit will be required during construction. This alternative may require additional staff to maintain and operate the system. Also, the evaporation ponds may require periodic disposal of accumulated salt deposits.

Hinds-Wildcat and Lockett Water Systems

The Hinds-Wildcat and Lockett Water Systems are two existing systems owned and operated by the Red River Authority of Texas that provide water for a population of approximately 596 persons in Wilbarger County. The water supply for each system comes from the Seymour Aquifer, which has nitrate levels that exceed TCEQ requirements, therefore both systems employ a bottled water program for customers requiring low nitrate water.

The same two potentially feasible strategies were evaluated for both the Hinds-Wildcat and Lockett Water Systems.

One alternative would be to construct a nitrate removal plant for each system and the second alternative would be to purchase treated water from the City of Vernon. In order to purchase water from Vernon, a 2.5 mile six-inch pipeline would need to be constructed to the Hinds Pump Station in order to provide for 40 ac-ft per year of treated water. For the Lockett System, the existing transmission line would need to be upgraded between Vernon and the Lockett Pump Station in order to provide for 109 ac-ft per year of treated water.

Quantity, Reliability, and Costs

Constructing a nitrate removal plant would provide 40 ac-ft per year of quality water for the Hinds-Wildcat system and 109 ac-ft per year for the Lockett Water System. The reliability of the Hinds-Wildcat System would be good, however, there is some concern about the long-term reliability of groundwater supply for the Lockett system.

Water purchased from the City of Vernon would provide a very reliable source to both systems, however, the costs would be substantially higher.

As shown in the detailed cost estimates provided in Attachment 4-2, the capital costs for Hinds-Wildcat treatment plant would be $412,000 with an annual cost of $49,000 and a cost of water delivered per ac-ft of $1,225. In comparison, the total capital costs to purchase water from Vernon would be $655,000 with an annual cost of $94,000 and a cost of water delivered per ac-ft of $2,350.

For the Lockett System, the total capital cost of the treatment plant would be $412,000 with an annual cost of $49,000 and a cost of water delivered per ac-ft of $450. In comparison, the total capital cost to purchase water from Vernon would be $1,272,000 with an annual cost of $202,000 and a cost of water delivered per ac-ft of $1,853.

Environmental Factors

The environmental impacts of the treatment plant would be low since there would be no waste discharged from the plant. Also, there would be minimal impacts due to pipeline construction assuming the route generally followed existing public roads. (See Attachment 4-1).

Impacts on Water Resources and Other Management Strategies

There are no anticipated impacts to water resources or other management strategies with either one of the alternatives.

Impacts on Agricultural and Natural Resources

Impacts agriculturally should be low. A minimum of one acre of existing agricultural land might be needed for the treatment plant site and evaporating pond. With all pipeline work being along public roads there would be minimal impact to agriculture or natural resources.

Other Relevant Factors

Construction of a treatment plant would require permitting by TCEQ which could take one to two years to complete.

4.2.3 Manufacturing Water Strategies

Wilbarger County Manufacturing

Region B has an adequate firm supply of water to meet the manufacturing needs through the 2060 planning period. However, as shown in Table 4-3 a safe supply shortage of 170 ac-ft per year is projected in Wilbarger County by the year 2010 and the shortage will increase to 241 ac-ft by the year 2050.

Currently, the City of Vernon is supplying the necessary water for manufacturing in Wilbarger County and it is anticipated that Vernon will supply the additional water through 2060 to meet the future Wilbarger demands.

Quantity, Reliability, and Costs

With improvements through the 2060 planning period, the City of Vernon can provide for a safe supply of 241 ac-ft per year to meet all the Wilbarger County manufacturing needs.

As shown in the detailed cost estimates in Attachment 4-2, the capital cost to meet this 241 ac-ft per year demand is $180,000 with an annual cost of $184,700 and cost of water delivered per ac-ft of $766.

Environmental Impacts

With the line upgrade being along public roads, the environmental impact would be very low. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

The impact on water resources would be minimal in that Vernon has an adequate supply of water. The only impact to other management strategies would be low as the City of Vernon would need to include this additional demand in their increase in water supply from the well field.

Impact on Agriculture and Natural Resources

This strategy would have no impact on agriculture or any of the natural resources.

Other Relevant Factors

There are no other relevant factors known at this time.

4.2.5 Steam Electric Power and Irrigation Water Strategies

Steam Electric Power and Irrigation water use within Region B accounts for approximately 66% of the total usage. With this usage projected to continue, it is imperative that an adequate supply of water be made available through the year 2060.

Archer, Clay, Wichita, and Wilbarger Counties

Based on Table 4-2, it is anticipated that there will be a water shortage for steam electric power in Wilbarger County by the year 2030. This supply shortage is anticipated to be 11,097 ac-ft per year by 2060.

In addition, it is projected that beginning in 2010 there will be a shortage of irrigation water supply within Archer County, Clay County and Wichita County. By the year 2060, it is projected that an additional 25,460 ac-ft per year of irrigation water will be needed within Region B.

The majority of the irrigation and steam electric water supply comes from Lake Kemp. As sedimentation increases within the lake, the supply capacity decreases. As noted in Chapter 3, the Lake Kemp supply is projected to decrease from 100,650 ac-ft per year in 2010 to 39,250 ac-ft per year in 2060. This relatively high rate of sedimentation was recognized by the Corps of Engineers during the re-design of the dam in 1973. The design memorandum for Lake Kemp allows for raising the conservation elevation to a maximum of 1149.8 feet MSL to compensate for decreased capacity due to sedimentation. This adjustment would require a new volumetric survey for Lake Kemp and a reallocation study. As an interim measure, Lake Kemp is currently allowed to store water up to elevation 1,145.5 (1.5 feet increase over normal conservation levels) during the months of April through October.

The management strategies that are proposed for Region B to meet the combined steam electric power and irrigation shortage of 36,557 ac-ft per year, are to increase the conservation storage capacity of Lake Kemp, provide for a seasonal conservation pool (April to October) and also make the necessary improvements in the Wichita County Water Improvement District conveyance system to substantially reduce water losses in the canal laterals.

Currently, the Lake Kemp conservation elevation is set at 1,144 MSL. If the conservation elevation was increased to elevation 1,148.3 MSL to compensate for sediment accumulation through year 2005, the supply yield would increase by 15,700 ac-ft per year in 2060. Also, if the lake level was operated at a seasonal (April to October) pool level of 1.5 feet above the new conservation level (seasonal increase to1,149.8 MSL) an additional supply of 6,250 ac-ft per year could be obtained for a total of 21,950 ac-ft per year in 2060. A summary of the proposed elevation changes and the impact to reservoir yield is shown on Table 4-12.

Table 4-12 Summary of Lake Kemp Conservation Elevation Increases

	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Lake Kemp (current conservation elevation at 1144 ft.)	90,417	80,184	69,951	59,718	49,485	39,250
Lake Kemp (conservation elevation increases to 1148.3 ft)	116,200	103,950	91,700	79,450	67,200	54,950
Increase in supply	*25,783*	*23,766*	*21,749*	*19,732*	*17,715*	*15,700*
Lake Kemp with seasonal pool (1.5 ft. above 1148.3 ft. from April to October – 1149.8 ft.)	121,200	110,908	100,616	90,324	80,032	61,200
Increase in supply	*5,000*	*5,250*	*5,500*	*5,750*	*6,000*	*6,250*
Total increase in supply (seasonal pool plus increase in elevation to 1148.3 ft.)	**30,783**	**29,016**	**27,249**	**25,482**	**23,715**	**21,950**

This change in conservation elevation would not increase the permitted storage or diversion from the reservoir. Therefore, no modification to the water rights permit is needed. It should be understood that any changes in Lake Kemp operations must be approved by the U.S. Army Corps of Engineers. However, if the above scenario was approved, Lake Kemp would yield an additional supply of 21,950 ac-ft per year in the year 2060.

Wichita County Water Improvement District No. 2 currently maintains and operates approximately 192 miles of irrigation laterals within Archer, Clay, and Wichita Counties. Based on a recently completed study of the canal laterals, it was determined that approximately 15,000 ac-ft of irrigation water is lost annually due to the operational constraints of the open canal laterals. It is anticipated that this water could be saved by enclosing the canal laterals in pipe. Preliminary calculations show that on average a 30" diameter pipe would be required for each lateral.

In summary, in order to provide the additional 36,557 ac-ft of steam electric power and irrigation water through the year 2060, the Lake Kemp conservation level must be raised in addition to enclosing in pipe approximately 100 miles of irrigation canal laterals within the Wichita County Water Improvement District No. 2 irrigation system.

Quantity, Reliability, and Cost

As shown in the detailed estimates provided in Attachment 4-2, the capital costs for Lake Kemp improvements are $100,000 with an annual cost of $8,700 and annual cost of water delivered per ac-ft of $0.40.

For the canal system improvements, the capital costs are $58,500,000 with an annual cost of $5,700,000 and annual cost of water delivered per ac-ft of $390.

Environmental Impacts

There are no known adverse environmental impacts relating to either the Lake Kemp improvements or the canal system improvements. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

Lake Kemp improvements will increase the available yield of the lake and enclosing the canals in pipe will conserve a large amount of irrigation water previously lost.

Impact on Agriculture and Natural Resources

Increasing the yield of Lake Kemp for irrigation purposes will benefit the agriculture lands along with providing the required additional water needed for steam electric power.

Other Relevant Factors

There are no other known relevant factors.

4.2.6 Mining Water Strategies

Essentially, the only mining activity in Region B is the oil and gas industry. Water is used to drill new wells or in some cases used to water flood selected wells or well fields. Water for mining uses accounts for less than 1.0% of the total water used in Region B.

Montague County Mining

Based on Table 4-2 Montague County is projected to have a mining water shortage of 113 ac-ft per year, by the year 2010. Two potentially feasible strategies were considered to meet the mining need.

One option would be to develop additional groundwater supplies in the county. To meet the required demand utilizing groundwater, it is anticipated that one well would need to be drilled in addition to installing 10,000 LF of six inch transmission line.

A second option would be to provide for the additional supply from an existing local provider. Depending on the demand location, the local provider would be one of the current water user groups within Montague County or a smaller provider included in the County-Other category. For planning purposes it was assumed that as a minimum the local providers system would require an upgrade of approximately 10,000 LF of six inch line in addition to the costs of purchasing the additional required volume of treated water.

Quantity, Reliability, and Cost

A firm supply of 113 ac-ft per year can be provided by developing a groundwater supply well or by purchasing additional water from an existing local provider.

It is anticipated that the supply reliability from the local provider might be better than the groundwater supply since water levels tend to decline over time.

As shown in the detailed cost estimate provided in Attachment 4-2, the capital cost for the additional groundwater supply is $553,500 with an annual cost of $62,300 and an annual cost of water delivered per ac-ft of $551.

In comparison, the capital cost for additional water from a local provider is $409,000 with an annual cost of $166,400 and an annual cost of water delivered per ac-ft of $1,473.

Environmental Impacts

Environmental impacts would be minimal for both strategies, assuming that the pipeline could be installed generally along public roads. There could likely be some creek crossings along the route, however, there are no major issues with either strategy that are readily apparent. (See Attachment 4-1).

Impacts on Water Resources and Water Management Strategies

With regards to developing an additional groundwater supply there would be a low impact on the existing water resources and no impact on other water management strategies.

The impacts to other resources and strategies with regards to additional water from a local provider would be indirect. In order for the local providers to provide the required water for mining purposes, the local provider must first have the water to sell. That may require the local provider to purchase additional water from an entity like the City of Bowie or City of Nocona prior to entering into a contract to meet the additional water demand.

Impacts on Agricultural and Natural Resources

In developing a groundwater supply well there is a potential that a small portion of agricultural land could be impacted. However, it is believed the impact would be minimal.

With the local provider strategy and the only anticipated construction being the water line improvements along public roads, only minimal agricultural and natural resource impacts are anticipated.

Other Relevant Factors

No other relevant factors regarding either strategy have been identified at this time.

4.2.7 Regional Water Strategy

Chloride Control Project

The concentration of dissolved salts, particularly chloride, in some surface waters in Region B limits the use of these waters for municipal, industrial, and agricultural purposes. The Red River Authority of Texas is the local sponsor and has been working in cooperation with the U.S. Army Corps of Engineers (USACE) for a number of years on a project to reduce the chloride concentration of waters in the Red River Basin. The successful completion of this project would result in an increase in the volume of water available for municipal and industrial purposes in Region B and water would be available for a broader range of agricultural activities. Therefore, the Chloride Control Project (CCP) is included in the Regional Water Plan as one of the feasible strategies for meeting the water supply needed in Region B. Following is a summary of the CCP that presents the background of the project, the components, and current status of the project, and an analysis of the CCP as a regional water resource strategy.

Background

In 1957 the U.S. Public Health Service initiated a study to locate the natural sources that contribute high concentrations of chloride to surface waters in the Red River Basin. It was determined that ten natural salt source areas in the basin contributed approximately 3,300 tons of chloride each day to the Red River.

In 1959 the USACE performed a study to identify control measures for these salt sources. Subsequently, structural measures were recommended for eight source areas.

Description of the Chloride Control Project

The primary strategy for reducing the flow of highly saline waters to the Red River is to impound these flows behind low flow dams and pump the saline waters to off-channel brine reservoirs where the water evaporates or is disposed of by deep-well injection. During high-flow periods, when the chloride concentration is lower, waters flow over the low dams and proceed downstream. Figure 5 identifies the locations of the eight saline inflow areas, the existing and proposed low-flow dams, and the existing and proposed brine reservoirs.

There are four saline inflow areas that impact water quality in Region B:

- Areas VII, VIII, and X affect the quality of water in the Wichita River including Lake Kemp and Lake Diversion.
- Area IX affects the quality of waters in the Pease River, including the proposed Pease River Reservoir.

Construction of the chloride control facilities at Area VIII on the South Fork of the Wichita River in King County and Knox County was authorized in 1974. These facilities include a low flow dam near Guthrie, Texas, with a deflatable weir to collect the saline inflows; the Truscott Brine Reservoir near Truscott, Texas; and, a pump station and pipeline to transport the saline water from the impoundment at Guthrie to the Truscott Brine Reservoir. These facilities have been in operation since May 1987. Construction of the facilities at Area X was initiated in 1991, but they have not been completed due to a decision to modify the design of these facilities, a change to the brine disposal area, and a need to address environmental issues identified by the U.S. Fish and Wildlife Service (USFWS) and the Texas Parks and Wildlife Department (TPWD). A Final Environmental Statement (FES) was prepared for the project and published in 1977. A supplement to the FES (SFES) and an Economic evaluation of the project were completed for the Wichita Basin in 2003. These studies found that the Wichita River Basin CCP is economically and environmentally feasible and the Record of Decision was signed in March 2004. Construction of the facilities for Areas X and VII are waiting for budget approval.

The effectiveness and environmental impacts of the project will be evaluated as the CCP facilities are completed and operating within the Wichita River Basin. The results of this effort will be used to determine if and, if so, how CCP facilities will be provided for Area IX on the Pease River. The potential Pease River Reservoir would not be viable for a municipal water supply without completion of the CCP for the Pease River Basin.

Analysis of Strategy

Because of the improved water quality resulting from implementation of the CCP, it has been identified as a feasible supply alternative for Region B. Following is an evaluation of the quantity and quality of water that would be provided; the reliability of the supply; the cost to distribute, treat, or convey the water; potential impacts on the environment and agriculture in the area; the regulatory and political acceptability of, and public support for, the project; and the extent to which this strategy could affect other strategies.

This is not a stand-alone alternative. Rather, it is a variation of the other alternatives that include the use of Lake Kemp/Diversion waters. The CCP is a component of a regional alternative in which treatment to remove salts for municipal water use is significantly reduced or replaced by source control for the salt being introduced to the Lake Kemp/Diversion systems.

Red River Basin Chloride Control Project
Texas and Oklahoma

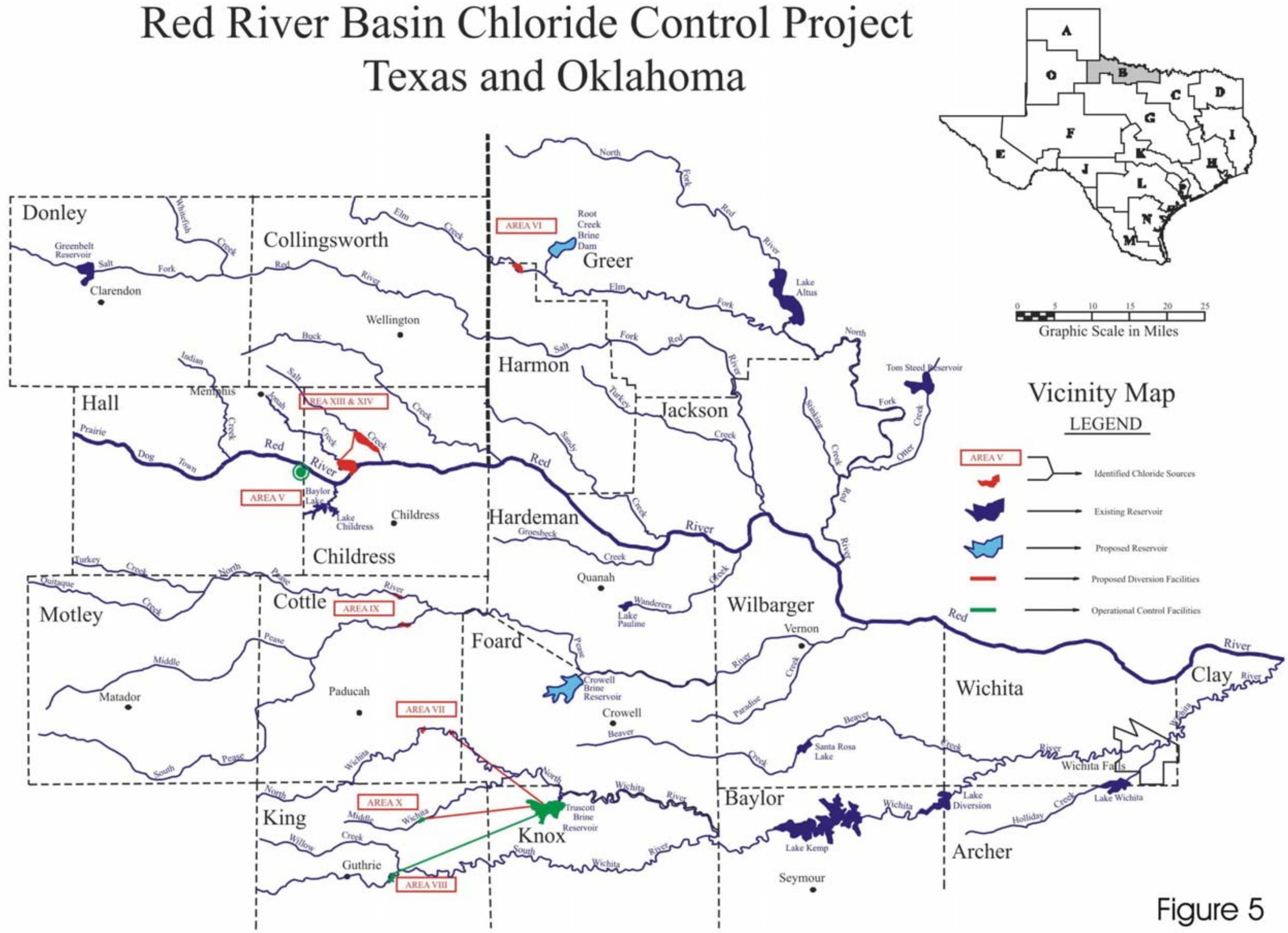


Figure 5

With implementation of the CCP, concentrations will change over time. The lowest concentrations anticipated will not require additional treatment 50 percent of the time although, the highest concentrations would still require some form of treatment or blending to reduce the salt content to meet state standards. However, the highest expected concentration of approximately 489 milligrams per liter would be a vast reduction from the pre-project concentrations of approximately 1.985 milligrams per liter.

However, the benefits of this alternative are not restricted solely to the elimination of the cost of membrane treatment (which is certainly beneficial because it may increase the feasibility of providing Lake Kemp/Diversion waters to some of the smaller communities). In addition, it minimizes or eliminates the problems and potential adverse environmental impacts of disposal of the brine waste stream from membrane treatment, provides regional economic benefits to the agricultural and industrial sectors of the economy, and extends water supplies for steam electric power generation. These benefits are discussed in more detail later in this section.

<u>Quantity, Reliability, and Cost</u>

The Wichita Basin phase of the CCP that is currently being implemented will increase water resources in the Wichita River Basin and is addressed in this initial regional plan. When the scheduling for the Pease River Basin phase of the project is more certain, the regional plan should be amended to include an evaluation of the effects of the Pease River phase of the project on water resources in Region B.

The water supply source that will be enhanced by the Wichita Basin CCP is the Lake Kemp/Diversion system. As previously described in Chapter 3 of the Region B Water Plan, the firm yield of this system is estimated at 100,650 ac-ft per year in 2000, 80,184 ac-ft per year in 2020, and 39,250 ac-ft per year in 2060. The yield decrease, which is attributable to sedimentation, is expected to be mitigated through an increase in the water conservation elevation and use of a seasonal pool during the irrigation months. Benefits of the CCP would be applicable to all waters stored in the Lake Kemp/Diversion system.

Waters from the Lake Kemp/Diversion system can be used for municipal purposes and agricultural irrigation pursuant to existing water rights. By contract, waters from the system can be used for steam generation of electricity and mining purposes. The waters are also used for recreation.

The total volume of water permitted for use from Lake Kemp/Diversion, and which can be provided in most non-drought years, is 193,000 ac-ft per year.

A significant barrier to the further use of Lake Kemp/Diversion water is the quality of the water. The water quality improvement that would occur as a result of the CCP would make this water suitable for a wider variety of uses, including municipal use that does not require membrane treatment, and more diverse agricultural use. Lower TDS concentrations can also reduce the amount of water needed for irrigation of existing lands and crops through increased efficiencies, and water needed for cooling for industrial purposes.

The CCP strategy alternative has been evaluated to determine yield and cost using the methods specified by the TWDB for the regional planning process. Significant features of these evaluation methods, as they apply to the CCP, are as follows:

- The yield is based on the amount of water available during critical drought conditions.
- The storage volume of the reservoirs will decrease over time as a result of sedimentation.
- The volume of water being used by existing irrigators is expected to decrease over time as a result of the use of water conservation measures. However, as the quality improves, the quantity utilized for irrigation of additional acreage within the existing irrigation district may increase.

It was also assumed that the full benefit of the CCP may not be realized until the year 2020, in accordance with the FES for the CCP, which was prepared in 1976.

The FES projected that the salt content in Lake Kemp would decrease over time after project completion. The projected concentrations that would not be exceeded 98 percent of the time are as follows:

Time	Chloride mg/L	Sulfate mg/L	TDS mg/L
Pre-project	1,312	755	3,254
Twenty years after implementation	318	395	1,108

These estimates are based on the assumption that the CCP will control 83 percent of the chloride load from Areas VII, VIII, and X.

Studies by the U.S. Geological Survey and others have evaluated the effectiveness of the Area VIII control structure (which was completed in 1987). These studies confirm that the Area VIII CCP removes approximately 80 percent of the chloride load introduced by Area VIII sources. Accordingly, the average chloride concentration in Lake Kemp has decreased to approximately 1,000 milligrams per liter (mg/L). Since current studies tend to confirm the general reliability of the 1976 projections regarding the effectiveness of salt removal, it appears that within 20 years after the completion of the CCP for Areas X and VII, it may no longer be necessary to remove chlorides from waters withdrawn from Lake Kemp/Diversion for municipal supply by demineralization.

Potentially more water will be available for municipal use as a result of the CCP. At the present time, small amounts of water from Lake Kemp/Diversion are used to extend other available supplies. Wichita Falls intends to use water from Lake Kemp with membrane treatment by 2006. As the CCP improves water quality, the efficiency of the treatment system will increase and the amount of water lost as reject water will be reduced.

The yield of additional water from the CCP is difficult to estimate because its primary purpose is to improve water quality, which increases the usability of the water. Considering improved efficiencies for municipal, industrial, and irrigation uses, it is estimated that the CCP could produce up to 30 percent of water savings of current use. This is attributed to reduced losses with municipal treatment and improved water transport in soils for irrigation. By 2020, these savings are estimated to be 26,500 ac-ft per year.

As shown in the detailed cost estimates in Attachment 4-2, the capital costs for the CCP is $77,500,000 with an annual cost of $5,989,000 and a cost of water delivered per ac-ft of $226. NOTE: Remaining cost to completion is $50,032,000 and remaining annual cost is $4,808,900.

It should also be noted that the cost impacts of the CCP on residents of Region B and the State of Texas are different than the cost impacts of membrane treatment or other supply strategies. The capital costs of the CCP facilities will be funded with federal monies. The full capital costs of membrane treatment will be funded by local users.

In addition, there are other economic benefits to the region and further value added to the water resources of the region because the quality improvement associated with the CCP will result in more efficient utilization of water. Improvement of the quality of the water will make it feasible for irrigators to grow a wider range of crops. At the present time, only crops with a high salt tolerance can be irrigated with water from Lake Kemp/Diversion. Being able to irrigate a wider range of crops can allow the irrigators to grow crops of higher value.

The CCP will also provide benefits to the industrial sector of the economy and have a positive effect on water supplies for steam power generation because it will reduce the water demand. The concentration of TDS in a water supply limits the number of times the water can be cycled through the cooling system. If the TDS concentration is decreased, the number of cooling cycles can be increased. Subsequently, the blow-down volume will decrease, reducing disposal costs.

The water supply produced by the CCP would be of high reliability. However, the ability of the Lake Kemp/Diversion system to deliver the full volume of water authorized by existing water rights during drought conditions is questionable because the sum of authorized water rights for all uses exceeds the firm yield of the Lake Kemp/Diversion system. Therefore, in times of drought, appropriate adjustments may be required if all users wish to take their fully authorized amount. However, a significant volume of water will be reliably available for each of the authorized uses if the CCP is implemented.

This alternative provides an additional quantity of water that has a quality suitable for a wide variety of municipal, industrial, agricultural, and steam electric purposes. The resultant water supply is projected to achieve the EPA secondary criteria for drinking water 94 to 98 percent of the time.

Environmental Factors

As previously noted, several environmental impact studies have been completed and the conclusion of these studies is that the CCP is an environmentally feasible project.

Monitoring to evaluate the environmental issues that have been previously raised will continue after construction of the remaining CCP facilities in the Wichita River Basin. If no significant adverse impacts attributable to the CCP are identified, consideration will be given to proceeding with the Pease River Basin CCP facilities.

The environmental issues that have been identified are summarized below:

- Selenium (Se) is a naturally occurring element in soils in the western United States and in the waters of the CCP project area. Se in trace amounts is an essential dietary component. However, it has been concluded that, in higher concentrations in water and sediment, Se adversely impacts aquatic birds in some areas of the country. Concern has been expressed that the concentration of Se in the brine disposal reservoirs will increase due to evaporation and pose a threat to local and migratory birds, fish, and wildlife. Data collected at the Truscott Brine Reservoir have found no increases in Selenium concentrations following 11 years of operation and Selenium is not expected to result in excessive risk at the Brine Lake.

- Small decreases in flows are projected to occur in the Wichita River and the Red River between the Wichita River confluence and Lake Texoma. These flow decreases will result from the diversion of low flows to the brine disposal reservoirs and increased use of the river flow for irrigation when the quality improves. Changes in water quality and quantity could impact the composition of vegetation along these river reaches and result in vegetative encroachment on the stream channel. There is a concern that decreased flows and changes in vegetative composition could adversely affect the habitat for aquatic life, birds, and wildlife. These changes are expected to be low to moderate and potential impacts are addressed in the monitoring and mitigation plan for the project.

- There is a concern that wetlands in the Red River flood plain will be adversely impacted as a result of both changes in the hydrologic regime and the conversion of land adjacent to the river to cropland and pasture. These potential impacts are also addressed in the monitoring and mitigation plan for the CCP.

- Concern has been expressed that the reduction in the TDS concentration in Lake Texoma, associated changes in physical characteristics of the lake (turbidity), a decrease in primary production rates due to a decrease in the depth of the eutrophic zone, and alterations in nutrient cycling will reduce the sport fish harvest in the lake, and may affect the aesthetic quality of the lake. Studies have shown that the changes in TDS concentration in Lake Texoma associated with the Wichita River CCP are expected to have negligible adverse impacts to fisheries or aesthetics to the lake.

Each of these issues was addressed in the SFEIS, and the report concludes there will not be significant impacts in most cases. Where potential impacts have been identified, mitigation and monitoring measures are proposed.

Several state and federally listed threatened and endangered species are present in, or migrate through, the project area. To address concerns related to the bald eagle, whooping crane, and least tern, in 1994 the USFWS and USACE agreed upon a Biological Opinion that defines Reasonable and Prudent Measures to protect these species. These measures are described in Supplement I to the SFES.

Impacts on Water Resources and Other Water Management Strategies

Other strategies considered for the Lake Kemp/Diversion include increasing the conservation pool elevation and enclosing canal laterals in pipe. Each of these strategies will increase the available supply from the Lake Kemp/Diversion system. Successful implementation of the CCP will ultimately improve the water quality in the lake, which will reduce treatment costs and improve efficiencies for users that utilize Lake Kemp/Diversion. For Wichita Falls that will be using water from Lake Diversion as a municipal water source, the CCP will reduce the amount of treatment needed to produce high quality drinking water and increase the ratio of produced water to raw water. For industrial and irrigation water users, the CCP will allow more efficient use of the water supply, providing a positive impact to the other strategies identified for Lake Kemp/Diversion water users.

Impacts on Agriculture and Natural Resources

The impacts on agriculture associated with the CCP are positive. The improvements in the quality of water will allow the water to be used to irrigate a wider variety of crops and reduce the potential for salt build-up in soils.

Other Relevant Factors

The CCP is waiting for funding appropriations through the Corps of Engineers.

The political acceptability of the project varies depending on the sector of the community. Municipalities, industries, and the agricultural community are supportive of the project. The degree of support for the project is evidenced by the congressional approval and funding of the project in bills enacted in 1962, 1966, 1970, 1974, 1976, and 1986. In 1988, a special panel created by the Water Resource Development Act of 1986 issued a report favorable to the project. The natural resource agencies, Lake Texoma sport fishermen, and related lake businesses have expressed opposition to the project. However, substantial progress has been made in addressing the natural resource and fishing concerns.

4.3 Selection of Preferred Water Management Strategies by County

Based on a comparison of the total regional water supply to demand as shown in Table 4-1, it was determined that there is adequate water supply to meet the needs of Region B as a whole up to the year of 2040. However, by the year 2050, the region is projected to have a supply shortage of 769 ac-ft per year and by 2060 the shortage will increase to 12,053 ac-ft per year.

In addition, based on a comparison of the supply to demand of each water user group in Region B, the various water needs were identified and water management strategies were evaluated as documented in this chapter. Though all the strategies may be viable options and should be considered by each affected entity, the following is a listing by county of the preferred water management strategies for each water user group with projected water supply needs.

4.3.1 Archer County

The maximum projected water need for Archer County is 1,678 ac-ft per year. Most of this need (1,370 ac-ft per year) is associated with the irrigation supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Archer Co. (other)	Municipal Conservation	18 [1.]	$1.72	2010
	Purchase water from Local Provider	296	$5.26	2010
Lakeside City	Municipal Conservation	11	0	2010
	Purchase water from Wichita Falls	12	$1.25	2010
Archer Co. Irrigation	Increase water conservation elevation at Lake Kemp	1,096 [1.]	$0.01	2010
	Seasonal Conservation Pool (April-Oct.)	274 [1.]	$0.01	2020
TOTAL		**1,707**		
ALTERNATE STRATEGIES – NONE IDENTIFIED				

[1.] Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

4.3.2 Baylor County

There are no projected water shortages in Baylor County of Region B, however, an emergency interconnect for Baylor WSC is recommended.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Baylor WSC and City of Seymour	Emergency Interconnect Millers Creek Reservoir	250	$3.80	2010

4.3.3 Clay County

The maximum projected water need for Clay County is 747 ac-ft per year. Most of this need (513 ac-ft per year) is associated with the irrigation supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Clay Co. (other)	Municipal Conservation	39 [1.]	$0.78	2010
	Purchase water from Local Provider	223	$4.44	2010
City of Byers	Municipal Conservation	3 [1]	$0	2010
	Purchase water from Dean Dale WSC	11	$2.29	2010
Clay Co. Irrigation	Increase water conservation elevation at Lake Kemp	411 [1.]	$0.01	2010
	Seasonal Conservation Pool (April-Oct.)	102 [1.]	$0.01	2010
Charlie WSC	Nitrate Removal Plant	10	$6.90	2010
TOTAL		**796**		
ALTERNATE STRATEGIES – NONE IDENTIFIED				

1. Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

4.3.4 Cottle County

There are no projected water shortages in Cottle County of Region B.

4.3.5 Foard County

There are no projected water shortages in Foard County of Region B.

4.3.6 Hardeman County

There are no projected water shortages in Hardeman County of Region B.

4.3.7 King County

There are no projected water shortages in King County of Region B.

4.3.8 Montague County

The maximum projected water need for Montague County is 733 ac-ft per year. Most of this need (486 ac-ft per year) is associated with a safe need for Montague County (other).

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Montague Co. (other)	Municipal Conservation	81 [1]	$0	2010
	Develop Additional Groundwater Supplies	486	$1.54	2010
City of Bowie	Municipal Conservation	72 [1.]	$0.71	2010
	Wastewater Reuse	134	$2.80	2040
Montague Co. (Mining)	Purchase Water from Local Provider	113	$4.52	2010
TOTAL		**805**		
ALTERNATE STRATEGIES				
Montague Co. (other)	Purchase water from Local Provider	486	$3.75	2010
City of Bowie	Develop Additional Groundwater Supply	134	$3.73	2040
Montague Co. (Mining)	Develop Additional Groundwater Supply	113	$1.54	2010

1. Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

4.3.9 Wichita County

The maximum projected water need for Wichita County is 26,745 ac-ft per year. Most of this need (23,577 ac-ft per year) is associated with the irrigation supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
City of Electra	Municipal Conservation	38 [1.]	$1.24	2010
	Purchase Water from Wichita Falls	1680	$2.48	2010
City of Iowa Park	Municipal Conservation	80 [1.]	$0.83	2010
	Purchase Water from Wichita Falls	1680	$1.65	2010
City of Wichita Falls	Municipal Conservation	1367 [1.]	$0.24	2010
	Wastewater Reuse	11,000	$1.76	2020
Wichita Co. Irrigation	Increase water conservation elevation at Lake Kemp	10,000 [1.]	$0.01	2010
	Seasonal Conservation Pool (April-Oct.)	5,000 [1.]	$0.01	2010
	Enclose Canal Laterals in Pipe	8,577	$1.20	2040
TOTAL		**39,422**		
ALTERNATE STRATEGIES				
City of Wichita Falls	Construct Lake Ringgold	27,000	$3.30	2060

[1.] Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

4.3.10 Wilbarger County

The maximum projected water need for Wilbarger County is 11,761 ac-ft per year. Most of this need (11,097 ac-ft per year) is associated with the steam-electric power supply shortage from Lake Kemp.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
City of Vernon	Municipal Conservation	146 [1.]	$0.45	2010
	Develop Additional Groundwater Supply	664	$0.94	2010
Lockett Water System	Purchase water from City of Vernon	109	$5.68	2010
Hinds-Wildcat System	Nitrate Removal Plant	40	$3.76	2010
Wilbarger Co. Steam Electric Power	Increase Water Conservation elevation at Lake Kemp	4,193 [1.]	$0.01	2010
	Seasonal Conservation Pool (April – Oct.)	874 [1.]	$0.01	2010
	Enclose Canal Laterals in Pipe	6,030	$1.20	2040
Wilbarger Co. Manufacturing	Purchase water from City of Vernon	241	$2.35	2010
TOTAL		**12,297**		
ALTERNATE STRATEGIES				
Lockett Water System	Nitrate Removal Plant	109	$1.38	2010
Hinds-Wildcat System	Purchase water from City of Vernon	40	$7.21	2010

[1.] Supply varies by decade. The amount shown is the supply from this strategy in year 2060.

4.3.11 Young County

There are no projected water shortages in Young County of Region B.

4.3.12 Regional Strategies

The Chloride Control Project in the Wichita River Basin is a recommended regional strategy for Region B. This project will provide water savings through increased efficiencies in municipal water treatment and irrigation use due to improved water quality.

Water User	Strategy Description	Supply (ac-ft/yr)	Cost/ 1,000 gal	Implement Decade
Regional	Wichita Basin Chloride Control Project	26,500	$0.69	2010

LIST OF REFERENCES

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ATTACHMENT 4-1

REGIONAL WATER PLANNING GROUP B

STRATEGY EVALUATION MATRIX

ATTACHMENT 4-1
STRATEGY EVALUATION MATRIX – REGION B

Water User Group	Strategy Description	Quantity, Reliability, and Cost	Environmental Impacts	Impacts on Water Resources and Other Water Management Strategies	Impacts on Agriculture and Natural Resources	Other Relevant Factors	Overall Rating
Archer Co. (Other)	Purchase water from Local Provider	Adequate Quantity, Good Reliability, Moderate Cost	Low impact from pipeline	Low Impact	Low Impact	None identified	N.A
Baylor WSC	Emergency Interconnect w/Millers Creek Res.	Good Quality, Good Reliability, Moderate Cost	Low Impact	Low Impact	Low Impact	Emergency Connection only	N.A
Clay Co. (Other)	Purchase water from Local Provider	Adequate Quantity, Good Reliability, Moderate Cost	Low impact from pipeline	Low Impact	Low Impact	None identified	N.A
Montague Co. (Other)	Develop Additional Groundwater Supply Score:	Adequate Quantity, Good Reliability, Low Cost 9	Low to moderate impact 8	Low Impact 8	Low to moderate impact 8	None identified 9	51
	Purchase water from Local Provider Score:	Adequate Quantity, Good Reliability, Moderate Cost 7	Low Impact 9	Low Impact 8	Low Impact 9	None identified 9	49
City of Bowie	Develop Groundwater Supplier Score:	Adequate Quantity, Good Reliability, Moderate Cost 7	Low to moderate impact 8	Low to moderate impact 8	Low to moderate impact 8	Mixing surface water with groundwater 8	46
	Wastewater Reuse Score:	Adequate Quantity, Good Reliability, Low Cost 9	Low to moderate impact 8	Low impact 9	Low impact 9	Public perceptions 7	51
City of Byers	Purchase additional water from Dean Dale	Adequate Quantity, Good Reliability, Low Cost	Low impact	Low impact	Low Impact	None identified	N.A
City of Electra	Purchase water from Wichita Falls	Good Quantity, Good Reliability, Moderate cost	Low impact	Low impact	Low Impact	None identified	N.A
City of Iowa Park	Purchase additional water from Wichita Falls	Good Quantity, Good Reliability, Low Cost	Low impact	Low impact	Low Impact	None identified	N.A
Lakeside City	Purchase additional water from Wichita Falls	Good Quantity, Good Reliability, Low Cost	Low impact	Low impact	Low Impact	None identified	N.A
City of Vernon	Develop Additional Groundwater Supply	Good Quantity, Good Reliability, Low Cost	Low to moderate	Low to moderate impact	Low to moderate impact	None identified	N.A
City of Wichita Falls	Wastewater Reuse Score:	Good Quantity, Good Reliability, Low Cost 10	Low impact 8	Low to moderate impact 7	Low Impact/Moderate to High 9	Public perceptions 4	48
	Construct Lake Ringgold Score:	Good Quantity, Good Reliability, High Costs 6	Moderate impact 5	Decrease flow in Red River 6	Moderate to High impact 4	Permitting and Time Issues 4	31

Score Rating: 1 through 10 with 10 being most favorable rating. Quality, Reliability and Cost weighted by factor of 2.

ATTACHMENT 4-1
STRATEGY EVALUATION MATRIX – REGION B

Water User Group	Strategy Description	Quantity, Reliability, and Cost	Environmental Impacts	Impacts on Water Resources and Other Water Management Strategies	Impacts on Agriculture and Natural Resources	Other Relevant Factors	Overall Rating
Charlie WSC	Nitrate Removal Plant	Adequate Quantity, Good Reliability, Moderate Cost	Low impact	Low Impact	Low Impact	None identified	N.A
Hinds-Wildcat System	Nitrate Removal Plant Score:	Adequate Quantity, Good Reliability, Moderate Cost 9	Low impact 9	Low Impact 9	Low Impact 9	None identified 9	54
	Purchase water from Vernon Score:	Adequate Quantity, Good Reliability, High Costs 7	Low impact 9	Low Impact 9	Low Impact 9	None identified 9	50
Lockett Water System	Nitrate Removal Plant Score:	Concerns of Quantity and Reliability, Low costs 7	Low impact 7	Low Impact 9	Low to moderate impact 8	None identified 9	47
	Purchase water from Vernon Score:	Good Quantity, Good Reliability, High Costs 8	Low impact 8	Low Impact 9	Low Impact 9	None identified 9	51
Wilbarger Co. Manufacturing	Purchase water from Vernon	Good Quantity, Good Reliability, Moderate Cost	Low impact	Low Impact	Low Impact	None identified	N.A
Wilbarger Co. Steam Electric Power	Increase Water Conservation elevation at Lake Kemp Score:	Good Quantity, Good Reliability, Low Cost 10	Low impact 9	Low Impact 9	Low Impact 9	None identified 9	56
	Seasonal conservation pool (April-Oct) Score:	Good Quantity, Good Reliability, Low Cost 10	Low impact 9	Low Impact 9	Low Impact 9	None identified 9	56
	Enclose canal Laterals in pipe Score:	Good Quantity, Good Reliability, Moderate Cost 8	Low impact 9	Low Impact 9	Low Impact 9	None identified 9	52
Archer Co. Irrigation	Increase Water Conservation elevation at Lake Kemp Score:	Good Quantity, Good Reliability, Low Cost 10	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	56
	Seasonal conservation pool (April-Oct) Score:	Good Quantity, Good Reliability, Low Cost 10	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	56

Score Rating: 1 through 10 with 10 being most favorable rating. Quality, Reliability and Cost weighted by factor of 2.

ATTACHMENT 4-1
STRATEGY EVALUATION MATRIX – REGION B

Water User Group	Strategy Description	Quantity, Reliability, and Cost	Environmental Impacts	Impacts on Water Resources and Other Water Management Strategies	Impacts on Agriculture and Natural Resources	Other Relevant Factors	Overall Rating
Clay Co. Irrigation	Increase Water Conservation elevation at Lake Kemp Score:	Good Quantity, Good Reliability, Low Cost 10	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	56
	Seasonal conservation pool (April-Oct) Score:	Good Quantity, Good Reliability, Low Cost 10	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	56
Wichita Co. Irrigation	Increase Water Conservation elevation at Lake Kemp Score:	Good Quantity, Good Reliability, Low Cost 10	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	56
	Seasonal conservation pool (April-Oct) Score:	Good Quantity, Good Reliability, Low Cost 10	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	56
	Enclose canal Laterals in pipe Score:	Good Quantity, Good Reliability, Moderate Cost 8	Low Impact 9	Low Impact 9	Low Impact 9	None identified 9	52
Montague Co. Mining	Purchase water from Local Provider Score:	Good Quality, Good Reliability, High Costs 8	Low Impact 9	Low Impact 9	Low Impact 9	Typically Short-Term use 9	52
	Develop Groundwater Supply Score:	Good Quality, Good Reliability, Low Cost 9	Low Impact 9	Low Impact 9	Low Impact 8	Typically Short-Term use 7	51
Water User Group	Strategy Description	Quantity, Reliability, and Cost	Environmental Impacts	Impacts on Water Resources and Other Water Management Strategies	Impacts on Agriculture and Natural Resources	Other Relevant Factors	Overall Rating
Regional	Construct Chloride Control Project	Good Quantity Moderate Costs	Being evaluated by USACE	Should Improve Water Quality Enhance R.O. Treatment	Should Improve Agriculture Lands	Effects not realized for 20 yr.	N.A

Score Rating: 1 through 10 with 10 being most favorable rating. Quality, Reliability and Cost weighted by factor of 2.

Attachment 4-1
Summary of Environmental Assessment – Region B

Water USER Group	Strategy Description	Environmental Factors							
Water USER Group	**Strategy Description**	**Total Acres Impacted**	**Wetland Acres[1]**	**Environmental Water Needs**	**Habitat**	**Cultural Resources**	**Bays & Estuaries**	**Environmental Water Quality**	**Overall Environmental Impacts**
Name(s)	Name	#	#	(1-10)	(1-10)	(1-10)	(1-10)	(1-10)	(1-10)
Archer Co. (Other)	Purchase Water from Local Provider	5	0	9	9	9	9	9	9
Baylor WSC	Emergency Interconnect w/Millers Creek Res.	5	0	9	9	9	9	9	9
Clay Co. (Other)	Purchase Water from Local Provider	5	0	9	9	9	9	9	9
Montague Co. (Other)	Develop Additional Groundwater Supply	20	0						8
	Purchase Water from Local Provider	5	0	9	9	9	9	9	9
City of Bowie	Develop Groundwater Supply	10	0						8
	Wastewater Reuse	3	0						8
City of Byers	Purchase Additional Water from Dean Dale	0	0	9	9	9	9	9	9
City of Electra	Purchase Water from Wichita Falls	55	0	9	9	9	9	9	9
City of Iowa Park	Purchase Additional Water from Wichita Falls	16	0	9	9	9	9	9	9
Lakeside City	Pruchase Additional Water from Wichita Falls	0	0	9	9	9	9	9	9
City of Vernon	Develop Additional Groundwater Supply	20	0	9	9	9	9	9	8
City of Wichita Falls	Wastewater Reuse	25	0	8	8	9	9	9	8
	Construct Lake Ringgold	17,100	1,150	5	2	6	7	7	5
Charlie WSC	Nitrate Removal Plant	10	0	9	9	9	9	9	9
Hinds-Wildcat Water System	Nitrate Removal Plant	10	0	9	9	9	9	9	9
	Purchase Water from Vernon	6	0	9	9	9	9	9	9
Lockett Water System	Nitrate Removal Plant	10	0	9	9	9	9	9	9
	Purchase Water from Vernon	0	0	9	9	9	9	9	8
Wilbarger Co. Manufacturing	Purchase Water from Vernon	10	0	9	9	9	9	9	9
Wilbarger Co. Steam Electric Power	Increase Water Conservation Elevation at Lake Kemp			8	9	9	9	9	9
	Seasonal Conservation Pool (April-Oct)			8	9	9	9	9	9
	Enclose Canal Laterals in Pipe	0	0	8	9	9	9	9	9
Archer Co. Irrigation	Increase Water Conservation Elevation at Lake Kemp			8	9	9	9	9	9
	Seasonal Conservation Pool (April-Oct)			8	9	9	9	9	9
Clay Co. Irrigation	Increase Water Conservation Elevation at Lake Kemp			8	9	9	9	9	9
	Seasonal Conservation Pool (April-Oct)			8	9	9	9	9	9
Wichita Co. Irrigation	Increase Water Conservation Elevation at Lake Kemp			8	9	9	9	9	9
	Seasonal Conservation Pool (April-Oct)			8	9	9	9	9	9
	Enclose Canal Laterals in Pipe	0	0	8	9	9	9	9	9
Montague Co. Mining	Purchase Water from Local Provider	0	0	8	9	9	9	9	9
	Develop Groundwater Supply	10	0	8	9	9	9	9	9

[1]Based on National Wetlands Inventory digital data for Riverland Cemetery USGS Quad.

Score Rating: 1 through 10 with 10 being most favorable rating. Quality, Reliability and Cost weighted by factor of 2.

ATTACHMENT 4-2

REGIONAL WATER PLANNING GROUP B

DETAILED COST ESTIMATES

ATTACHMENT 4-2
DETAILED COST ESTIMATES

The following cost estimates were prepared in general compliance with SB1 guidelines and capital costs based on the latest cost estimates for similar type work recently completed within Region B. Both capital costs and annual costs are identified for each strategy in addition to the cost of water delivered per acre-foot and cost of water delivered per 1,000 gallons.

Capital costs include all conveyance system construction, pipelines, pump stations, storage tanks, treatment facilities, disinfection facilities, and all required capital improvement expenditures.

Operations and Maintenance costs includes power costs, chemical costs and annual required maintenance expenditures.

All debt service was calculated over 20 years at a six percent interest rate except for the Lake Ringgold and Chloride Control Projects which were calculated over 40 years at a six percent interest rate.

Archer County (other)

Assumption: Purchase water from Local Provider
Need: 187 AF/YR (FIRM) 296 AF/YR (SAFE)

Construction Costs:	
6" Water Line Upgrade	$250,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	75,000
Pipeline Easements	10,000
Interest During Const. (6 months)	7,500
Total Capital Costs:	**$342,500**
Annual Costs:	
Debt Service (20 yrs @ 6%)	30,000
Operation & Maint.	1,500
Water Purchases ($5.00/1,000 Gals)	476,000
Total Annual Costs:	**$507,500**
Available Water (AF/YR)	296
Available Water (MGD)	0.26
Cost of Water Delivered ($/A.F.)	**$1,715**
Cost of Water Delivered ($/1,000 Gals)	**$5.26**

Baylor WSC

Assumption: Emergency Interconnect with Millers Creek Reservoir
Need: Emergency – 250 AF/YR

Construction Costs:	
6" Water Line	$500,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	150,000
Pipeline Easements	10,000
Interest During Const. (4 months)	13,000
Total Capital Costs:	**$673,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	58,000
Operation & Maint.	7,500
Water Purchases ($3.00/1,000 Gals)	244,000
Total Annual Costs:	**$309,500**
Available Water (AF/YR)	250
Available Water (MGD)	0.22
Cost of Water Delivered ($/A.F.)	**$1,238**
Cost of Water Delivered ($/1,000 Gals)	**$3.80**

<u>Clay County (Other)</u>

Assumption: Purchase water from Local Provider
Need: 145 AF/YR (FIRM) 223 AF/YR (SAFE)

Construction Costs:	
6" Water Line Upgrade	$250,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	75,000
Pipeline Easements	10,000
Interest During Const. (6 months)	7,500
Total Capital Costs:	**$342,500**
Annual Costs:	
Debt Service (20 yrs @ 6%)	30,000
Operation & Maint.	1,500
Water Purchases ($4.00/1,000 Gals)	291,000
Total Annual Costs:	**$322,500**
Available Water (AF/YR)	223
Available Water (MGD)	0.20
Cost of Water Delivered ($/A.F.)	**$1,446**
Cost of Water Delivered ($1/1,000 Gals)	**$4.44**

Montague County (Other) – Option 1

Assumption: Develop Additional Groundwater Supply
Need: 206 AF/YR (FIRM) 486 AF/YR (SAFE)

Construction Costs:	
Water Supply Wells (6 EA)	$450,000
6" Transmission Line	300,000
Pump Sta. & Ground Storage	300,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	315,000
Land & Easements	250,000
Interest During Const. (12 Months)	95,000
Total Capital Costs:	**$1,710,000**
Annual Costs:	
Debt Service: (20 YRS @ 6%)	$149,000
Operation & Maint.	$35,000
Pumping Costs	$60,000
Total Annual Costs:	**$244,000**
Available Water (AF/YR)	486
Available Water (MGD)	0.43
Cost of Water Delivered ($/AF)	**$502**
Cost of Water Delivered ($/1000 Gals)	**$1.54**

<u>Montague County (Other) – Option 2</u>

Assumption: Purchase Water from Local Provider
Need: 206 AF (FIRM) 486 AF/YR (SAFE)

Construction Costs:	
6" Transmission Line	$300,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	90,000
Pipeline Easements	10,000
Interest During Const. (6 months)	9,000
Total Capital Costs:	**$409,000**
Annual Costs:	
Debt Services (20 yrs. @ 6%)	$36,000
Operation & Maint.	1,500
Water Purchases ($3.50/1000 Gals)	554,000
Total Annual Costs	**$591,500**
Available Water (AF/YR)	486
Available Water (MGD)	0.43
Annual Cost of Water Delivered ($/AF)	**$1,217**
Annual Cost of Water Delivered ($/1,000 Gals)	**$3.75**

City of Bowie – Option 1

Assumption: Develop Groundwater Supply
Need: 0 (FIRM) 134 (SAFE)

Construction Costs:	
Water Supply Wells (2 EA)	$200,000
6" Transmission Line	300,000
Pump Sta. & Ground Storage	300,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	240,000
Land & Easements	250,000
Interest During Const. (12 Months)	77,000
Total Capital Costs:	**$1,367,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	$119,200
Operation & Maintenance	24,000
Pumping Costs	20,000
Total Annual Costs:	**$163,200**
Available Water (AF/YR)	134
Available Water (MGD)	0.12
Cost of Water Delivered ($/AF)	**$1,218**
Cost of Water Delivered ($/1000 Gals)	**$3.73**

City of Bowie – Option 2

Assumption: Wastewater Reuse
Need: 0 (FIRM) 134 (SAFE)

Construction Costs:	
Treatment Facilities	$250,000
Pump Station	200,000
8" Pipeline	185,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	$200,000
Pipeline Easements	10,000
Interest During Const. (12 Months)	50,000
Total Capital Costs:	**$895,000**
Annual Costs:	
Debt Service (20 yrs. @ 6%)	78,000
Operation & Maintenance	20,000
Pumping Costs	24,000
Total Annual Costs	**$122,000**
Available Water (AF/YR)	134
Available Water (MGD)	0.12
Cost of Water Delivered ($/AF)	**$911**
Cost of Water Delivered ($/1,000 Gals)	**$2.80**

<u>City of Byers</u>

Assumption: Purchase Additional water from Dean Dale WSC
Need: 0 (FIRM) 11 (SAFE)

Construction Costs:	**0**
Other Project Costs:	**0**
Total Capital Costs:	**0**
Annual Costs:	
Debt Service	0
Operation & Maint.	0
Water Purchase ($2.29/1000 Gals)	$8,200
Total Annual Costs:	**$8,200**
Available Water (AF/YR)	11
Available Water (MGD)	.01
Cost of Water Delivered ($/A.F.)	**$746**
Cost of Water Delivered ($/1,000 Gals)	**$2.29**

City of Electra

Assumption: Purchase Water from Wichita Falls
Need: 146 AF/YR (FIRM) 261 AF/YR (SAFE)

Construction Costs:	
Pump Station Facilities	$630,000
16" Water Line	4,830,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	$1,575,000
Pipeline Easements	115,000
Interest During Const.	350,000
Total Capital Costs:	**$7,500,000**
Annual Costs:	
Debt Service (20 YRS @ 6%)	$654,000
Operation & Maint.	20,000
Water Purchases	684,000
Total Annual Costs:	**$1,358,000**
Available Water (AF/YR)	1,680
Available Water (MGD)	1.5
Cost of Water Delivered ($/AF)	**$808**
Cost of Water Delivered ($/1,000 Gals)	**$2.48**

<u>City of Iowa Park</u>

Assumption: Purchase Additional Water from Wichita Falls
Need: 0 (FIRM) 142 AF/YR (SAFE)

Construction Costs:	
16" Water Transmission Line	$1,650,000
Other Costs:	
Engineering, Contingencies and Legal (30%)	495,000
Interest During Construction (6 months)	65,000
Total Capital Costs:	**$2,210,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	$193,000
Operation and Maintenance	30,000
Water Purchases	680,000
Total Annual Costs:	**$903,000**
Available Water (AF/YR)	1680
Available Water (MGD)	1.5
Cost of Water Delivered ($/AF)	**$538**
Cost of Water Delivered ($/1000 Gals)	**$1.65**

City of Lakeside City

Assumption: Purchase Additional Water from Wichita Falls
Need: 0 (FIRM) 12 (SAFE)

Construction Costs:	**0**
Other Project Costs:	**0**
Total Capital Costs:	**0**
Annual Costs:	
Debt Service	0
Operation & Maint.	0
Water Purchase ($1.25/1,000 Gal)	$4,887
Total Annual Costs:	**$4,887**
Available Water (AF/YR)	12
Available Water (MGD)	.01
Cost of Water Delivered ($/AF)	**$407**
Cost of Water Delivered ($/1,000 Gals)	**$1.25**

<u>City of Vernon</u>

Assumption: Develop Additional Groundwater Supply
Need: 0 (FIRM) 423 (SAFE)

Construction Costs:	
Water Supply Wells	$100,000
8" Transmission Line	625,000
Other Projected Costs:	
Engineering, Contingencies & Legal @ 30%	$217,500
Easements	25,000
Land Purchase	330,000
Interest during Construction	58,000
Total Capital Costs	**$1,355,500**
Annual Costs:	
Debt Service (20 yrs @ 6%)	118,200
Operation & Maintenance	25,000
Pumping Costs	25,000
Treatment Costs	35,000
Total Annual Costs	**$203,200**
Available Water (AF/YR)	664
Available Water (MGD)	0.59
Cost of Water Delivered ($/AF)	**$306**
Cost of Water Delivered ($/1,000 Gal)	**$.94**

City of Wichita Falls-Option 1

Assumption: Wastewater Reuse
Need: 0 (FIRM) 2765 (SAFE)

Construction Costs:	
RRWWTP Denitrification Improvements	$6,000,000
Microfiltration Treatment	7,000,000
UV Disinfection	2,000,000
RRWWTP Pump Station	1,500,000
30" Pipeline to Secondary Reservoir (12 miles)	7,000,000
Storage Reservoir at Jasper WTP	1,500,000
10 MGD Pump Station and Water Treatment	9,000,000
Other Project Costs:	
Engineering, Legal, Financial & Contingencies	$11,550,000
Land and Easements	100,000
Environmental Studies, Mitigation & Permitting	400,000
Interest During Construction (18 Months)	2,650,000
Total Capital Project Costs:	**$48,700,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	$4,246,000
Operation and Maintenance	158,000
Power Costs (Pumping Facilities)	125,000
Water Treatment Costs ($0.50/1,000 Gal.)	1,792,000
Total Annual Cost:	**$6,321,000**
Available Water (AF/YR)	11,000
Available Water (MGD)	10
Cost of Water Delivered ($/AF)	**$575**
Cost of Water Delivered ($/1000 Gallons)	**$1.76**

<u>City of Wichita Falls-Option 2</u>

Assumption: Construct Lake Ringgold
Need: 0 (FIRM) 2765 (SAFE)

Construction Costs:	
Ringgold Reservoir (275,000 Acre-Feet Capacity)	$64,746,000
Pumping Facilities (2-24.5 MGD)	6,500,000
54" Raw Water Line to Storage, Reservoir (40 miles)	80,000,000
24.5 MGD Pumping Facility @ Storage Reservoir	3,500,000
24.5 MGD Water Treatment Facility	20,000,000
Other Project Costs:	
Engineering, Legal, Financial, & Contingencies	60,000,000
Land and Easements	15,000,000
Environmental Studies, Mitigation & Permitting	15,000,000
Interest During Construction (5 years)	55,000,000
Total Capital Project Cost	**$319,746,000**
Annual Costs:	
Debt Service (Reservoir 40 yrs. @ 6%)	9,975,000
Debt Service (Pipeline/Pump Sta. 30 yrs. @ 6%)	12,340,500
Operation & Maintenance	3,500,000
Power Cost (Pumping Facilities)	1,000,000
Water Treatment Costs ($0.25/1,000 Gal.)	2,200,000
Total Annual Cost	**$29,015,500**
Available Water (AF/YR)	27,000
Available Water (MGD)	24.5
Cost of Water Delivered ($/AF)	**$1,075**
Cost of Water Delivered ($/1000 Gallons)	**$3.30**

<u>Charlie Water Supply Corporation</u>

Assumption: Construct Nitrate Removal Plant
Need: Water Quality – 10 AF/YR

Construction Costs:	
Nitrate Removal System	$75,000
Building	35,000
Evaporation Pond	2,000
Other Costs:	
Engineering, Contingencies & Legal @ 30%	33,000
Easement and Land	15,000
Interest During Construction	5,000
Total capital Costs:	**$165,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	14,500
Operation and Maintenance	5,000
Pumping Cost	3,000
Total Annual Cost	**$22,500**
Available Water (AF/YR)	10
Available Water (MGD)	0.01
Cost of Water Delivered ($/AF)	**$2,250**
Cost of Water Delivered ($/1000 Gals)	**$6.90**

Hinds-Wildcat System – Option 1

Assumption: Construct Nitrate Removal Plant
Need: Water Quality – 40 AF/YR

Construction Cost:	
Ion-Exchange Equipment	$150,000
Building/Electrical	100,000
Evaporation Pond	30,000
Other Project Costs:	
Engineering, Contingencies and Legal @ 30%	84,000
Land Purchase	10,000
Permitting	15,000
Interest During Construction (12 months)	23,000
Total Capital Cost:	**$412,000**
Annual Costs:	
Debt Service (20 yrs. @ 6%)	$36,000
Operation and Maintenance	8,000
Treatment Cost	5,000
Total Annual Costs:	**$49,000**
Available Water (AF/YR)	40
Available Water (MGD)	.03
Cost of Water Delivered ($/AF)	**1,225**
Cost of Water Delivered ($/1,000 Gals)	**$3.76**

Hinds-Wildcat System – Option 2

Assumption: Purchase Water From Vernon
Need: Water Quality – 40 AF/YR

Construction Costs:	
6" Pipeline	$238,000
ROW Costs	24,000
Pump Station	250,000
Road Crossings	9,000
Railroad Crossings	18,000
River Crossings	18,000
Metering Vaults	16,000
Other Project Costs:	
Engineering, Contingencies, & Legal @ 30%	50,000
Mitigation & Permitting	13,000
Interest during construction (6 months)	19,000
Total Capital Costs	**$655,000**
Annual Costs:	
Debt Service (20 years @ 6%)	57,000
Operation and Maintenance	4,000
Pumping Costs	5,000
Water Purchase Costs ($2.14/1000 Gals)	28,000
Total Annual Costs	**$94,000**
Available Water (AF/YR)	40
Available Water (MGD)	0.03
Cost of Water Delivered ($/AF)	**$2,350**
Cost of Water Delivered ($/1000 Gals)	**$7.21**

Lockett Water System – Option 1

Assumption: Construct Nitrate Removal Plant
Need: Water Quality – 109 AF/YR

Construction Costs:	
Ion-Exchange Equipment	$150,000
Building/Electrical	100,000
Evaporation Pond	30,000
Other Project Costs:	
Engineering, Contingencies and Legal @ 30%	84,000
Land Purchase	10,000
Permitting	15,000
Interest During Construction (12 Months)	23,000
Total Capital Costs:	**$412,000**
Annual Costs:	
Debt Service (20 yrs. @ 6%)	$36,000
Operation and Maintenance	8,000
Treatment Cost	5,000
Total Annual Costs:	**$49,000**
Available Water (AF/YR)	109
Available Water (MGD)	0.10
Cost of Water Delivered ($/AF)	**$450**
Cost of Water Delivered ($/1,000 Gals)	**$1.38**

Lockett Water System – Option 2

Assumption: Purchase Water from Vernon
Need: Water Quality – 109 AF/YR

Construction Costs:	
6" Pipeline	$827,000
ROW Costs	84,000
Pump Station	100,000
Highway Crossings	54,000
Metering Vaults	16,000
Subtotal Construction Costs	1,081,000
Other Project Costs:	
Engineering, Contingencies and Legal @ 30%	$108,000
Mitigation & Permitting	32,000
Interest During Construction (12 months)	51,000
Total Capital Project Costs:	**$1,272,000**
Annual Costs	
Debt Service (20 years @ 6%)	$111,000
Operation and Maintenance	13,000
Pumping Costs	3,000
Water Purchase Costs	75,000
Total Annual Costs:	**$202,000**
Available Water (AF/YR)	109
Available Water (MGD)	0.10
Cost of Water Delivered ($/AF)	**$1,853**
Cost of Water Delivered ($/1,000 Gals)	**$5.68**

Wilbarger Manufacturing

Assumption: Purchase Water from Vernon
Need: 0 (FIRM) 241 (SAFE)

Construction Costs:	
6" Water Line Upgrade	$132,000
Other Project Costs:	
Engineering, Contingencies and Legal @ 30%	40,000
Easements	5,000
Interest during Construction (3 months)	3,000
Total Capital Costs:	**$180,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	$15,700
Operation and Maintenance	1,000
Purchase Water ($2.14/1,000 Gals)	168,000
Total Annual Costs:	**$184,700**
Available Water (AF/YR)	241
Available Water (MGD)	0.22
Cost of Water Delivered ($/AF)	**$766**
Cost of Water Delivered ($/1,000 Gals)	**$2.35**

Lake Kemp Improvements

Assumption: Increase Conservation Level and Provide Seasonal Pool
Need: 21,950 AF/YR

Construction Costs:	0
Other Project Costs:	
Engineering, Contingencies and Legal	$100,000
Total Capital Costs:	**$100,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	$8,700
Total Annual Costs:	**$8,700**
Available Water (AF/YR)	21,950
Available Water (MGD)	19.6
Cost of Water Delivered ($/AF)	**$0.40**
Cost of Water Delivered ($/1,000 Gals)	**$0.01**

Irrigation Canal Improvements

Assumption: Enclose Laterals in 30" Pipe
Need: 14,607 AF/YR

Construction Costs:	
Install 30" Pipe in Laterals	40,000,000
Other Project Costs:	
Engineering, Contingencies and Legal @ 30%	12,000,000
Interest during Construction (2 years)	6,500,000
Total Capital Costs:	**$58,500,000**
Annual Costs:	
Debt Service (20 yrs @ 6%)	$5,100,000
Operation and Maintenance	600,000
Total Annual Costs:	**5,700,000**
Available Water (AF/YR)	14,607
Available Water (MGD)	13
Cost of Water Delivered ($/AF)	**$390**
Cost of Water Delivered ($/1,000 Gals)	**$1.20**

Montague County Mining – Option 1

Assumption: Develop Additional Groundwater Supply
Need: 113 AF/YR (FIRM)

Construction Costs:	
Water Supply Well	$75,000
6" Transmission Line	300,000
Other Project Costs:	
Engineering, Contingencies, & Legal @ 30%	112,500
Land & Easements	50,000
Interest During Const. (6 months)	16,000
Total Capital Costs:	**$553,500**
Annual Costs:	
Debt Service (20 yrs @ 6%)	$48,300
Operation & Maint.	$10,000
Pumping Costs	$4,000
Total Annual Costs:	**$62,300**
Available Water (AF/YR)	113
Available Water (MGD)	0.10
Cost of Water Delivered ($/AF)	**$551**
Cost of Water Delivered ($/1,000 Gals)	**$1.69**

<u>Montague County Mining – Option 2</u>

Assumption: Purchase Water from Local Provider
Need: 113 AF (FIRM)

Construction Costs:	
6" Transmission Line	$300,000
Other Project Costs:	
Engineering, Contingencies & Legal @ 30%	90,000
Pipeline Easements	10,000
Interest During Const. (6 months)	9,000
Total Capital Costs:	**$409,000**
Annual Costs:	
Debt Services (20 yrs. @ 6%)	$36,000
Operation & Maint.	$1,500
Water Purchases ($3.50/1,000 Gals)	$128,900
Total Annual Costs:	**$166,400**
Available Water (AF/YR)	113
Available Water (MGD)	0.10
Annual Cost of Water Delivered ($/AF)	**$1,473**
Annual Cost of Water Delivered ($/1,000 Gals)	**$4.52**

Regional Water Strategy

Assumption: Construct Chloride Control Project
Need: 26,500 AF/YR

Construction Costs:	
Raise Truscott Brine Reservoir Dam	$21,763,000
Construct North Fork Wichita River Dam	19,900,000
Construct Pipeline from Middle Fork Wichita River to Truscott Brine Reservoir (14 miles)	3,721,000
Replace Pipeline from South Fork Wichita River to Truscott Brine Reservoir (22 miles)	8,986,000
Other Project Costs:	
Engineering, Contingencies and Legal	16,311,000
Land and Easements	432,000
Environmental Studies, Mitigation, Permitting	200,000
Interest During Construction (24 months)	6,187,000
Total Capital Project Costs	**$77,500,000**
Annual Costs:	
Debt Service (40 years @ 6%)	$5,154,000
Operation and Maintenance	675,000
Power Costs	160,000
Total Annual Costs	**$5,989,000**
Available Water (AF/YR)	26,500
Available Water (MGD)	23.7
Cost of Water Delivered ($/AF)	**$226**
Cost of Water Delivered ($/1,000 gals)	**$0.69**

ATTACHMENT 4-3

REGIONAL WATER PLANNING GROUP B

SOCIOECONOMIC IMPACTS OF UNMET WATER NEEDS

Socioeconomic Impacts of Unmet Water Needs in the Region B Water Planning Area

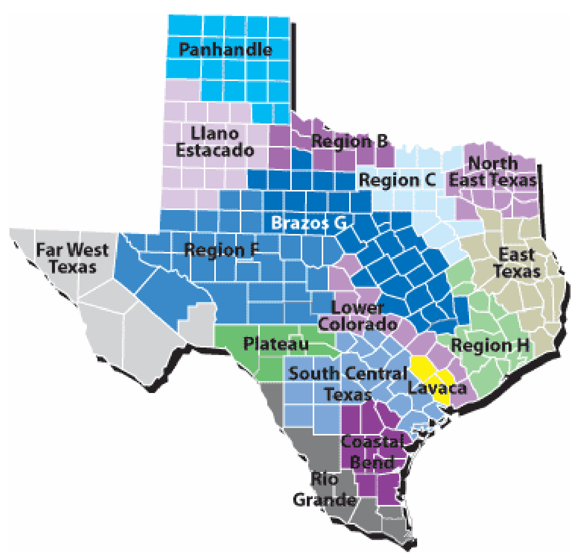
Prepared by:

Stuart Norvell and Kevin Kluge of The Texas Water Development Board's Office of Water Resources Planning

Prepared in support of the:

Region B Regional Water Planning Group and the 2006 Texas State Water Plan

April 2005



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Executive Summary

Background

Water shortages due to severe drought combined with infrastructure limitations would likely curtail or eliminate economic activity in business and industries heavily reliant on water. For example, without water farmers cannot irrigate; refineries cannot produce gasoline and paper mills cannot make paper. Unreliable water supplies would not only have an immediate and real impact on business and industry, but they might also bias corporate decision makers against plant expansion or plant location in Texas. From a societal perspective, water supply reliability is critical as well. Shortages would disrupt activity in homes, schools and government and could adversely affect public health and safety. For all of the above reasons, it is important to analyze and understand how restricted water supplies during drought could affect communities throughout the state.

Section 357.7(4) of the rules for implementing Texas Senate Bill 1 requires regional water planning groups to evaluate the social and economic impacts of projected water shortages (i.e., “unmet water needs”) as part of the planning process. The rules contain provisions that direct the Texas Water Development Board (TWDB) to provide technical assistance to complete socioeconomic impact assessments. In response to requests from regional planning groups, staff of the TWDB’s Office of Water Resources Planning designed and conducted analyses to evaluate socioeconomic impacts of unmet water needs.

Overview of Methodology

Two components make up the overall approach to this study: 1) an economic impact module and 2) a social impact module. Economic analysis addresses potential impacts of unmet water needs including effects on residential water consumers and losses to regional economies stemming from reductions in economic output for agricultural, industrial and commercial water uses. Impacts to agriculture, industry and commercial enterprises were estimated using regional “input-output” models commonly used by researchers to estimate how reductions in business activity might affect a given economy. Details regarding the methodology and assumptions for individual water use categories (i.e., municipal consumers including residential and commercial water users, manufacturing, steam-electric, mining, and agriculture) are in the main body of the report (see Section 2).

The social component focuses on demographic effects including changes in population and school enrollment. Methods are based on population projection models developed by the TWDB for regional and state water planning. With the assistance of the Texas State Data Center, TWDB staff modified these models and applied them for use here. Basically, the social impact module incorporates results from the economic impact module and assesses how changes in a region’s economy due to water shortages could affect patterns of migration in a region.

Several clarifications regarding this study are warranted. For one, estimated impacts are *independent* and distinct “what if” scenarios for a given point in time (i.e., 2010, 2020, 2030, 2040, 2050 and 2060). Reported figures are scenarios that illustrate what could happen in a given year if: 1) water supply infrastructure and/or water management strategies do not change through time, 2) the drought of record recurs.

Given, that reported figures are not cumulative in nature, it is incorrect to sum impacts over the entire planning horizon. Doing so would imply that the analysis predicts that drought of record conditions will occur every ten years in the future, which is not the case. Similarly, authors of this report recognize that in many communities needs are driven by population growth, and in the future total population will exceed the amount of water available due to infrastructure limitations *regardless of whether or not there is a drought*. This implies that infrastructure limitations would constrain economic growth. Conversely, in cases such as the Texas Panhandle communities face shortages due to declining aquifer levels. However, since needs as defined by planning rules are based upon water supply and demand under the assumption of drought of record conditions, it is not possible to conduct economic analysis that focuses on growth related impacts over the planning horizon. Estimating lost economic activity related to constraints on population and commercial growth would require developing water supply and demand forecasts under "average" or "most likely" future climatic conditions.

In addition, although useful for planning purposes, this study is not a benefit-cost analysis. Benefit-cost analysis (BCA) is a tool widely used to evaluate the economic feasibility of specific policies or projects designed to mitigate water shortages as opposed to estimating the economic impacts of unmet water needs. One could include monetary impacts measured here as part of a BCA. However, since this is not a BCA, future impacts are not weighted differently in this report. In other words, estimates are not "discounted." If used as a measure of benefits in a BCA, one should consider the uncertainty of future monetary impacts. All monetary figures are reported in constant year 2000 dollars. Other clarifications, limitations and assumptions can be found in the main body of the report (see Section 1.4).

Summary of Results

Table E-1 and Figure E-1 summarize estimated economic impacts. Variables shown include:[1]

- **sales** - economic output measured by sales revenue;
- **jobs** - number of full and part-time jobs required by a given industry including self-employment;
- **regional income** - total payroll costs (wages and salaries plus benefits) paid by industries, corporate income, rental income and interest payments for the region; and
- **business taxes** - sales, excise, fees, licenses and other taxes paid during normal operation of an industry (does not include any type of income tax).

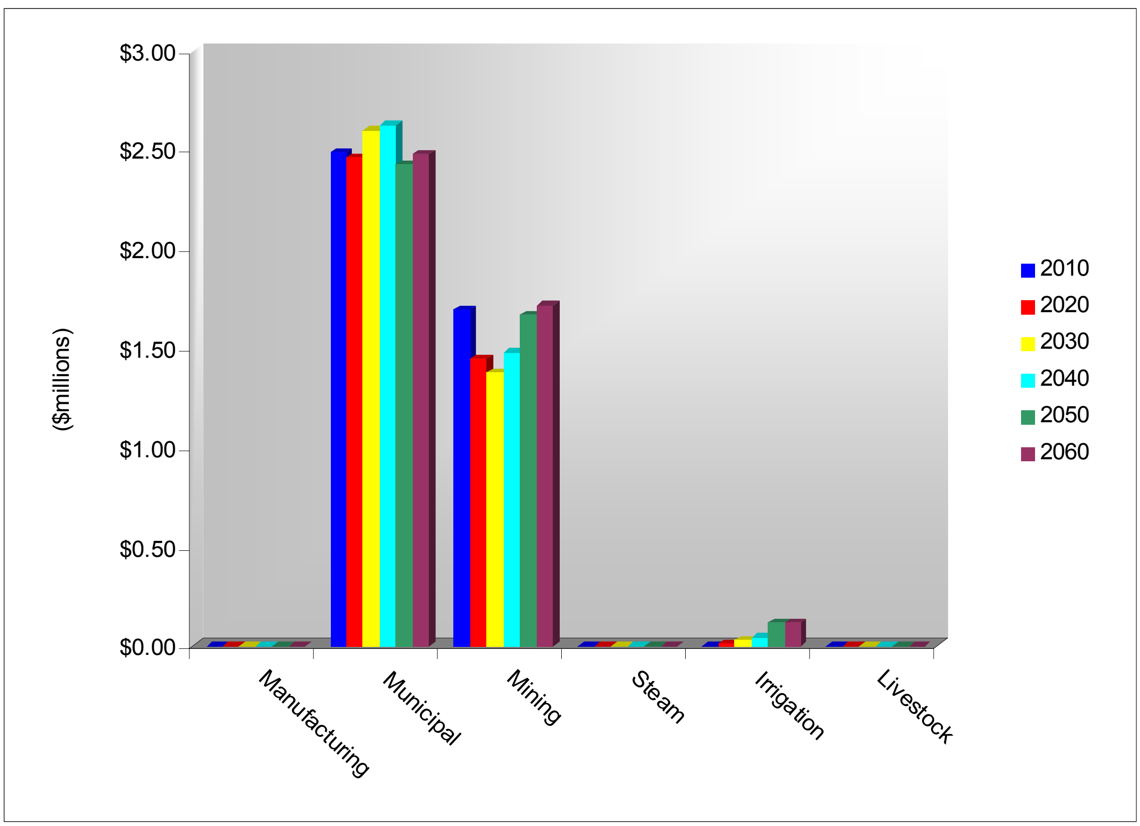
If drought of records conditions return and water supplies are not developed, study results indicate that Region B would suffer significant losses. If such conditions occurred 2010 lost income to residents in the region could total $4.18 million and 52 jobs would be lost. State and local governments could lose roughly$0.24 million in tax receipts. If such conditions occurred in 2060, models show income losses of $4.35 million and job losses of 64. Nearly $0.25 million worth of state and local taxes would be lost. Reported figures are probably conservative because they are based on estimated costs for a single year; but in much of Texas, the drought of record lasted several years. For example, in 2030 models indicate that shortages would cost residents and businesses in Region B about $4.00 million in lost income. Thus, if shortages lasted for three years total losses related could easily exceed $12.00 million.

Given that unmet needs relative to total water demand are small, social impact models do not show significant changes in population or school enrollment in any year.

[1] Total sales are not a good measure of economic prosperity because they include sales to other industries for further processing. For example, a farmer sells rice to a rice mill, which the rice mill processes and sells it to another consumer. Both transactions are counted in an input-output model. Thus, total sales "double count." Regional income plus business taxes are more suitable because they are a better measure of net economic returns.

Table E-1: Annual Economic Impacts of Unmet Water Needs (years, 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)				
Year	Sales ($millions)	Income ($millions)	Jobs	State and Local Taxes ($millions)
2010	$6.95	$4.18	52	$0.24
2020	$6.32	$3.92	49	$0.20
2030	$6.47	$4.00	52	$0.20
2040	$6.73	$4.14	54	$0.21
2050	$7.16	$4.21	60	$0.24
2060	$7.49	$4.35	64	$0.25
Source: Texas Water Development Board, Office of Water Resources Planning				

Figure E-1: Distribution of Lost Income by Water Use Category
(years, 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)



Source: Analysis of the Texas Water Development Boards, Office of Water Resource Planning

Introduction

Texas is one the nation's fastest growing states. From 1950 to 2000, population in the state grew from about 8 million to nearly 21 million. By the year 2050, the total number of people living in Texas is expected to reach 40 million. Rapid growth combined with Texas' susceptibility to severe drought makes water supply a crucial issue. If water infrastructure and water management strategies are not improved, Texas could face serious social, economic and environmental consequences - not only in our large metropolitan cities, but also on our farms and rural areas.

Water shortages due to severe drought combined with infrastructure limitations would likely curtail or eliminate economic activity in business and industries heavily reliant on water. For example, without water farmers cannot irrigate; refineries cannot produce gasoline and paper mills cannot make paper. Unreliable water supplies would not only have an immediate and real impact on business and industry, but they might also bias corporate decision makers against plant expansion or plant location in Texas. From a societal perspective, water supply reliability is critical as well. Shortages would disrupt activity in homes, schools and government and could adversely affect public health and safety. For all of the above reasons, it is important to analyze and understand how restricted water supplies during drought could affect communities throughout the state.

Section 357.7(4) of the rules for implementing Texas Senate Bill 1 requires regional water planning groups to evaluate the social and economic impacts of unmet water needs as part of the planning process. The rules contain provisions that direct the Texas Water Development Board (TWDB) to provide technical assistance to complete socioeconomic impact analyses. In response to requests from regional planning groups, TWDB staff designed and conducted required studies. The following document prepared by the TWDB's Office of Water Resources Planning summarizes analysis and results for the Region B Water Planning Area. Section 1 provides an overview of concepts and methodologies used in the study. Sections 2 and 3 provide detailed information and analyses for each water use category employed in the planning process (i.e., irrigation, livestock, municipal, manufacturing, mining and steam-electric).

1. Overview of Terms and Methodology

Section 1 provides a general overview of how economic and social impacts were measured. In addition, it summarizes important clarifications, assumptions and limitations of the study.

1.2 Measuring Economic Impacts

Economic analysis as it relates to water resources planning generally falls into two broad areas. Supply side analysis focuses on costs and alternatives of developing new water supplies or implementing programs that provide additional water from current supplies. Demand side analysis concentrates on impacts and benefits of providing water to people, businesses and the environment. Analysis in this report focuses strictly on demand side impacts. Specifically, it addresses the potential economic impacts of unmet water needs including: 1) losses to regional economies stemming from reductions in economic output, and 2) costs to residential water consumers associated with implementing emergency water procurement and conservation programs.

1.2.1 Impacts to Agriculture, Business and Industry

As mentioned earlier, severe water shortages would likely affect the ability of business and industry to operate resulting in lost output, which would adversely affect the regional economy. A variety tools are available to estimate such impacts, but by far, the most widely used today are input-output models (IO models) combined with social accounting matrices (SAMs). Referred to as IO/SAM models, these tools formed the basis for estimating economic impacts for agriculture (irrigation and livestock water uses) and industry (manufacturing, mining, steam-electric and commercial business activity for municipal water uses).

Basically, an IO/SAM model is an accounting framework that traces spending and consumption between different economic sectors including businesses, households, government and "foreign" economies in the form of exports and imports. As an example, Table 1 shows a highly aggregated segment of an IO/SAM model that focuses on key agricultural sectors in a local economy. The table contains transactions data for three agricultural sectors (cattle ranchers, dairies and alfalfa farms). Rows in Table 1 reflect sales from each sector to other local industries and institutions including households, government and consumers outside of the region in the form of exports. Columns in the table show purchases by each sector in the same fashion. For instance, the dairy industry buys $11.62 million worth of goods and services needed to produce milk. Local alfalfa farmers provide $2.11 million worth of hay and local households provide about $1.03 million worth of labor. Dairies import $4.17 million worth of inputs and pay $2.37 million in taxes and profits. Total economic activity in the region amounts to about $807.45 million. The entire table is like an accounting balance sheet where total sales equal total purchases.

Table 1: Example of a County-level Transaction and Social Accounting Matrix for Agricultural Sectors ($millions)

Sectors	Cattle	Dairy	Alfalfa	All other Industries	Taxes, govt. & profits	Households	Exports	Total
Cattle	$3.10	$0.01	$0.00	$0.03	$0.02	$0.06	$10.76	$13.98
Dairy	$0.07	$0.13	$0.00	$0.25	$0.01	$0.00	$11.14	$11.60
Alfalfa	$0.00	$2.11	$0.00	$0.01	$0.02	$0.01	$10.38	$12.53
Other industries	$2.20	$1.56	$2.90	$50.02	$70.64	$66.03	$48.48	$241.83
Taxes, govt. & profits	$2.37	$2.61	$5.10	$77.42	$0.23	$49.43	$83.29	$220.45
Households	$0.82	$1.03	$1.38	$50.94	$45.36	$7.13	$14.64	$121.30
Imports	$5.41	$4.17	$3.16	$63.32	$104.17	$5.53	$0.00	$185.76
Total	$13.97	$11.62	$12.54	$241.99	$220.45	$128.19	$178.69	$807.45

* Columns contain purchases and rows represent sales. Source: Adapted from Harris, T.R., Narayanan, R., Englin, J.E., MacDiarmid, T.R., Stoddard, S.W. and Reid, M.E. "*Economic Linkages of Churchill County*." University of Nevada Reno. May 1993.

To understand how an IO/SAM model works, first visualize that $1 of additional sales of milk is injected into the dairy industry in Table 1. For every $1 the dairies receive in revenue, they spend 18 cents on alfalfa to feed their cows; nine cents is paid to households who provide farm labor, and another 13 cents goes to the category "other industries" to buy items such as machinery, fuel, transportation, accounting services etc. Nearly 22 cents is paid out in the form of profits (i.e., returns to dairy owners) and taxes/fees to local, state and federal government. The value of the initial $1 of revenue in the dairy sector is referred to as a first-round or **direct effect.**

As the name implies, first-round or direct effects are only part of the story. In the example above, alfalfa farmers must make 18 cents worth of hay to supply the increased demand for their product. To do so, they purchase their own inputs, and thus, they spend part of the original 18 cents that they received from the dairies on firms that support their own operations. For example, 12 cents is spent on fertilizers and other chemicals needed to grow alfalfa. The fertilizer industry in turn would take these 12 cents and spend them on inputs in its production process and so on. The sum of all re-spending is referred to as the **indirect effect** of an initial increase in output in the dairy sector.

While direct and indirect impacts capture how industries respond to a change, **induced impacts** measure the behavior of the labor force. As demand for production increases, employees in base industries and supporting industries will have to work more; or alternatively, businesses will have to hire more people. As employment increases, household spending rises. Thus, seemingly unrelated businesses such as video stores, supermarkets and car dealers also feel the effects of an initial change.

Collectively, indirect and induced effects are referred to as **secondary impacts**. In their entirety, all of the above changes (direct and secondary) are referred to as **total economic impacts**. By nature, total impacts are greater than initial changes because of secondary effects. The magnitude of the increase is what is popularly termed a multiplier effect. Input-output models generate numerical multipliers that estimate indirect and induced effects.

In an IO/SAM model impacts stem from changes in output measured by sales revenue that in turn come from changes in consumer demand. In the case of water shortages, one is not assuming a change in demand, but rather a supply shock – in this case severe drought. Demand for a product such as corn has not necessarily changed during a drought. However, farmers in question lack a crucial input (i.e., irrigation water) for which there is no *short-term* substitute. Without irrigation, she cannot grow irrigated crops. As a result, her cash flows decline or cease all together depending upon the severity of the situation. As cash flows dwindle, the farmer's income falls, and she has to reduce expenditures on farm inputs such as labor. Lower revenues not only affect her operation and her employees directly, but they also indirectly affect businesses who sell her inputs such as fuel, chemicals, seeds, consultant services, fertilizer etc.

The methodology used to estimate regional economic impacts consists of three steps: 1) develop IO/SAM models for each county in the region and for the region as whole, 2) estimate direct impacts to economic sectors resulting from water shortages, and 3) calculate total economic impacts (i.e., direct plus secondary effects).

Step 1*: Generate IO/SAM Models and Develop Economic Baseline*

IO/SAM models were estimated using propriety software known as IMPLAN PRO™ (Impact for Planning Analysis). IMPLAN is a modeling system originally developed by the U.S. Forestry Service in the late 1970s. Today, the Minnesota IMPLAN Group (MIG Inc.) owns the copyright and distributes data and software. It is probably the most widely used economic impact model in existence. IMPLAN comes with databases containing the most recently available economic data from a variety of sources.[2] Using IMPLAN software and data, transaction tables

[2]The basic IMPLAN database consists of national level technology matrices based on the Benchmark Input-Output Accounts generated the U.S. Bureau of Economic Analysis and estimates of final demand, final payments, industry output and employment for various economic sectors. IMPLAN's regional data (i.e. states, a counties or groups of counties within a state) are divided into two basic categories: 1) data on an industry basis including value-added, output and employment and 2) data on a commodity basis including final demands and institutional sales. State-level data are balanced to the national totals using a matrix ratio allocation system and county data are balanced to state totals. In other words, much of the data in IMPLAN is based on a national average for all industries.

conceptually similar to the one discussed previously (see Table 1 on page 9) were estimated for each county in the region and for the region as a whole. Each transaction table contains 528 economic sectors and allows one to estimate a variety of economic statistics including:

- **total sales -** total production measured by sales revenues;
- **intermediate sales -** sales to other businesses and industry within a given region;
- **final sales** – sales to end users in a region and exports out of a region;
- **employment -** number of full and part-time jobs (annual average) required by a given industry including self-employment;
- **regional income -** total payroll costs (wages and salaries plus benefits) paid by industries, corporate income, rental income and interest payments; and
- **business taxes -** sales, excise, fees, licenses and other taxes paid during normal operation of an industry (does not include income taxes).

TWDB analysts developed an economic baseline containing each of the above variables using year 2000 data. Since the planning horizon extends through 2060, economic variables in the baseline were allowed to change in accordance with projected changes in demographic and economic activity. Growth rates for municipal water use sectors (i.e., commercial, residential and institutional) are based on TWDB population forecasts. Projections for manufacturing, agriculture, and mining and steam-electric activity are based on the same underlying economic forecasts used to estimate future water use for each category. Monetary impacts in future years are reported in year 2000 dollars.

It is important to stress that employment, income and business taxes are the most useful variables when comparing the relative contribution of an economic sector to a regional economy. Total sales as reported in IO/SAM models are less desirable and can be misleading because they include sales to other industries in the region for use in the production of other goods. For example, if a mill buys grain from local farmers and uses it to produce feed, sales of both the processed feed and raw corn are counted as "output" in an IO model. Thus, total sales double-count or overstate the true economic value of goods and services produced in an economy. They are not consistent with commonly used measures of output such as Gross National Product (GNP), which counts only final sales.

Another important distinction relates to terminology. Throughout this report, the term *sector* refers to economic subdivisions used in the IMPLAN database and resultant input-output models (528 individual sectors based on Standard Industrial Classification Codes). In contrast, the phrase *water use category* refers to water user groups employed in state and regional water planning including irrigation, livestock, mining, municipal, manufacturing and steam electric. All sectors in the IMPLAN database were assigned to a specific water use category (see Attachment A of this report).

Step 2: *Estimate Direct Economic Impacts of Water Shortages*

As mentioned above, direct impacts accrue to immediate businesses and industries that rely on water. Without water industrial processes could suffer. However, output responses would likely vary depending upon the severity of a shortage. A small shortage relative to total water use may have a nominal effect, but as shortages became more critical, effects on productive capacity would increase.

For example, farmers facing small shortages might fallow marginally productive acreage to save water for more valuable crops. Livestock producers might employ emergency culling strategies, or they may consider hauling water by truck to fill stock tanks. In the case of manufacturing, a good example occurred in the summer of 1999 when Toyota Motor Manufacturing experienced water shortages at a facility near Georgetown, Kentucky. As water levels in the Kentucky River fell to historic lows due to drought, plant managers sought ways to curtail water use such as reducing rinse operations to a bare minimum and recycling water by funneling it from paint shops to boilers. They even considered trucking in water at a cost of 10 times what they were paying. Fortunately, rains at the end of the summer restored river levels, and Toyota managed to implement cutbacks without affecting production. But it was a close call. If rains had not replenished the river, shortages could have severely reduced output.[3]

Note that the efforts described above are not planned programmatic or long-term operational changes. They are emergency measures that individuals might pursue to alleviate what they consider a temporary condition. Thus, they are not characteristic of long-term management strategies designed to ensure more dependable water supplies such as capital investments in conservation technology or development of new water supplies.

To account for uncertainty regarding the relative magnitude of impacts to farm and business operations, the following analysis employs the concept of elasticity. Elasticity is a number that shows how a change in one variable will affect another. In this case, it measures the relationship between a percentage reduction in water availability and a percentage reduction in output. For example, an elasticity of 1.0 indicates that a 1.0 percent reduction in water availability would result in a 1.0 percent reduction in economic output. An elasticity of 0.50 would indicate that for every 1.0 percent of unavailable water, output is reduced by 0.50 percent and so on. Output elasticities used in this study are:[4]

- if unmet water needs are 0 to 5 percent of total water demand, no corresponding reduction in output is assumed;

- if water shortages are 5 to 30 percent of total water demand, for every 1.0 one percent of unmet need, there is a corresponding 0.25 percent reduction in output;

- if water shortages are 30 to 50 percent of total water demand, for every 1.0 one percent of unmet need, there is a corresponding 0.50 percent reduction in output; and

- if water shortages are greater than 50 percent of total water demand, for every 1.0 one percent of unmet need, there is a corresponding 1.0 percent (i.e., a proportional reduction).

Once output responses to water shortages were estimated, direct impacts to total sales, employment, regional income and business taxes were derived using regional level economic multipliers estimating using IO/SAM models. When calculating direct effects for the municipal, steam electric, manufacturing and livestock water use categories, sales to final demand were applied to avoid double counting impacts. The formula for a given IMPLAN sector is:

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[3] See, Royal, W. "*High And Dry - Industrial Centers Face Water Shortages*." in Industry Week, Sept, 2000.

[4] Elasticities are based on one of the few empirical studies that analyze potential relationships between economic output and water shortages in the United States. The study, conducted in California, showed that a significant number of industries would suffer reduced output during water shortages. Using a survey based approach researchers posed two scenarios to different industries. In the first scenario, they asked how a 15 percent cutback in water supply lasting one year would affect operations. In the second scenario, they asked how a 30 percent reduction lasting one year would affect plant operations. In the case of a 15 percent shortage, reported output elasticities ranged from 0.00 to 0.76 with an average value of 0.25. For a 30 percent shortage, elasticities ranged from 0.00 to 1.39 with average of 0.47. For further information, see, California Urban Water Agencies, "*Cost of Industrial Water Shortages*." Prepared by Spectrum Economics, Inc. November, 1991.

$D_{i,t} = Q_{i,t} *_{,} S_{i,t} * E_Q * RFD_i * DM_{i(Q,\, L,\, I,\, T\,)}$

where:

$D_{i,t}$ = direct economic impact to sector *i* in period *t*

$Q_{i,t}$ = total sales for sector *i* in period *t* in an affected county

$RFD_{i,}$ = ratio of final demand to total sales for sector *i* for a given region

$S_{i,t}$ = water shortage as percentage of total water use in period *t*

E_Q = elasticity of output and water use

$DM_{i(L,\, I,\, T\,)}$ = direct output multiplier coefficients for labor (L), income (I) and taxes (T) for sector *i*.

Direct impacts to irrigation and mining are based upon the same formula; however, total sales as opposed to final sales were used. To avoid double counting, secondary impacts in sectors other than irrigation and mining (e.g., manufacturing) were reduced by an amount equal to or less than direct losses to irrigation and mining. In addition, in some instances closely linked sectors were moved from one water use category to another. For example, although meat packers and rice mills are technically manufacturers, in some regions they were reclassified as either livestock or irrigation. All direct effects were estimated at the county level and then summed to arrive at a regional figure. See Section 2 of this report for additional discussion regarding methodology and caveats used when estimating direct impacts for each water use category.

Step 3: *Estimate Secondary and Total Economic Impacts of Water Shortages*

As noted earlier, the effects of reduced output would extend well beyond sectors directly affected. Secondary impacts were derived using the same formula used to estimate direct impacts; however, regional level *indirect* and *induced* multiplier coefficients were applied and only final sales were multiplied.

1.2.2 Impacts Associated with Domestic Water Uses

IO/SAM models are not well suited for measuring impacts of shortages for domestic uses, which make up the majority of the municipal category.[5] To estimate impacts associated with domestic uses, municipal water demand and thus needs were subdivided into two categories – residential and commercial. Residential water is considered "domestic" and includes water that people use in their homes for things such as cooking, bathing, drinking and removing household waste and for outdoor purposes including lawn watering, car-washing and swimming pools. Shortages to residential uses were valued using a tiered approach. In other words, the more severe the shortage, the more costly it becomes. For instance, a 2 acre-foot shortage for a group of households that use 10 acre-feet per year would not be as severe as a shortage that amounted to 8 acre-feet. In the case of a 2 acre-foot shortage, households would probably have to eliminate some or all outdoor water use, which could have implicit and explicit economic costs including losses to the horticultural and landscaping industry. In the case of an 8 acre-foot shortage, people would have to forgo all outdoor water use and most indoor water consumption. Economic costs would be much higher in this case because people could probably not live with such a reduction,

[5] A notable exception is the potential impacts to the nursery and landscaping industry that could arise due to reductions in outdoor residential uses and impacts to "water intensive" commercial businesses (see Section 2.3.3).

and would be forced to find emergency alternatives. The alternative assumed in this study is a very uneconomical and worst-case scenario (i.e., hauling water in from other communities by truck or rail). Section 2.3.3 of this report discusses methodology for municipal uses in greater detail.

1.3 Measuring Social Impacts

As the name implies, the effects of water shortages can be social or economic. Distinctions between the two are both semantic and analytical in nature – more so analytic in the sense that social impacts are much harder to measure in quantitative terms. Nevertheless, social effects associated with drought and water shortages usually have close ties to economic impacts. For example, they might include:

- demographic effects such as changes in population,
- disruptions in institutional settings including activity in schools and government,
- conflicts between water users such as farmers and urban consumers,
- health-related low-flow problems (e.g., cross-connection contamination, diminished sewage flows, increased pollutant concentrations),
- mental and physical stress (e.g., anxiety, depression, domestic violence),
- public safety issues from forest and range fires and reduced fire fighting capability,
- increased disease caused by wildlife concentrations,
- loss of aesthetic and property values, and
- reduced recreational opportunities.[6]

Social impacts measured in this study focus strictly on demographic effects including changes in population and school enrollment. Methods are based on models used by the TWDB for state water planning and by the U.S. Census Bureau for national level population projections. With the assistance of the Texas State Data Center (TSDC), TWDB staff modified population projection models used for state water planning and applied them here. Basically, the social impact model incorporates results from the economic component of the study and assesses how changes in labor demand due to unmet water needs could affect migration patterns in a region. Before discussing particulars of the approach model, some background information regarding population projection models is useful in understanding the overall approach.

1.3.1 Overview of Demographic Projection Models

More often than not, population projections are reported as a single number that represents the size of an overall population. While useful in many cases, a single number says nothing about the composition of projected populations, which is critical to public officials who must make decisions regarding future spending on public services. For example, will a population in the future have more elderly people relative to today, or will it have more children? More children might mean that more schools are needed. Conversely, a population with a greater percentage of elderly people may need additional healthcare facilities. When projecting future populations, cohort-survival models break down a population into groups (i.e., cohorts) based on

[6] Based on information from the website of the National Drought Mitigation Center at the University of Nebraska Lincoln. Available online at: http://www.drought.unl.edu/risk/impacts.htm. See also, Vanclay, F. "*Social Impact Assessment*." in Petts, J. (ed) International Handbook of Environmental Impact Assessment. 1999.

factors such as age, sex and race. Once a population is separated into cohorts, one can estimate the magnitude and composition of future population changes.

Changes in a population's size and makeup in survival cohort models are driven by three factors:

1. *Births:* Obviously, more babies mean more people. However, only certain groups in a population are physically capable of bearing children– typically women between the ages of 13 and 49. The U.S. Census Bureau and the TSDC continually updates fertility rates for different cohorts. For each race/ethnicity category, birth rates decline and then stabilize in the future.

2. *Deaths:* When people die, populations shrink. Unlike giving birth, however, everyone is capable of dying and mortality rates are applied to all cohorts in a given population. Hence their name, cohort-survival models use survival rates as opposed to mortality rates. A survival rate is simply the probability that a given person with certain attributes (i.e., race, age and sex) will survive over a given period of time.

3. *Migration*: Migration is the movement of people in or out of a region. Migration rates used to project future changes in a region are usually based on historic population data. When analyzing historic data, losses or increases that are not attributed to births or deaths are assumed to be the result of migration. Migration can be further broken down into changes resulting from economic and non-economic factors. Economic migrants include workers and their families that relocate because of job losses (or gains), while non-economic migrants move due to lifestyles choices (e.g., retirees fleeing winter cold in the nation's heartland and moving to Texas).

In summary, knowledge of a population's composition in terms of age, sex and race combined with information regarding birth and survival rates, and migratory patterns, allows a great deal of flexibility and realism when estimating future populations. For example, an analyst can isolate population changes due to deaths and births from changes due to people moving in and out of a region. Or perhaps, one could analyze how potential changes in medical technology would affect population by reducing death rates among certain cohorts. Lastly, one could assess how changes in *economic conditions* might affect a regional population

1.3.2 Methodology for Social Impacts

Two components make up the model. The first component projects populations for a given year based on the following six steps:

1) *Separate "special" populations from the "general" population of a region:* The general population of a region includes the portion subject to rates of survival, fertility, economic migration and non-economic migration. In other words, they live, die, have children and can move in and out of a region freely. "Special populations," on the other hand, include college students, prisoners and military personnel. Special populations are treated differently than the general population. For example, fertility rates are not applied to prisoners because in general inmates at correctional facilities do not have children, and they are incapable of freely migrating or out of a region. Projections for special populations were compiled by the TSDC using data from the Higher Education Coordinating Board, the Texas Department of Criminal Justice and the U.S. Department of Defense. Starting from the 2000 Census, general and special populations were broken down into the following cohorts:

- age cohorts ranging from age zero to 75 and older,
- race/ethnicity cohorts, including Anglo, Black, Hispanic and "other," and
- gender cohorts (male and female).

2) *Apply survival and fertility rates to the general population* : Survival and fertility rates were compiled by the TSDC with data from the Texas Department of Health (TDH). Natural decreases (i.e., deaths) are estimated by applying survival rates to each cohort and then subtracting estimated deaths from the total population. Birth rates were then applied to females in each age and race cohort in general and special populations (college and military only) to arrive at a total figure for new births.

3) *Estimate economic migration based on labor supply and demand*: TSDC year 2000 labor supply estimates include all non-disabled and non-incarcerated civilians between the ages of 16 and 65. Thus, prisoners are not included. Labor supply for years beyond 2001 was calculated by converting year 2000 data to rates according to cohort and applying these rates to future years. Projected labor demand was estimated based on historical employment rates. Differences between total labor supply and labor demand determines the amount of in or out migration in a region. If supply is greater than demand, there is an out-migration of labor. Conversely, if demand is greater than supply, there is an in-migration of labor. The number of migrants does not necessarily reflect total population changes because some migrants have families. To estimate how many people might accompany workers, a migrant worker profile was developed based on the U.S. Census Bureau's Public Use Microdata Samples (PUMs) data. Migrant profiles estimate the number of additional family members, by age and gender that accompany migrating workers. Together, workers and their families constitute economic migration for a given year.

4) *Estimate non-economic migration*: As noted previously, migration patterns of individuals age 65 and older are generally independent of economic conditions. Retirees usually do not work, and when they relocate, it is primarily because of lifestyle preferences. Migratory patterns for people age 65 or older are based on historical PUMs data from the U.S. Census.

5) *Calculate ending population for a given year*: The total year-ending population is estimated by adding together: 1) surviving population from the previous year, 2) new births, 3) net economic migration, 4) net non-economic migration and 5) special populations. This figure serves as the baseline population for the next year and the process repeats itself.

The second component of the social impact model is identical to the first and includes the five steps listed above for each year where water shortages are reported (i.e., 2010, 2020, 2030, 2040, 2050 and 2060). The only difference is that labor demand changes in years with shortages. Shifts in labor demand stem from employment impacts estimated as part of the economic analysis component of this study with some slight modifications. IMPLAN employment data is based on the number of full and part-time jobs as opposed to the number of people working. To remedy discrepancies, employment impacts from IMPLAN were adjusted to reflect the number of people employed by using simple ratios (i.e., labor supply divided by number of jobs) at the county level. Declines in labor demand as measured using adjusted IMPLAN data are assumed to affect net economic migration in a given regional water planning area. Employment losses are adjusted to reflect the notion that some people would not relocate but would seek employment in the region and/or public assistance and wait for conditions to improve. Changes in school enrollment are simply the proportion of lost population between the ages of 5 and 17.

1.4 Clarifications, Assumptions and Limitations of Analysis

As with any attempt to measure and quantify human activities at a societal level, assumptions are necessary and every model has limitations. Assumptions are needed to maintain a level of generality and simplicity such that models can be applied on several geographic levels and across different economic sectors. In terms of the general approach used here several clarifications and cautions are warranted:

1) While useful for planning purposes, this study is not a benefit-cost analysis (BCA). BCA is a tool widely used to evaluate the economic feasibility of specific policies or projects as opposed to estimating economic impacts of unmet water needs. Nevertheless, one could include some impacts measured in this study as part of a BCA if done so properly.

2) Since this is not a BCA, future impacts are not weighted differently. In other words, estimates are not "discounted." If used as a measure of benefits in a BCA, one must consider the uncertainty of estimated monetary impacts.

3) All monetary figures are reported in constant year 2000 dollars.

4) Shortages reported by regional planning groups are the starting point for socioeconomic analyses. No adjustments or assumptions regarding the magnitude or distributions of unmet needs among different water use categories are incorporated in the analysis.

5) Estimated impacts are point estimates for years in which needs are reported (i.e., 2010, 2020, 2030, 2040, 2050 and 2060).They are independent and distinct "what if" scenarios for each particular year and water shortages are assumed to be temporary events resulting from severe drought conditions combined with infrastructure limitations. In other words, growth occurs and future shocks are imposed on an economy at 10-year intervals and resultant impacts are measured. Given, that reported figures are not cumulative in nature, it is inappropriate to sum impacts over the entire planning horizon. Doing so, would imply that the analysis predicts that drought of record conditions will occur every ten years in the future, which is not the case. Similarly, authors of this report recognize that in many communities needs are driven by population growth, and in the future total population will exceed the amount of water available due to infrastructure limitations, *regardless of whether or not there is a drought*. This implies that infrastructure limitations would constrain economic growth. However, since needs as defined by planning rules are based upon water supply and demand under the assumption of drought of record conditions, it improper to conduct economic analysis that focuses on growth related impacts over the planning horizon. Figures generated from such an analysis would presume a 50-year drought of record, which is unrealistic. Estimating lost economic activity related to constraints on population and commercial growth due to lack of water would require developing water supply and demand forecasts under "normal" or "most likely" future climatic conditions.

6) IO multipliers measure the strength of backward linkages to supporting industries (i.e., those who sell inputs to an affected sector). However, multipliers say nothing about forward linkages consisting of businesses that purchase goods from an affected sector for further processing. For example, ranchers in many areas sell most of their animals to local meat packers who process animals into a form that consumers ultimately see in grocery stores and restaurants. Multipliers do not capture forward linkages to meat packers, and since meat packers sell livestock purchased from ranchers as "final sales," multipliers for the ranching sector do fully account for all losses to a region's economy. Thus, as mentioned previously, in some cases closely linked sectors were moved from on water use category to another.

7) Cautions regarding interpretations of direct and secondary impacts are warranted. IO/SAM multipliers are based on "fixed-proportion production functions," which basically means that input use - including labor - moves in lockstep fashion with changes in levels of output. In a scenario where output (i.e., sales) declines, losses in the immediate sector or supporting sectors could be much less than predicted by an IO/SAM model for several reasons. For one, businesses will likely expect to continue operating so they might maintain spending on inputs for future use; or they may be under contractual obligations to purchase inputs for an extended period regardless of external conditions. Also, employers may not lay-off workers given that experienced labor is sometimes scarce and skilled personnel may not be readily available when water shortages subside. Lastly

people who lose jobs might find other employment in the region. As a result, direct losses for employment and secondary losses in sales and employment should be considered an *upper bound*. Similarly, since population projections are based on reduced employment in the region, they should be considered an upper bound as well.

8) IO models are static in nature. Models and resultant multipliers are based upon the structure of the U.S. and regional economies in the year 2000. In contrast, unmet water needs are projected to occur well into the future (i.e., 2010 through 2060). Thus, the analysis assumes that the general structure of the economy remains the same over the planning horizon.

9) With respect to municipal needs, an important assumption is that people would eliminate all outdoor water use before indoor water uses were affected, and people would implement emergency indoor water conservation measures before commercial businesses had to curtail operations, and households had to seek alternative sources of water. Section 2.3.3 discusses this in greater detail.

10) Impacts are annual estimates. If one were to assume that conditions persisted for more than one year, figures should be adjusted to reflect the extended duration. The drought of record in Texas for many communities lasted several years.

2. Economic Impact Analysis

Part 2 of this report summarizes economic analysis for each water use category. Section 2.1 presents the year 2000 economic baseline for Region B. Section 2.2 presents results for agricultural water uses including livestock and irrigated crop production, while Section 2.3 reviews impacts to municipal and industrial water uses including manufacturing, mining, steam-electric and municipal demands.[7]

2.1 Economic Baseline

Table 2 summarizes baseline economic variables for Region B. In year 2000, the region produced $8,923 million in output that generated nearly $4,183 million in income for residents in the region. Economic activity supported an estimated 90,155 full and part-time jobs. Business and industry also generated $397 million in state and local taxes. Sections 2.2.and 2.3 discuss contributions of individual water use categories in greater detail.

[7] Attachment B of this report contains tables showing the distribution of impacts at the county level and city level (municipal uses only).

Table 2: Year 2000 Economic Baseline for Region B (monetary figures are reported in $millions)						
	Sales Activity			Jobs	Regional Income	Business Taxes
	Total	Intermediate	Final			
Irrigation	$10.18	$1.20	$8.98	285	$3.64	$0.31
% of Total	<1%	<1%	<1%	<1%	<1%	<1%
Livestock	$203.88	$37.40	$166.48	3555	$74.66	$4.46
% of Total	2%	2%	2%	4%	2%	1%
Manufacturing	$2,698.45	$339.08	$2,359.37	19,180	$961.73	$27.95
% of Total	30%	17%	34%	21%	23%	7%
Mining	$1,494.47	$306.93	$1,187.54	4,125	$652.03	$75.98
% of Total	17%	15%	17%	5%	16%	19%
Steam Electric	$128.08	$39.24	$88.84	270	$85.75	$14.71
% of Total	1%	2%	1%	0%	2%	4%
Municipal *	$4,388.59	$1,277.64	$3,110.95	62,740	$2,405.30	$273.27
% of Total	49%	64%	45%	70%	58%	69%
Total	$8,923.64	$2,001.49	$6,922.15	90,155	$4,183.10	$396.67
% of Total	100%	100%	100%	100%	100%	100%

* Municipal includes all non-industrial commercial enterprises and institutional water uses such as the military, schools and other government organizations. Source: Generated by the Texas Water Development Board, Office of Water Planning using IMPLAN models and data from MIG, Inc.

2.2 Agriculture

Agriculture is a small but important component of the region's economy. In 2000, farmers using irrigation produced about $10.8 million dollars worth of crops that generated a total of almost $3.64 million in income – less than one percent of all income in the region. With $203.88 million in sales, the region's livestock industry is considerably larger. Collectively, irrigated farming and the livestock industry accounted for less than three percent of income and five percent of jobs in Region B.

2.2.1 Irrigation

The first step in estimating impacts to irrigation required calculating gross sales for IMPLAN crop sectors. Default IMPLAN data do not distinguish irrigated production from dry-land production. Once gross sales were known other statistics such as employment and income were derived using IMPLAN direct multiplier coefficients. Gross sales for a given crop are based on two data sources:

1) county-level statistics collected and maintained by the TWDB and the USDA Natural Resources Conservation Service (NRCS) including the number of irrigated acres by crop type and water application per acre, and

2) regional-level data published by the Texas Agricultural Statistics Service (TASS) including prices received for crops (marketing year averages), crop yields and crop acreages.

Crop categories used by the TWDB differ from those used in IMPLAN datasets. To maintain consistency, sales and other statistics are reported using IMPLAN crop classifications. Table 3 shows the TWDB crops included in corresponding IMPLAN sectors. Table 4 summarizes acreage and estimated annual water use for each crop classification (year 2000). Table 5 shows year 2000 economic data for irrigated crop production in the region. When measured in dollars, oil crops, hay and pasture and cotton were the most active sectors generating $7.84 million in output and $2.44 million worth of income for Region B residents.

Table 3: Crop Classifications Used in TWDB Water Use Survey and Corresponding IMPLAN Crop Sectors Applied in Socioeconomic Impact Analysis

IMPLAN Sector	TWDB Sector
Cotton	Cotton
Feed Grains	Corn, sorghum and “forage crops”
Food Grains	Rice, wheat and "other grains"
Fruits	Citrus
Hay and Pasture	Alfalfa and “other hay and pasture”
Oil Crops	Peanuts, soybeans and “other oil crops”
Sugar Crops	Sugarbeets and sugarcane
Tree Nuts	Pecans
Vegetables *	Deep-rooted vegetables, shallow-rooted vegetables and potatoes
Other Crops	"All other crops" "other orchards" and vineyards

* includes melons.

Table 4. Summary of Irrigated Crop Acreage and Water Demand for Region B (Year 2000)

Sector	Acres (1000s)	Distribution of Acres	Water Use (1000s of AF)	Distribution of Water Use
Hay and Pasture	18,274	41%	33,547	50%
Oil Crops	8,235	19%	13,594	20%
Food Grains	7,005	16%	6,671	10%
Cotton	5,940	13%	5,830	9%
Feed Grains	3,139	7%	4,406	7%
Vegetables	667	2%	891	1%
Tree Nuts	504	1%	888	1%
Other Crops	499	1%	677	1%
Total	44,263	100%	66,504	100%

Source: Water demand figures are taken from the Texas Water Development Board 2006 Water Plan Projections data for year 2000. Statistics for irrigated crop acreage are based upon annual survey data collected by the TWDB and the National Resources Conservation Service (USDA).

Table 5: Year 2000 Baseline Economic Activity Associated with Water Shortages to Irrigated Crop Production in Region B (monetary figures are reported in $millions)						
	Sales Activity			Jobs	Regional Income	Business Taxes
	Total	Intermediate	Final			
Oil Bearing Crops	$3.29	$0.20	$3.09	55	$0.93	$0.09
Hay and Pasture	$2.74	$0.56	$2.18	170	$0.81	$0.08
Cotton	$1.78	$0.23	$1.55	15	$0.70	$0.06
Vegetables	$0.93	$0.09	$0.85	15	$0.58	$0.02
Food Grains	$0.63	$0.01	$0.62	20	$0.22	$0.02
Feed Grains	$0.53	$0.11	$0.42	10	$0.25	$0.03
Tree Nuts	$0.26	$0.00	$0.26	5	$0.15	$0.00
Total	$10.18	$1.20	$8.98	290	$3.64	$0.31

* Does not include dry-land crop production. Source: Generated by the Texas Water Development Board, Office of Water Planning using IMPLAN Pro™ software and data.

An important consideration when estimating impacts to irrigation was determining which crops are affected by water shortages. Several options are available. One approach is the so-called rationing model, which assumes that farmers respond to water supply cutbacks by fallowing the lowest value crops in the region first and the highest valued crops last until the amount of water saved equals the shortage.[8] For example, if farmer A grows vegetables (higher value) and farmer B grows wheat (lower value) and they both face a proportionate cutback in irrigation water, then farmer B will sell water to farmer A. Farmer B will fallow her irrigated acreage before farmer A fallows anything. Of course, this assumes that farmers can and do transfer enough water to allow this to happen. A different approach involves constructing farm-level profit maximization models that conform to widely-accepted economic theory that farmers make decisions based on marginal net returns. Such models have good predictive capability, but data requirements and complexity are high. Given that a detailed analysis for each region would require a *substantial* amount of farm-level data and analysis, the following investigation assumes that projected shortages are distributed equally across predominant crops in the region. "Predominant" in this case are crops that comprise at least one percent of total acreage in the region (see Table 4).

The following steps outline the overall method used to estimate direct impacts to irrigated agriculture:

1. *Distribute shortages across predominant crop types in the region*. Again, unmet water needs were distributed equally across crop sectors that constitute one percent or more of irrigated acreage in 2000.

2. *Estimate associated reductions in output for affected crop sectors*. Output reductions are based on elasticities discussed in Section 1.2.1 and on estimated values per acre for

[8] The rationing model was initially proposed by researchers at the University of California at Berkeley, and was then modified for use in a study conducted by the U.S. Environmental Protection Agency that evaluated how proposed water supply cutbacks recommended to protect water quality in the Bay/Delta complex in California would affect farmers in the Central Valley. See, Zilberman, D., Howitt, R. and Sunding, D. "*Economic Impacts of Water Quality Regulations in the San Francisco Bay and Delt*a." Western Consortium for Public Health. May 1993.

different crops. Values per acre stem from the same data used to estimate output for the year 2000 baseline. Given that 2000 may have been an unusually poor or productive year for some crops and not necessarily representative of normal conditions, statistics regarding yield, price and acreage for crop sectors were averaged over a five-year period (1995-2000) if sufficient data were available.

3. *Offset reductions in output by revenues from dry-land production.* If TASS acreage data indicate that farmers grow a dry-land version of a given crop in the region (e.g., cotton or corn), estimated losses from irrigated acreage are offset by assumed revenues from dry-land harvests. Basically, the analysis assumes that farmers who use irrigation would have some output even if irrigation water were not available. Given that water shortages are expected to occur under drought conditions, values per acre for dry-land crops are based on 1998 and/or 1996 yields and prices. Both 1996 and 1998 were particularly bad drought years for much of Texas. Table 6 summarizes data used to estimate the value of lost output.

Table 6: Data Used to Estimate Impacts to Irrigated Crop Production in Region B.			
Crop sector	Gross sales revenue per irrigated acre	Gross sales revenue per dry-land acre (drought conditions)	Data Sources for yield, prices and planted acreage used to estimate gross sales per acre
Hay and Pasture	$150	$75	Gross sales = statewide average values for TASS "all hay" (1995-2000). Dry-land assumes 50 percent reduction in yield.
Food Grains	$90	$50	Gross sales = average value based on TASS data for Northern and Southern Plains, Blacklands Region and Cross Timbers region wheat crop (1995-2000). Dry-land value based on same data using 1998 yields and prices.
Cotton	$300	$30	Gross sales = averages (1995-2000) for cotton in TASS Southern Low Plains district. Dry-land same data, but based on 1996 yields and prices.
Oil Crops	$400	$100	Gross sales = average value for peanut crop (1995-2000) based on TASS data for Cross Timbers region. Dry-land value based on same data using 1998 yields and prices.
Feed Grains	$170	$60	Gross sales are an average value weighted by acreage of corn, forage crops and grain sorghum. Corn value base on 5-year (1995-2000) TASS data for Blacklands Region. Sorghum values. Forage crops based on TAMU Central crop budgets for Bermuda and Ryegrass. Sorghum based average (1995-2000) TASS data for Cross Timbers and Blacklands regions. Dry-land value based on same data sources using 1996 and/or 1998 yields and prices.
Vegetables	$1,400	$0	Average weighted by acreage for shallow-rooted vegetables, deep rooted vegetables and potatoes. Data source: gross revenues based on price, yield and planted acreage data from TASS. No dry-land output assumed.
Tree Nuts	$520	$0	Gross sales = state average for pecans (1995-2000) based on TASS data. No dry-land.
*All values are rounded. TASS = Texas Agricultural Statistics Service. TAMU = Texas A&M University.			

The Region B 2006 Water Plan indicates that under drought of record conditions, shortages to irrigation could occur in Archer, Clay and Wichita counties. All shortages are in the Red River Basin. Table 7 summarizes estimated impacts. Attachment B of this report shows impacts by county.

Table 7: Annual Economic Impacts of Unmet Water Needs for Irrigation in Region B
(years 2000, 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

Year	Sales ($millions)	Regional Income ($millions)	Jobs	Business Taxes ($millions)
2010	$0.00	$0.00	0	$0.000
2020	$0.05	$0.01	1	$0.001
2030	$0.10	$0.03	2	$0.003
2040	$0.15	$0.04	3	$0.004
2050	$0.39	$0.12	8	$0.011
2060	$0.52	$0.15	11	$0.015

* Estimates are based on *projected* economic activity in the region. Source: Based on economic impact models developed by the Texas Water Development Board, Office of Water Planning.

2.2.2 Livestock

No water shortages for livestock were reported in Region B.

2.3 Municipal and Industrial

2.3.1 Mining

Table 8 summarizes sales, employment and regional income for the mining industry in Region B. In 2000, mining sectors generated $1,494 million worth of income and provided jobs for 4,126 workers in the region. Natural gas and petroleum extraction accounts for about 97 percent of mining activity. About 20 percent of output from the gas and crude extraction sector goes directly to other regional industries in the form of intermediate sales. Thus, reduced drilling activity resulting from water shortages could affect regional oil refineries or other upstream processors. However, given that the majority (80 percent) of oil and gas leaves the region for further processing, and because shortages are relatively limited, impacts to upstream sectors at the regional level would likely be negligible.

Table 8: Year 2000 Baseline Economic Activity for Mining in Region B (monetary figures are reported in $millions)						
Sector	Sales Activity			Jobs	Regional Income	Business Taxes
	Total	Intermediate	Final			
Natural Gas & Crude Petroleum	$1,459.97	$304.53	$1,155.44	3,931	$633.05	$74.29
All Other Mining Sectors	$34.50	$2.40	$32.10	195	$18.98	$1.69
Total	$1,494.47	$306.93	$1,187.54	4,126	$652.03	$75.98
Source: Generated by the Texas Water Development Board, Office of Water Planning using IMPLAN Pro™ software and data.						

Another consideration is that the petroleum and gas extraction industry only uses water in significant amounts for secondary recovery. Known in the industry as “enhanced” or “water flood” extraction, secondary recovery involves pumping water down injection wells to increase underground pressure thereby pushing oil or gas into other wells. IMPLAN output numbers do not distinguish between secondary and non-secondary recovery. To account for the discrepancy, county-level data from the Texas Railroad Commission (TRC) showing the proportion of barrels produced using secondary methods were used to adjust IMPLAN data to reflect only the portion of sales attributed to secondary recovery.

An additional problem with standard IMPLAN data matter relates to estimates of output at the county-level. In general, IMPLAN data for mining at the county level reflect sales and employment, but not necessarily physical output. For instance, a mining company and its employees may be based in Dallas County, Texas but most of its product comes from oil well leases in West Texas. However, company sales and employment figures are reported for Dallas County. Another good example includes coastal counties in the state (e.g., Harris County in Region H) where reported sales include off-shore gas and oil extraction in the Gulf of Mexico. To account for potential discrepancies, analysts relied on data from the TRC to gauge the accuracy of output in affected counties by comparing average well-head market prices for crude and gas to TRC production statistics in each county. If there were large discrepancies, estimates based on TRC information were used instead of IMPLAN data.

The Region B 2006 Water Plan indicates that under drought of record conditions, shortages to mining would occur in Montague County. Table 9 summarizes estimated impacts. Attachment B of this report shows impacts by county. All unmet needs are in the Red River Basin.

Table 9: Annual Economic Impacts of Unmet Water Needs for Mining in Region B (years 2000, 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)				
Year	Sales ($millions)	Regional Income ($millions)	Jobs	Business Taxes ($millions)
2010	$3.58	$1.70	19	$0.21
2020	$3.06	$1.45	17	$0.18
2030	$2.91	$1.38	16	$0.17
2040	$3.12	$1.48	17	$0.19
2050	$3.53	$1.67	19	$0.21
2060	$3.63	$1.72	20	$0.22
* Estimates are based on *projected* economic activity in the region. Source: Generated by the Texas Water Development Board, Office of Water Planning.				

2.3.2 Municipal

Table 10 summarizes economic activity for municipal uses. In 2000, businesses and institutions that make up the municipal category produced $4,388 million worth of goods and services. In return, they received $2,405 million in wages, salaries and profits. Municipal uses generate the bulk of business taxes in the region – $273 million (70 percent). Top commercial sectors in terms of income and output include banking, real estate, wholesale trade, medical professions, transportation and eating and drinking establishments.

Table 10: Year 2000 Baseline Economic Activity for Municipal Water Uses in Region B						
Sector	Sales Activity			Jobs	Regional Income	Business Taxes
	Total	Intermediate	Final			
Banking	$329.82	$86.48	$243.34	1,818	$213.08	$5.33
Real Estate	$303.74	$162.08	$141.67	1,644	$180.13	$35.94
Wholesale Trade	$270.22	$139.41	$130.82	3,179	$147.83	$38.46
Doctors and Dentists	$215.41	$0.00	$215.41	2,460	$140.48	$2.70
Eating & Drinking	$208.33	$11.76	$196.57	6,297	$91.87	$12.82
Freight Transport and Warehousing	$171.25	$118.20	$53.06	1,731	$65.05	$2.04
Hospitals	$158.73	$0.22	$158.51	2,472	$97.62	$0.55
Communications	$146.73	$63.75	$82.98	589	$73.56	$7.83
All other municipal sectors	$2,584.35	$695.75	$1,888.60	42,551	$1,395.67	$167.60
Total	$4,388.59	$1,277.64	$3,110.95	62,739	$2,405.30	$273.27
Source: Generated by the Texas Water Development Board, Office of Water Planning using IMPLAN Pro™ software and data.						

Estimating direct economics impacts for the municipal category is complicated for a number of reasons. For one, municipal uses comprise a range of different consumers including commercial businesses, institutions (e.g., schools and government) and households. However, reported shortages do not specify how needs are distributed among different consumers. In other words, how much of a municipal need is commercial and how much is residential? The amount of commercial water use as a percentage of total municipal demand was estimated based on "GED" coefficients (gallons per employee per day) published in secondary sources (see Attachment A). For example, if year 2000 baseline data for a given economic sector (e.g., amusement and recreation services) shows employment at 30 jobs and the GED coefficient is 200, then average daily water use by that sector is (30 x 200 = 6,000 gallons) and thus annual use is 6.7 acre-feet. Water not attributed to commercial use is considered domestic, which includes single and multi-family residential consumption, institutional uses and all use designated as "county-other." The estimated proportion of water used for commercial purposes ranges from about 5 to 35 percent of total municipal demand at the county level. Less populated rural counties occupy the lower end of the spectrum, while larger metropolitan counties are at the higher end.

As mentioned earlier, a key study assumption is that people would eliminate outdoor water use before indoor water consumption was affected; and they would implement *voluntary* emergency indoor water conservation measures before people had to curtail business operations or seek emergency sources of water. This is logical because most water utilities have drought contingency plans. Plans usually specify curtailment or elimination of outdoor water use during periods of drought. In Texas, state law requires retail and wholesale water providers to prepare and submit plans to the Texas Commission on Environmental Quality (TCEQ). Plans must specify demand management measures for use during drought including curtailment of "non-essential water uses."[9] Thus, when assessing municipal needs there are several important considerations: 1) how much of a need would people reduce via eliminating outdoor uses and implementing emergency indoor conservation measures; and 2) what are the economic implications of such measures?

Determining how much water is used for outdoor purposes is key to answering these questions. The proportion used here is based on several secondary sources. The first is a major study sponsored by the American Water Works Association, which surveyed cities in states including Colorado, Oregon, Washington, California, Florida and Arizona. On average across all cities surveyed 58 percent of residential water use was for outdoor activities. In cities with climates comparable to large metropolitan areas of Texas, the average was 40 percent.[10]Earlier findings of the U.S. Water Resources Council showed a national average of 33 percent. Similarly, the United States Environmental Protection Agency (USEPA) estimated that landscape watering accounts for 32 percent of total residential and commercial water use on annual basis.[11] A study conducted for the California Urban Water Agencies (CUWA) calculated values ranging from 25 to 35 percent.[12] Unfortunately, there does not appear to be any comprehensive research that has estimated non-agricultural outdoor water use in Texas. As an approximation, an average annual value of 30 percent based on the above references was selected to serve as a rough estimate in this study. With respect to emergency indoor conservation measures, this analysis assumes that citizens in affected communities would reduce needs by an additional 20 percent. Thus, 50

[9] Non-essential uses include, but are not limited to, landscape irrigation and water for swimming pools or fountains. For further information see the Texas Environmental Quality Code §288.20.

[10] See, Mayer, P.W., DeOreo, W.B., Opitz, E.M., Kiefer, J.C., Davis, W., Dziegielewski, D., Nelson, J.O. "*Residential End Uses of Water*." Research sponsored by the American Water Works Association and completed by Aquacraft, Inc. and Planning and Management Consultants, Ltd. (PMCL@CDM).

[11] U.S. Environmental Protection Agency. *"Cleaner Water through Conservation*." USEPA Report no. 841-B-95-002. April, 1995.

[12] Planning and Management Consultants, Ltd. "*Evaluating Urban Water Conservation Programs: A Procedures Manual*." Prepared for the California Urban Water Agencies. February 1992.

percent of total needs could be eliminated before households and businesses had to implement emergency water procurement activities.

Eliminating outdoor watering would have a range of economic implications. For one, such a restriction would likely have adverse impacts on the landscaping and horticultural industry. If people are unable to water their lawns, they will likely purchase less lawn and garden materials such as plants and fertilizers. On the other hand, during a bad drought people may decide to invest in drought tolerant landscaping, or they might install more efficient landscape plumbing and other water saving devices. But in general, the horticultural industry would probably suffer considerable losses if outdoor water uses were restricted or eliminated. For example, many communities in Colorado, which is in the midst of a prolonged drought, have severely restricted lawn irrigation. In response, the turf industry in Colorado has laid off at least 50 percent of its 2,000 employees.[13] To capture impacts to the horticultural industry, regional sales net of exports for the greenhouse and nursery sectors and the landscaping services sector were reduced by proportion equal to reductions in outdoor water use. Note that these losses would not necessarily appear as losses to the regional or state economies because people would likely spend the money that they would have spent on landscaping on other goods in the economy. Thus, the net effect to state or regional accounts could be neutral.

Other considerations include the "welfare" losses to consumers who had to forgo outdoor and indoor water uses to reduce needs. In other words, the water that people would have to give up has an economic value. Estimating the economic value of this forgone water for each planning area would be a very time consuming and costly task, and thus secondary sources served as a proxy. Previous research funded by the TWDB, explored consumer "willingness to pay" for avoiding restrictions on water use.[14] Surveys revealed that residential water consumers in Texas would be willing to pay – on average across all income levels - $36 to avoid a 30 percent reduction in water availability lasting for at least 28 days. Assuming the average person in Texas uses 140 gallons per day and the typical household in the state has 2.7 persons (based on U.S. Census data), total monthly water use is 13,205 gallons per household. Therefore, the value of restoring 30 percent of average monthly water use during shortages to residential consumers is roughly one cent per gallon or $2,930 per acre-foot. This figure serves as a proxy to measure consumer welfare losses that would result from restricted outdoor uses and emergency indoor restrictions.

The above data help address the impacts of incurring water needs that are 50 percent or less of projected use. Any amount greater than 50 percent would result in municipal water consumers having to seek alternative sources. Costs to residential and non-water intensive commercial operations (i.e., those that use water only for sanitary purposes) are based on the most likely alternative source of water in the absence of water management strategies. In this case, the most likely alternative is assumed to be "hauled-in" water from other communities at annual cost of $6,530 per acre-foot for small rural communities and approximately and $10,995 per acre-foot for metropolitan areas.[15]

This is not an unreasonable assumption. It happened during the 1950s drought and more recently. For example, in 2000 at the heels of three consecutive drought years Electra - a small town in North Texas - was down to its last 45 days worth of reservoir water when rain replenished the lake, and the city was able to refurbish old wells to provide supplemental groundwater. At the

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[13] Based on assessments of the Rocky Mountain Sod Growers. See, "*Drought Drying Up Business for Landscapers*." Associated Press. September, 17 2002.

[14] See, Griffin, R.C., and Mjelde, W.M. "*Valuing and Managing Water Supply Reliability*. Final Research Report for the Texas Water Development Board: Contract no. 95-483-140." December 1997.

[15] For rural communities, figure assumes an average truck hauling distance of 50 miles at a cost of 8.4 cents per ton-mile (an acre foot of water weighs about 1,350 tons) with no rail shipment. For communities in metropolitan areas, figure assumes a 50 mile truck haul, and a rail haul of 300 miles at a cost of 1.2 cents per ton-mile. Cents per ton-mile are based on figures in: Forkenbrock, D.J., "*Comparison of External Costs of Rail and Truck Freight Transportation*." Transportation Research. Vol. 35 (2001).

time, residents were forced to limit water use to 1,000 gallons per person per month - less than half of what most people use - and many were having water hauled delivered to their homes by private contractors.[16] In 2003 citizens of Ballinger, Texas, were also faced with a dwindling water supply due to prolonged drought. After three years of drought, Lake Ballinger, which supplies water to more than 4,300 residents in Ballinger and to 600 residents in nearby Rowena, was almost dry. Each day, people lined up to get water from a well in nearby City Park. Trucks hauling trailers outfitted with large plastic and metal tanks hauled water to and from City Park to Ballinger.[17] In Australia, four cities have run out of water as a result of drought, and residents have been trucking in water since November 2002. One town has five trucks carting about one acre-foot eight times daily from a source 20 miles away. They had to build new roads and infrastructure to accommodate the trucks. Residents are currently restricted to indoor water use only.[18]

Direct impacts to commercial sectors were estimated in a fashion similar to other business sectors. Output was reduced among "water intensive" commercial sectors according to the severity of projected shortages. Water intensive is defined as non-medical related sectors that are heavily dependent upon water to provide their services. These include:

- car-washes,
- laundry and cleaning facilities,
- sports and recreation clubs and facilities including race tracks,
- amusement and recreation services,
- hotels and lodging places, and
- eating and drinking establishments.

For non-water intensive sectors, it is assumed that businesses would haul water by truck and/or rail.

An example will illustrate the breakdown of municipal water needs and the overall approach to estimating impacts of municipal needs. Assume City B has an unmet need of 50 acre feet in 2020 and projected demands of 200 acre-feet. In this case, residents of City B could eliminate needs via restricting all outdoor water use. City A, on the other hand, has an unmet need of 150 acre-feet in 2020 with a projected demand of 200 acre-feet. Thus, total shortages are 75 percent of total demand. Emergency outdoor and indoor conservation measures would eliminate 50 acre-feet of projected needs; however, 50 acre-feet would still remain. This remaining portion would result in costs to residential and commercial water users. Water intensive businesses such as car washes, restaurants, motels, race tracks would have to curtail operations (i.e., output would decline), and residents and non-water intensive businesses would have to have water hauled-in assuming it was available.

The last element of municipal water shortages considered focused on lost water utility revenues. Estimating these was straightforward. Analyst used annual data from the "*Water and Wastewater Rate Survey*" published annually by the Texas Municipal League to calculate an average value per acre-foot for water and sewer. For water revenues, averages rates multiplied by total water needs served as a proxy. For lost wastewater, total unmet needs were adjusted for return flow factor of 0.60 and multiplied by average sewer rates for the region. Needs reported as "county-other" were excluded under the presumption that these consist primarily of self-supplied water uses. In addition, 15 percent of water demand and needs are considered non-billed or "unaccountable" water that comprises things such leakages and water for municipal government functions (e.g., fire departments). Lost tax receipts are based on current rates for the

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[16] Zewe, C. "*Tap Threatens to Run Dry in Texas Town*." July 11, 2000. CNN Cable News Network.

[17] Associated Press, "*Ballinger Scrambles to Finish Pipeline before Lake Dries Up*." May 19, 2003.

[18] Healey, N. (2003) *Water on Wheels*, Water: Journal of the Australian Water Association, June 2003.

“miscellaneous gross receipts tax, “which the state collects from utilities located in most incorporated cities or towns in Texas.

The Region B 2006 Water Plan indicates that under drought of record conditions, shortages to municipal water uses would occur in Archer (county-other), Clay (county-other), Montague (County-other) and Wichita (Electra). Tables 11 through 14 summarize estimated impacts to residents, commercial businesses (water intensive and non-water intensive), water utilities and the horticultural industry. Attachment B of this report shows impacts by county, and Attachment C shows impacts by major river basin.

Table 11: Annual Economic Impacts of Unmet Water Needs for the Horticultural Industry
(years 2000, 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

Year	Sales ($millions)	Regional Income ($millions)	Jobs	Business Taxes ($millions)
2010	$3.08	$1.04	33	$0.02
2020	$2.96	$1.00	32	$0.02
2030	$3.22	$1.09	34	$0.02
2040	$3.23	$1.09	34	$0.02
2050	$3.01	$1.01	32	$0.02
2060	$3.09	$1.04	33	$0.02

Source: Generated by the Texas Water Development Board, Office of Water Planning.

Table 12: Annual Economic Impacts of Unmet Water Needs for Water Intensive Commercial Businesses
(years 2000, 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)

Year	Sales ($millions)	Regional Income ($millions)	Jobs	Business Taxes ($millions)
2010	$0.00	$0.00	0	$0.00
2020	$0.00	$0.00	0	$0.00
2030	$0.00	$0.00	0	$0.00
2040	$0.00	$0.00	0	$0.00
2050	$0.00	$0.00	0	$0.00
2060	$0.00	$0.00	0	$0.00

* Estimates are based on *projected* economic activity in the region. Source: Source: Generated by the Texas Water Development Board, Office of Water Planning.

Table 13: Annual Losses of Water Utility Revenues and Taxes due to Unmet Water Needs (years 2000, 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)		
Year	Revenues ($millions)	Utility Taxes $millions)
2010	$0.29	$0.005
2020	$0.25	$0.004
2030	$0.24	$0.004
2040	$0.23	$0.004
2050	$0.23	$0.004
2060	$0.24	$0.004

Figures do not include potential losses related to water shortages for manufacturing sectors that purchase utility water. Source: Generated by the Texas Water Development Board, Office of Water Planning.

Table 14: Annual Losses to Residential Water Users (years 2000, 2010, 2020, 2030, 2040, 2050 and 2060, constant year 2000 dollars)	
Year	$millions
2010	$1.45
2020	$1.46
2030	$1.51
2040	$1.53
2050	$1.41
2060	$1.43

Source: Generated by the Texas Water Development Board, Office of Water Planning.

2.3.3 Manufacturing

No water shortages for manufacturing water uses were reported in Region B.

2.3.4 Steam Electric

No shortages associated for steam-electric water use were reported in Region B.

3. Social Impact Analysis

Given that unmet needs relative to total water demand are small, social impact models do not show significant changes in population or school enrollment in any year.

Attachment A: Baseline Regional Economic Data

Tables A-1 through A-6 contain data from several sources that form a basis of analyses in this report. Economic statistics were extracted and processed via databases purchased from MIG, Inc. using IMPLAN Pro™ software. Values for gallons per employee (i.e. GED coefficients) for the municipal water use category are based on several secondary sources.[19] County-level data sets along with multipliers are not included given their large sizes (i.e., 528 sectors per county each with 12 different multiplier coefficients). Fields in Tables A-1 through A-6 contain the following variables:

- *GED -* average gallons of water use per employee per day (municipal use only);
- *total sales -* total industry production measured in millions of dollars (equal to shipments plus net additions to inventories);
- *intermediate sales -* sales to other industries in the region measured in millions of dollars;
- *final sales -* all sales to end-users including sales to households in the region and exports out of the region;
- *jobs -* number of full and part-time jobs (annual average) required by a given industry;
- *regional income -* total payroll costs (wages and salaries plus benefits), proprietor income, corporate income, rental income and interest payments;
- *business taxes –* sales taxes, excise taxes, fees, licenses and other taxes paid during normal business operations (includes all payments to federal, state and local government except income taxes).

[19] Sources for GED coefficients include: Gleick, P.H., Haasz, D., Henges-Jeck, C., Srinivasan, V., Wolff, G. Cushing, K.K., and Mann, A. "*Waste Not, Want Not*. *The Potential for Urban Water Conservation in California*." Pacific Institute. November 2003. U.S. Bureau of the Census. 1982 Census of Manufacturers: Water Use in Manufacturing. USGPO, Washington D.C. See also: "*U.S. Army Engineer Institute for Water Resources, IWR Report 88-R-6.*," Fort Belvoir, VA. See also, Joseph, E. S., 1982, "*Municipal and Industrial Water Demands of the Western United States*." Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, v. 108, no. WR2, p. 204-216. See also, Baumann, D. D., Boland, J. J., and Sims, J. H., 1981, "*Evaluation of Water Conservation for Municipal and Industrial Water Supply*." U.S. Army Corps of Engineers, Institute for Water Resources, Contract no. 82-C1.

Table A-1: Economic Data for Irrigated Agriculture in Region B (Year 2000, monetary figures reported in $millions)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Cotton	$1.78	$0.23	$1.55	14	$0.70	$0.06
Food Grains	$0.63	$0.01	$0.62	19	$0.22	$0.02
Feed Grains	$0.53	$0.11	$0.42	10	$0.25	$0.03
Hay and Pasture	$2.74	$0.56	$2.18	168	$0.81	$0.08
Tree Nuts	$0.26	$0.00	$0.26	6	$0.15	$0.00
Vegetables	$0.93	$0.09	$0.85	13	$0.58	$0.02
Oil Bearing Crops	$3.29	$0.20	$3.09	54	$0.93	$0.09
Total	$10.18	$1.20	$8.98	284	$3.64	$0.31

Data do not include non-irrigated acreage.

Table A-2: Economic Data for Livestock Sectors, Region B (Year 2000, monetary figures reported in $millions)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Dairy Farm Products	$37.85	$0.26	$37.59	329	$13.49	$0.10
Poultry and Eggs	$3.84	$1.91	$1.93	24	$0.64	$0.01
Ranch Fed Cattle	$49.43	$8.32	$41.11	1,197	$14.31	$1.03
Range Fed Cattle	$67.89	$19.54	$48.35	1,515	$18.82	$1.21
Cattle Feedlots	$39.16	$5.38	$33.77	220	$25.97	$2.05
Sheep, Lambs and Goats	$0.06	$0.05	$0.00	7	$0.01	$0.00
Hogs, Pigs and Swine	$1.71	$1.69	$0.02	30	$0.34	$0.04
Miscellaneous Livestock	$3.94	$0.24	$3.70	234	$1.08	$0.03
Total	$203.88	$37.40	$166.48	3,556	$74.66	$4.46

Table A-3: Economic Data for Municipal Sectors, Region B (Year 2000, monetary figures reported in $millions)

Sector	GED	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Accounting, Auditing and Bookkeeping	120	$69.02	$41.58	$27.43	1191	$54.39	$0.62
Advertising	117	$7.79	$6.62	$1.18	80	$3.75	$0.07
Agricultural, Forestry, Fishery Services	-	$13.88	$13.55	$0.34	724	$7.73	$0.34
Air Transportation	171	$21.83	$6.71	$15.12	234	$10.85	$1.55
Amusement and Recreation Services,	427	$16.85	$0.28	$16.57	822	$9.25	$0.90
Apparel & Accessory Stores	68	$21.23	$1.08	$20.15	658	$11.73	$3.39
Arrangement Of Passenger	130	$11.87	$2.07	$9.81	79	$8.20	$0.35
Automobile Parking and Car Wash	681	$9.07	$0.77	$8.30	231	$6.13	$0.42
Automobile Rental and Leasing	147	$12.78	$8.84	$3.94	123	$7.46	$1.01
Automobile Repair and Services	55	$72.29	$16.06	$56.24	944	$36.12	$3.27
Automotive Dealers & Service Stations	49	$131.19	$20.04	$111.15	1771	$78.24	$20.29
Banking	59	$329.82	$86.48	$243.34	1818	$213.08	$5.33
Beauty and Barber Shops	216	$10.11	$0.76	$9.35	367	$6.17	$0.12
Bowling Alleys and Pool Halls	86	$0.97	$0.00	$0.97	42	$0.53	$0.09
Building Materials & Gardening	35	$26.77	$2.85	$23.92	597	$19.10	$4.40
Business Associations	160	$13.47	$3.95	$9.52	289	$9.88	$0.01
Child Day Care Services	120	$19.41	$0.00	$19.41	484	$6.34	$0.18
Colleges, Universities, Schools	75	$3.28	$0.04	$3.24	60	$2.63	$0.00
Commercial Fishing	-	$0.52	$0.06	$0.47	21	$0.47	$0.02
Commercial Sports Except Racing	391	$0.48	$0.28	$0.20	3	$0.33	$0.03
Communications, Except Radio and TV	47	$146.73	$63.75	$82.98	589	$73.56	$7.83
Computer and Data Processing	40	$33.70	$26.91	$6.78	391	$27.26	$0.51
Credit Agencies	156	$67.28	$41.61	$25.67	2051	$33.99	$2.23
Detective and Protective Services	84	$4.77	$2.88	$1.90	222	$3.54	$0.06
Doctors and Dentists	203	$215.41	$0.00	$215.41	2460	$140.48	$2.70
Eating & Drinking	157	$208.33	$11.76	$196.57	6297	$91.87	$12.82
Electrical Repair Service	37	$16.49	$4.41	$12.08	237	$6.01	$0.52
Elementary and Secondary Schools	169	$3.97	$0.00	$3.97	207	$2.09	$0.00
Engineering, Architectural Services	87	$70.46	$57.41	$13.05	769	$30.79	$0.45
Equipment Rental and Leasing	29	$24.70	$15.74	$8.96	226	$10.12	$0.70
Food Stores	98	$89.58	$2.41	$87.17	2873	$67.16	$14.32
Funeral Service and Crematories	111	$9.85	$0.00	$9.85	302	$6.52	$0.28
Furniture & Home Furnishings Stores	42	$18.74	$1.57	$17.17	482	$12.16	$2.94

Table A-3: Economic Data for Municipal Sectors, Region B (Year 2000, monetary figures reported in $millions)

Gas Production and Distribution	51	$64.44	$41.33	$23.11	65	$15.44	$4.27
General Merchandise Stores	47	$77.03	$2.20	$74.83	2498	$48.44	$12.29
Greenhouse and Nursery Products	-	$132.16	$17.52	$114.64	851	$18.13	$0.25
Hospitals	76	$158.73	$0.22	$158.51	2472	$97.62	$0.55
Hotels and Lodging Places	230	$25.69	$10.74	$14.96	633	$13.09	$1.68
Insurance Agents and Brokers	89	$42.11	$7.94	$34.17	971	$32.68	$0.45
Insurance Carriers	136	$31.65	$3.30	$28.35	314	$15.67	$1.60
Job Trainings & Related Services	141	$5.63	$2.05	$3.57	150	$2.86	$0.01
Labor and Civic Organizations	122	$21.80	$0.11	$21.69	1402	$16.54	$0.00
Landscape and Horticultural Services	-	$16.97	$10.66	$6.31	505	$10.08	$0.43
Laundry, Cleaning and Shoe Repair	517	$30.76	$4.02	$26.74	1314	$22.64	$0.79
Legal Services	76	$38.38	$15.02	$23.36	520	$29.54	$0.34
Local Government Passenger Transit	-	$0.29	$0.04	$0.25	8	-$0.88	$0.00
Local, Interurban Passenger Transit	68	$5.93	$0.79	$5.13	206	$2.94	$0.11
Management and Consulting Services	87	$27.14	$19.85	$7.29	314	$14.05	$0.19
Membership Sports and Recreation	427	$8.77	$0.32	$8.45	332	$4.34	$0.31
Miscellaneous Personal Services	129	$8.64	$0.50	$8.14	125	$2.43	$0.18
Miscellaneous Repair Shops	124	$22.04	$13.37	$8.67	346	$9.83	$0.61
Miscellaneous Retail	132	$121.28	$7.53	$113.75	3567	$76.07	$18.53
Motion Pictures	113	$12.27	$6.65	$5.62	175	$3.34	$0.12
Motor Freight Transport and	85	$171.25	$118.20	$53.06	1731	$65.05	$2.04
Nursing and Protective Care	197	$67.01	$0.00	$67.01	2304	$48.11	$1.63
Other Business Services	84	$74.32	$63.04	$11.28	804	$28.41	$1.03
Other Educational Services	116	$11.12	$1.57	$9.55	230	$4.19	$0.31
Other Federal Government Enterprises	-	$42.12	$5.18	$36.94	330	$4.80	$0.00
Other Medical and Health Services	168	$93.24	$4.77	$88.46	2415	$42.95	$1.34
Other Nonprofit Organizations	122	$7.66	$0.43	$7.23	279	$4.30	$0.05
Other State and Local Govt Enterprises	-	$73.18	$22.76	$50.42	404	$23.22	$0.00
Owner-occupied Dwellings	89	$430.13	$0.00	$430.13	0	$270.04	$55.77
Personnel Supply Services	484	$35.55	$30.04	$5.50	1684	$34.23	$0.68
Photofinishing, Commercial	112	$4.61	$2.76	$1.86	43	$1.79	$0.11
Pipe Lines, Except Natural Gas	49	$11.44	$1.05	$10.38	21	$7.94	$0.94
Portrait and Photographic Studios	184	$3.32	$0.19	$3.13	89	$1.52	$0.08
Racing and Track Operation	391	$1.05	$0.08	$0.97	22	$0.41	$0.19
Radio and TV Broadcasting	64	$44.41	$34.91	$9.51	281	$16.20	$0.60
Railroads and Related Services	68	$21.40	$13.33	$8.07	195	$5.46	$0.29
Real Estate	89	$303.74	$162.08	$141.67	1644	$180.13	$35.94
Religious Organizations	328	$0.75	$0.00	$0.75	6	$0.09	$0.00
Research, Development & Testing	123	$2.63	$2.09	$0.53	50	$1.29	$0.02
Residential Care	111	$15.75	$0.00	$15.75	580	$9.72	$0.14
Sanitary Services and Steam Supply	51	$4.90	$3.62	$1.28	27	$2.05	$0.90
Security and Commodity Brokers	59	$36.02	$23.10	$12.92	228	$10.40	$1.00
Services To Buildings	67	$39.34	$17.67	$21.66	832	$20.31	$0.81
Social Services, N.E.C.	42	$13.91	$1.05	$12.86	275	$5.05	$0.02
Theatrical Producers, Bands Etc.	36	$2.42	$1.47	$0.95	52	$0.28	$0.02
Transportation Services	40	$7.16	$5.16	$2.01	72	$5.35	$0.06
U.S. Postal Service	-	$38.89	$16.87	$22.03	513	$28.37	$0.00
Watch, Clock, Jewelry and Furniture	50	$0.25	$0.00	$0.24	5	$0.08	$0.01
Water Supply and Sewerage Systems	51	$4.39	$1.18	$3.21	22	$2.39	$0.30
Water Transportation	353	$2.06	$1.03	$1.03	9	$0.53	$0.05
Wholesale Trade	43	$270.22	$139.41	$130.82	3179	$147.83	$38.46
Total		$4,388.59	$1,277.64	$3,110.95	62,739	$2,405.30	$273.27

NEC = not elsewhere classified. “na” = not available.

Table A-4: Economic Data for Manufacturing Sectors, Region B (Year 2000, monetary figures reported in $millions)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Aircraft	$5.22	$0.15	$5.07	20	$1.18	$0.05
Aircraft and Missile Engines and Parts	$181.58	$25.42	$156.16	918	$49.99	$1.28
Aircraft and Missile Equipment,	$0.34	$0.00	$0.34	3	$0.12	$0.00
Aluminum Foundries	$0.84	$0.05	$0.80	7	$0.37	$0.01
Apparel Made From Purchased Materials	$28.60	$0.53	$28.07	262	$7.49	$0.12
Architectural Metal Work	$0.07	$0.00	$0.07	1	$0.03	$0.00
Automotive and Apparel Trimmings	$1.70	$0.66	$1.03	13	$0.24	$0.01
Blinds, Shades, and Drapery Hardware	$0.51	$0.00	$0.51	6	$0.21	$0.00
Book Publishing	$2.68	$0.16	$2.52	15	$0.44	$0.02
Bottled and Canned Soft Drinks & Water	$4.46	$0.02	$4.44	12	$1.12	$0.04
Broadwoven Fabric Mills and Finishing	$1.44	$0.41	$1.03	13	$0.41	$0.01
Canvas Products	$0.07	$0.04	$0.03	1	$0.04	$0.00
Clay Refractories	$0.33	$0.00	$0.33	3	$0.13	$0.00
Commercial Laundry Equipment	$18.48	$1.31	$17.17	138	$7.89	$0.18
Commercial Printing	$13.74	$6.63	$7.11	139	$3.57	$0.11
Concrete Products, N.E.C	$0.81	$0.00	$0.80	8	$0.19	$0.01
Construction Machinery and Equipment	$2.00	$0.13	$1.87	9	$0.25	$0.01
Conveyors and Conveying Equipment	$11.45	$2.36	$9.09	76	$3.58	$0.09
Cottonseed Oil Mills	$37.73	$3.47	$34.26	98	$4.75	$0.27
Cyclic Crudes, Interm. & Indus. Organic Chem.	$103.02	$34.66	$68.36	150	$19.46	$1.40
Electronic Components, N.E.C.	$0.84	$0.66	$0.19	3	$0.25	$0.01
Electronic Computers	$0.19	$0.04	$0.15	1	$0.03	$0.00
Engine Electrical Equipment	$2.60	$1.26	$1.34	13	$1.13	$0.03
Fabricated Metal Products, N.E.C.	$10.48	$0.84	$9.64	80	$3.19	$0.08
Fabricated Plate Work (Boiler Shops)	$39.80	$0.47	$39.33	370	$23.03	$0.40
Fabricated Rubber Products, N.E.C.	$3.87	$0.05	$3.82	26	$1.18	$0.03
Fabricated Structural Metal	$11.02	$0.19	$10.83	77	$3.50	$0.09
Food Preparations, N.E.C	$0.68	$0.00	$0.67	4	$0.12	$0.00
Footwear Cut Stock	$0.63	$0.00	$0.63	4	$0.30	$0.01
Forest Products	$0.05	$0.00	$0.04	1	$0.02	$0.00
Forestry Products	$0.34	$0.00	$0.34	3	$0.26	$0.05
General Industrial Machinery, N.E.C	$0.25	$0.01	$0.24	1	$0.10	$0.00
Glass and Glass Products, Exc Containers	$268.95	$36.48	$232.47	1823	$133.88	$3.37
Gypsum Products	$71.03	$1.52	$69.52	237	$13.38	$0.98
Hand and Edge Tools, N.E.C.	$88.62	$3.74	$84.88	541	$53.01	$0.95
Hardware, N.E.C.	$1.37	$0.21	$1.17	6	$0.68	$0.02
Hardwood Dimension and Flooring Mills	$2.82	$1.14	$1.68	34	$1.36	$0.03
Industrial and Fluid Valves	$0.61	$0.13	$0.48	3	$0.11	$0.00
Industrial Gases	$0.88	$0.30	$0.59	8	$0.68	$0.02
Industrial Machines N.E.C.	$33.82	$0.60	$33.22	345	$13.48	$0.27
Iron and Steel Foundries	$141.82	$0.80	$141.02	1028	$52.78	$1.43
Jewelry, Precious Metal	$0.12	$0.00	$0.12	1	$0.04	$0.00
Laboratory Apparatus & Furniture	$0.65	$0.13	$0.53	3	$0.10	$0.00
Leather Goods, N.E.C	$0.76	$0.07	$0.69	11	$0.57	$0.00
Lubricating Oils and Greases	$0.79	$0.56	$0.23	2	$0.12	$0.01
Maintenance and Repair Oil and Gas Wells	$54.18	$54.18	$0.00	557	$31.27	$2.13
Maintenance and Repair Other Facilities	$92.51	$44.40	$48.11	1699	$62.24	$0.42
Maintenance and Repair, Residential	$69.59	$22.00	$47.59	538	$18.28	$0.25
Manufactured Ice	$0.43	$0.01	$0.43	14	$0.21	$0.00
Manufacturing Industries, N.E.C.	$1.93	$0.04	$1.89	20	$0.77	$0.02
Mattresses and Bedsprings	$1.19	$0.07	$1.12	11	$0.31	$0.00
Meat Packing Plants	$0.53	$0.31	$0.22	2	$0.01	$0.00
Mechanical Measuring Devices	$3.34	$0.44	$2.89	20	$1.60	$0.04
Metal Coating and Allied Services	$0.45	$0.17	$0.28	3	$0.15	$0.00
Metal Doors, Sash, and Trim	$0.52	$0.02	$0.51	5	$0.22	$0.00
Metal Office Furniture	$0.21	$0.12	$0.10	1	$0.05	$0.00
Millwork	$0.07	$0.07	$0.00	1	$0.02	$0.00
Miscellaneous Plastics Products	$259.61	$5.06	$254.56	1333	$90.18	$2.12
Miscellaneous Publishing	$0.87	$0.60	$0.27	12	$0.28	$0.01
Mobile Homes	$25.97	$0.04	$25.93	222	$10.55	$0.35
Motor Vehicle Parts and Accessories	$0.57	$0.40	$0.17	3	$0.09	$0.00
Motors and Generators	$2.55	$0.65	$1.91	15	$1.32	$0.04
New Government Facilities	$117.89	$0.00	$117.89	813	$42.21	$0.66
New Highways and Streets	$28.83	$0.00	$28.83	276	$10.35	$0.17
New Industrial and Commercial Buildings	$113.95	$0.00	$113.95	1016	$37.47	$0.78
New Mineral Extraction Facilities	$71.61	$0.82	$70.80	1203	$42.75	$3.45
New Residential Structures	$220.45	$0.00	$220.45	1450	$38.13	$1.29
New Utility Structures	$49.16	$0.00	$49.16	497	$18.98	$0.25
Newspapers	$27.62	$17.09	$10.53	345	$12.72	$0.29
Nonmetallic Mineral Products, N.E.C.	$0.75	$0.02	$0.73	9	$0.28	$0.01
Oil Field Machinery	$26.21	$6.16	$20.04	243	$9.81	$0.20
Ophthalmic Goods	$0.82	$0.03	$0.78	6	$0.36	$0.01
Packaging Machinery	$0.35	$0.19	$0.16	2	$0.12	$0.00
Paints and Allied Products	$1.45	$0.02	$1.42	5	$0.41	$0.01
Petroleum Refining	$8.80	$4.07	$4.73	4	$0.30	$0.02
Pipe, Valves, and Pipe Fittings	$6.58	$1.40	$5.18	59	$2.39	$0.05

Table A-4: Economic Data for Manufacturing Sectors, Region B (Year 2000, monetary figures reported in $millions)

Plate Making	$0.13	$0.04	$0.09	4	$0.10	$0.00
Pleating and Stitching	$0.44	$0.13	$0.30	9	$0.29	$0.00
Power Transmission Equipment	$13.73	$0.16	$13.57	89	$4.49	$0.12
Prefabricated Metal Buildings	$0.36	$0.01	$0.36	3	$0.13	$0.00
Prefabricated Wood Buildings	$13.08	$0.11	$12.97	110	$3.88	$0.11
Prepared Feeds, N.E.C	$19.50	$0.31	$19.18	52	$2.01	$0.13
Pumps and Compressors	$1.04	$0.03	$1.02	4	$0.32	$0.01
Radio and Tv Communication Equipment	$2.53	$1.20	$1.33	4	$1.34	$0.03
Ready-mixed Concrete	$16.86	$0.10	$16.76	126	$4.59	$0.19
Refrigeration and Heating Equipment	$29.52	$11.46	$18.06	145	$7.09	$0.25
Relays & Industrial Controls	$84.70	$6.70	$78.01	397	$37.03	$0.88
Sausages and Other Prepared Meats	$154.02	$26.14	$127.88	699	$28.25	$1.07
Sawmills and Planing Mills, General	$0.13	$0.13	$0.00	1	$0.01	$0.00
Screw Machine Products and Bolts, Etc.	$0.37	$0.15	$0.21	2	$0.18	$0.00
Service Industry Machines, N.E.C.	$4.41	$0.81	$3.60	26	$1.32	$0.04
Sheet Metal Work	$13.99	$0.30	$13.69	123	$4.68	$0.10
Shoes, Except Rubber	$21.66	$0.08	$21.58	184	$12.86	$0.22
Signs and Advertising Displays	$1.09	$0.38	$0.71	13	$0.47	$0.01
Soap and Other Detergents	$0.62	$0.09	$0.53	5	$0.32	$0.01
Sporting and Athletic Goods, N.E.C.	$16.75	$0.10	$16.65	101	$7.88	$0.67
Surgical Appliances and Supplies	$1.79	$0.34	$1.44	8	$0.61	$0.02
Transportation Equipment, N.E.C	$0.86	$0.01	$0.85	4	$0.16	$0.01
Travel Trailers and Camper	$0.50	$0.00	$0.49	3	$0.08	$0.00
Truck Trailers	$0.59	$0.02	$0.57	5	$0.15	$0.00
Wood Household Furniture	$0.58	$0.05	$0.54	5	$0.26	$0.00
Wood Kitchen Cabinets	$1.93	$1.91	$0.02	29	$0.74	$0.01
Wood Pallets and Skids	$7.19	$3.13	$4.06	104	$2.74	$0.06
Wood Products, N.E.C	$2.98	$1.60	$1.38	28	$1.14	$0.03
Total	$2,698.45	$339.08	$2,359.37	19,182	$961.73	$27.95

NEC = not elsewhere classified. “na” = not available.

Table A-5: Economic Data for Mining Sectors, Region B (Year 2000, monetary figures reported in $millions)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Chemical, Fertilizer Mineral Mining	$2.88	$0.41	$2.47	25	$1.87	$0.13
Clay, Ceramic, Refractory Minerals	$2.27	$0.02	$2.25	6	$1.35	$0.08
Coal Mining	$5.40	$0.93	$4.47	16	$1.85	$0.71
Dimension Stone	$10.74	$0.19	$10.55	65	$6.54	$0.33
Misc. Nonmetallic Minerals, N.E.C.	$0.26	$0.01	$0.24	3	$0.16	$0.01
Natural Gas & Crude Petroleum	$1,459.97	$304.53	$1,155.44	3931	$633.05	$74.29
Natural Gas Liquids	$2.30	$0.48	$1.82	2	$0.70	$0.11
Nonmetallic Minerals (Except Fuels)	$0.35	$0.02	$0.33	6	$0.15	$0.01
Potash, Soda, and Borate Minerals	$0.84	$0.12	$0.72	3	$0.46	$0.03
Sand and Gravel	$9.47	$0.22	$9.24	69	$5.90	$0.30
Total	$1,494.47	$306.93	$1,187.54	4,126	$652.03	$75.98

na = “not available”

Table A-6: Economic Data for the Steam Electric Sector, Region B (Year 2000, monetary figures reported in $millions)

Sector	Total Sales	Intermediate Sales	Final Sales	Jobs	Regional Income	Business Taxes
Electric Services	$114.81	$35.19	$79.62	234	$82.10	$14.71
State and Local Electric Utilities	$13.27	$4.05	$9.22	37	$3.65	$0.00
Total	$128.08	$39.24	$88.84	272	$85.75	$14.71

na = “not available”

Attachment B: Distribution of Economic Impacts by County and Water User Group

Tables B-1 through B-6 show economic impacts by county and water user group; however, caution is warranted. Figures shown for specific counties are *direct* impacts only. For the most part, figures reported in the main text for all water use categories uses include *direct and secondary* impacts. Secondary effects were estimated using regional level multipliers that treat each regional water planning area as an aggregate and autonomous economy. Multipliers do not specify where secondary impacts will occur at a sub-regional level (i.e., in which counties or cities). All economic impacts that would accrue to a region as a whole due to secondary economic effects are reported in Tables B-1 through B-6 as "secondary regional level impacts."

For example, assume that in a given county (or city) water shortages caused significant reductions in output for a manufacturing plant. Reduced output resulted in lay-offs and lost income for workers and owners of the plant. This is a *direct* impact. Direct impacts were estimated at a county level; and thus one can say with certainty that direct impacts occurred in that county. However, secondary impacts accrue to businesses and households throughout the region where the business operates, and it is impossible using input-output models to determine where these businesses are located spatially.

The same logic applies to changes in population and school enrollment. Since employment losses and subsequent out-migration from a region were estimated using *direct* and *secondary* multipliers, it is impossible to say with any degree of certainty how many people a given county would lose regardless of whether the economic impact was direct or secondary. For example, assume the manufacturing plant referred to above is in County A. If the firm eliminated 50 jobs, one could state with certainty that water shortages in County A resulted in a loss of 50 jobs in that county. However, one could not unequivocally say whether 100 percent of the population loss due to lay-offs at the manufacturing would accrue to County A because many affected workers might commute from adjacent counties. This is particularly true in large metropolitan areas that overlay one or counties. Thus, population and school enrollment impacts cannot be reported at a county level.

Municipal

Impacts to the horticultural industry were estimated at the regional level only and are not included here. For figures show below, there were no significant secondary regional level impacts.

Table B-1: Lost Water Utility Revenues and Taxes (Municipal)

Revenues ($millions)						
County	2010	2020	2030	2040	2050	2060
Wichita (Electra)	$0.29	$0.25	$0.24	$0.23	$0.23	$0.24
Taxes ($millions)						
Wichita (Electra)	$0.005	$0.004	$0.004	$0.004	$0.004	$0.004

Source: Generated by the Texas Water Development Board, Office of Water Planning.

Table B-2: Impacts to Residential and Domestic Water Uses

County	2010	2020	2030	2040	2050	2060
Archer (County-other)	$0.13	$0.07	$0.06	$0.03	$0.00	$0.00
Clay (County-other)	$0.35	$0.42	$0.46	$0.49	$0.45	$0.45
Montague (County-other)	$0.53	$0.60	$0.64	$0.66	$0.62	$0.62
Wichita (Electra)	$0.43	$0.37	$0.35	$0.34	$0.34	$0.36
Total	$1.45	$1.46	$1.51	$1.53	$1.41	$1.43

Source: Generated by the Texas Water Development Board, Office of Water Planning.

Irrigation

Table B-3: Distribution of Economic Impacts by County and Water User Groups: (Irrigation)						
Lost Output (Total Sales, $millions)						
County	2010	2020	2030	2040	2050	2060
Archer						
Direct	$0.0000	$0.0026	$0.0051	$0.0078	$0.0211	$0.0286
Secondary Regional Level Impacts	$0.0000	$0.0014	$0.0029	$0.0044	$0.0120	$0.0162
Clay						
Direct	$0.0000	$0.0000	$0.0016	$0.0023	$0.0029	$0.0040
Secondary Regional Level Impacts	$0.0000	$0.0000	$0.0011	$0.0016	$0.0021	$0.0028
Wichita						
Direct	$0.0000	$0.0250	$0.0495	$0.0749	$0.2029	$0.2702
Secondary Regional Level Impacts	$0.0000	$0.0187	$0.0371	$0.0562	$0.1522	$0.2026
Total	$0.0000	$0.0477	$0.0974	$0.1473	$0.3932	$0.5244
Lost Income ($millions)						
County	2010	2020	2030	2040	2050	2060
Archer						
Direct	$0.0000	$0.0004	$0.0009	$0.0013	$0.0036	$0.0048
Secondary Regional Level Impacts	$0.0000	$0.0008	$0.0016	$0.0024	$0.0064	$0.0087
Clay						
Direct	$0.0000	$0.0000	$0.0003	$0.0005	$0.0006	$0.0008
Secondary Regional Level Impacts	$0.0000	$0.0000	$0.0006	$0.0009	$0.0011	$0.0015
Wichita						
Direct	$0.0000	$0.0028	$0.0056	$0.0085	$0.0231	$0.0307
Secondary Regional Level Impacts	$0.0000	$0.0099	$0.0197	$0.0298	$0.0807	$0.1075
Total	$0.0000	$0.0140	$0.0287	$0.0434	$0.1155	$0.1541
Lost Jobs						
	2010	2020	2030	2040	2050	2060
Archer						
Direct	0	0	0	0	0	0
Secondary Regional Level Impacts	0	0	0	0	0	0
Clay						
Direct	0	0	0	0	0	0
Secondary Regional Level Impacts	0	0	0	0	0	0
Wichita						
Direct	0	1	1	2	6	7
Secondary Regional Level Impacts	0	0	1	1	2	3
Total	0	1	2	3	8	11
Lost Business Taxes ($millions)						
County	2010	2020	2030	2040	2050	2060
Archer						
Direct	$0.0000	$0.0000	$0.0001	$0.0001	$0.0004	$0.0005
Secondary Regional Level Impacts	$0.0000	$0.0001	$0.0002	$0.0002	$0.0006	$0.0009
Clay						
Direct	$0.0000	$0.0000	$0.0000	$0.0000	$0.0000	$0.0001
Secondary Regional Level Impacts	$0.0000	$0.0000	$0.0001	$0.0001	$0.0001	$0.0001
Wichita						
Direct	$0.0000	$0.0003	$0.0005	$0.0008	$0.0022	$0.0029
Secondary Regional Level Impacts	$0.0000	$0.0010	$0.0019	$0.0029	$0.0078	$0.0104
Total	$0.0000	$0.0014	$0.0028	$0.0042	$0.0112	$0.0149

Mining

All impacts to Mining are associated with unmet needs in Montague County.

Attachment C: Allocation of Economic Impacts by River Basin

Tables C-1 shows regional economic impacts by major river basin. Impacts were allocated based on distribution of water shortages among counties. For instance, if 50 percent of water shortages in River Basin A and 50 percent occur in River Basin then impacts were split equally among the two basins.

Municipal

Table C-1: Distribution of Impacts among Major River Basins (Municipal Uses)						
Lost Output (Total Sales, $millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	$0.14	$0.02	$0.00	$0.00	$0.00	$0.00
Red	$1.94	$1.91	$2.07	$2.09	$2.03	$2.14
Trinity	$1.29	$1.28	$1.39	$1.37	$1.20	$1.19
Total	$3.37	$3.21	$3.46	$3.46	$3.24	$3.33
Lost Income ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	$0.11	$0.01	$0.00	$0.00	$0.00	$0.00
Red	$1.43	$1.47	$1.56	$1.58	$1.52	$1.59
Trinity	$0.95	$0.98	$1.04	$1.04	$0.90	$0.88
Total	$2.48	$2.46	$2.60	$2.62	$2.42	$2.48
Job Losses (numbers may not sum to figures in text due to rounding)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	1	0	0	0	0	0
Red	19	19	21	21	20	21
Trinity	13	13	14	14	12	12
Total	33	32	34	34	32	33
Lost Business Taxes ($millions)						
Basin	2010	2020	2030	2040	2050	2060
Brazos	$0.001	$0.000	$0.000	$0.000	$0.000	$0.000
Red	$0.013	$0.012	$0.013	$0.013	$0.013	$0.014
Trinity	$0.008	$0.008	$0.009	$0.009	$0.008	$0.008
Total	$0.022	$0.021	$0.022	$0.022	$0.021	$0.021

Irrigation

All impacts to irrigation occur in the Red River Basin.

Mining

All impacts to mining occur in the Red River Basin.

ATTACHMENT 4-4

REGIONAL WATER PLANNING GROUP B

SOUTH SIDE CANAL STUDY

REPORT ON
ENVIRONMENTAL STUDY
OF THE
WICHITA COUNTY WATER IMPROVEMENT DISTRICT NO. 2
SOUTH SIDE CANAL

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LIST OF ABBREVIATIONS

µS/cm	MicroSiemens per centimeter
APAI	Alan Plummer Associates, Inc.
BMI	Biggs and Mathews, Inc.
BOD_5	Five-day biochemical oxygen demand
CAFOs	Confined animal feeding operations
CCP	Chloride Control Project
CFR	Code of Federal Regulations
cfs	Cubic feet per second
City	City of Wichita Falls
Cond	Conductivity
CRP	Clean Rivers Program
DO	Dissolved oxygen
E coli	Escherichia coli
ºF	Degrees Fahrenheit
mg/L	Milligrams per liter
MGD	Million gallons per day
msl	mean sea level
NO_3+NO_2, (as N)	Nitrate + Nitrite, (as Nitrogen)
NRCS	Natural Resources Conservation Service
P	Total phosphorus
ºC	Degrees Celsius
RO	Reverse osmosis
RRA	Red River Authority
RWPG-B	Region B Water Planning Group
SU	Standard Units
TCEQ	Texas Commission on Environmental Quality
Temp	Temperature
TDS	Total dissolved solids

LIST OF ABBREVIATIONS
(Continued)

TKN	Total Kjeldahl nitrogen
TN	Total nitrogen
TOC	Total organic carbon
TPH	Total petroleum hydrocarbons
TPWD	Texas Parks and Wildlife Department
TSS	Total suspended solids
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VSS	Volatile suspended solids
WCWID No. 2	Wichita County Water Improvement District No. 2

CHAPTER I
INTRODUCTION

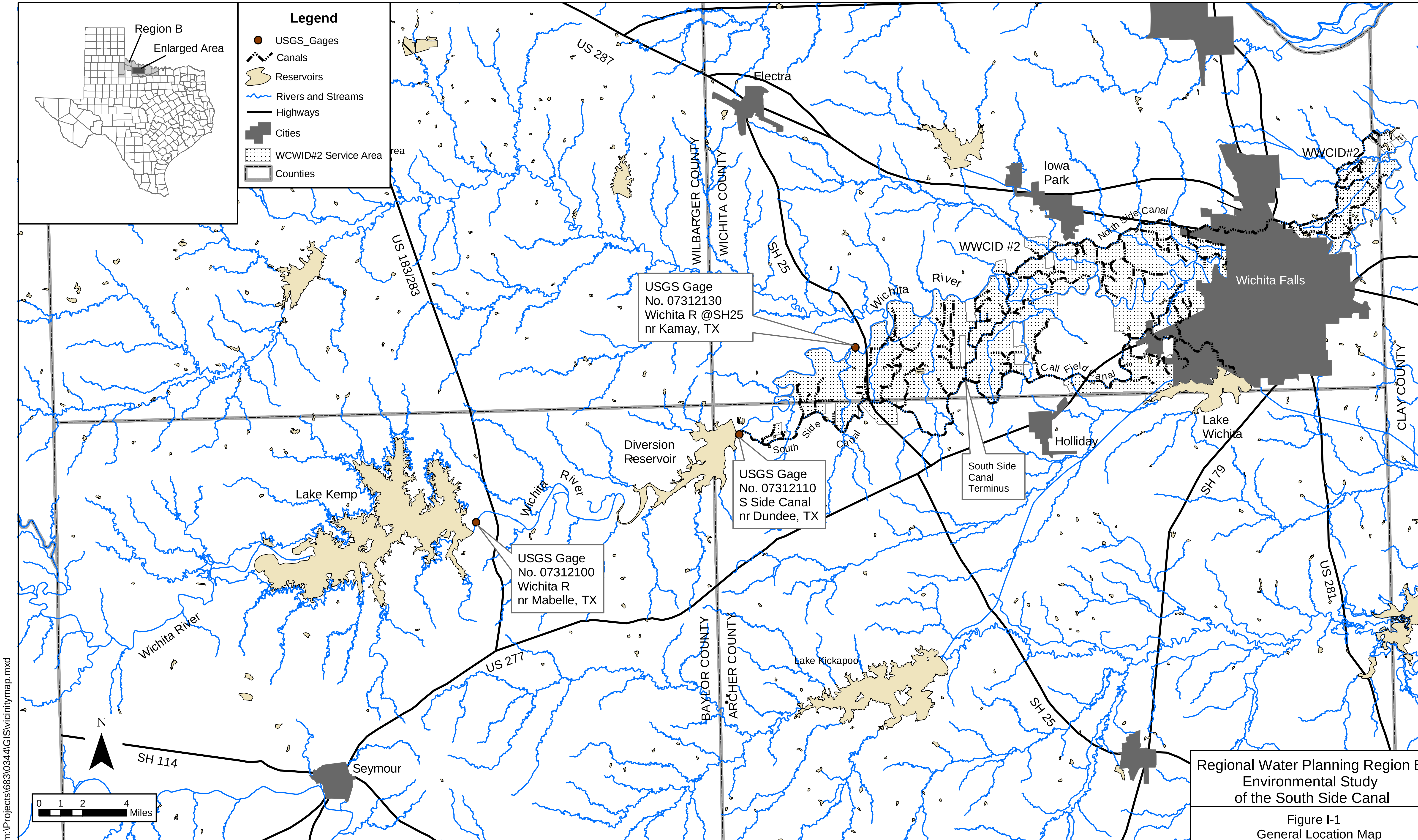
An environmental study has been performed on the South Side Canal, an irrigation canal located in the Region B water planning area. The objective of the environmental study has been to identify strategies for improved management of this valuable resource. This report describes the results of the environmental study of the canal. The study was performed as part of the regional planning effort being undertaken by the Region B Water Planning Group (RWPG-B).

The South Side Canal, located in northwestern Archer County and southwestern Wichita County, is part of a system of impoundments and irrigation canals known locally as the Wichita Valley Irrigation Project. Mr. J. A. Kemp, an area landowner and rancher, originally conceived the concept of a system of impoundments and canals in this area in the latter part of the 19^{th} century. However, construction of the lakes, canals, and laterals associated with the canal system did not begin until 1922. The system, as originally designed, was completed in 1925. This irrigation system serves a significant portion of the farming community in the Wichita River basin west of the City of Wichita Falls (City). The Wichita County Water Improvement District No. 2 (WCWID No. 2) jointly owns the system with the City. The system is operated and maintained by the WCWID No. 2.

The field work for the environmental study was a joint effort of the WCWID No. 2, Red River Authority (RRA), and Alan Plummer Associates, Inc. (APAI). APAI is providing services as part of the consulting team for the RWPG-B headed by Biggs and Mathews, Inc. (BMI), of Wichita Falls. Management and staff of the WCWID No. 2, RRA, APAI, and BMI collaborated in the development and implementation of the environmental study. The report has been prepared by APAI.

CANAL SYSTEM OVERVIEW

Figure I-1 depicts the general location of the canal system. Shown are the two reservoirs (Kemp and Diversion) and the three canals (South Side, North Side, and Call Field) that comprise the system. Water is stored in Lake Kemp and released as needed to Lake Diversion.



Regional Water Planning Region B Environmental Study of the South Side Canal

Figure I-1
General Location Map

Irrigation water is released to the South Side Canal through a gate structure at the Lake Diversion dam. Water is distributed to the North Side and Call Field Canals via gate structures at the eastern terminus of the South Side Canal.

The irrigation system includes approximately 192 miles of canals and laterals. The three canals and the majority of the associated laterals are unlined earthen channels. A number of years ago, some segments of the laterals were lined with concrete to reduce seepage losses. The WCWID No. 2 has also initiated a program to refit laterals with pipe in order to reduce losses. Although resources to accomplish pipe placement are limited, a number of segments of the open ditch lateral system have been replaced with pipe.

WATER USES

The primary function of Lakes Kemp and Diversion is to provide storage of water for irrigation. However, the lakes also serve as flood control reservoirs. When necessary to prevent flooding downstream, the United States Army Corps of Engineers (USACE) has the authority to control flood storage levels in Lakes Kemp and Diversion. Lake Diversion water is also used by a power plant to supplement its cooling water and by the Dundee Fish Hatchery, operated by the Texas Parks and Wildlife Department (TPWD). Currently, the only other significant use of Lake Diversion is recreation (e.g., fishing and boating).

Water is diverted from Lakes Kemp and Diversion in accordance with a Certificate of Adjudication (Water Right) owned by the WCWID No. 2 and the City. This Water Right authorizes the diversion of up to 193,000 acre-feet (ac-ft) per year for a variety of purposes, including irrigation, municipal, industrial, mining, and recreational uses. The safe yield of Lakes Kemp and Diversion is currently estimated to be 126,000 ac-ft of water per year. Therefore, potentially, a shortfall of water would exist if the water rights were fully utilized.

At this time, the majority of water use is for irrigation. However, water-use practices from this lake system will soon change. The City is currently designing a water treatment plant that will utilize Lake Diversion as a source of raw water. Part of the delivery system for the raw water will be the South Side Canal. The City plans to pump water from the terminus of the South Side Canal (where the North Side and Call Field Canals begin) to a large storage basin to be constructed nearby and, thence, to the water treatment plant via a pipeline. This proposed system was identified in the 2001 Regional Water Plan as a top priority water management strategy for the City. The water treatment plant is scheduled to begin operating in 2007.

STUDY DESCRIPTION

The scope of the 2005 update to the Regional Water Plan calls for additional environmental study of the City's plan to obtain water from Lake Diversion. The scope includes a study of the South Side Canal to assess the following:

- Flow and flow losses
- Existing water quality conditions
- Potential impacts of surrounding land uses on water quality

The approach to this study has been to conduct measurements in the South Side Canal system and compare results of the measurements with other existing data and information about the South Side Canal. These observations and evaluations were used to develop recommendations for measures to conserve water resources and maintain good quality raw water for municipal and agricultural uses.

The scope of this study is confined to the South Side Canal and the laterals that extend from the South Side Canal. The North Side Canal and Call Field Canal also represent a significant portion of the overall irrigation system. However, the South Side Canal is the only part of the canal system that will carry water for both municipal and agricultural purposes. For purposes of the Regional Water Plan update, the study was limited to this part of the overall system.

CHAPTER II

GENERAL DESCRIPTION OF THE SOUTH SIDE CANAL AND SURROUNDING AREA

All water for irrigation supplied by the WCWID No. 2 flows from Lake Diversion, through the South Side Canal, and into open ditches, known as laterals, that extend from the canal. The laterals distribute water to the tracts where crops are grown. At the termination of the South Side Canal, the flow that has not been diverted into laterals is split between two subsequent canals. Each of these subsequent canals also supports a series of laterals. Figure II-1 indicates the course of the South Side Canal from the dam at Lake Diversion to its end at Headquarters Road.

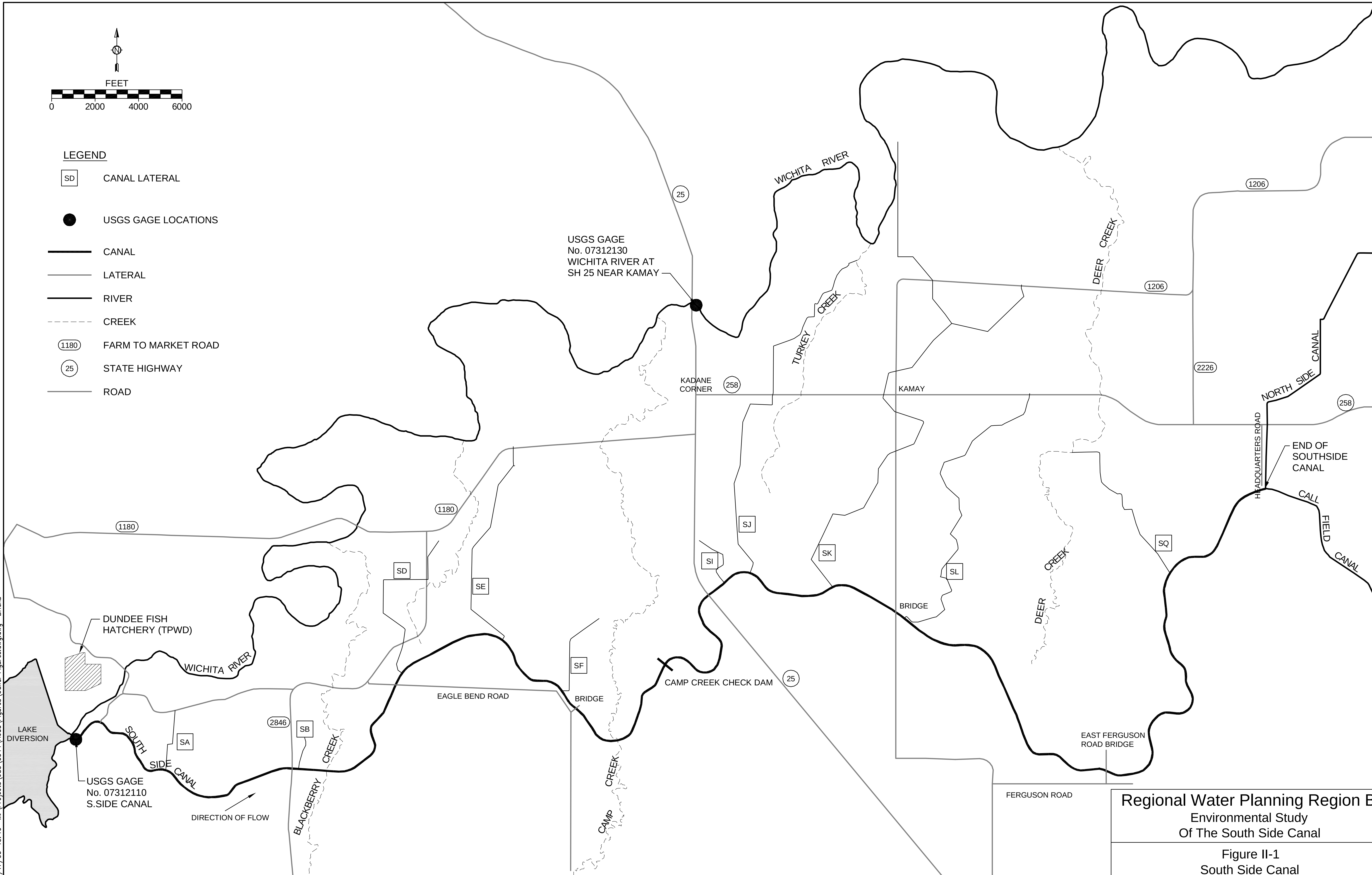
Numerous factors may affect the quantity and quality of water in the canal, including the following:

- Canal characteristics and configuration
- Geology and soils characteristics
- Surrounding land use
- Area climate
- Canal operation

These factors are addressed in more detail below. As previously indicated, most water use from the system has historically been for irrigation purposes. Additional detail regarding historical water use, particularly for irrigation purposes, follows.

CANAL CHARACTERISTICS AND CONFIGURATION

The South Side Canal is earthen throughout its entire length; water in the canal is in direct contact with *in-situ* soils and with soils that make up the constructed embankments on either side of the canal. For the most part, the canal was excavated into natural soils, and the excavated material used to construct adjacent embankments. Where natural grade dropped (i.e., at creek crossings), the channel and adjacent embankments were built higher to maintain the appropriate grade. In those areas, soil from nearby excavations was used to complete the embankments.



Regional Water Planning Region B
Environmental Study
Of The South Side Canal

Figure II-1
South Side Canal

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The canal is approximately 17 miles long from its beginning at the Lake Diversion Dam to its termination at the gates that divert water into the North Side Canal and Call Field Canal. A series of laterals and sublaterals extend north from the South Side Canal toward the Wichita River (see Figure II-1) for the delivery of irrigation water to users. The canal is designed to deliver water to each lateral, sublateral, and to the two subsequent canals entirely by gravity. The canal is located within the Wichita River watershed and parallels the general course of the Wichita River at a higher elevation than the river itself.

The canal slopes at an average grade of approximately 0.2 percent grade in a generally eastward direction. The canal is characterized by long, gently curving reaches. The canal floor generally follows the 1,050-foot mean sea level (msl) contour line through the first-half of the canal length. As it continues to the east, the flowline eventually falls below the 1,040-foot msl contour and approaches the 1,030-foot msl contour. There is an elevation difference between the canal and the Wichita River of approximately 30 - 35 feet in the vicinity of the Lake Diversion Dam. This elevation differential between the canal and the river is generally maintained throughout the length of the canal.

The canal is trapezoidal in section, with a width at the top of the embankment that varies from approximately 55 feet to 80 feet. The depth from the top of the embankment to the canal floor generally varies from approximately 9 feet to 18 feet. The side slopes of the embankments vary significantly from one location to another, possibly due to ongoing erosion and maintenance along the canal over the years. Periodically, portions of the canal are dredged to remove accumulated sediment, and the dredged material placed on top of, or adjacent to, the embankment.

The South Side Canal intersects two major creeks ? Blackberry Creek and Camp Creek (see Figure II-1). Blackberry Creek and Camp Creek flow beneath the canal, through concrete conduits constructed below the canal bottom. In addition, butterfly valve structures were constructed at these two creek crossings. These were constructed to provide the capability to divert canal water into the creeks below in the event it should become necessary to lower the water level in the canal. However, the butterfly valves are no longer functional, although the concrete structures that house them are still in place at each creek.

GEOLOGY AND SOILS CHARACTERISTICS

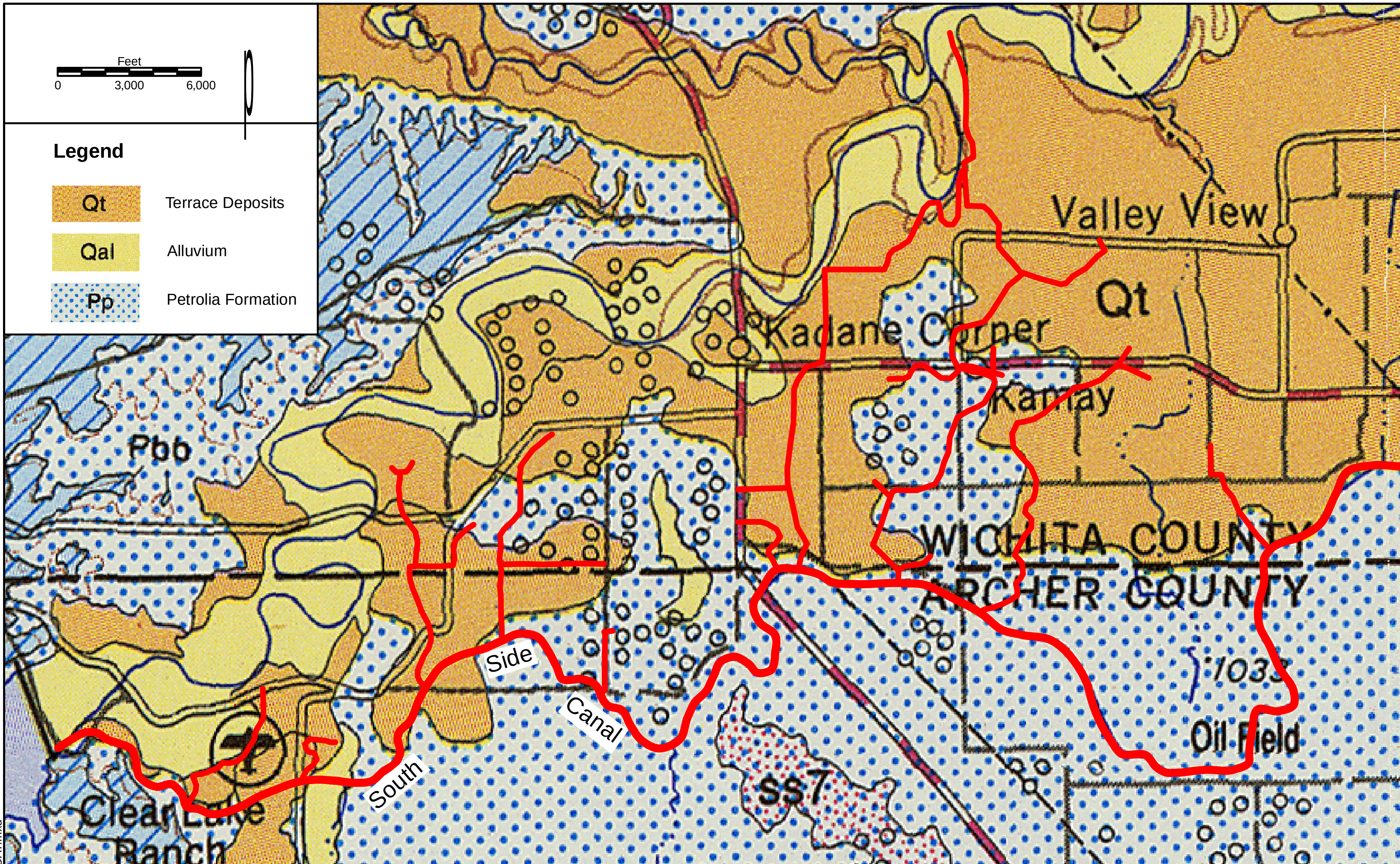
Site-specific geotechnical investigations for the canal construction are not available. Figure II-2 shows the general geological information from the University of Texas Bureau of Economic Geology for the canal and surrounding area. Figure II-3 delineates the various types of soils for the same area, based on soil surveys from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). The soil survey for Archer County was published in April 1995 and the soil survey of Wichita County was published in May 1977. These documents provide a description of the shallow soils in Archer and Wichita Counties; and discussions of the suitability, limitations, and management of the soils for specified uses. Based on these soil surveys, the South Side Canal passes through a wide variety of soil types. Typical soil types include the following major soils units:

- Kamay-Deandale
- Vernon-Knoco
- Winters-Deandale
- Wheatwood-Mangum

In general, these soils units are described in the soil surveys as moderately to very slowly permeable with varying surface-layer depths. The surface layer is often underlain with clay and clay loams with a relatively high shrink-swell potential. These soils are described as generally suitable for agricultural use (i.e., cropland or rangeland).

The soil surveys identify a limited number of areas along the canal route as oil-waste land. These areas have been damaged by the use of heavy machinery and contamination by oil derivatives and oil production by-products such as brine, drilling mud, and sludge.

The South Side Canal is almost entirely located in soils with generally low seepage potential under natural conditions. The potential for seepage through embankments constructed of the materials found along the route is somewhat dependent on construction techniques and maintenance history. Given the age of the South Side Canal, some seepage through embankments could be expected.



Data Source: University of Texas,
Bureau of Economic Geology
Geologic NW Quadrangle Map

Regional Water Planning Region B
Environmental Study
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Figure II-2
Geology Map

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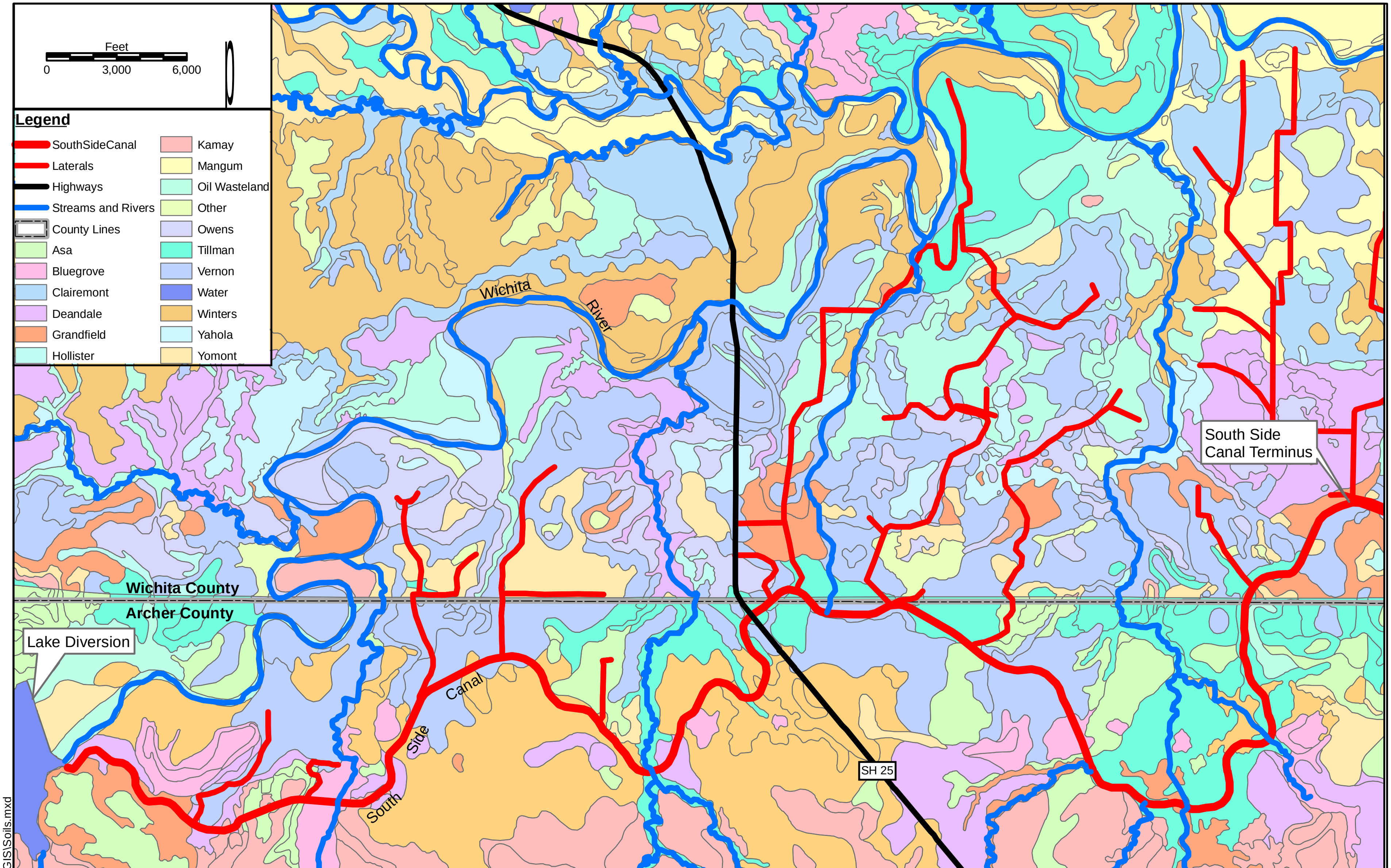

Data Source: USDA, NRCS SSURGO database for Archer and Wichita Counties

Regional Water Planning Region B
Environmental Study
of the South Side Canal

Figure II-3
Soils Map

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SURROUNDING LAND USES

Predominant land uses in the area surrounding the South Side Canal are ranching, farming, and oil extraction. Limited urbanization is also developing to the west and south of Wichita Falls. Ranching activities in the surrounding area include livestock grazing of native rangeland, cultivation and grazing of improved pastureland, and confined animal feeding operations (CAFOs). Principal crops cultivated in the area include sorghums, cotton, grasses, wheat, and other small grains. Land uses are depicted in Figure II-4.

AREA CLIMATE

The most significant climatological characteristics impacting irrigation are temperature, humidity, precipitation, and evaporation. In the study area, climate is characterized by hot, dry weather during the typical peak irrigation season (generally April through September). Daily high temperatures during the season range from over 80º Fahrenheit (ºF) to over 100ºF. Humidity is typically low, especially during the summer. The high temperatures and low humidity result in high evaporation rates. Table II-1 summarizes the average precipitation rates and average pan evaporation rates for the study area.

Table II-1

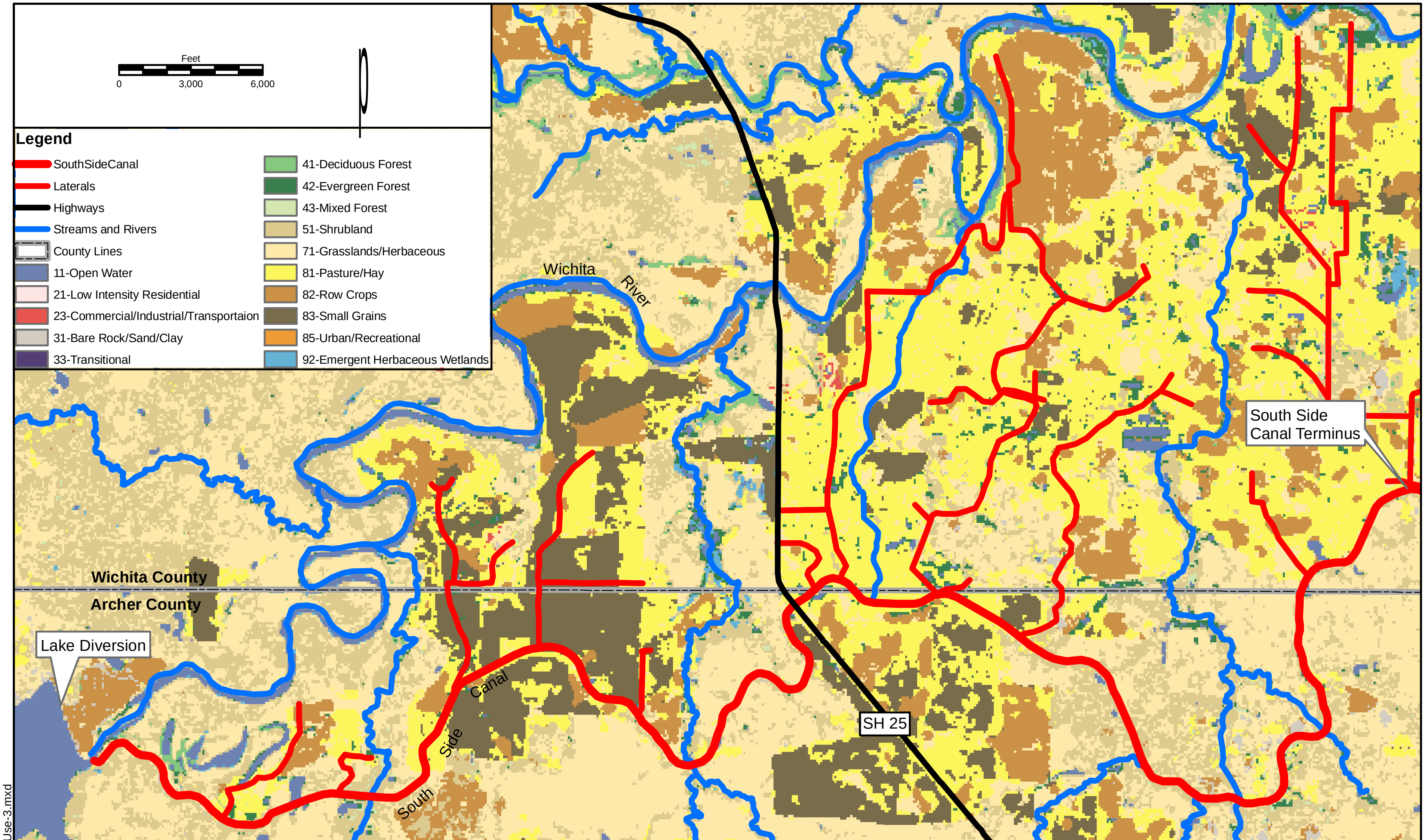
WCWID No. 2 South Side Canal
Environmental Study

Monthly Average Precipitation and Evaporation
Wichita Falls, Texas

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Precipitation (inches)[1]	1.12	1.57	2.27	2.62	3.92	3.69	1.58	2.38	3.19	3.11	1.68	1.68
Average Pan Evaporation (inches)[2]	2.29	3.16	5.82	8.56	9.50	11.21	12.66	11.70	8.78	6.62	4.19	3.00

(1) Period of record from 1971 to 2001, measured at the Wichita Falls Airport.
(2) Averaged between stations at Lake Kemp (1974-2003) and Lake Kickapoo (1948-1964).

The Wichita Falls area receives an average of 28.8 inches of precipitation annually. Approximately 60 percent of the average annual precipitation occurs during the peak irrigation season. The April through September period is, in fact, a relatively wet part of the year; but the



Data Source: USGS 1992 Land Cover Dataset

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Regional Water Planning Region B

Environmental Study

of the South Side Canal

Figure II-4
Land Use Map

amount of rainfall received during this period (approximately 17.4 inches) is substantially less than is needed to sustain most crops. Hence, irrigation is extremely important to agriculture in the area.

Pan evaporation is a measure of the amount of evaporation that might be expected from a water body. It is particularly important when considering water losses from reservoirs with large exposed surface areas. However, its impact on any water body can be determined if the surface area of the water body is known. The South Side Canal is approximately 17 miles long, with a water surface area at normal flow of approximately 4.5 million square feet. Evaporation from the South Side Canal in September averages 8.78 inches (see Table II-1), or a rate of approximately 1.25 cfs.

CANAL OPERATION

The WCWID No. 2 operates the canal system on an “on demand” basis. However, irrigation water is only released to downstream users after an adequate quantity of water has been requested to justify the use of the main canal system. The quantity of water released through laterals and sublaterals for irrigation is not metered. In addition, a significant quantity of water (sometimes called “push water”) is needed to effectively transport irrigation water to the users at the end of the laterals. Excess push water ultimately drains (directly or indirectly) to the Wichita River.

Diversion of water for irrigation is seasonal. Diversions generally begin each year in April and end in October. Weather conditions obviously play a substantial role in when irrigation demand begins and ends. During the irrigation season, diversions can run as high as 170 to 190 cfs. Flow can vary substantially from day to day, depending on weather conditions and demand throughout the system.

Diversion gates at the dam are closed between the end of one irrigation season and the beginning of the next. Minor leakage through the gates produces minimal flow in the canal during the winter season. The gates at the end of the South Side Canal (leading to the North Side and Call Field Canals) hold most of this water in the South Side Canal during the winter season. Water levels in the South Side canal are generally below the lateral outlets during this time.

HISTORICAL WATER USE AND AVAILABILITY PROJECTIONS

The Lake Kemp/Lake Diversion adjudicated water right includes the following allowable diversions:

Municipal	25,150	ac-ft/year
Industrial	40,000	ac-ft/year
Mining	2,000	ac-ft/year
Recreational	5,850	ac-ft/year
Agricultural	120,000	ac-ft/year
	193,000	ac-ft/year

Currently, water is diverted for industrial, recreation, and agricultural purposes.

Industrial diversions are used for cooling water for the Oklaunion Power Plant (American Electric Power), located in Wilbarger County north of Lake Diversion. Currently, the facility utilizes approximately 8,000 ac-ft per year from Lake Diversion from a 20,000 ac-ft per year contract with the WCWID No. 2.

Recreational diversions consist of water diverted from the Call Field Canal to a tributary of Lake Wichita (see Figure I-1). The diverted water flows into Lake Wichita and is used to maintain water levels in the lake. The diversion of water into Lake Wichita is on a demand basis by the City of Wichita Falls. During relatively wet years, there may be no diversion requested by the City. During the five years between 2000 and 2004, there were no diversions for two of the years. The average annual diversion for the remaining three years was approximately 5,140 ac-ft.

Agricultural diversions include irrigation via the Wichita Valley Irrigation Project and releases to the Dundee Fish Hatchery located on the Wichita River immediately below the Lake Diversion Dam. The fish hatchery is authorized, by contract with the WCWID No. 2, to divert up to 2,200 ac-ft of water per year and currently takes approximately 1,750 ac-ft annually.

Irrigation accounts for the largest diversion from the Lake Kemp/Lake Diversion system. However, it cannot be precisely quantified because flow from the canal to area farms is not measured.

Water availability and demands have been analyzed for the Lake Kemp/Lake Diversion system for the current regional water planning effort. Table II-2 summarizes availability and demands for the period 2010 through 2060.

Flow from Lake Diversion into the canal is measured at the United States Geological Survey (USGS) Gauge No. 07312110 (Dundee Gauge) located immediately below the dam. Flow is recorded continuously at this location. The recorded volume of water released into the canal for the period from October 1994 through September 2003 has averaged about 54,000 ac-ft per year. During the same 10-year period, the annual flow has ranged from a minimum of 33,000 ac-ft (October 2002 – September 2003) to a maximum of 75,000 ac-ft (October 1995 – September 1996). It should be noted that October 1995 – September 1996 was a wet year and the canal system was used to divert excess flows from Lake Kemp and Lake Diversion.

Table II-2
WCWID No. 2 South Side Canal
Environmental Study

Projected Annual Water Availability and
Water Demands for Lake Kemp/Lake Diversion
(units are ac-ft per year)

	2010	2020	2030	2040	2050	2060
Projected Lake Kemp Availability*	90,417	80,184	69,951	59,718	49,485	39,250
Run-of-the-River (water right)	8,850	8,850	8,850	8,850	8,850	8,850
Total Projected Availability	99,267	89,034	78,801	68,567	58,336	48,100
Total Projected Demands**	87,015	88,356	89,697	87,038	84,379	82,917
Projected Surplus/Deficit***	12,252	678	-10,896	-18,471	-26,043	-34,817

*Projected safe yield of Lake Kemp, as estimated by Freese and Nichols, Inc. for the 2005 update to the Region B water plan.
**Demand as projected for the 2005 update to the Region B water plan.
***Positive numbers indicate surplus and negative numbers indicate deficit.

Availability, as projected in Table II-2, is based on an analysis of the Lake Kemp/Lake Diversion system performed by Freese and Nichols, Inc., for the 2005 update to the Regional Water Plan. The projected capacity of the lakes drops substantially over the planning period. The projection is based on relatively old data (the last volumetric survey of Lake Kemp was performed in 1973;

sedimentation rates were last estimated in 1976). A new survey is needed to provide a better estimate of the lake's yield. The USACE plans to perform a new volumetric survey. Whenever the lake reaches its pool elevation. However, it may be very difficult for the lake to reach the pool elevation, given the climate of the area.

Demand projections in Table II-2 include demands on the system from irrigation, steam electric, and municipal uses. The projected irrigation demands include water delivered to farms for use and water losses within the canal system. It should be noted from Table II-2 that potential shortages of water from the Lake Kemp/Lake Diversion system could potentially develop around the year 2020.

HISTORICAL WATER QUALITY

Historically, water quality has not been monitored in the South Side Canal. However, the RRA monitors water quality in Lake Diversion and in the Wichita River nearby as part of the Clean Rivers Program (CRP). The Wichita River below Lake Diversion (Classified Segment 0214) flows for approximately 111 miles to its confluence with the Red River in Clay County. According to a water-quality assessment by the TCEQ in 2002, Segment 0214 is fully supporting of all designated uses for the segment.

The 2002 Texas Water Quality Inventory indicated that there are concerns regarding levels of ammonia, total phosphorus, and ortho-phosphate in the downstream portion of Segment 0214 northeast of the City of Wichita Falls in eastern Wichita County and western Clay County. It also indicated concerns about excessive algal growth and nickel in sediments of the same portion of the segment. RRA water quality monitoring data for 2002 indicate a trend of increasing total phosphorus and chlorophyll-*a* (an indicator of algal growth). The latest Basin Summary Report for the Red River Basin (Red River Authority, 2004) associated the nutrient and algae problems with portions of the segment significantly downstream of Lake Diversion.

Specific conductivity is monitored continuously at USGS gauging stations in the Wichita River above and below Lake Diversion. Specific conductivity can be used to approximate the concentration of total dissolved solids (TDS) in the water with an appropriate multiplier. Recent analyses of specific conductivity and TDS indicate that the appropriate multiplier for this portion of the Wichita River is 0.61. Therefore, TDS may be estimated by multiplying the specific conductivity reading by 0.61. Table II-3 summarizes TDS levels at two stations on the Wichita River for the five-year period from 1998 to 2002.

Table II-3

WCWID No. 2 South Side Canal
Environmental Study

Summary of Total Dissolved Solids Concentrations
in the Wichita River

	USGS Gauging Stations			
	No. 07312100, near Mabelle		No. 07312130, at SH 25 near Kamay	
Year	Average* (mg/L)	Range of Monthly Averages (mg/L)	Average* (mg/L)	Range of Monthly Averages (mg/L)
1998	2,804	2,501 – 3,142	3,649	2,525 – 4,331
1999	3,066	2,782 – 3,288	3,895	3,349 – 4,618
2000	3,229	3,099 – 3,379	3,935	3,495 – 4,203
2001	2,955	2,763 – 3,276	3,552	2,464 – 4,477
2002	2,693	2,312 – 3,050	3,661	2,788 – 4,728

*Average of monthly average TDS values for the period

The station near Mabelle is located in the Wichita River above Lake Diversion and below Lake Kemp (see Figure I-1). The station near Kamay is located below Lake Diversion (see Figures I-1 and II-1). An increase in TDS is evident from the upstream station to the downstream station (as little as 22 percent in 2000 to as much as 36 percent in 2002).

CHAPTER III
FIELD INVESTIGATIONS

Field investigations were conducted to evaluate water quality, environmental conditions, and the potential for water losses in the canal system. Two field investigations were initiated during September 2003. The first event occurred on September 3 and 4, 2003. The second event occurred on September 29 through October 1, 2003. The two initial field investigations were designed to develop a general understanding of flow and quality of the water as it passed through the canal, and to develop an initial inventory of potential environmental concerns. A third field investigation was conducted on September 21–23, 2004. This investigation included field observations throughout the lower reach of the South Side Canal, flow measurements, and water quality monitoring.

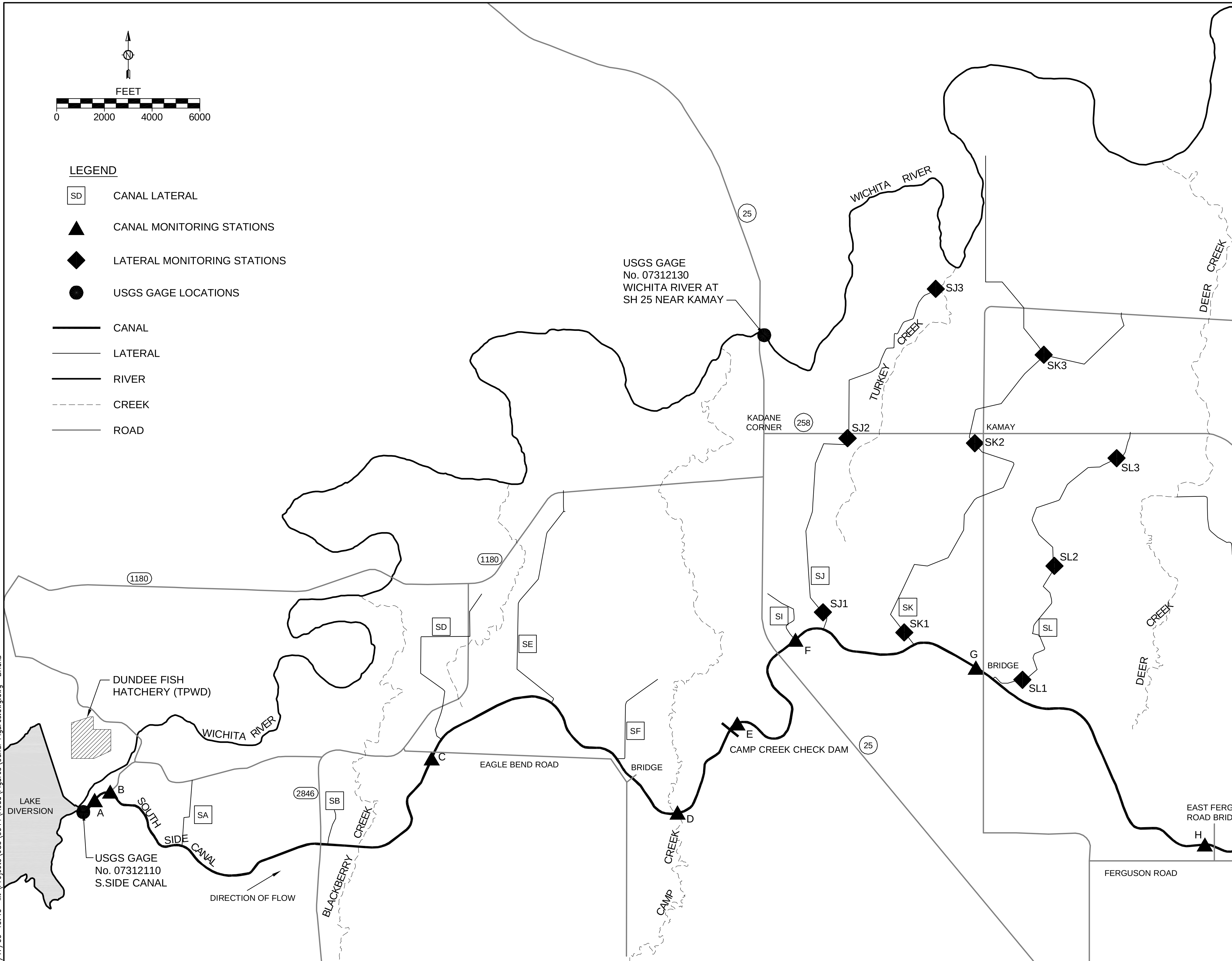
Ten monitoring sites along the South Side Canal were selected for measurements of flow and/or water quality. The sites were selected in consultation with WCWID No. 2 and the RRA. The monitoring sites are depicted in Figure III-1. The description of each site is provided in Table III-1.

In addition, flow was measured at three locations in each of three of the laterals (SJ, SK, and SL). The locations of the lateral monitoring stations are depicted in Figure III-1. The description of each lateral monitoring station is provided in Table III-2.

The field investigation also included observations of environmental conditions in and adjacent to the South Side Canal. Observations were made primarily from a canoe or small boat. Observations were also made from land where access to the canal could be gained by county road or bridge. Flow measurements, water quality monitoring results, and environmental observations are addressed in the following sections of this report.

FLOW MEASUREMENTS

The objective of the flow measurements in the canal and in the canal's laterals was to determine how much of the flow might be expected to be lost for use. Losses could be a result of seepage into the soils that make up the canal and laterals; leakage at the butterfly valves or from



Regional Water Planning Area B
Environmental Study
Of The South Side Canal

Figure III-1
Flow And Water Quality
Monitoring Locations

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Table III-1

WCWID No. 2 South Side Canal
Environmental Study

Canal Monitoring Stations

Station Identification	Description
A	Downstream of Lake Diversion
B	At road to the Lake Diversion Spillway (downstream side of bridge)
C	At the west Eagle Bend Road bridge
D	At Camp Creek
E	Approximately 300 feet downstream of Camp Creek check dam
F	Approximately 800 feet downstream of State Highway 25
G	Approximately 100 feet upstream of SL bridge
H	Approximately 300 feet upstream of East Ferguson bridge
I	Approximately 4000 feet upstream of Headquarters Road
J	Approximately 300 feet upstream of Headquarters Road

Table III-2

WCWID No. 2 South Side Canal
Environmental Study

Lateral Monitoring Stations

Station Identification	Description
SJ1	Approximately 700 feet downstream of South Side Canal
SJ2	Approximately 150 feet south of State Highway 258
SJ3	Approximately 1000 feet upstream of SJ spill to Wichita River
SK1	Approximately 500 feet downstream of South Side Canal
SK2	Approximately 400 feet south of State Highway 258
SK3	Approximately 1 mile north of Kamay
SL1	Approximately 1200 feet downstream of South Side Canal
SL2	Approximately 8000 feet downstream of South Side Canal
SL3	Approximately 1200 feet south of State Highway 258

otherwise closed lateral gates; evaporation from the canal and lateral water surfaces; wastage from the laterals to the Wichita River (the result of required push water); or even theft.

Flow was measured at each location by taking water depth measurements and instantaneous flow velocities at regular intervals across the canal (or lateral). The flow for each interval is the product of the interval width, the water depth, and the instantaneous velocity. The total flow at the location is the sum of the individual interval flows.

Flow losses in a reach may be estimated by taking the difference between flow into the reach and flow out of the reach at a single point in time. If flows cannot be measured at a single point in time, then the losses may still be approximated as the difference in the inflow and outflow, provided the reach is in steady-state flow condition during the time between the two measurements. Steady-state flow, in this case, means that flow into the reach and flow out of the reach (including any losses) are constant over the time interval. It must also be assumed that losses (by all potential routes) are relatively constant during the period between measurements. In the South Side Canal study, flow measurements were taken over a period of about 24 hours. During the periods of measurement, flow into and out of the canal was relatively constant.

Flow was measured on three occasions in the South Side Canal: (September 3-4, 2003; September 29-30, 2003; and September 21-23, 2004). Flow was also measured in the laterals that were operating during the periods of measurement on September 3, September 30, and October 1, 2003; and September 21-23, 2004. Measurements were taken at multiple locations in the canal during each monitoring event. The results of flow measurements are summarized and discussed in this section.

<u>Summary</u>

The results of the flow measurements conducted during the first field investigation are summarized in Table III-3.

Flow measured at USGS gauge No. 07312110 averaged 165 cfs on September 3 and 4, 2003. Several days before the measurements were made, the WCWID No. 2 staff adjusted flow to this rate, in order to create relatively steady flow conditions during measurement. In addition, water

Table III-3

WCWID No. 2 South Side Canal
Environmental Study

First Field Investigation
Canal Flow Measurement Summary

Station Identification	Date of Measurement	Approximate Time of Measurement	Flow (cfs)
A	9/03/03	10:30 AM	169
B	9/03/03	11:00 AM	185
C	9/03/03	1:30 PM	170
E	9/03/03	3:30 PM	154
SK1	9/03/03	not recorded	13
G	9/03/03	6:00 PM	140
H	9/04/03	9:30 AM	153
J	9/04/03	not recorded	151

was being diverted to only one lateral (SK). The diversion to the SK lateral had also been relatively constant for several days. Flow in the system was, therefore, considered to be in a steady-state condition.

The flow measurements made during the second field investigation in the South Side Canal are summarized in Table III-4.

Flow, as measured at USGS gauge No. 07312110, averaged approximately 103 cfs during this monitoring event. As in the first field event, the WCWID No. 2 staff had stabilized flows several days prior to the field investigation. Outflow to laterals was allowed only to the SJ, SK, and SL laterals. The system was considered to be steady state flow during the second field investigation.

During the third field investigation in September 2004, flow measurements were only conducted at stations A and J on the main canal. As in the previous field investigations, a steady rate of flow in the main canal and laterals was initiated several days prior to the field investigations.

Table III-4

WCWID No. 2 South Side Canal
Environmental Study

Second Field Investigation
Canal Flow Measurement Summary

Station Identification	Date of Measurement	Approximate Time of Measurement	Flow (cfs)
A	9/29/03	9:00 AM	97
E	9/29/03	1:00 PM	94
SJ1	9/30/03	11:00 AM	14
SK1	9/30/03	11:30 AM	10
G	9/29/03	3:00 PM	89
SL1	10/01/03	10:00 AM	4
H	9/29/03	4:30 PM	77
J	9/30/03	9:30 AM	81

The flow in the main canal at Station A was measured at 124 cfs, and a flow of 98 cfs was measured at Station J.

The results of the field measurements on laterals SJ, SK, and SL for the second and third field investigations are summarized in Tables III-5 and III-6, respectively. Limited access and heavy bank vegetation along the laterals, made it difficult to conduct a conclusive assessment of bank conditions and potential water losses in the laterals. Similar field conditions were also encountered during the third field investigation.

Discussion

The flow measurement data collected for the preliminary study indicate that water losses within the canal itself are very low. However, some laterals may experience significant losses.

Table III-5

WCWID No. 2 South Side Canal
Environmental Study

Second Field Investigation
Lateral Flow Measurement Summary

Lateral	Station	Date of Measurement	Approximate Time of Measurement	Flow (cfs)
SJ	SJ1	9/30/03	11:00 AM	14
	SJ2	9/30/03	10:30 AM	8
	SJ3	9/30/03	9:00 AM	5
SK	SK1	9/30/03	11:30 AM	10
	SK2	9/30/03	10:00 AM	9
	SK3	9/30/03	8:30 AM	10
SL	SL1	10/01/03	10:00 AM	4
	SL2	10/01/03	11:00 AM	4
	SL3	10/01/03	12:00 PM	4

Table III-6

WCWID No. 2 South Side Canal
Preliminary Environmental Study

Third Field Investigation
Lateral Flow Measurements

Lateral	Station	Date of Measurement	Approximate Time of Measurement	Flow (cfs)
SJ	SJ1	9/22/2004	8:45 AM	10
	SJ3	9/22/2004	9:15 AM	2
SK	SK1	9/22/2004	10:55 AM	10
	SK2	9/22/2004	11:20 AM	10
	SK3	9/22/2004	11:45 AM	9
SL	SL1	9/22/2004	10:30 AM	4
	SL3	9/22/2004	9:56 AM	4

First Investigation

During the first field investigation in early September 2003, water was being released into the canal at a rate of 165 to 170 cfs. Only one lateral (SK) was open at the time, receiving water at approximately 13 cfs. Therefore, the net flow in the canal after the SK Lateral, not including losses, would be expected to be 152 to 157 cfs.

Flow appeared to increase from Station A to Station B. However, the measurement at Station B was taken from a bridge. Measured flow velocities were probably higher than actual velocities due to the influence of bridge abutments in the canal. Flow rate from Station A to Station C was essentially unchanged. Between Stations C and E, there was a significant drop in flow rate (16 cfs). This may be due, in part, to canal leakage from the Camp Creek butterfly valve and through the canal embankments around Camp Creek. It might also be partially due to inaccuracies in measurement introduced as a result of the Camp Creek Check Dam located upstream of the measurement location. The measured flow rate dropped by 14 cfs from Station E to Station G, with most of the difference occurring as a result of diversion into Lateral SK (13 cfs). However, between Station G and Station H, the flow rate appeared to increase. There are no known sources of water into the canal (other than Lake Diversion), so this apparent increase in flow is not readily explained. It should be noted that the flow measurement at Station H occurred approximately 15 hours after that at Station G (the next morning). While flow was supposedly constant during this period, there could have been some fluctuation overnight that would account for a flow increase. Flow from Station G to Station H fell slightly (by 2 cfs).

As previously indicated, flow in the canal after the SK Lateral should have been around 155 cfs, exclusive of any losses to evaporation, leakage, or seepage, etc. This is the gross flow rate in the canal. The three measured stations after the SK Lateral were G, H, and J. Estimates of losses in the canal may then be summarized as in Table III-7.

Based on results of the first field investigation, flow losses may be inferred to be in the range of 1 to 10 percent in the canal, with values on the lower end of the range more likely to be appropriate.

Table III-7

WCWID No. 2 South Side Canal
Preliminary Environmental Study

Summary of Estimated Flow Losses for the First Field Investigation

Station	Measured Flow (cfs)	Difference in Flow From the Gross Flow[1] (cfs)	(%)
G	140	15	9.7
H	153	2	1.3
J	151	4	2.6

[1] Gross Flow = 155 cfs

Second Investigation

For the second field investigation in late September 2003, flow was again observed to generally drop from Lake Diversion to Headquarters Road. However, the losses all appeared to be due to diversions to laterals.

Flow measurements in the laterals provided mixed results. Losses in the SJ Lateral appeared to be significant (9 cfs loss or over 64 percent from SJ1 to SJ3). Flow did not appear to change significantly in the SK and SL laterals. The vegetation growing in the laterals made measurement difficult and likely contributed to unreliable results.

Third Investigation

During the third field investigation in September 2004, flow measurements were conducted at Station A and Station J. As with the previous field investigations, flow measurements decreased between these two stations. The flow differential between the stations was 26 cfs. Flow was also measured in three laterals: SJ, SK, and SL. The sum of the flow diversions into the three laterals was measured at 25 cfs. The similarity between the flow differential in the main canal and the volume of flow diversions into the three laterals indicates that losses in the main canal are minimal.

Flow measurements in the laterals, especially at the downstream sites, again proved challenging due to vegetation growing in the laterals and varying channel morphologies. As with the previous flow measurements in the laterals, flow did not appear to change significantly in the SK and SL laterals. However, flow losses again appeared to be significant in the SJ lateral (8 cfs or 78 percent from SJ1 to SJ3).

WATER QUALITY

Water quality in the South Side Canal was monitored during the second and third field investigations at Stations A, D, H, and I. Both instream (field) monitoring and laboratory testing of samples were utilized to evaluate water quality. The following parameters were monitored:

- Instream Parameters
  - Temperature (Temp)
  - Conductivity (Cond)
  - Dissolved Oxygen (DO)
  - pH

- Laboratory Parameters
  - 5-day Biochemical Oxygen Demand (BOD_5)
  - Total Dissolved Solids (TDS)
  - Total Suspended Solids (TSS)
  - Volatile Suspended Solids (VSS)
  - Total Organic Carbon (TOC)
  - Total Petroleum Hydrocarbons (TPH)
  - Total Nitrogen (TN)
  - Total Kjeldahl Nitrogen (TKN)
  - Nitrate + Nitrite (NO_3+NO_2, as N)
  - Total Phosphorus (P)
  - Escherichia coli (E coli)

The instream parameters were monitored over a 24-hour period using gauges (YSI datasondes); which were temporarily installed in the canal at various locations. Grab samples of water were collected for analysis at the RRA environmental laboratory. Samples were collected, preserved, and transported in general accordance with protocols of the Texas Commission on Environmental Quality (TCEQ).

During the September 2004 field investigation, field parameters were measured at four sites (including stations A and J) and grab samples for laboratory analyses were collected at five sites. Laboratory analysis was limited to TSS and TDS.

A summary of water quality data obtained is presented below. Following is a discussion of the results.

Summary

Instream monitoring was performed at Stations A, D, H, and I (see Figure III-1 for locations). Table III-8 summarizes the instream monitoring data results. Laboratory testing was performed on samples collected at stations A, D, F, H, and I. Results of laboratory testing are summarized in Table III-9.

Table III-8

WCWID No. 2 South Side Canal
Environmental Study

Instream Water Quality Data

Station	Monitoring Period (date-approx time)	Range of Results			
		Temp (ºC)	Cond (µS/cm)	DO (mg/L)	pH
A	09/29/03 – 2:00 PM to 09/30/03 – 3:00 PM	22.0 – 23.3	4,700 – 4,720	7.9 – 8.9	8.4 – 8.5
	09/23/04 – 11:00 AM to 09/24/04 – 11:30 AM	24.5 – 26.5	5,080 – 5,100	6.8 – 8.5	7.9 – 8.3
D	10/01/03 – 3:00 PM to 10/02/03 – 3:30 PM	19.4 – 20.6	4,710 – 4,720	7.7 – 9.2	8.3 – 8.5
	09/21/04 – 3:00 PM to 09/22/04 – 2:30 PM	24.0 – 26.8	5,100 – 5,140	5.7 – 8.1	7.9 – 8.4
H	10/01/03 – 2:30 PM to 10/02/03 – 3:00 PM	18.5 – 21.1	4,700 – 4,740	8.2 – 10.1	8.2 – 8.5
	09/23/04 –10:30 AM to 09/24/04 – 11:00 AM	23.8 – 26.3	5,090 – 5,120	6.7 – 9.1	7.8 – 8.4
I	09/29/03 – 3:00 PM to 09/30/03 – 3:30 PM	18.8 – 22.7	4,660 – 4,730	7.7 – 9.6	8.2 – 8.5
	09/21/04 – 3:30 PM to 09/22/04 – 3:30 PM	23.4 – 27.2	5,110 – 5,150	6.4 – 9.7	7.9 – 8.5

Table III-9

WCWID No. 2 South Side Canal
Environmental Study

Laboratory Water Quality Data

Station	Sampling Date	Approx Sample Collection Time	BOD_5 (mg/L)	TDS (mg/L)	TSS (mg/L)	VSS (mg/L)	TOC (mg/L)	TPH (mg/L)	N, total (mg/L)	TKN (mg/L)	NO_3+NO_2, as N (mg/L)	P, total (mg/L)	E. coli (#/100 ml)[1]
A	10/01/2003	3:15 pm	<4.0	2,746	7	6	6.0	0.45	0.93	0.63	0.3	0.13	<1
	09/21/2004	9:30 am	-	3,212	10	-	-	-	-	-	-	-	-
D	10/01/2003	2:30 pm	<4.0	2,888	29	7	5.5	0.62	1.48	0.88	0.6	0.21	62
	09/21/2004	9:10 am	-	3,256	12	-	-	-	-	-	-	-	-
F	10/01/2003	3:40 pm	<4.0	2,952	34	7	5.7	0.26	0.83	0.43	0.4	0.20	65
	09/21/2004	10:00 am	-	3,242	35	-	-	-	-	-	-	-	-
H	10/01/2003	1:50 pm	<4.0	2,841	28	7	5.6	0.62	1.74	1.04	0.7	0.20	115
	09/21/2004	10:30 am	-	3,234	26	-	-	-	-	-	-	-	-
I	10/01/2003	4:00 pm	<4.0	2,984	47	8	5.4	0.20	1.29	0.79	0.5	0.24	61
	09/21/2004	11:00 am	-	3,285	20	-	-	-	-	-	-	-	-

[1]#/100 ml – number of colonies per 100 milliliters

Discussion

Water quality in the South Side Canal was found to be generally good for the parameters analyzed in the environmental study. No water quality parameter tested was found to be outside typically acceptable ranges of values. The parameters selected included only basic water quality constituents and characteristics

Instream monitoring, performed over a 24-hour period indicated that the values for temperature, conductivity, and pH do not vary substantially over the course of a day. The concentrations for temperature, conductivity and pH shown in Table III-8 appear to be at background levels. Dissolved oxygen concentrations have a diurnal variation. The variations of DO summarized in Table III-8 are within expected ranges, and the concentrations are well above the DO criteria established for the Wichita River into which the water eventually flows.

For the most part, the concentrations of parameters analyzed for the grab samples (see Table III-9) were found to be relatively consistent throughout the canal. Biochemical oxygen demand (BOD_5) was below detectable limits at all locations. The E coli count ranged from <1 colony per 100 ml to 115 colonies per 100 ml. These values are below standards for contact recreation, and indicate minimal impact from livestock at the time of the sample.

Nutrients (TN, TKN, NO_3 + NO_2 as N, and P) were all relatively low. The only nutrient tested that appeared to increase from the Lake Diversion Dam to Headquarters Road was P. The concentration almost doubled, from 0.13 mg/L to 0.24 mg/L. Despite the increase, these values of P are considered to be well within an acceptable range. The configuration of the canal, being higher in elevation than adjacent natural grade, may preclude the introduction of nutrients by way of runoff.

The presence or absence of petroleum product in the canal could be indicated by testing for TPH. The TPH results in Table III-9 show that TPH concentrations were very low at the time of the environmental study.

The concentration of TOC in the water is an indication of the amount of organic content. High organic content can contribute to the formation of halogenated compounds as a by-product of water treatment. The TOC concentrations were found to be consistently low within the canal.

There was a distinct increase in TSS from upstream to downstream. Concentrations were only about 7 mg/L at Lake Diversion, but they were 47 mg/L at Headquarters Road. The volatile fraction of suspended solids (VSS) was also measured. It remained virtually constant throughout the canal. This indicates the increase in TSS was due to inorganic materials becoming suspended in the water.

The dissolved solids concentration in the water was a primary concern of this study from the outset, due to the cost for removal for municipal supply. Any increases in TDS, as a result of evaporation or through contamination from oil-well activity, could cause an increase in the cost for its removal during treatment for drinking water. The samples collected on October 1, 2003, did show an increase in TDS from one end of the canal to the other. The concentration of TDS rose from 2,750 mg/L near Lake Diversion to 2,980 mg/L at Headquarters Road. This is an increase of about 8.7 percent. It should be noted that the TDS levels measured in October 2003 are somewhat lower than typically observed, although still well within the expected range of values. The relatively low TDS may have been the result of recent rains depressing the natural TDS of the system. TDS samples were also collected in September 2004. Laboratory results (Table III-9) indicate concentrations ranging from 3,210 mg/L at Station A to 3,290 at Station I. The small increase (less than 2.5 percent) between the most upstream and downstream sites is not significant.

ENVIRONMENTAL EVALUATION

During the field investigations in 2003 and 2004, participating staff identified and documented general observations of environmental conditions and specific physical and environmental factors that may have the potential to negatively impact water quality. Included are observations of aquatic flora; bank slope, canal characteristics; cattle and ranching activities; oil extraction activities; waste disposal activities; and algal blooms.

Aquatic Flora

During the first field investigations, field staff observed a general increase in submerged aquatic vegetation at the downstream sites. In the main canal, the aquatic macrophyte community is dominated by several species of pondweed, *Potamogeton spp*. The pondweed is an attached macrophyte that can occur in long, dense patches that parallel the banks of the canal. At the downstream sites, pondweed was observed floating in the water and a significant quantity of plant material accumulated on the transect rope at the SL lateral bridge during the first field investigation.

The plant-like alga *Chara sp*. was the only taxon of algae observed during the first field investigation. Floating mats of algae or patches of filamentous green algae (indicators of increased nutrients or eutrophication) were not observed at any of the monitoring stations.

During the second and third field investigations, field staff did not observe the floating aquatic vegetation documented at the downstream sites during the first field investigation. This may have been a factor of the lower flow regime that occurred during the second investigation. Additionally, APAI field staff did not observe an increase in submerged vegetation between the upstream and downstream monitoring sites. The presence of significant stands of submerged aquatic vegetation in the canal appears to be a function of water depth and flow velocity in the main canal rather than elevated nutrient concentrations.

Canal Characteristics

As originally constructed, the main canal had inside slopes of 2 horizontal to 1 vertical (2H:1V) and outer slopes of 1.5H:1V with bank maintenance roads measuring 8-to-10 feet in width. After decades of operation and routine maintenance, the main canal banks can be described as moderately steep to nearly vertical. Total bank height varies from 9 feet to 18 feet. The steep slope of the bank may be contributing to an increase in erosion and sedimentation in the canal. There is also abundant evidence along the banks of cattle accessing the water in the canal. Many areas of the canal banks are devoid of vegetation. These exposed areas, without stabilizing vegetation, are more susceptible to erosion and increased sedimentation in the canal. Field investigations in 2003 documented an increase in TSS and sediment deposits at the most downstream sites, possibly reflecting erosion of canal banks.

Ranching and Cattle Activities

Field investigations in 2003 noted numerous ranching and cattle operations in the area surrounding the South Side Canal. One large confined cattle feeding operation (CAFO) is located adjacent to the south bank of the main canal near State Highway 25. Canal embankments in this reach are devoid of vegetation, and there is evidence of bank deterioration and erosion due to cattle accessing the water in the canal. Other reaches of the canal also exhibit evidence of bank deterioration as a result of cattle and ranching activities. WCWID No. 2

staff confirmed that cattle have a significant impact on the structural integrity of the canal embankments. Livestock can also impact water quality by increasing nutrient loadings, as well as bacteria and pathogens.

Oil and Gas Production

Oil extraction in Wichita County began in the early 1900's. It continues to be one of the major industries in the region. The process of oil extraction may impact water quality in the following ways:

- Drilling operations may destroy surrounding vegetation and increase runoff into the canal.
- Spillage of extracted crude petroleum product or brines onto the ground can cause surface and subsurface contamination that can potentially flow or seep into the canal.
- Leakage from gathering pipelines adjacent to the canal or crossing the canal could contaminate water in the canal.

Portions of the canal traverse areas identified by the NRCS soil surveys as oil-waste land. Figure III-1 indicates the general location of these areas. Such areas would be of particular concern from an environmental standpoint. However, it is not clear whether such areas are currently impacting water quality in the canal.

Numerous crude oil collection lines and pipelines traverse the canal route. The larger diameter lines cross under the canal. Smaller lines are suspended from cables or along the sides of bridges. Collection lines can pose a significant threat to water quality if a spill occurs. Field investigations documented various types of piping and suspension methods. However, cursory observations are not sufficient to determine which lines are operational and which lines have been abandoned. A more intensive survey of oil extraction operations will be required to determine the extent to which these activities may impact the water quality in the canal.

Waste Disposal

A large portion of the South Side Canal and connecting laterals are located in remote, relatively unpopulated areas of Archer and Wichita Counties. The illegal dumping of trash and debris in remote, rural areas is not uncommon. The results of such practices were observed in the South Side Canal. Dumped wastes may contain materials or chemicals that will have a direct impact on water quality. Household trash may include animal wastes, kitchen grease, chemical cleansers, batteries, used motor oil and filters, glass, plastics, and tin and aluminum cans. Some of these items have the potential to degrade water quality, while others may pose a threat to aquatic life and aquatic habitat. Items such as glass, plastics, and aluminum may remain in the canal system for decades. Hard-to-dispose items such as appliances, furniture, and brush, if illegally dumped in the canal, can have a significant impact on the routine operation of the canal. Large items can block gates, clog culverts and pipe intakes, and impede flow in the laterals. The WCWID No. 2 staff removes tons of trash and large debris that have been discarded in and around the canal system on an annual basis.

Algae Blooms

During the past two decades, golden algae blooms have occurred in five major river systems in Texas, including the Red River. These blooms tend to occur in waterbodies with elevated concentrations of chlorides, during periods of cooler water temperatures. Often these blooms are toxic to aquatic life and result in large fish kills. The Texas Parks and Wildlife Department has formed the Golden Alga Task Force to study this problem and recommend remedial actions.

During the past years, golden algae blooms have been reported at Lake Kemp, Diversion Lake, Dundee State Fish Hatchery, and South Side Canal. In 2001 a bloom at the fish hatchery killed approximately 5,000,000 fish. A golden algae bloom in Lake Kemp killed a reported 7,400 fish in 2002. Subsequent blooms were reported in Lake Kemp, Diversion Lake, and the South Side Canal in 2003. At the present time, very little is known about the causes of these blooms or control measures.

CHAPTER IV
CONCLUSIONS AND RECOMMENDATIONS

The purpose of the South Side Canal Environmental Study has been to identify potential strategies for improved management of the canal and the water supplied by it. These issues have always been important for the agricultural uses of the canal. However, water availability, water quality, and environmental protection on the South Side Canal will become increasingly important as the City of Wichita Falls implements a water management strategy to treat Lake Kemp/Lake Diversion water for municipal purposes. Conclusions and recommendations resulting from the study follow.

CONCLUSIONS

The following general conclusions may be drawn from the Environmental Study of the South Side Canal:

- Flow losses in the canal itself are minimal. Losses are more significant in some laterals, due largely to releases of water at the ends of the laterals.

- Water quality in the canal is relatively good, although parameters such as TDS are naturally high. Water quality was not observed to degrade significantly from the upper end of the canal to the lower end, except with respect to TSS and phosphorus.

- The remoteness of the canal, coupled with its open nature and accessibility via county roads and state highways, make it vulnerable to water quality degradation due to illegal dumping. This could become an increasing problem as the population of the area grows.

- Operation of the canal is currently seasonal, enabling work crews to perform maintenance on canal embankments and remove accumulated aquatic vegetation during the winter season. Full time operation of the canal, as may occur once the City begins to utilize the water for municipal purposes, could affect ongoing maintenance and clean up efforts.

- Livestock appear to have had significant impacts on embankment erosion in some reaches of the canal. This increases maintenance requirements for the embankments and likely is a cause of increases in suspended solids and sediment from one end of the canal to the other.

RECOMMENDATIONS

The study of the South Side Canal has provided useful information related to the canal's current and future uses. This information, coupled with the conclusions resulting from the study has been used to formulate the following recommendations regarding water availability, water quality, and environmental conditions.

Canal System Piping Improvements

Since water demand is projected to exceed water availability within the next 12 to15 years, conservation must be a foremost focus in the canal system. Significant conservation of water could be accomplished with improvements to laterals throughout the canal system. Lateral improvements include primarily replacing the current system of open channels with pipe. Piping the laterals would eliminate the need to spill water out the ends of the laterals in order to maintain water levels to serve the farms. For example, based on results of the field investigations, the piping of laterals SJ, SK and SL is estimated to save 5,700 acre-feet of water per year (based on a total spillage of approximately 19 cfs for the three canals over five months of the year). The pipelines would also reduce long-term seepage and evaporation, resulting in additional water savings. Laterals SJ, SK and SL have a total length of about 15 to 20 miles.

A program to pipe laterals could be developed that would identify lateral losses throughout the canal system (including laterals in the North Side and Call Field Canals) and prioritize improvements according to need and funding availability. Assuming that spillage from other laterals throughout the canal system is similar to spillage in those specifically investigated, it is estimated that construction of 100 miles of pipeline would save approximately 15,000 acre-feet of water per year.

Funding for the canal system improvements could potentially come from increasing taxes on irrigated lands, grant funds from state and federal agencies, or loan funds from Texas Water Development Board.

Reduce Exposure to Petroleum Gathering Operations

A program should be developed and implemented to reduce the risks associated with operating petroleum production and gathering in the vicinity of the South Side Canal. Such a program could focus on the following aspects of environmental protection:

- Perform periodic inspections of nearby petroleum production operations, gathering pipelines, and petroleum storage facilities.

- Work with petroleum producers to reduce the number of gathering pipelines crossing the canal and improve, where necessary, the condition of pipelines that remain.

- Work with petroleum producers and regulatory authorities to determine if there is petroleum production contamination in the vicinity of the canal.

The success of this program will be related, in part, to how well the support of petroleum producers and regulatory authorities can be garnered.

Limit Access to the Canal by Livestock

Access by livestock to the South Side Canal should be limited by fencing. Fencing along the entire length could be prohibitively expensive and unnecessary. However, areas most prone to intrusion by livestock (such as the reach downstream of State Highway 25 on the southern side of the canal) could be identified and fenced initially. Fencing could than be extended as needed to further reduce exposure.

Implement a Public Education Program to Reduce Illegal Dumping

Educating the public on the issues related to illegal dumping in and near the South Side Canal should be a significant focus in the future. Such a program should highlight both the environmental and health-related risks. Public education should make outreach to area schools a priority. This type of public education program could easily be integrated with other programs, such as storm water awareness, etc.

Continue to Maintain the Canal

Ongoing maintenance of the South Side Canal is crucial to its ability to transport water for agricultural and public water supply. The WCWID No. 2 performs routine maintenance during the period when irrigation is not required (generally November to March). Maintenance may include removal of water vegetation and debris, stabilization of embankments, dredging to remove accumulated silt, or other improvements.

When the City begins to utilize the South Side Canal on a daily basis, scheduling maintenance for the South Side Canal will require close coordination between the City and WCWID No. 2. Prior to implementing the use of the canal to transmit raw water to the Cypress WTP, the City and WCWID No. 2 should develop a schedule or otherwise establish procedures that will enable periodic maintenance of the canal. Because water must be maintained in the canal continuously during the irrigation season, most maintenance will still need to be performed between November and March. This should generally coincide with lower demand for drinking water as well.

Implement a Water Quality Monitoring Program for the Canal

The most effective means of determining whether other efforts to protect water quality in the South Side Canal are working is to monitor water quality on a regular basis. Requirements for monitoring can vary, depending primarily on the needs of the City. However, quarterly monitoring may be adequate. At a minimum, monitoring stations should be located in the vicinity of the dam at Lake Diversion and near Headquarters Road. Basic water quality parameters should include the instream and laboratory parameters listed in Chapter III of this report. Standard sampling protocols should be followed. Laboratory testing procedures provided in 40 Code of Federal Regulations (CFR) Part 136 should be utilized to analyze samples.

ATTACHMENT 4-5

REGIONAL WATER PLANNING GROUP B

WATER CONSERVATION

Freese and Nichols

MEMORANDUM

TO: File

FROM: Simone Kiel

SUBJECT: Conservation

DATE: December 22, 2004 (updated November 17, 2005)

As part of our planning efforts for Region B, water conservation must be considered when developing water management strategies for water user groups with needs. An expected level of conservation is included in the demand projections due to the natural replacement of inefficient plumbing fixtures with low flow fixtures, as mandated under the State Plumbing Code. For Region B, the total municipal water savings associated with plumbing fixtures is approximately 11 percent of the projected demand if no conservation occurred.

Additional conservation savings can potentially be achieved in the region through the implementation of conservation best management practices. It is assumed that entities with low gpcd water use will have minimal impacts on water use through conservation. In Region B there are nine municipal water user groups with identified safe supply shortages. For these entities, Byers, Lakeside City and Montague County-Other have low per capita water use (less than 140 gpcd). Therefore, municipal conservation strategies, with the exception of passive clothes washers, will not be evaluated for these water user groups.

To assess appropriate strategies for Region B, we reviewed the conservation strategies identified through the Water Conservation Implementation Task Force. The Task Force identified 21 municipal conservation strategies and 15 strategies for industrial water users. In addition the State has adopted new regulations that require all new clothes washers to be more water efficient by 2007. After review and consideration of these strategies, it is recommended that four conservation strategies be evaluated for municipal water users with needs. These include:

- Public and School Education
- Reduction of Unaccounted for Water through Water Audits
- Water Conservation Pricing
- Federal Clothes Washer Rules

Best Management Practices (BMPs) not selected include rebate programs, accelerated plumbing fixtures replacements, and specific outdoor watering measures. The benefits of outdoor watering strategies were assumed to be accounted under the public and school education BMP. Also, many of the entities in Region B already use restrictions on outdoor watering as a drought management measure. Accelerated fixture replacements do not reduce the ultimate water need, but could delay when the need begins. In Region B, the largest municipal water user, Wichita Falls, has water needs beginning in 2060. No additional savings can be achieved through accelerated implementation of plumbing fixtures. This is also true for rebate programs that simply accelerate the already assumed conservation savings. The likelihood of implementing rebate programs in rural communities is low and previous studies have shown these programs to be relatively costly per acre-foot of water saved.

No industrial BMPs were evaluated because there is insufficient data to evaluate these strategies for the manufacturing safe needs in Wilbarger County. Where possible, reuse will be considered as a strategy for this need. For the irrigation and steam electric power needs associated with shortages in Lake Kemp, we will look at conserving water in the canal distribution system. This will be evaluated separately.

A summary of the assumptions in costs and savings for the selected municipal conservation strategies is presented below.

Public and School Education

Potential water savings associated with education programs are difficult to assess because the results often overlap with other measures. Literature reviews indicate the savings can range from 1 to 5 percent of the projected demand. For cities that have already implemented an aggressive education program, the additional savings may be on the lower side of this range. In Region B, it is assumed that conservation savings associated with education will be 2.5% the first decade, and 3% in subsequent decades. For Wichita Falls, which has an on-going education program, the additional savings are estimated at 2% of the projected demands. This strategy was evaluated for municipal water user groups with a need and per capita water use greater than 140 gpcd.

Annual costs were estimated at $5,000 for small rural communities to nearly $100,000 for Wichita Falls. These costs include personnel to develop and oversee the program, public outreach through the news media, public meetings, school education materials, giveaways, and other miscellaneous program specific costs. Note: Some benefits associated with school education for Archer County-Other may also be realized in Lakeside City. There is overlap of school systems for education.

Water Audits

Under House Bill 3338, all retail public utilities serving 3,300 people or more will be required to conduct water system audits to identify the system water loss. These audits will be required beginning in 2005 and performed every 5 years. The audit itself does not reduce water loss, but can identify potential infrastructure problems contributing to water loss. The TWDB recommends that water system losses should be less than 15% of the total water used. The American Water Works Association leak Detection Committee recommends a goal of 10%. Due to the variability of calculating water loss by different providers and the unknown capital cost associated with reducing water loss, it is assumed that there is no water savings associated with this BMP for the regional water plan. Region B recognizes the benefits of water audits as good stewardship for all water systems and recommends that all system conduct water audits.

Costs for this strategy are only those costs associated with the audit itself. It is assumed that the audit will cost $5,000 for each system. These costs reflect the additional personnel time needed to complete the audit and maintain records. For cities that already maintain and report this information, the additional cost for audits may be less. These costs are amortized over 5 years, which is the schedule for water audits.

Water Conservation Pricing

This BMP can apply to two different conditions: 1) use of rate structures to discourage inefficient and/or excessive water use (e.g., inverted block rates), and 2) natural reduction of use in response to overall rate increases. The amount of water use reduction is based on price elasticity. A price elasticity of -0.1 means that a 1 percent increase in water rates will result in a -0.1 percent decrease in water usage. Previous studies by the TWDB (1991) show that the price elasticity for water in the Wichita Falls area is -0.181 in the summer and -0.543 in the winter. This is among the highest price elasticities of the cities studied and reflects the sensitivity of water rates in this area. However, the city has found that the water use will increase back up over time. For this plan, we are assuming that there will be some reduction in water use as new more expensive water is developed. This will apply to the cities of Wichita Falls, Vernon and Electra. It is assumed that any new water supplies for the city of Bowie will not cause a significant increase in water rates. For calculation of potential water savings, a potential water savings of 1.5% of the projected demand was used for Wichita Falls and 1% of the demand was used for Vernon and Electra.

The costs for this strategy are based on a rate study for the city and implementation of a rate change. There is no capital cost associated with water conservation pricing.

Federal Clothes Washer Rules

New regulations governing the manufacturing of clothes washers will require all new washers to be energy efficient by 2007. One option to achieve the efficiency mandate is to reduce water volume (less energy would be needed to heat the water). The water savings per washer is estimated at 5.6 gallons per person per day. It was assumed that 90 percent of the single family homes had washing machines and 3 percent of these homes would have water efficient machines as of year 2000. The average life of a washing machine is 13 years, and the natural replacement rate was assumed at 7.7 percent per year.

This strategy was evaluated for each municipal water user group with a need. It was assumed that these new regulations will occur without any cost to the water user group. Estimates of the number of clothes washers was made for each municipal water user group and savings calculated accordingly.

Summary of Findings

The water savings and costs for each of the conservation strategies recommended for Region B municipal water user groups are summarized in the following tables. As discussed above, the savings associated with water audits is assumed to be zero as a direct result of the audit. Savings realized through a leak and repair program will vary with each water user and is not included in these water savings totals.

Savings Associated with Public and School Education Program

	Water Savings (Acre-feet/year)					
Water User Group	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Iowa Park	13	20	24	27	31	35
Electra	6	9	11	12	14	16
Vernon	30	44	53	59	64	67
Wichita Falls[a]	0	0	0	0	0	457
Bowie[a]	0	0	0	22	25	28
Byers[b]	0	0	0	0	0	0
Lakeside City[b]	2	3	3	4	4	5
Archer County-Other	6	8	10	12	13	14
Clay County-Other	10	15	17	18	16	16
Montague County-Other[b]	0	0	0	0	0	0

a. Conservation savings are reported for the first decade that the entity has a water need.

b. Byers, Lakeside City and Montague County-Other have per capita water use below the screening criteria of 140 gpcd. There are no reported savings for Byers and Montague County-Other. The savings associated with Lakeside City are the result of an overlapping education system with Archer County-Other.

Savings Associated with Water Conservation Pricing

	Water Savings (Acre-feet/year)					
Water User Group	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Iowa Park	0	6	12	12	12	12
Electra	0	3	5	5	5	5
Vernon	0	13	26	25	24	22
Wichita Falls[a]	0	0	0	0	0	343
Bowie[a]	0	0	0	5	9	9
Byers[b]	0	0	0	0	0	0
Lakeside City[b]	0	0	0	0	0	0
Archer County-Other	0	0	0	0	0	0
Clay County-Other	0	0	0	0	0	0
Montague County-Other[b]	0	0	0	0	0	0

a. Conservation savings are reported for the first decade that the entity has a water need.

b. Byers, Lakeside City and Montague County-Other have per capita water use below the screening criteria of 140 gpcd. This strategy was not evaluated for these entities.

Savings Associated with Federal Clothes Washer Rules

	Water Savings (Acre-feet/year)					
Water User Group	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Iowa Park	7	32	32	33	33	33
Electra	4	17	17	17	17	17
Vernon	15	65	65	64	61	57
Wichita Falls	124	533	548	556	562	566
Bowie	8	34	34	34	34	34
Byers	1	3	3	3	3	3
Lakeside City	1	7	7	7	7	7
Archer County-Other	1	4	4	4	4	4
Clay County-Other	6	28	28	27	25	23
Montague County-Other	18	78	80	80	81	81

Total Water Savings Associated with Conservation Strategies*

	Water Savings (Acre-feet/year)					
Water User Group	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Iowa Park	21	57	68	72	76	80
Electra	10	28	33	34	36	38
Vernon	45	122	144	148	148	146
Wichita Falls	124	533	548	556	562	1,367
Bowie	8	34	34	61	69	72
Byers	1	3	3	3	3	3
Lakeside City	3	9	10	11	11	11
Archer County-Other	7	11	14	16	17	18
Clay County-Other	16	42	45	45	41	39
Montague County-Other	18	78	80	80	81	81

Total Annual Cost for Conservation Strategies

Water User Group	2010	2020	2030	2040	2050	2060
Iowa Park	$15,436	$21,550	$21,550	$21,550	$21,550	$21,550
Electra	$10,712	$15,263	$15,263	$15,263	$15,263	$15,263
Vernon	$15,436	$21,550	$21,550	$21,550	$21,550	$21,550
Wichita Falls	$1,187	$1,187	$1,187	$1,187	$1,187	$108,711
Bowie	$436	$436	$436	$16,550	$16,550	$16,550
Byers	$0	$0	$0	$0	$0	$0
Lakeside City	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
Archer County-Other	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Clay County-Other	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
Montague County-Other	$0	$0	$0	$0	$0	$0

Cost per Acre-Foot of Water Saved

Water User Group	2010	2020	2030	2040	2050	2060
Iowa Park	$742	$375	$318	$300	$285	$269
Electra	$1,049	$536	$465	$444	$424	$403
Vernon	$346	$176	$150	$146	$146	$147
Wichita Falls	$10	$2	$2	$2	$2	$80
Bowie	$56	$13	$13	$271	$241	$230
Byers	$0	$0	$0	$0	$0	$0
Lakeside City	$1,495	$542	$481	$454	$450	$446
Archer County-Other	$1,530	$879	$722	$618	$602	$559
Clay County-Other	$610	$235	$223	$224	$242	$254
Montague County-Other	$0	$0	$0	$0	$0	$0

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Projected Safe Supply Water Needs after Conservation
(acre-feet per year)

Water User Group	2010	2020	2030	2040	2050	2060
Iowa Park	89	38	35	42	48	62
Electra	251	208	195	189	186	191
Vernon	310	272	280	262	218	35
Wichita Falls	0	0	0	0	0	1,398
Bowie	0	0	0	0	0	62
Byers	10	5	2	0	0	0
Lakeside City	0	0	1	0	0	0
Archer County-Other	262	212	251	280	225	217
Clay County-Other	207	157	134	35	0	0
Montague County-Other	376	380	395	406	390	394

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CHAPTER 5

REGIONAL WATER PLANNING GROUP B

IMPACTS OF SELECTED WATER MANAGEMENT STRATEGIES ON KEY PARAMETERS OF WATER QUALITY AND IMPACTS OF MOVING WATER FROM RURAL AND AGRICULTURAL AREAS

IMPACTS OF SELECTED WATER MANAGEMENT STRATEGIES ON KEY PARAMETERS OF WATER QUALITY AND IMPACTS OF MOVING WATER FROM RURAL AND AGRICULTURAL AREAS TEXAS STATE SENATE BILL 1 REGION B

5.1 Introduction

The regulations that describe the content and process for the development of regional water plans direct that the plan include "a description of the major impacts of recommended water management strategies on key parameters of water quality identified by the regional water planning group . . ." [30 TAC 357.7(a)(12)]. This chapter provides information and recommendations to assist the Regional Water Planning Group B (RWPG-B) to identify the key water quality parameters that may be impacted.

This chapter presents an identification of the potential water management strategies (WMS) for RWPG-B and an assessment of the key water quality parameters that could be affected by the implementation of each WMS. Based on this assessment, recommendations are made with respect to which parameters should be designated as key water quality parameters for each type of WMS. From this determination, the specific water management strategies selected for Region B were evaluated for potential impacts on the identified key parameters.

In addition, this chapter provides information relating to the potential impacts of moving water used for rural or agricultural purposes to urban uses.

5.2 Summary of Key Water Quality Parameters

The key water quality parameters to be evaluated are dependent on the proposed WMS. Table 5-1 summarizes the most pertinent water quality parameters for the types of WMS expected to be proposed in the Region B Water Plan. It is recommended that these be identified as the key water quality parameters for these WMS in Region B.

The implementation of specific WMS can potentially impact both the physical and chemical characteristics of water resources in the region. Following is an assessment of the characteristics of each WMS that can affect water quality, and an identification of the specific water quality parameters that could be affected based on those characteristics.

5.2.1 Expanded Use of Surface Water Resources

This WMS includes increased use of both water in streams and water in existing reservoirs. In both cases, the primary physical impact is a decrease in the volume of water. From a water quality perspective, a decrease in volume is more likely to be significant in a stream than in a reservoir. Several conditions can develop as streamflows decrease that may impact water quality:

- There is less dilution for stream inflows. If those inflows are associated with treated industrial wastewater, treated domestic wastewater, discharges of power plant cooling water blowdown, or groundwater seeps or springs with high concentrations of minerals, for example, the quality of the stream can be affected. However, for permitted discharges, permit limits would be adjusted to avoid adverse impacts. The water quality parameters most likely to be affected are total dissolved solids (TDS) and nutrients.
- In some cases there could be an increase in the concentration of one or more metals in the stream as a result of a decrease in the dilution of discharge flows. However, this potential is dependent on the types of discharges to the stream.
- In addition, a decrease in stream flow could decrease the stream's ability to assimilate loadings of oxygen-demanding materials such as biochemical oxygen demand (BOD) and ammonia associated with permitted discharges or non-point sources. The water quality parameter affected would be dissolved oxygen (DO). However, as discussed above, for permitted discharges, it is expected that permit limits for BOD and ammonia

Table 5-1: Region B 2005 Water Plan, Evaluation of Water Management Strategy Impacts Key Water Quality Parameters

Water Quality Parameter	Water Management Strategy							
	Expanded Use of Surface Water		New Reservoirs	Interbasin Transfers	Expanded Use of Reclaimed Water	Expanded Use of Groundwater	Water Conservation	Special Water Management Strategy
	Streams	Lakes						
TDS	X	X	X	X	X	X		X
Alkalinity				X		X		
Hardness				X		X		
Dissolved Oxygen	X	X	X	X	X			
Nitrogen	X	X	X	X	X			
Phosphorus	X	X	X	X	X			
Metals(1)	X	X	X	X	X	X		
Sediment Quality			X					X
Turbidity				X				

(1) Only for specific metals where there are significant discharges of the metal.

would be appropriately adjusted to avoid adverse impacts and to maintain compliance with the DO criteria in the Texas Surface Water Quality Standards. However, the amount of water in the stream could be reduced to the point that DO would be significantly impacted, and water quality standards would not be met even with stringent permit limits. In some cases, the DO standard may not be maintained even when there are no permitted discharges. If the DO standard is not maintained, the affected stream could be included on the List of Impaired Waters prepared by the Texas Commission on Environmental Quality (TCEQ) pursuant to Section 303(d) of the Clean Water Act. Inclusion on that list could have significant implications for point and non-point sources in the watershed.

The potential for significant water quality impacts as a result of increased use of waters in a reservoir is much lower than that associated with increased use of a stream. Even if increased use of the reservoir requires significant construction of pipelines or an intake structure, the potential for impact is low. Existing requirements for stormwater permits for construction activity and 404 permits for construction in waterbodies minimize the potential for water quality impacts.

In most cases, there is very little possibility of significant impacts on water quality in a reservoir as a result of increased use. If impacts occur, they are most likely to occur in the stream below the reservoir. Increased usage of a reservoir can result in decreased releases from the reservoir and, thus, a decrease in downstream flow. This decrease in downstream flow below a reservoir could have the same impacts as discussed immediately above. However, during drought of record conditions there should be little to no changes to releases from reservoirs.

5.2.2 New Reservoirs

The most potentially significant impact of new reservoir construction is the inundation of bottomlands and a decrease in instream flows below the reservoir. If this occurs, the potential impacts include those described in the previous section when instream flow is reduced due to increased stream usage, i.e., potential impacts on TDS, nutrients, DO, and, in some cases, metals.

Another factor to consider with respect to new reservoirs may be the potential for effects due to increased sedimentation downstream of the reservoir. If the soils in the watershed that drains to the stream below the reservoir are highly erodible, and flow velocities in the stream are reduced, the rate of accumulation of sediments in the stream may increase. This condition may be further exacerbated by the fact that, if there were no reservoir, relatively small flood events (which occur more frequently than floods sufficient in size to produce major releases from a reservoir) would more frequently scour out these deposits. Without these scouring events, the sediments continue to accumulate. Depending on the nature of land uses in the watershed, these sediments could create a nutrient-rich or highly organic sediment layer in the streambed. The combination of shallower depths and higher concentrations of nutrients could produce significant growths of algae and/or aquatic vegetation in the stream. Either the algal growth or the organic matter in the sediments also could affect the DO concentration in the stream.

However, studies have shown that reservoirs do not always reduce downstream flows. Because they capture flood flows and release them in a controlled manner, there are cases where downstream flow is increased. An increase in downstream flow is not expected to have adverse water quality impacts. Also, any new reservoir would have instream flow requirements that would minimize water quality and environmental impacts.

Significant water quality impacts have resulted from reservoir construction when the dam release structures are designed to release water from the hypolimnion (e.g., bottom release of water through the dam). During the summer season, water quality concerns with respect to waters in the hypolimnion include decreased oxygen levels, low temperature, and high nutrient concentrations. However, there is currently an awareness of this problem, and it is not anticipated that a new dam would be constructed that would only release water from the hypolimnion.

5.2.3 Interbasin Water Transfers

If waters are transferred from one basin to another, there can be a decrease in instream flows below the location of the diversion. The water quality parameters potentially impacted by that action are as previously discussed: TDS, nutrients, DO, and, in some cases, metals.

Additionally, changes in TDS, alkalinity, hardness, or turbidity can impact water users, particularly industrial users that have treatment processes to produce high quality waters (for boiler feed, for example) and water treatment plants. Water treatment processes are tailored to the quality of the water being treated. If the quality of the feed water changes, the treatment process may have to be changed, also.

Changes in nutrient concentrations or water clarity can affect the extent of growth of algae or aquatic vegetation in a stream. The same concentration of nutrients can produce different levels of algal growth in different waterbodies depending on factors such as water clarity, shading, stream configuration, or other chemical constituents in the waters.

With respect to water clarity, there are also aesthetic considerations. It is generally not desirable to introduce waters with higher turbidity, or color, into high clarity waters.

5.2.4 Expanded Use of Reclaimed Waters

In general, there are three possible water quality effects associated with an increased use of reclaimed water:

- There can be a reduction in instream flow, if treated wastewaters are not returned to the stream. This could affect TDS, nutrients, DO, and metals concentrations.
- Conversely, in some cases, reducing the volume of treated wastewater discharged to a stream could have a positive effect, reducing concentrations of TDS, nutrients, and metals, and increasing DO concentrations.
- Reusing water multiple times and then discharging it can significantly increase the TDS concentration in the effluent and, thus, in the receiving stream.

5.2.5 Expanded Use of Groundwater Resources

Increased use of groundwater can decrease instream flows, if the base flow is supported by spring flow. This is not known to be a significant factor for streams in Region B.

There is a potential that increased use of groundwater will increase TDS concentrations in area streams. Groundwater can contain higher concentrations of TDS or hardness than are considered desirable for domestic uses. Homeowners may install treatment systems to reduce TDS or hardness, which may introduce small amounts of high concentrations of TDS to municipal wastewater systems or area streams. Because these discharges are expected to be small, the overall impacts should be negligible.

There could also be WMS proposed to treat brackish or high nitrate groundwater with a membrane system in order to increase the suitability of those waters for domestic use. These treatment systems create a waste stream that is high in TDS. Disposal of this waste stream could adversely affect TDS concentrations and sediment quality in area waters. However, in Region B many streams have naturally occurring salts and high TDS levels. In some cases, wastewater discharge concentrations of TDS are not significantly different from the stream standards.

5.2.6 Water Conservation

The water conservation measures most likely to be recommended in Region B are not expected to affect water quality adversely. The results should be beneficial because the demand on surface and groundwater resources will be decreased. Quantifying such positive impacts could be very difficult.

5.3 Impacts of Region B Water Management Strategies on Key Water Quality Parameters

The Region B Water Planning Group is proposing five preferred water management strategies. These strategies are as follows:

- Increase Lake Kemp Conservation Pool
- Purchase water from local providers
- Wastewater reuse
- Expanded use of groundwater
- Nitrate removal
- Water Conservation

The description of each of these WMS follows.

5.3.1 Increase Lake Kemp Conservation Pool

One of the Region B strategies is to increase the conservation pool level in Lake Kemp. Implementation of this strategy will result in maintaining the total storage capacity of Lake Kemp to historical levels. Entities that will benefit from this strategy are as follows:

- Archer County – Irrigation
- Clay County – Irrigation
- Wichita County – Irrigation
- Wilbarger County – Steam-Electric

Implementation of this strategy will provide additional water supplies with no significant impact to water quality.

5.3.2 Purchase Water from Local Provider

It is proposed that the following entities purchase additional water from local providers. These entities are as follows:

- Wilbarger County – Manufacturing
- Archer County – Other
- Clay County – Other
- Lockett Water System
- Montague County – Mining
- Byers
- Electra
- Lakeside City

Additional water use from existing surface and groundwater supplies can decrease the quantity of available water in reservoirs and streams. However, the amount of additional water use by these entities is not expected to significantly increase current water use from area water sources, and will not likely impact water quality.

5.3.3 Wastewater Reuse

Wastewater reuse is proposed as a strategy for the cities of Wichita Falls and Bowie. Treated wastewater effluent will be used for irrigation on non-agricultural, municipal properties. The proposed project includes the reuse of 11,000 acre-feet per year of treated effluent. This project could have positive impacts on key water quality parameters downstream of the current discharge. The project will result in a decrease to the volume of water discharged via the City of Wichita Falls' wastewater treatment system to the Wichita River. The reduction in discharge could reduce the TDS loading into the Wichita River, and increase DO levels immediately downstream of the discharge by the reduction in BOD loading. Any metals that may be present in the treated effluent would likewise be reduced in the receiving stream.

5.3.4 Expanded Use of Groundwater

The preferred management strategies for Region B include the expanded use of groundwater. As currently proposed, the City of Vernon and Montague County (Other) will benefit from additional groundwater. Increased groundwater removal may impact TDS, DO, and nutrient levels in the aquifer. However, at the proposed rate of 664 acre feet per year for Vernon and 486 acre feet per year for Montague County (Other), this strategy will not have a significant impact on water quality in the aquifer.

5.3.5 Nitrate Removal

Several of the groundwater sources in Region B exhibit nitrate levels that exceed the EPA primary drinking water standard. These waters have to be treated by advanced technology (e.g., reverse osmosis) in order to reduce drinking water nitrate levels to an acceptable level. The cities of Burkburnett, Electra, Seymour, and Vernon have installed this treatment technology at their water treatment plants. Additional water supply systems which have experienced nitrate problems include Charlie Water Supply Corporation and Hinds – Wildcat. Current technologies are available for nitrate removal; however, disposal of filter backwash and residuals remains a concern with respect to water quality. Potential impacts and appropriate mitigation, if needed, will be addressed during the permitting process.

5.3.6 Water Conservation

As required by Senate Bill 2, water conservation was considered when developing water management strategies for water user groups with needs. Conservation strategies appropriate for Region B were evaluated based on the best management practices identified through the State Water Conservation Implementation Task Force.

After review and consideration of these strategies, the recommended conservation package for Region B included the following four management practices, of which are not expected to adversely impact key water quality parameters in Region B:

- Public and School Education
- Reduction of Unaccounted for Water through Water Audits
- Water Conservation Pricing
- Federal Clothes Washer Rules

5.4 Impacts of Moving Rural Water to Municipal Uses

The recommended strategy for the City of Vernon is to expand groundwater use from the Seymour Aquifer. As part of this strategy, the City has purchased additional acreage near its existing groundwater well fields, and is expected to purchase additional acreage. The water analysis indicates there is sufficient groundwater to meet agricultural needs and expanded municipal use should have no impacts on available supply. The demand projections show declining agricultural water use in Wilbarger County. Conversion of irrigation acreage to other uses is expected to occur naturally. Thus, the transfer of water is not expected to cause any agricultural impacts.

CHAPTER 6

REGIONAL WATER PLANNING GROUP B

CONSOLIDATED WATER CONSERVATION AND DROUGHT MANAGEMENT RECOMMENDATIONS

WATER CONSERVATION AND DROUGHT MANAGEMENT RECOMMENDATIONS
TEXAS STATE SENATE BILL 1
REGION B

6.1 Introduction

Water conservation is a potentially feasible water savings strategy that can be used to preserve the supplies of existing water resources. Some of the demand projections developed for Senate Bill 1 planning incorporate an expected level of conservation to be implemented over the planning period. For municipal use, the assumed reductions in per capita water use are the result of the implementation of the State Water-Efficiency Plumbing Act. On a regional basis, this is about a 5.4 percent reduction in municipal water use by year 2060 (from a regional per capita use of 165 gallons per person per day to 156 gallons per person per day). Additional municipal water savings may be expected as the federal mandate for water-efficient clothes washing machines takes effect in 2007.

Advanced drought planning and conservation can be also used to protect water supplies, as well as increase reliability during drought conditions. Drought contingency plans are required of all public water suppliers and irrigation districts, and they serve as a temporary strategy to limit water use during drought conditions. Conservation and drought contingency are related strategies, and adherence to the former can ease the burden of the latter. Nevertheless, all water suppliers must be prepared to address water shortages in the event of a severe drought situation.

Senate Bill 1 requires each region's water plan to address conservation and drought management for each supply source within the region. This includes both groundwater and surface water. In fulfillment of this requirement, the remainder of this chapter will serve to identify users and suppliers required to submit water conservation plans and drought contingency plans, respectively, as well as to identify appropriate conservation measures for different types of users. Model water conservation and drought contingency plans for the various types of entities are provided as attachments to this chapter.

6.2 Water Conservation Plans

The TCEQ defines water conservation as "a strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water, and for preventing the pollution of water."

Since 1997, the TCEQ has required water conservation plans for all municipal and industrial water users with surface water rights of 1,000 ac-ft per year or more and irrigation water users with surface water right of 10,000 ac-ft per year or more (Texas Water Code, Section 11.1271). Water conservation plans are also required for all water users applying for a state water right, and may also be required for entities seeking state funding for water supply projects. Legislation passed in 2003 adds a requirement that all conservation plans specify quantifiable five-year and ten-year conservation goals and targets. While these goals are not enforceable, they must be identified. All updated water conservation plans, reflecting these new goals, must be submitted to the Executive Director of the TCEQ by May 1, 2005.

In the Regional Water Planning Area B, six entities hold municipal or industrial rights in excess of 1,000 ac-ft per year and one entity holds irrigation water rights greater than 10,000 ac-ft per year. Each of these entities is required to develop and submit to the TCEQ a water conservation plan. Several other water users have contracts with regional water providers for water of 1,000 ac-ft per year or more. Presently, these water users are not required to develop water conservation plans unless the user is seeking state funding; however, a wholesale water provider may require that its customers prepare a conservation plan to assist in meeting the goals and targets of the wholesale water provider's plan. A list of the users in Region B required to submit water conservation plans is shown in Table 6.1.

Table 6-1: Region B Water Users Required to Prepare Water Conservation Plans

WUG	Type of Use
City of Bowie	Municipal
City of Henrietta	Municipal
City of Olney	Municipal
City of Wichita Falls	Municipal
North Montague County	Municipal
Red River Authority	Municipal*
American Electric Power Company	Industrial
Wichita County WID No. 2	Irrigation

*The Red River Authority holds surface water rights in Lake Texoma, which is located in Region C

In addition to water users listed in Table 6-1, North Central Texas MWA owns and operates Millers Creek Lake, which is located in both Regions B and G. Currently North Central Texas MWA serves customers only in Region G and planning for this entity is included in the Brazos G water plan.

To assist entities in the Region B area with developing water conservation plans, model plans for municipal water users (wholesale or retail public water suppliers, industrial users, and irrigation districts are included in Attachment 6-1). Each of these model plans address the latest TCEQ requirements and is intended to be modified by each user to best reflect the activities appropriate to the entity.

Some of the conservation activities for municipal water users in Region B include:

- Education and public awareness programs
- Reduction of unaccounted for water through water audits and maintenance of water systems
- Water rate structures that discourage water waste

Industrial water users in Region B include several power plants as well as local manufacturers. Conservation activities associated with industries are very site and industry-specific. Some industries can utilize brackish water supplies or wastewater effluent while others require only potable water. It is important in evaluating conservation strategies for industries to balance the water savings from conservation to economic benefits to the industry and the region. Requiring costly changes to processes and equipment may not be practical and beneficial to the region at this point in time.

In light of these considerations, the focus of conservation activities for industrial users should be:

- Evaluation of water saving equipment and processes
- Water rate structures that discourage water waste

The only large irrigation district in Region B is the Wichita County Water Improvement District No. 2, which holds an irrigation water right of 120,000 ac-ft per year. Appropriate conservation activities for large irrigators in the Region B area include:

- Reduction in operational losses and losses associated with conveyance systems
- Coordination of irrigation deliveries to maximize efficiencies
- Encourage water saving irrigation equipment and land practices for customers

6.3 Drought Contingency Plans

Drought management is a temporary strategy to conserve available water supplies during times of drought or emergencies. This strategy is not recommended to meet long-term growth in demands, but rather acts as a means to minimize the adverse impacts of water supply shortages during drought. Drought contingency plans are required of all wholesale and retail public water suppliers and irrigation districts by the Texas Water Code (Section 11.1272) and by TCEQ Rules (30 TAC Chapter 288). A drought contingency plan may also be required for entities seeking state funding for water projects. In general, drought contingency plans must include, at minimum, the following elements:

- Provisions for public input
- Provisions for public education
- Coordination with the Regional Water Planning Group

- Criteria for initiation and termination of drought response stages
- Identification of drought response stages
- Assessment of water management strategies for specific drought conditions
- Procedures for notification of the public
- Methods for determining the allocation of supplies to individual users (irrigation plans)
- Monitoring procedures to initiate or terminate a drought response stage
- Procedures for accounting for use during implementation of water allocation (irrigation plans)
- Supply or demand measures to be implemented during the stages of the plan
- Procedures for granting variances
- Procedures for enforcement of water use restrictions

Drought contingency plans typically identify different stages of drought and specific triggers and response for each stage. In addition, the plan must specify quantifiable targets for water use reductions for each stage, and a means and method for enforcement. As with the water conservation plans, drought contingency plans are to be updated and submitted to the TCEQ by May 1, 2005.

Drought contingency plans were developed for Region B RWPG during the previous regional water planning effort. Each plan identifies at least four drought stages: mild, moderate, severe, and emergency. The recommended responses range from notification of drought conditions and voluntary reductions in the "mild" stage to mandatory restrictions during an "emergency" stage. Each entity will select the trigger conditions for the different stages and appropriate response.

Forty-six drought contingency plans were prepared. The majority of the plans use trigger conditions based on the demands placed on the water distribution system, but can also trigger drought stages based on a supplier's request to reduce demand. Of the plans reviewed, eleven users based trigger actions on well levels, eight based actions on reservoir levels, and two based actions on climate or weather conditions.

Drought trigger conditions for surface water supply are customarily related to reservoir levels. The Region B Regional Water Planning Group will be working with the regional operators of reservoirs to establish the trigger conditions. Trigger conditions which have been ascertained for the region's reservoirs follows:

Lake Kickapoo and Lake Arrowhead

The City of Wichita Falls operates Lake Kickapoo and Lake Arrowhead. The following describes the existing drought stages triggers in these lakes under the city's DCP:

- Stage 1 – Combined storage levels fall below 50% of conservation storage
- Stage 2 – Combined storage levels fall below 40% of conservation storage
- Stage 3 – Combined storage levels fall below 30% of conservation storage

Lake Kemp

The Wichita County Water Improvement District operates Lake Kemp. The following describes the existing drought stages triggers for this lake under the city's DCP:

- Stage 1 – Lake elevation drops below 1,133 ft msl
- Stage 2 – Lake elevation drops below 1,130 ft msl
- Stage 3 – Lake elevation drops below 1,123 ft msl
- Stage 4 – Lake elevation drops below 1,114 ft msl

Petrolia City Lake

The City of Petrolia operates Petrolia City Lake. The following describes the existing drought stages triggers for this lake under the city's DCP:

- Stage 1 – Lake storage drops below 60% capacity
- Stage 2 – Lake storage drops below 50% capacity
- Stage 3 – Lake storage drops below 35% capacity

Lakes Olney and Cooper

The City of Olney operates Lakes Olney and Cooper. The following describes the existing drought stages triggers for this lake under the city's DCP:

- Stage 1 – Lake elevation drops below 1,135 ft msl
- Stage 2 – Lake elevation drops below 1,133 ft msl
- Stage 3 – Lake elevation drops below 1,130 ft msl
- Stage 4 – Lake elevation drops below 1,127 ft msl

Megargel City Lake

The City of Megargel operates City Lake. The following describes the existing drought stages triggers for this lake under the city's DCP:

- Stage 1 – Lake elevation drops 7 feet below normal pool
- Stage 2 – Lake elevation drops 9 feet below normal pool
- Stage 3 – Lake elevation drops 11 feet below normal pool

North Fork Buffalo Creek Lake

The City of Iowa Falls operates North Fork Buffalo Creek. The following describes the existing drought stages triggers for this lake under the city's DCP:

- Stage 1 – June 1
- Stage 2 – Lake elevation drops below 1,040 ft msl
- Stage 3 – Lake elevation drops below 1,038 ft msl
- Stage 4 – Lake elevation drops below 1,032 ft msl
- Stage 5 – Lake elevation drops below 1,030 ft msl or emergency

Lake Electra

The City of Electra operates Lake Electra. The following describes the existing drought stages triggers for this lake under the city's DCP:

- Stage 1 – Lake storage drops below 1,700 acre-ft
- Stage 2 – Lake storage drops below 1,500 acre-ft
- Stage 3 – Lake storage drops below 1,300 acre-ft
- Stage 4 – Lake storage drops below 1,000 acre-ft

Lake Amon G. Carter

The City of Bowie operates Lake Amon G. Carter. The following describes the existing drought stages triggers in these lakes under the city's DCP:

- Stage 1 – Lake elevation drops below 916 feet msl
- Stage 2 – Lake elevation drops below 912 feet msl
- Stage 3 – Lake elevation drops below 908 feet msl

6.4 Summary of Water Conservation and Drought Management Recommendations

Water conservation and drought management are often a way of life in Region B. With frequent periods of drought, water providers recognize the importance of active management and conservation of local water resources. The Region B Water Planning Group also recognizes that advanced water conservation measures (i.e. savings associated with active conservation measures for municipal and industrial uses) will be implemented by local governing entities or water users as conditions arise. The recommended strategies presented in this plan provide a framework from which water providers can use to develop plans and/or strategies to meet their needs. Region B Planning Group supports the use and consideration of any water conservation strategy deemed appropriate by a water user.

Acknowledging the importance of water conservation to meet future water needs in Region B, this water plan recommends several water conservation strategies for users with identified needs:

- Municipal conservation
- Municipal reuse
- Irrigation conveyance loss reduction

The amount of conservation from each of these strategies is shown in Table 6-2, and represents approximately 52 percent of the total supply from all recommended strategies by 2060.

Table 6-2: Conservation by Strategy

Strategy	2010	2020	2030	2040	2050	2060
Additional Municipal Conservation	252	920	979	1,027	1,043	1,855
Wichita Falls Reuse		11,000	11,000	11,000	11,000	11,000
Bowie Reuse				134	134	134
Lake Kemp Canal Project				14,600	14,600	14,600
Total Conservation	**252**	**11,920**	**11,979**	**26,761**	**26,777**	**27,589**
New Supplies						
Increase conservation elevation at Lake Kemp	25,783	23,766	21,749	19,732	17,715	15,700
Seasonal pool at Lake Kemp	5,000	5,250	5,500	5,750	6,000	6,250
Additional groundwater for Vernon	664	664	664	664	664	664
Additional groundwater for Montague County-Other	394	458	475	486	486	486
Conservation and reuse	252	11,920	11,979	26,761	26,777	27,589
Total – New Supplies[1]	**32,093**	**42,058**	**40,367**	**53,393**	**51,642**	**50,689**
% Conservation	1%	28%	30%	50%	52%	54%

[1] New supplies include conservation savings.

ATTACHMENT 6-1

REGIONAL WATER PLANNING GROUP B

MODEL WATER CONSERVATION PLANS

Model Water Conservation Plan for [Entity]

Date

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APPENDICES

Model Water Conservation Plan for [Entity]

1 OBJECTIVES

Recognizing the need for efficient use of existing water supplies, the Texas Commission on Environmental Quality (TCEQ) has developed guidelines and requirements governing the development of water conservation plans for public water suppliers. The objectives of this water conservation plan are as follows:

- To reduce water consumption from the levels that would prevail without conservation efforts.
- To reduce the loss and waste of water.
- To improve efficiency in the use of water.
- To document the level of recycling and reuse in the water supply.
- To extend the life of current water supplies by reducing the rate of growth in demand.

The water conservation plan presented in this document is a model water conservation plan intended for adoption by wholesale or retail public water suppliers in Region B. This model plan includes all of the elements required by TCEQ. In order to adopt this plan, each water supplier will need to do the following:

- Complete the water utility profile.
- Set five- and ten-year goals for per capita water use.
- Adopt ordinance(s) or regulation(s) approving the model plan.

2 TEXAS COMMISSION ON ENVIRONMENTAL QUALITY RULES

2.1 Conservation Plans

The TCEQ rules governing development of water conservation plans for public water suppliers are contained in Title 30, Part 1, Chapter 288, Subchapter A, Rule 288.2 of the Texas Administrative Code. For the purpose of these rules, a water conservation plan is defined as "A strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water, and for preventing the pollution of water[1]." The elements in the TCEQ water conservation rules covered in this conservation plan are listed below.

[1] Title 30 of the Texas Administrative Code, Part 1, Chapter 288, Subchapter A, Rules 288.1 and 288.2, and Subchapter B, Rule 288.20, downloaded from http://www.tnrcc.state.tx.us/oprd/rules/pdflib/288a.pdf, November 2003.

Minimum Conservation Plan Requirements

The minimum requirements in the Texas Administrative Code for Water Conservation Plans for Public Water Suppliers are covered in this report as follows:

- 288.2(a)(1)(A) – Utility Profile – Section 3
- 288.2(a)(1)(B) – Specification of Goals – Section 4
- 288.2(a)(1)(C) – Accurate Metering – Section 5.1
- 288.2(a)(1)(D) – Universal Metering – Section 5.1
- 288.2(a)(1)(E) – Determination and Control of Unaccounted Water – Section 5.3
- 288.2(a)(1)(F) – Public Education and Information Program – Section 6
- 288.2(a)(1)(G) – Non-Promotional Water Rate Structure – Section 7
- 288.2(a)(1)(H) – Reservoir System Operation Plan – Section 8.2
- 288.2(a)(1)(I) – Means of Implementation and Enforcement – Section 9
- 288.2(a)(1)(J) – Coordination with Regional Water Planning Group – Section 8.5

Conservation Additional Requirements (Population over 5,000)

The Texas Administrative Code includes additional requirements for water conservation plans for cities with a population over 5,000:

- 288.2(a)(2)(A) – Leak Detection, Repair, and Water Loss Accounting – Sections 5.3, 5.4, and 5.5
- 288.2(a)(2)(B) – Record Management System – Section 5.2
- 288.2(a)(2)(C) – Requirement for Water Conservation Plans by Wholesale Customers – Section 8.4

Additional Conservation Strategies

TCEQ rules also list additional optional but not required conservation strategies, which may be adopted by suppliers. The following optional strategies are included in this plan:

- 288.2(a)(3)(A) – Conservation Oriented Water Rates – Section 7
- 288.2(a)(3)(B) – Ordinances, Plumbing Codes or Rules on Water-Conserving Fixtures – Section 8.1
- 288.2(a)(3)(F) – Considerations for Landscape Water Management Regulations – Section 8.3
- 288.2(a)(3)(G) – Monitoring Method – Section 5.5

3 WATER UTILITY PROFILE

Appendix A to this water conservation plan is a sample water utility profile based on the format recommended by the TCEQ.
[Water supplier is to complete the utility profile and provide information on the public water supply system and customers if appropriate for this section.]

4 SPECIFICATION OF WATER CONSERVATION GOALS

[Current TCEQ rules require the adoption of specific water conservation goals for a water conservation plan. As part of plan adoption, each water supplier will develop 5-year and 10-year goals for per capita municipal use, following TCEQ procedures described in the water utility profile (Appendix A).]

The goals for this water conservation plan include the following:

- Strive to attain the per capita municipal water use below the specified amount in gallons per capita per day shown on the completed Table C-1 using a 5-year rolling average calculation. (See 5-year and 10-year goals in Appendix A)
- Conduct water audits as required by the TCEQ and maintain unaccounted for water to *[insert amount]* percent of the total water used through existing and new maintenance programs.
- Raise public awareness of water conservation and encourage responsible public behavior by a public education and information program, as discussed in Section 6.

5 METERING, WATER USE RECORDS, CONTROL OF UNACCOUNTED WATER, AND LEAK DETECTION AND REPAIR

One of the key elements in water conservation is careful tracking of water use and control of losses through illegal diversions and leaks. Careful metering of water deliveries and water use, detection, and repair of leaks in the distribution system and regular monitoring of unaccounted water are important in controlling losses. *[Water suppliers serving a population of 5,000 people or more or having a projected population of greater than 5,000 people or more within the next ten years must include the following elements in their water conservation plans:]*

5.1 Metering of Customer and Public Uses and Meter Testing, Repair, and Replacement

All customers of wholesale or retail public water suppliers, including public and governmental users, should be metered. In many cases, water suppliers already meter all of their water users. For those water suppliers who do not currently meter all of their water uses, these entities will implement a program to meter all water uses within the next five years.

Most water suppliers test and replace their customer meters on a regular basis. All customer meters should be replaced on a 15-year cycle. Those who do not currently have a meter testing and replacement program will implement such a program over the next five years.

5.2 Record Management System

As required by TAC Title 30, Part 1, Chapter 288, Subchapter A, Rule 288.2(a)(2)(B), the record management system allows for the separation of water sales and uses into residential, commercial, public/institutional, and industrial categories. This information will be included in an annual water conservation report, as described in Section 5.5 below.

For those entities whose record management systems do not currently allow for the separation of water sales as described above, they will move to implement such a system within the next five years.

5.3 Determination and Control of Unaccounted Water

Unaccounted water is the difference between water delivered to customers and metered deliveries to customers plus authorized but unmetered uses. (Authorized but unmetered uses would include use for fire fighting, releases for flushing of lines, and uses associated with new construction.) Unaccounted water can include several categories:

- Inaccuracies in customer meters. (Customer meters tend to run more slowly as they age and under-report actual use.)
- Accounts which are being used but have not yet been added to the billing system.
- Losses due to water main breaks and leaks in the water distribution system.
- Losses due to illegal connections and theft.
- Other.

Measures to control unaccounted water are part of the routine operations of water suppliers. Water audits are useful methods of accounting for water usage within a system. Water audits will be conducted by water suppliers in order to decrease water loss. Maintenance crews and personnel will look for and report evidence of leaks in the water distribution system. The leak detection and repair program is described in Section 5.5 below. Meter readers are asked to watch for and report signs of illegal connections, so they can be addressed quickly. Unaccounted water is calculated as part of the utility profile and is included in Appendix A.

5.4 Leak Detection and Repair

City crews and personnel will look for and report evidence of leaks in the water distribution system. Areas of the water distribution system in which numerous leaks and line breaks occur are targeted for replacement as funds are available.

5.5 Monitoring of Effectiveness and Efficiency - Annual Water Conservation Report

An annual conservation report will be completed by *[insert date]* of the following year and will be used to monitor the effectiveness and efficiency of the water conservation program and to plan conservation-related activities for the next year. This report records the water use by category, per capita municipal use, and unaccounted water for the current year and compares them to historical values.

6 CONTINUING PUBLIC EDUCATION AND INFORMATION CAMPAIGN

The continuing public education and information campaign on water conservation includes the following elements: *[Water provider is to select the appropriate measures for its system.]*

- Insert water conservation information with water bills. Inserts will include material developed by the [water supplier] staff and material obtained from the TWDB, the TCEQ, and other sources.
- Encourage local media coverage of water conservation issues and the importance of water conservation.
- Make the *Texas Smartscape CD*, water conservation brochures, and other water conservation materials available to the public.
- Make information on water conservation available on its website (if any) and include links to the *Texas Smartscape* website and to information on water conservation on the TWDB and TCEQ web sites.
- Provide water conservation materials to schools and utilize existing age-appropriate education programs available through the TCEQ and TWDB.
- Support the State-initiated Water Conservation Awareness and Education Campaign.

7 WATER RATE STRUCTURE

[If a water supplier has a decreasing block rate structure, it is recommended that a flat rate or increasing rate structure be adopted.]

An increasing block rate water structure that is intended to encourage water conservation and discourage excessive use and waste of water will be adopted upon completion of the next rate study or within five years. An example water rate structure is as follows:

Residential Rates

1. Monthly minimum charge. This can (but does not have to) include up to 2,000 gallons water use with no additional charge.

2. Base charge per 1,000 gallons up to the approximate average residential use.

3. 2nd tier (from the average to 2 times the approximate average) at 1.25 to 2.0 times the base charge.

4. 3rd tier (above 2 times the approximate average) at 1.25 to 2.0 times the second tier.

5. The residential rate can also include a lower tier for basic household use up to 4,000 gallons per month or so.

Commercial/Industrial Rates

Commercial/industrial rates should include at least 2 tiers, with rates for the 2nd tier at 1.25 to 2.0 times the first tier.

[If a water supplier has an increasing rate structure, state the current rate structure as follows.]

The [water supplier] has adopted an increasing block rate water structure that is intended to encourage water conservation and discourage excessive use and waste of water. The water rate structure adopted on *[insert date]* is as follows:

Residential Rates

[To be completed by the supplier]

Commercial/Industrial Rates

[To be completed by the supplier]

8 OTHER WATER CONSERVATION MEASURES

8.1 Ordinances, Plumbing Codes, or Rules on Water-Conserving Fixtures

The State of Texas has required water-conserving fixtures in new construction and renovations since 1992. The state standards call for flows of no more than 2.5 gallons per minute (gpm) for faucets, 3.0 gpm for showerheads, and 1.6 gallons per flush for toilets. Similar standards are now required nationally under federal law. These state and federal standards assure that all new construction and renovations will use water-conserving fixtures. In addition, federal standards governing clothes washing machines will require all washers produced by 2007 to meet higher efficiency standards, which may include lower water use machines. The potential savings from these fixtures can be significant, but historically have been difficult to measure independently from other factors.

8.2 Reservoir System Operation Plan

[Insert description of reservoir system operation plan if public supplier has such a plan.]
or
The [water supplier] purchases water from [name] and does not have surface water supplies for which to implement a reservoir system operation plan.

8.3 Considerations for Landscape Water Management Regulations (Optional)

[The water supplier may choose to adopt landscape water management regulations as part of the development of this water conservation plan. These regulations are intended to minimize waste in landscape irrigation. The proposed regulations might include the following elements:

- *Require that all new irrigation systems be in compliance with state design and installation regulations (TAC Title 30, Part 1, Chapter 344).*
- *Prohibit irrigation systems that spray directly onto impervious surfaces or onto other non-irrigated areas. (Wind driven water drift will be taken into consideration.)*
- *Prohibit use of poorly maintained sprinkler systems that waste water.*
- *Prohibit outdoor watering during any form of precipitation.*
- *Enforce the regulations by a system of warnings followed by fines for continued or repeat violations.*
- *Implement other measures to encourage off-peak water use.]*

8.4 Requirement for Water Conservation Plans by Wholesale Customers

[Required for cities with populations over 5,000]

Every contract for the wholesale sale of water by customers that is entered into, renewed, or extended after the adoption of this water conservation and drought contingency plan will include a requirement that the wholesale customer and any wholesale customers of that wholesale customer develop and implement a water conservation plan meeting the requirements of Title 30, Part 1, Chapter 288, Subchapter A, Rule 288.2 of the Texas Administrative Code. The requirement will also extend to each successive wholesale customer in the resale of the water.

8.5 Coordination with Regional Water Planning Group

In accordance with TCEQ regulations, a copy of this adopted water conservation plan will be sent to the Regional Water Planning Group.

9 IMPLEMENTATION AND ENFORCEMENT OF THE WATER CONSERVATION PLAN

A copy of [an ordinance, order, or resolution] adopted by the [City Council or governing board] regarding this water conservation plan is attached to and made part of this plan. The [ordinance, order, or resolution] designates responsible officials to implement and enforce the water conservation plan.

Model Water Conservation Plan for [Industrial Entity]

Date

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Model Water Conservation Plan for [Industrial Entity]

1. Objectives

The Texas Commission on Environmental Quality has developed guidelines and requirements governing the development of water conservation plans for industrial or mining use. The purpose of this water conservation plan is to:

- To reduce water consumption from the levels that would exist without conservation efforts.
- To reduce the loss and waste of water.
- To encourage improvement of processes that inefficiently consume water.
- To extend the life of current supplies by reducing the rate of growth in demand.
- To document the level of recycling and reuse in the water supply.

This water conservation plan is intended to serve as a guide to [entity]. The following plan includes all conservation measures required by TCEQ.

2. Description of Water Use

The TCEQ requires that each mining or industrial water user must document how water is used in the production process.

- *[Entity provides information including:]*
  - *How water flows to and through their systems*
  - *What purpose water serves in the production process*
  - *How much water is consumed in the production process and not available for reuse*
  - *Means of discharging water used in industrial processes]*

3. Specification of Water Conservation Goals

The TCEQ regulations require that each industrial and mining user adopt quantifiable water conservation goals in their water conservation plan. *[Entity]* has specified a five-year and ten-year target for water savings. *[Include quantifiable water savings targets and the details of the basis for the development of these goals.]*

The goals for this water conservation plan include the following:

- *[Name goals.] Potential goals are:*
  - *Meter water use to decrease water loss through leaks*
  - *Regularly inspect systems for leaks and promptly repair in order to control unaccounted water*
  - *Improve, modify, or audit processes in order to increase efficient water use*

4. Metering of Industrial and Mining Water Users

[Entity]'s water use is metered at [description of location]. Submetering is a good strategy for some industrial water users. Processes or equipment that consume large quantities of water could be usefully submetered. Submetering is an effective way to account for all water use by process, subprocess, or piece of equipment in a facility. *[Identify processes and/or equipment that are currently submetered.]*

5. Control of Unaccounted Water and Leak Detection and Repair

Careful metering of water use, detection, and repair of leaks in the distribution system and regular monitoring of unaccounted water are important in controlling losses.

Unaccounted water is the difference between water delivered to a system and water delivered to a system plus authorized but unmetered uses. Authorized but unmetered uses includes water for fire fighting, releases for flushing of lines, and water used during new construction. Unaccounted water can be attributed to several things including:

- Inaccuracies in meters. Older meters tend to run slowly and therefore under-report actual use
- Loss due to leaks and main breaks in the system
- Illegal connections to a system
- [Other]

In order to control unaccounted water, persons in industry are asked to watch for and report water main breaks and leaks. Broken and leaking lines should be replaced or repaired in a timely manner. Meter readers are asked to report signs of illegal connections so they can be quickly assessed.

[Entity] will implement and maintain a water loss program. This program will serve to reduce losses due to leakage. The measures of the water loss program include *[select applicable measure]*:

- Conducting regular inspections of water main fittings and connections
- Installing leak noise detectors and loggers
- Using a leakage modeling program
- Metering individual pressure zones
- Controlling pressure just above the minimum standard-of-service level
- Limiting surges in pressure
- [Other]

6. Improving, Modifying, and Auditing Processes and Equipment

[Entity] can increase water efficiency by improving, modifying, and auditing facility processes and equipment. Water can be conserved through the following measures *[select appropriate measure]*:

- Implementing a Water Waste Reduction Program
- Optimizing the water-use efficiency of cooling systems (other than cooling towers)
- Reducing water loss in cooling towers

Water Waste Reduction Programs cause [Entity] personnel to be more aware of wasteful activities. Measures resulting from a Water Waste Reduction Program include:

- Install water saving devices on equipment
- Replace current equipment with more water-efficient equipment
- Recycle water within a process
- Change to waterless equipment or process

7. Implementation and Modifications to Water Conservation Plan

Upon implementation of this water conservation plan, [Entity] is required by the TCEQ to update the plan at least every five years. New goals will be based on previous five-year and ten-year goals and any new information.

An implementation report will be prepared by the [date] of each year following the adoption of this plan. A sample report is included in Appendix C. This report includes:

- The list of dates and descriptions of conservation measures implemented
- Amount of water saved
- Data about whether or not targets in the plan are met
- If targets are not met, an explanation as to why the target was not met and a discussion of the progress to meet the target

Model Water Conservation Plan for [Irrigation District]

Date

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Model Water Conservation Plan for [Irrigation District]

1. Objectives

The Texas Commission on Environmental Quality has developed guidelines and requirements governing the development of water conservation plans for irrigation use. The purpose of this water conservation plan is:

- To reduce water consumption from the levels that would exist without conservation efforts
- To reduce the loss and waste of water
- To encourage improvement of processes that inefficiently consume water
- To extend the life of current supplies by reducing the rate of growth in demand

This water conservation plan is intended to serve as a guide to [irrigation district]. The following plan includes all conservation measures required by TCEQ.

2. Description of Water Use

[The TCEQ requires that each irrigation user must document how water is used in the irrigation production process.

- *Irrigation users will provide information including:*
  - *Type of crops.*
  - *Acreage of each crop to be irrigated.*
  - *Monthly irrigation diversions.*
  - *Details of seasonal or annual crop rotation.*
  - *Soil types of the land to be irrigated.*
  - *Description of the irrigation method including flow rates, plans, and sketches of the system layout.*
  - *Details of equipment used in the process within an accuracy of +/- 5 %.]*

3. Specification of Water Conservation Goals

[The Irrigation District must specify a five-year and ten-year target for water savings and detail the basis for the development of these goals. These goals will include targets for water use efficiency and a pollution abatement and prevention plan.]

The TCEQ regulations require that each irrigation user adopt quantifiable water conservation goals in their water conservation plan. The *[Irrigation District]* has adopted goals related to improving water efficiency of its delivery system. The *[Irrigation District]* will strive to increase water efficiency per irrigated acre by *[insert amount]* percent within 5 years and *[insert amount]* percent within 10 years.

[Alternate goal] The *[Irrigation District]* will maintain the water efficiency per irrigated acre of *[insert amount]* percent within 5 years and *[insert amount]* percent within 10 years.

The goals for this water conservation plan will be achieved through the following: *[select applicable measures and/or include additional measures.]*

- Regular inspections of systems for controllable operation losses or leaks
- Coordination of irrigation deliveries with customers
- Schedule the timing or measure the amount of water applied.
- Improve or modify irrigation processes in order to increase efficient water use.
- Employ water-conserving irrigation equipment or improve existing equipment.
- Implement methods of land improvement that reduce runoff and increase rain infiltration to the soil.
- Establish a tailwater recovery and reuse program.

4. Control of Unaccounted Water and Leak Detection and Repair

Detection and repair of leaks in an irrigation system is important in controlling losses. Unaccounted for water is the difference between water delivered to a system and water delivered to a system plus authorized but unmetered uses. Unaccounted water in the irrigation system can be attributed to several things including:

- Inaccuracies in meters
- Loss due to leaks in the conveyance system
- Operational losses
- Illegal connections to a system
- Other

To help control unaccounted water, *[irrigation district]* will monitor supply deliveries, conduct water audits and adjust operations to minimize losses if applicable. Broken water lines will be replaced or repaired in a timely manner.

5. Irrigation Scheduling and Volumetric Measuring of Irrigation Water Use

Volumetric Measuring

Measuring the volume of water being used to irrigate a crop is useful because it provides [irrigation district] with information needed to evaluate the efficiency of an irrigation system. With this information, [irrigation district] and customers can better manage their crops. Irrigation water users will employ a method of measuring how much irrigation water is used in their system.

The following methods may be used to directly measure amounts of irrigation water being used *[select appropriate methods]*:

- Propeller meters
- Orifice, venture or differential pressure meters
- Ultrasonic
- Stage Discharge Rating Tables
- Area/Point Velocity Measurements

Indirect methods that may be used to measure irrigation water quantities include:

- Measurement of time of irrigation and size of irrigation delivery system
- Measurement of end-pressure in a sprinkler irrigation system
- Measurement of energy used by a pump supplying water to an irrigation system
- Change in the elevation of water stored in an irrigation water supply reservoir

Irrigation Scheduling

Coordination of irrigation schedules of customers can reduce losses associated with conveying irrigation water. The *[irrigation district]* will implement an irrigation schedule for deliveries to customers to best meet the customers' water needs and minimize conveyance losses.

6. Methods of Land Improvement

To reduce the amount of water required for irrigation, the following land improvement practices are encouraged for customers of the *[irrigation district]*:

- Creation of furrow dikes
- Crop residue management and conservation tillage
- Land leveling
- Contour farming

7. Improvements to Irrigation Equipment

The *[irrigation district]* encourages customers to utilize efficient irrigation equipment, including:

- Installation of a drip/micro-irrigation system
- Installation of gated and flexible pipe for field water distribution systems
- Replacement of on-farm irrigation ditches with pipelines
- Lining of on-farm irrigation ditches
- Installation of low pressure center pivot sprinkler irrigation systems

8. Implementation of Water Conservation Plan

Upon implementation of this water conservation plan, *[irrigation district]* is required by the TCEQ to update the plan at least every five years. Goals for irrigation use will be re-evaluated based on previous five-year and ten-year goals and any new information.

An implementation report will be prepared by the [date] of each year following the adoption of this plan. A sample report is included in Appendix C. This report includes:

- The list of dates and descriptions of conservation measures implemented
- Amount of water saved
- Data about whether or not targets in the plan are met
- If targets are not met, an explanation as to why the target was not met and a discussion of the progress to meet the target

ATTACHMENT 6-2

REGIONAL WATER PLANNING GROUP B

MODEL DROUGHT CONTINGENCY PLANS

Model Drought Contingency Plan for [Irrigation District]

Date

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Model Drought Contingency Plan for [Irrigation District]

1. Objectives

This drought contingency plan is intended for use by [irrigation district]. The plan includes all current TCEQ requirements for a drought contingency plan.

This drought contingency plan serves to:
- Conserve available water supplies during times of drought and emergency
- Minimize adverse impacts of water supply shortages
- Minimize the adverse impacts of emergency water supply conditions

2. Texas Commission on Environmental Quality Rules

The TCEQ rules governing development of drought contingency plans for irrigation districts are contained in Title 30, Part 1, Chapter 288, Subchapter B, Rule 288.21 of the Texas Administrative Code.

3. Provisions to Inform the Public and Opportunity for Public Input

[Irrigation district] will give customers the opportunity to provide public input into the preparation of the plan by one of the following methods:
- Holding a public meeting
- Providing written notice of the proposed plan and the opportunity to comment on the plan by newspaper or posted notice

4. Coordination with the Region B Water Planning Group

This drought contingency plan will be sent to the Chair of the Region B Water Planning Group in order to ensure consistency with the Region B Water Plan.

5. Initiation and Termination of Drought Response Stages

Official designees order the implementation of a drought response stage when one or more of the trigger conditions for that stage are met. Official designees may also order the termination of a drought response stage when the termination criteria are met or at their own discretion. The official designee for the [irrigation district] is:

Name
Title
Contact Information

If any mandatory provisions have been implemented or terminated, [irrigation district] is required to notify the Executive Director of the TCEQ within five business days.

6. Goals for Reduction in Water Use

TCEQ requires that each irrigation water user develop goals for water use reduction for each stage of the drought contingency plan. [Entity]'s goals are independently developed and given below.

7. Drought and Emergency Response Stages

Stage 1, Mild

Trigger Conditions for Stage 1, Mild

- A wholesale water supplier that provides all or part of an irrigation user's supply has initiated Stage 1, Mild
- *[Select appropriate other triggers]*
    - When [irrigation district]'s available water supply is equal or less than [amount in ac-ft, percent of storage, etc.]
    - When total daily demand equals [number] million gallons for [number] consecutive days or [number] million gallons on a single day
    - When the water level in [irrigation district]'s well(s) is equal or less than [number] feet above/below mean sea level
    - When flows in the [name of river or stream segment] are equal to or less than [number] cubic feet per second

Goals for Use Reduction and Actions Available Under Stage 1, Mild
[Entity]'s will reduce water use by [goal]. Irrigation water suppliers may order the implementation of any of the strategies listed below in order to reduce water use:

- Request voluntary reductions in water use
- Review the problems that caused the initiation of Stage 1

Stage 1 is intended to raise awareness of potential drought problems. Stage 1 will end when the circumstances that caused the initiation of Stage 1 no longer exist.

Stage 2, Moderate

Trigger Conditions for Stage 2, Moderate

- A wholesale water supplier that provides all or part of an irrigation user's supply has initiated Stage 2, Moderate
- *[Select appropriate other triggers]*
    - When [irrigation district]'s available water supply is equal or less than [amount in ac-ft, percent of storage, etc.]
    - When total daily demand equals [number] million gallons for [number] consecutive days or [number] million gallons on a single day
    - When the water level in [irrigation district]'s well(s) is equal or less than [number] feet above/below mean sea level
    - When flows in the [name of river or stream segment] are equal to or less than [number] cubic feet per second

Goals for Use Reduction and Actions Available Under Stage 2, Moderate
[Entity]'s will reduce water use by [goal]. Irrigation water suppliers may order the implementation of any of the strategies listed below in order to reduce water use:

- Request voluntary reductions in water use
- Review the problems that caused the initiation of Stage 2
- Intensify leak detection and repair efforts
- Other

Stage 2 will end when the circumstances that caused the initiation of Stage 2 no longer exist.

Stage 3, Severe

Trigger Conditions for Stage 3, Severe

- A wholesale water supplier that provides all or part of an irrigation user's supply has initiated Stage 3, Severe
- *[Select appropriate other triggers]*
    - When [irrigation district]'s available water supply is equal or less than [amount in ac-ft, percent of storage, etc.]
    - When total daily demand equals [number] million gallons for [number] consecutive days or [number] million gallons on a single day
    - When the water level in [irrigation district]'s well(s) is equal or less than [number] feet above/below mean sea level
    - When flows in the [name of river or stream segment] are equal to or less than [number] cubic feet per second

Goals for Use Reduction and Actions Available Under Stage 3, Severe
[Entity]'s will reduce water use by [goal]. Irrigation water suppliers may order the implementation of any of the strategies listed below in order to reduce water use:

- Request voluntary reductions in water use
- Review the problems that caused the initiation of Stage 3
- Intensify leak detection and repair efforts
- Implement mandatory watering days and/or times
- Other

Stage 3 will end when the circumstances that caused the initiation of Stage 3 no longer exist.

Stage 4, Emergency

Trigger Conditions for Stage 4, Emergency

- A wholesale water supplier that provides all or part of an irrigation user's supply has initiated Stage 4, Emergency
- *[Select appropriate other triggers]*
    - o When [irrigation district]'s available water supply is equal or less than [amount in ac-ft, percent of storage, etc.]
    - o When total daily demand equals [number] million gallons for [number] consecutive days or [number] million gallons on a single day
    - o When the water level in [irrigation district]'s well(s) is equal or less than [number] feet above/below mean sea level
    - o When flows in the [name of river or stream segment] are equal to or less than [number] cubic feet per second

Goals for Use Reduction and Actions Available Under Stage 4, Emergency
[Entity]'s will reduce water use by [goal]. Irrigation water suppliers may order the implementation of any of the strategies listed below in order to reduce water use:

- Review the problems that caused the initiation of Stage 4
- Intensify leak detection and repair efforts
- Implement mandatory watering days and/or times
- Implement mandatory reductions in water deliveries
- Other

Stage 4 will end when the circumstances that caused the initiation of Stage 4 no longer exist.

8. Penalty for Violation of Water Use Restriction

Mandatory water use restrictions are implemented in Stages [1, 2, 3, or 4]. These restrictions will be strictly enforced with the following penalties:

- Potential penalties include:
    - o Written warning that they have violated the mandatory water use restriction
    - o Issue a citation. Minimum and maximum fines are established by ordinance or other order
    - o Discontinue water service to the user

9. Review and Update of Drought Contingency Plan

This drought contingency plan will be updated at least every five years as required by TCEQ regulations.

Model Drought Contingency Plan for [Public Water Supplier]

Date

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Model Drought Contingency Plan for [Public Water Supplier]

1. Objectives

This drought contingency plan (the Plan) is intended for use by [municipal water supplier]. The plan includes all current TCEQ requirements for a drought contingency plan.

This drought contingency plan serves to:

- Conserve available water supplies during times of drought and emergency
- Minimize adverse impacts of water supply shortages
- Minimize the adverse impacts of emergency water supply conditions
- Preserve public health, welfare, and safety

2. Texas Commission on Environmental Quality Rules

The TCEQ rules governing development of drought contingency plans for public water suppliers are contained in Title 30, Part 1, Chapter 288, Subchapter B, Rule 288.20 of the Texas Administrative Code.

3. Provisions to Inform the Public and Opportunity for Public Input

[Public water supplier] will give customers the opportunity to provide public input into the preparation of the plan by one of the following methods:

- Holding a public meeting
- Providing written notice of the proposed plan and the opportunity to comment on the plan by newspaper or posted notice

4. Public Education

[Public water supplier] will notify the public about the drought contingency plan, including changes in stage and drought measures to be implemented, by one or more of the following methods:

- Prepare a description of the Plan and make it available to customers at appropriate locations
- Include utility bill inserts that detail the Plan
- Provide radio announcements that inform customers of stages to be initiated or terminated and drought measures to be taken
- Include an ad in a newspaper of general circulation to inform customers of stages to be initiated or terminated and drought measures to be taken

5. Coordination with the Region B Water Planning Group

This drought contingency plan will be sent to the Chair of the Region B Water Planning Group in order to ensure consistency with the Region B Water Plan. If any changes are made to the drought contingency plan, a copy of the newly adopted plan will be sent to the Regional Water Planning Group.

6. Initiation and Termination of Drought Response Stages

The designated official will order the implementation of a drought response stage when one or more of the trigger conditions for that stage exist. Official designees may also order the termination of a drought response stage when the termination criteria are met or at their own discretion.

If any mandatory provisions have been implemented or terminated, the water supplier is required to notify the Executive Director of the TCEQ within five business days.

7. Goals for Reduction in Water Use

TCEQ requires that each public water supplier develop quantifiable goals for water use reduction for each stage of the drought contingency plan. These goals are outlined below.

[To be developed by each supplier. An example is provided.]

- Stage 1, Mild
  - 0 to 2 percent reduction in use that would have occurred in the absence of drought contingency measures.
- Stage 2, Moderate
  - 2 to 6 percent reduction in use that would have occurred in the absence of drought contingency measures
- Stage 3, Severe
  - 6 to 10 percent reduction in use that would have occurred in the absence of drought contingency measures
- Stage 4, Emergency
  - 10 to 14 percent reduction in use that would have occurred in the absence of drought contingency measures

8. Drought and Emergency Response Stages

Stage 1, Mild

Trigger Conditions for Stage 1, Mild

- A wholesale water supplier that provides all or part of [public water supplier]'s supply has initiated Stage 1, Mild
- [To be otherwise completed by public water supplier]
  - Potential triggers are:

        - When [public water supplier]'s available water supply is equal or less than [amount in ac-ft, percent of storage, etc.].
        - When total daily demand equals [number] million gallons for [number] consecutive days or [number] million gallons on a single day.
        - When the water level in [public water supplier]'s well(s) is equal or less than [number] feet above/below mean sea level.
        - When flows in the [name of river or stream segment] are equal to or less than [number] cubic feet per second.

Stage 1 will end when the circumstances that caused the initiation of Stage 1 no longer exist.

Goals for Use Reduction and Actions Available Under Stage 1, Mild
[Public water supplier] will reduce water use by [goal]. [Public water supplier] may order the implementation of any of the strategies listed below in order to decrease water use:

- Request voluntary reductions in water use.
- Review the problems that caused the initiation of Stage 1.
- Intensify leak detection and repair efforts

Stage 2, Moderate

Trigger Conditions for Stage 2, Moderate

- A wholesale water supplier that provides all or part of [public water supplier]'s supply has initiated Stage 2, Moderate
- [To be otherwise completed by public water supplier]
    - Potential triggers are:
        - When [public water supplier]'s available water supply is equal or less than [amount in ac-ft, percent of storage, etc.].
        - When total daily demand equals [number] million gallons for [number] consecutive days or [number] million gallons on a single day.
        - When the water level in [public water supplier]'s well(s) is equal or less than [number] feet above/below mean sea level.
        - When flows in the [name of river or stream segment] are equal to or less than [number] cubic feet per second.

Stage 2 will end when the circumstances that caused the initiation of Stage 2 no longer exist.

Goals for Use Reduction and Actions Available Under Stage 2, Moderate
[Public water supplier] will reduce water use by [goal]. [Public water supplier] may order the implementation of any of the strategies listed below in order to decrease water use:

- Request voluntary reductions in water use
- Halt non-essential city government use
- Review the problems that caused the initiation of Stage 2
- Intensify leak detection and repair efforts
- Implement mandatory restrictions on time of day outdoor water use in the summer

Stage 3, Severe

Trigger Conditions for Stage 3, Severe

- A wholesale water supplier that provides all or part of [public water supplier]'s supply has initiated Stage 3, Severe
- [To be otherwise completed by public water supplier]
    - Potential triggers are:
        - When [public water supplier]'s available water supply is equal or less than [amount in ac-ft, percent of storage, etc.].
        - When total daily demand equals [number] million gallons for [number] consecutive days or [number] million gallons on a single day.
        - When the water level in [public water supplier]'s well(s) is equal or less than [number] feet above/below mean sea level.
        - When flows in the [name of river or stream segment] are equal to or less than [number] cubic feet per second.

Stage 3 will end when the circumstances that caused the initiation of Stage 3 no longer exist.

Goals for Use Reduction and Actions Available Under Stage 3, Severe
[Public water supplier] will reduce water use by [goal]. [Public water supplier] may order the implementation of any of the strategies listed below in order to decrease water use:

- Request voluntary reductions in water use
- Require mandatory reductions in water use
- Halt non-essential city government use
- Review the problems that caused the initiation of Stage 3
- Intensify leak detection and repair efforts
- Implement mandatory restrictions on time of day outdoor water use in the summer
- Limit outdoor watering to specific weekdays
- Create and implement a landscape ordinance

Stage 4, Emergency

Trigger Conditions for Stage 4, Emergency

- A wholesale water supplier that provides all or part of [public water supplier]'s supply has initiated Stage 4, Emergency
- [To be otherwise completed by public water supplier]
    - Potential triggers are:
        - When [public water supplier]'s demand exceeds the amount that can be delivered to customers.
        - When [public water supplier]'s source becomes contaminated
        - [Public water supplier]'s system is unable to deliver water due to the failure or damage of major water system components.

Stage 4 will end when the circumstances that caused the initiation of Stage 4 no longer exist.

Goals for Use Reduction and Actions Available Under Stage 4, Emergency
[Public water supplier] will reduce water use by [goal]. [Public water supplier] may order the implementation of any of the strategies listed below in order to decrease water use:

- Require mandatory reductions in water use
- Halt non-essential city government use
- Review the problems that caused the initiation of Stage 4
- Intensify leak detection and repair efforts
- Implement mandatory restrictions on time of day outdoor water use in the summer
- Limit outdoor watering to specific weekdays
- Create and implement a landscape ordinance
- Prohibit washing of vehicles except as necessary for health, sanitation, or safety reasons
- Prohibit commercial and residential landscape watering
- Prohibit golf course watering except for greens and tee boxes
- Prohibit filling of private pools
- Initiate a rate surcharge for all water use over [amount in gallons per month]

9. Penalty for Violation of Water Use Restriction

Mandatory restrictions are required by TCEQ regulation to have a penalty. These restrictions will be strictly enforced with the following penalties:

- Potential penalties
    - Written warning that they have violated the mandatory water use restriction.
    - Issue a citation. Minimum and maximum fines are established by ordinance.
    - Discontinue water service to the user.

10. Review and Update of Drought Contingency Plan

This drought contingency plan will be updated at least every five years as required by TCEQ regulations.

CHAPTER 7

REGIONAL WATER PLANNING GROUP B

DESCRIPTION OF HOW THE REGIONAL WATER PLAN IS CONSISTENT WITH LONG-TERM PROTECTION OF THE STATE'S WATER RESOURCES, AGRICULTURAL RESOURCES, AND NATURAL RESOURCES

DESCRIPTION OF HOW THE REGIONAL WATER PLAN IS CONSISTENT WITH LONG-TERM PROTECTION OF THE STATE'S WATER RESOURCES, AGRICULTURAL RESOURCES, AND NATURAL RESOURCES
TEXAS STATE SENATE BILL 1
REGION B

7.1 Introduction

The development of viable strategies to meet the demand for water is the primary focus of regional water planning. However, another important goal of water planning is the long-term protection of resources that contribute to water availability, and to the quality of life in the state. The purpose of this chapter is to describe how the 2006 Update to the Region B Water Plan is consistent with the long-term protection of the state's water resources, agricultural resources, and natural resources. The requirement to evaluate the consistency of the regional water plan with protection of resources is found in 31 TAC Chapter 357.14(2)(C), which states, in part:

> "The regional water plan is consistent with the guidance principles if it is developed in accordance with §358.3 of this title (relating to Guidelines), §357.5 of this title (relating to Guidelines for Development of Regional Water Plans), §357.7 of this title (relating to Regional Water Plan Development), §357.8 of this title (relating to Ecologically Unique River and Stream Segments), and §357.9 of this title (relating to Unique Sites for Reservoir Construction).

Chapter 7 addresses this issue by providing general descriptions of how the plan is consistent with protection of water resources, agricultural resources, and natural resources. Additionally, the chapter will specifically address consistency of the 2006 Region B Regional Water Plan with the state's water planning requirements. To demonstrate compliance with the state's requirements, a matrix has been developed and will be addressed in this chapter.

7.2 Consistency with the Protection of Water Resources

The water resources in Region B include three river basins providing surface water and three aquifers providing groundwater. The three major river basins within Region B boundaries include the Red River Basin, the Trinity River Basin, and the Brazos River Basin. The respective boundaries of these basins are depicted on Figure 2, in Chapter 1. The region's groundwater resources include, primarily, the Seymour, Blaine, and Trinity Aquifers. The extents of these aquifers within the region are depicted on Figures 3 and 4 in Chapter 1.

The source of most of the region's surface water supply is the Red River Basin, which supplies much of the municipal, industrial, mining, and irrigation needs in the region. Amon Carter Lake in the Trinity River Basin is a major reservoir in the southeast part of the region. Small amounts of irrigation water are supplied from the Brazos River basin. Currently, approximately 98 percent of all available surface water supply in Region B comes from the Red River Basin.

The Seymour Aquifer is, by far, the most important groundwater resource in Region B. Over 50 percent of total available groundwater supply in the region comes from the Seymour. Most of the remainder of available supply (approximately 45 percent) is from the Blaine, although much of this resource is currently not useable due to excessive naturally occurring dissolved minerals.

To be consistent with the long-term protection of water resources, the plan must recommend strategies that minimize threats to the region's sources of water over the planning period. The water management strategies identified in Chapter 4 were evaluated for threats to water resources. The recommended strategies represent a comprehensive plan for meeting the needs of the region while effectively minimizing threats to water resources. Descriptions of the major strategies and the ways in which they minimize threats include the following:

- Water Conservation. Strategies for water conservation have been recommended that will help reduce the demand for water, thereby reducing the impact on the region's groundwater and surface water sources. Water conservation practices are expected to save approximately 1,855 acre-feet of water annually, reducing impacts on both groundwater and surface water resources. The plan also assumes an additional 2,500 acre-feet per year in savings in municipal demands due to the implementation of plumbing codes.
- Wichita Falls Wastewater Reuse. This strategy will provide highly treated wastewater effluent for various irrigation and other needs for the City of Wichita Falls. This strategy

will effectively reduce the impact on the city's current sources of supply, Lake Kickapoo and Lake Arrowhead.

- Irrigation Canal Improvements. This strategy will reduce water losses in the laterals that deliver irrigation water to farms by enclosing the laterals in pipes. This protects the Lake Kemp/Lake Diversion system by reducing the amount of water released to meet irrigation needs.
- Increase Water Conservation Elevation at Lake Kemp. This strategy will preserve and prolong the usability of Lake Kemp. This protects the water for agricultural uses and environmental needs, including the TPWD Fish Hatchery that receives water from Lake Kemp.
- Expanded Use of Groundwater. This strategy is recommended for entities with limited alternative sources and sufficient groundwater supplies to meet needs. Groundwater availability reported in the plan is the long-term sustainability of the aquifer, and is based on aquifer recharge. No strategies are recommended to use water above the sustainable level.

7.3 Consistency with Protection of Agricultural Resources

Agriculture is an important economic cornerstone of Region B. Given the relatively low rainfall, irrigation is a critical aspect of agriculture in the region. The source of most of the region's irrigation is the Lake Kemp/Lake Diversion system, which provides water via a canal system located in Archer, Wichita, and Clay Counties.

Protection of the Lake Kemp/Lake Diversion system has been a central focus of the water planning process for Region B. Water losses and environmental conditions in a portion of the canal were the subject of a major study performed as part of the 2006 Update of the Region B Water Plan. The study identified strategies for reducing losses, and for reducing environmental threats to the canal. As previously addressed, one of the preferred water management strategies includes enclosing portions of the laterals associated with the canal in pipelines to reduce losses and conserve water.

7.4 Consistency with Protection of Natural Resources

Region B contains many natural resources that must be considered in water planning. Natural resources include threatened or endangered species; local, state, and federal parks and public land; and energy/mineral reserves. The Region B Water Plan is consistent with the long-term protection of these resources. Following is a brief discussion of consistency of the plan with protection of natural resources.

7.4.1 Threatened/Endangered Species

A list of threatened or endangered species located within Region B is contained in Table 1-13, in Chapter 1. Included are 10 species of birds, two mammals, two reptiles, and one fish. None of the water management strategies evaluated for the Region B Water Plan are expected to adversely impact any of the listed species.

7.4.2 Parks and Public Lands

Two state parks (Copper Breaks and Lake Arrowhead) and one state wildlife management area (Matador) are located in Region B. In addition, there are a number of city parks, recreational facilities, and public lands located throughout the region. None of the water management strategies evaluated for the Region B Water Plan are expected to adversely impact parks or public land. The development of wastewater reuse for the City of Wichita Falls could ultimately reduce the reliance on water from Lakes Arrowhead and Kickapoo. Reducing the need for diversions from these lakes may enhance recreational facilities on both lakes, including Lake Arrowhead State Park.

7.4.3 Energy Reserves

There are over 30,000 producing oil and gas wells located within Region B, representing an important economic base for the region. None of the water management strategies is expected to significantly impact oil or gas production in the region.

7.4.4 Navigation

Since there are no navigable waterways located in Region B, none of the management strategies are expected to impact navigation.

7.5 Consistency with State Water Planning Guidelines

To be considered consistent with long-term protection of the state's water, agricultural, and natural resources, the Region B Water Plan must be determined to be in compliance with the following regulations:

- 31 TAC Chapter 358.3
- 31 TAC Chapter 357.5
- 31 TAC Chapter 357.7
- 31 TAC Chapter 357.8
- 31 TAC Chapter 357.9

The information, data, evaluation, and recommendations included in Chapters 1 through 6 and Chapter 8 of the Region B Water Plan collectively comply with these regulations. To assist with demonstrating compliance, Region B has developed a matrix addressing the specific recommendations contained in the above referenced regulations.

The matrix is a checklist highlighting each pertinent paragraph of the regulations. The content of the Region B Water Plan has been evaluated against this matrix. Attachment 7-1 contains a completed matrix.

ATTACHMENT 7-1

REGIONAL WATER PLANNING GROUP B

CHECKLIST FOR COMPARISON OF THE REGIONAL WATER PLAN TO APPLICABLE WATER PLANNING REGULATIONS

ATTACHMENT 7-1

CHECKLIST FOR COMPARISON OF THE REGIONAL WATER PLAN TO APPLICABLE WATER PLANNING REGULATIONS

The purpose of this attachment is to facilitate the determination of how the Regional Water Plan is consistent with the long-term protection of the water, agricultural, and natural resources of the State of Texas, particularly within this region. The following checklist includes a regulatory citation (Column 1) for all subsections and paragraphs contained in the following applicable portions of the water planning regulations:

- 31 TAC Chapter 358.3
- 31 TAC Chapter 357.5
- 31 TAC Chapter 357.7
- 31 TAC Chapter 357.8
- 31 TAC Chapter 357.9

According to 31 TAC Chapter 357.14(b), the Regional Water Plan is considered to be consistent with the long-term protection of the state's resources if complies with the above listed requirements. Therefore, the Regional Water Plan has been compared to each applicable section of the regulations as a means of determining consistency.

The checklist also includes a summary description of each cited regulation (Column 2). It should be understood that this summary is intended only to provide a general description of the particular section of the regulation and should not be assumed to contain all specifics of the actual regulation. The evaluation of the Regional Water Plan should be performed against the complete regulation, as contained in the actual 31 TAC 358 and 31 TAC 357 regulations.

Column 3 of the checklist provides the evaluation response as affirmative, negative, or not applicable. A "Yes" in this column indicates that the Regional Water Plan has been evaluated to comply with the stated section of the regulation. A "No" response indicates that the Regional Water Plan does not comply with the stated regulation. A response of "NA" (or not applicable) indicates that the stated section of the regulation does not apply to this Regional Water Plan.

The evidence of where, in the Regional Water Plan, the stated regulation is addressed is provided in Column 4. Where the regulation is addressed in multiple locations within the Regional Water Plan, this column may cite only the primary locations. In addition to identifying where the regulation is addressed, this column may include commentary about the application of the regulation in the Regional Water Plan.

The above-listed regulations are repetitive, in some instances. One section of the regulations may be restated or paraphrased elsewhere within the regulations. In some cases, multiple sections of the regulations may be combined into one separate regulation section. Therefore, Column 5 provides cross-referencing.

CHECKLIST FOR COMPARISON OF THE REGIONAL WATER PLAN TO APPLICABLE WATER PLANNING REGULATIONS

Regulatory Citation (Col 1)	Summary of Requirement (Col 2)	Response (Yes/No/ NA) (Col 3)	Location(s) in Regional Plan and/or Commentary (Col 4)	Regulatory Cross References (Col 5)
31 TAC §358.3				
358.3(a)	TWDB shall develop a State Water Plan (SWP) with 50-year planning cycle, and based on the Regional Water Plan (RWP)	NA	Applies to the State Water Plan. The Regional Water Plan is based on a 50-year planning cycle, however.	
358.3(b)	RWP is guided by the following principles			
(b)(1)	Identified policies and actions so that water will be available at reasonable cost, to satisfy reasonable projected use and protect resources	Yes	Chapters 4 and 8	§358.3(b)(4), §357.5 (a); §357.7 (a)(9)
(b)(2)	Open and accountable decision-making based on accurate, objective information	Yes	Regular public meetings of the RWPG; Public hearing for initially prepared RWP	§357.5 (e)(6)
(b)(3)	Consideration of effects of plan on the public interest, and on entities providing water supply	Yes	Chapter 4	
(b)(4)	Consideration and approval of cost-effective strategies that meet needs and respond to drought, and are consistent with long-term protection of resources	Yes	Chapters 4, 6, and 7	§358.3(b)(1), §357.5 (e)(4) and §357.5 (e)(6); §357.7(a)(9)
(b)(5)	Consideration of opportunities that encourage the voluntary transfer of water resources	Yes	Chapter 4	
(b)(6)	Consideration of a balance of economic, social, aesthetic, and ecological viability	Yes	Chapter 4	
(b)(7)	The use of information from the adopted SWP for regions without a RWP	NA		
(b)(8)	The orderly development, management, and conservation of water resources	Yes	Chapter 4	§357.5(a)
(b)(9)	Surface waters are held in trust by the State, and governed by doctrine of prior appropriation	Yes	Chapter 3	
(b)(10)	Existing water rights, contracts, and option agreements are protected	Yes	Chapter 4	§357.5(e)(3)
(b)(11)	Groundwater is governed by the right of capture unless under local control of a groundwater management district	Yes	Chapter 4	
(b)(12)	Consideration of recommendation of stream segments of unique ecological value	Yes	Chapter 8. The RWPG decided to not recommend any of the Region's stream segments for designation as a segment of unique ecological value	§357.8

Regulatory Citation (Col 1)	Summary of Requirement (Col 2)	Response (Yes/No/ NA) (Col 3)	Location(s) in Regional Plan and/or Commentary (Col 4)	Regulatory Cross References (Col 5)
(b)(13)	Consideration of recommendation of sites of unique value for the construction of reservoirs	Yes	The RWPG decided to not recommend any location as a site of unique values for construction of reservoirs	§357.9
(b)(14)	Local, regional, state, and federal agency water planning coordination	Yes	The regional water planning process has included all levels of coordination, as necessary	
(b)(15)	Improvement or maintenance of water quality and related uses as designated by the State Water Quality Plan	Yes	Chapters 4 and 5	
(b)(16)	Cooperation between neighboring water planning regions to identify common needs and issues	Yes	The regional water planning process has included coordination with neighboring regions, as needed	
(b)(17)	WMS described sufficiently to allow a state agency making financial or regulatory decisions to determine consistency of the WMS with the RWP	NA	To be determined by the State after completion of the RWP	§357.7(a)(9)
(b)(18)	Environmental evaluations are based on site-specific information or state environmental planning criteria	Yes	Chapter 4; to the extent that such information was available	§357.5(e)(1); §357.5 (e)(6); §357.5(k)(1)(H)
(b)(19)	Consideration of environmental water needs, including instream flows and bay and estuary inflows	Yes	Chapter 4	§357.5(e)(1); §357.5(l); §357.7 (a)(8)(A)(ii)
(b)(20)	Planning is consistent with all laws applicable to water use for state and regional water planning	Yes	The regional water planning process has considered applicable water planning laws in development of the RWP	§357.5(f)
(b)(21)	Ongoing permitted water development projects are included	Yes	Chapter 4	
31 TAC §357.5				
(a)	The RWP: provides for the orderly development, management, and conservation of water resources; prepares for drought conditions; and protects agricultural, natural, and water resources	Yes	Chapter 7	§358.3(b)(1).
(b)	The RWP submitted by January 5, 2006	NA	To be submitted	
(c)	The RWP is consistent with 31 TAC §358 and 31 TAC §357, and guided by State and local water plans	Yes	Chapter 7 and throughout the RWP	
(d)(1)&(2)	The RWP uses State population and water demand projections from the SWP; or revised population or water demand projections that are adopted by the State	Yes	Chapter 2	

Regulatory Citation (Col 1)	Summary of Requirement (Col 2)	Response (Yes/No/ NA) (Col 3)	Location(s) in Regional Plan and/or Commentary (Col 4)	Regulatory Cross References (Col 5)
(e)(1)	The RWP provides WMS adjusted for appropriate environmental water needs; environmental evaluations are based on site-specific information or state environmental planning criteria	Yes	Chapter 4	§358.3(b)(1); §358.3(b)(18); §357.7 (a)(8)(A)(ii)
(e)(2)	The RWP provides WMS that may be used during a drought of record	Yes	Chapter 4	
(e)(3)	The RWP protects existing water rights, contracts, and option agreements	Yes	Chapters 3 and 4	§358.3(b)(10)
(e)(4)	The RWP provides cost-effective and environmentally sensitive WMS based on comparisons of all potentially feasible WMS; The process is documented and presented to the public for comment.	Yes	Chapter 4; WMS have been presented to, and adopted by, the RWPG	§358.3(b)(4)
(e)(5)	The RWP incorporates water conservation planning and drought contingency planning	Yes	Chapters 4 and 6	§357.5(k)(1)(A)&(B); §357.7(a)(7)(B)
(e)(6)	The RWP achieves efficient use of existing supplies and promotes regional water supplies or regional management of existing supplies; Public involvement is included in the decision-making process	Yes	Chapter 4	§358.3(b)(2)
(e)(7)(A)&(B)	The RWP identifies (A) drought triggers, and (B) drought responses for designated water supplies	Yes	Chapter 6	§357.5(e)(5); §357.5(k)(1)(A)&(B)
(e)(8)	The RWP considers the effect of the plan on navigation	Yes	Navigation impacts have been considered to the extent necessary	
(f)	Planning is consistent with all laws applicable to water use in the Region	Yes	The regional water planning process has considered applicable water planning laws in development of the RWP	§358.3(b)(20)
(g)	The following characteristics of a candidate special water resource are considered:			
(g)(1)	The surface water rights are owned by an entity headquartered in another region.	NA	No Special Water Resources (as defined in §357) exist in the Region at this time	
(g)(2)	A water supply contract commits water to an entity headquartered in another region.	NA		
(g)(3)	An option agreement may result in water being supplied to an entity headquartered in another region.	NA		
(h)	Water rights, contracts, and option agreements of special water resources are protected in the RWP	NA		

Regulatory Citation (Col 1)	Summary of Requirement (Col 2)	Response (Yes/No/ NA) (Col 3)	Location(s) in Regional Plan and/or Commentary (Col 4)	Regulatory Cross References (Col 5)
(i)	The RWP considers emergency transfers of surface water rights	NA	NO emergency transfers of water are necessary in the region	
(j)(1)-(3)	Simplified planning is used in the RWP in accordance with TWDB rules	NA	Normal water planning process used in the Region	
(k)(1)&(2)	The RWP shall consider existing plans and information, and existing programs and goals related to local or regional water planning	Yes	Chapters 1 and 4	
(l)	The RWP considers environmental water needs including instream flows and bays and estuary flows	Yes	Chapter 4	§358.3(b)(19); §357.7 (a)(8)(A)(ii)
31 TAC §357.7				
(a)(1)(A)-(M)	The RWP shall describe the region, including specific requirements of paragraphs A through M of this section of the regulations	Yes	Chapters 1 and 4; Note: The regulations include a requirement to utilize information compiled by the TWDB from water loss audits. This information is not due to the TWDB until after the RWP is due, and is not included here.	§357.7(a)(8)(A)(iii); §357.7(a)(8)(D); §357.5(k)(1)(C); §357.7(a)(7)(A)(iv)
(a)(2)(A)-(C)	The RWP includes a presentation of current and projected population and water demands, reported in accordance with paragraphs A through C of this section of the regulations	Yes	Chapter 2	
(a)(3)(A)&(B)	The RWP includes the evaluation of current water supplies available (including a presentation of reservoir firm yields) to the Region for use during drought of record conditions, reported by the type of entity and wholesale providers	Yes	Chapter 3	
(a)(4) (A)&(B)	The RWP includes water supply and demand analysis, comparing the type of entity and wholesale providers	Yes	Chapter 4	
(a)(5)(A)-(C)	The RWP provides sufficient water supply to meet the identified needs, in accordance with requirements of paragraphs A through C of this section of the regulations	Yes	Chapter 4	
(a)(6)	The RWP presents data required in paragraphs (2) - (5) of this subsection in subdivisions of the reporting units required, if desired by the RWPG	Yes	Chapters 2, 3, and 4	

Regulatory Citation (Col 1)	Summary of Requirement (Col 2)	Response (Yes/No/ NA) (Col 3)	Location(s) in Regional Plan and/or Commentary (Col 4)	Regulatory Cross References (Col 5)
(a)(7)(A)-(G)	The RWP evaluates all WMS determined to be potentially feasible, in accordance with paragraphs A through G of this section of the regulations	Yes	Chapter 4; Note: The regulations include a requirement to utilize information compiled by the TWDB from water loss audits. This information is not due to the TWDB until after the RWP is due, and is not included here.	§357.5(k)(1)(C); §357.7(a)(1)(M); §357.5(e)(5); §357.5(k)(1)(B)
(a)(8)(A)-(H)	The RWP evaluates all WMS determined to be potentially feasible, by considering the requirements of paragraphs A through H of this section of the regulations	Yes	Chapter 4	§358.3(b)(19); §357.5(e)(1); §357.5(l); §357.7(a)(1)(L); §357.7(a)(8)(D); §357.7(a)(8)(A)(iii);
(a)(9)	The RWP makes specific recommendations of WMS in sufficient detail to allow state agencies to make financial or regulatory decisions to determine the consistency of the proposed action with an approved RWP	NA	To be determined by the State after completion of the RWP	§358.3(b)(1); §358.3(b)(4); §358.3(b)(17)
(a)(10)	The RWP includes regulatory, administrative, or legislative recommendations to facilitate the orderly development, management, and conservation of water resources; prepares for drought conditions; and protects agricultural, natural, and water resources	Yes	Chapter 8	§358.3(b)(1) §357.5(a)
(a)(11)	The RWP includes a chapter consolidating the water conservation and drought management recommendations	Yes	Chapter 6	
(a)(12)	The RWP includes a chapter describing the major impacts of recommended WMS on key parameters of water quality	Yes	Chapter 5	
(a)(13)	The RWP includes a chapter describing how it is consistent with long-term protection of the state's water, agricultural, and natural resources	Yes	Chapter 7	
(a)(14)	The RWP includes a chapter describing the financing needed to implement the water management strategies recommended	NA	Will be provided (Chapter 9)	
(b)	The RWP excludes WMS for political subdivisions that object to inclusion and provide reasons for objection	NA		
(c)	The RWP includes model water conservation plan(s)	Yes	Chapter 6	
(d)	The RWP includes model drought contingency plan(s)	Yes	Chapter 6	
(e)	The RWP includes provisions for assistance of the TWDB in performing regional water planning activities and/or resolving conflicts within the Region	NA	No know conflicts within the region	

Regulatory Citation (Col 1)	Summary of Requirement (Col 2)	Response (Yes/No/ NA) (Col 3)	Location(s) in Regional Plan and/or Commentary (Col 4)	Regulatory Cross References (Col 5)
31 TAC §357.8				
(a)	The RWP considers the inclusion of recommendations for the designation of river and stream segments of unique ecological value within the Region	Yes	Chapter 8. The RWPG decided to not recommend any of the Region's stream segments for designation as a segment of unique ecological value	§358.3(b)(12)
(b)	If river or stream segments of unique ecological value are recommended, such recommendations are made in the plan on the basis of the criteria established in this section of the regulations	NA		
(c)	If the RWP recommends designation of river or stream segments of unique ecological value, the impact of the regional water plan on these segments is assessed	NA		
31 TAC §357.9				
(1)	The RWP considers the inclusion of recommendations for the designation of sites of unique value for construction of reservoirs	Yes	The RWPG decided to not recommend any location as a site of unique values for construction of reservoirs	§358.3(b)(13)
(2)	If sites of unique value for construction of reservoirs are recommended, such recommendations are made in the plan on the basis of criteria established in this section of the regulations	NA		

CHAPTER 8

REGIONAL WATER PLANNING GROUP B

RECOMMENDATIONS INCLUDING UNIQUE ECOLOGICAL STREAM SEGMENTS, RESERVOIR SITES, LEGISLATIVE AND REGIONAL POLICY ISSUES

RECOMMENDATIONS INCLUDING UNIQUE ECOLOGICAL STREAM SEGMENTS, RESERVOIR SITES, LEGISLATIVE AND REGIONAL POLICY ISSUES
TEXAS STATE SENATE BILL 1
REGION B

8.1 Introduction

With the passage of Senate Bill 1, the 75th Legislature established a regional process to plan for the water needs of Texas. As a part of this planning process, the Texas Water Development Board created 16 regional water planning groups and implemented rules and regulations to govern the process on a regional basis.

In accordance with Senate Bill 1 and Senate Bill 2 the Region B Planning Group has revised and refined their previously approved Regional Water Plan in an effort to respond to changed conditions that may impact estimated demands for water, water supplies, or recommended water strategies.

Region B, as designated by Senate Bill 1, is comprised of 10 counties and a portion of another in North Central Texas.

As a part of the revised plan, this chapter identifies and makes recommendations that the Regional Water Planning Group deems vital to the management and conservation of the water resources in Region B.

8.2 Discussion of Regional Issues

In addition to the specific water management strategies recommended for Region B in Chapter 4 of the plan, there were several other issues that the Regional Water Planning Group deemed to be significant water management concepts to be given further consideration as part of the Region B Plan. The Chloride Control Project on the Wichita and Pease Rivers is a water management strategy with high regional support. Other strategies that enhance and/or increase the existing supplies in the region, such as land stewardship (brush management), groundwater recharge enhancement, weather modification, and increased conservation storage for Lake Kemp, are each potentially feasible management strategies throughout and perhaps beyond the 50-year planning horizon.

Senate Bill 1 requires future projects to be consistent with the approved regional water plan to be eligible for TWDB funding and TCEQ permitting. However, it is the intention of the RWPG that surface water uses that will not have a significant impact on the region's water supply and water supply projects that do not involve the development of or connection to a new water source are deemed consistent with the regional water plan even though not specifically recommended in the plan.

8.2.1 Chloride Control Project

Natural mineral pollutants, primarily chloride and sulfates in the upper reaches of the Red River Basin in Region B, render downstream waters unusable for most beneficial purposes. From a study initiated by the U.S. Public Health Service in 1957, it was determined that ten natural salt source areas located in the Red River Basin contribute a daily average of about 3,300 tons of chloride to the Red River. Subsequent to that study, in 1959 the U.S. Army Corps of Engineers proposed measures to control the natural chloride pollution by recommending control/structural facilities for eight of the ten salt source areas.

These recommended chloride control structures are proposed to improve the water quality conditions of the Red River and its tributaries to the extent that the water may be utilized for municipal, industrial, and agricultural uses on a regular basis.

It is anticipated that the Wichita River Basin Chloride Control Project will effectively remove 362 tons per day of the 429 tons per day of chloride entering the Wichita River System. This improved water quality will allow for full utilization of Lakes Kemp and Diversion.

This additional source would not only increase the reliability of the City of Wichita Falls system, but it would also likely provide for more diverse and expanded agricultural use and more efficient industrial use.

Also, in the long term, as chloride control facilities are constructed on the Pease River in conjunction with the Crowell Brine Reservoir, the potential exists for another freshwater supply reservoir on the Pease River near Crowell in Foard County, with an estimated yield of 138,000 acre-feet per year.

8.2.2 Land Stewardship

Land stewardship is the practice of managing land to conserve or enhance the ecosystem values of the land. It is a benefit to the state's natural resources by improving watershed productivity through increased surface water runoff and groundwater recharge. Land stewardship is a practice that is supported and encouraged by Region B.

Some land stewardship practices that are most applicable in Region B include managed grazing, brush management, erosion management, riparian management, and stream bank protection. One area of concern in Region B is the encroachment of brush in the watersheds of water supply reservoirs. The U.S. Natural Resource Conservation Service (NRCS) estimates that brush in Texas uses about ten million acre-feet of water annually versus the 15 million acre-feet per year for current human use.

Though water yield following brush management has been investigated in several areas of Texas, the economic benefits and overall productivity of a brush management program may vary significantly depending on geology, nature of water yield, presence of brush, type of brush, and impact on threatened or endangered species.

Over the past four years two studies have been completed within Region B which can be used to determine the feasibility of implementing a brush management program to increase watershed yield. The first study was completed jointly by the Texas State Soil and Water Conservation Board (TSSWCB) and the Red River Authority of Texas (RRA) in December 2000 and included approximately 1,335,040 acres of the Wichita River watershed above Lake Kemp. Subsequently, in December 2002 the TSSWCB and RRA completed a second study which included approximately 529,280 acres of the Lake Arrowhead watershed on the Little Wichita River.

In both studies, the preliminary results showed that implementation of an aggressive brush management program could potentially provide a net increase in the overall watershed yield.

Based on the Lake Kemp study, a net increase in the range of 32,900 acre-feet per year to 46,330 acre-feet per year could be expected over a measured long-term average. With the implementation cost of a brush control program being $70.37 per acre of removed brush and the state funding $52.78 per acre, it is anticipated that landowners would be required to fund the remaining $17.59 per acre.

Similarly, the results of the Lake Arrowhead study showed a net increase in the overall watershed yield of approximately 151,623 acre-feet per year. With a cost of $94.12 per acre of removed brush and the state funding of $75.64 per acre, it is anticipated that the landowner would be required to fund the remaining $18.48 per acre.

Based on the results of the completed studies, the planning group will continue to evaluate the potential effect of land stewardship, and in particular brush management, on water flow and ecosystem components such as wildlife, livestock production, aesthetics, and land values.

8.2.3 Recharge Enhancement

Recharge enhancement is the process in which surface water is purposefully directed to areas where permeable soils or fractured rock allow rapid infiltration of the surface water into the subsurface to increase localized groundwater recharge. This would include any man-made structure that would slow down or hold surface water to increase the probability of groundwater recharge.

In Region B, groundwater is a major source of water for much of the western portion of the region. The Seymour Aquifer, which is generally unconfined, is fairly responsive to local recharge and may benefit from enhanced recharge programs. Further study is needed to determine the applicability of such programs in Region B, the quantity of increased groundwater supplies from enhanced recharge structures, and the potential impacts to surface water rights.

8.2.4 Weather Modification

Weather modification is an attempt to increase the efficiency of a cloud to produce precipitation. Efforts to enhance rainfall in Texas began in 1880 and have continued to the present day. Several weather modification programs are in place in areas to the west of Region B. While research has suggested increases of 15 percent or more of rainfall in areas participating in weather modification, some areas in west Texas have shown greater increases in rainfall. Weather modification programs in Region B could potentially increase surface runoff to reservoirs, reduce irrigation demands, and increase recharge to groundwater sources. Based on existing programs, the cost of operating a weather modification program is approximately ten cents per acre.

8.2.5 Increase Conservation Storage for Lake Kemp

The U.S. Army Corps of Engineers (USCOE) constructed Lake Kemp for flood control and water supply. It is located in an area with high sedimentation rates, and as a result, the firm yield of the reservoir is expected to decrease significantly over the planning period. A new sedimentation survey of Lake Kemp was initiated in 1999, but due to low lake levels, the survey has not been completed. With the completion of the chloride control project, water quality in the Wichita basin is expected to improve such that the water from Lake Kemp will become more desirable for existing and future users.

The USCOE has provisions to transfer a portion of the flood storage to conservation storage to compensate for siltation, if there is a need for water supply. Since there is regional concern over the long-term quantity of supply from Lake Kemp, it is recommended that Region B pursue transferring flood storage to conservation storage. This is a recommended water management strategy for the region.

8.2.6 Sediment Control Structures

The accumulation of sediment in existing reservoirs can have a significant impact on the reliable supply from those reservoirs over time. For Region B reservoirs, there is a projected reduction in reservoir yield of 67,400 acre-feet per year over the 60-year period from 2000 to 2060. Most of this reduction is associated with sediment accumulation in Lake Kemp.

Since the 1950s numerous dams and structures in Texas have been constructed to help reduce the amount of sediment carried downstream into water supply sources. Many of these structures are approaching the end of their useful life and will require rehabilitation or new structures. Studies conducted by the Tarrant Regional Water District in the Trinity River Basin estimate that existing Natural Resources Conservation Service (NRCS) control structures provide considerable reductions in sediment loading to downstream reservoirs. In the West Fork System watershed, the cost per acre-foot of sediment retained was estimated by the District at $435. Based on the projected sediment accumulation in the lakes and the corresponding reduction in yield, the cost of water saved would be about $200 per acre-foot. This indicates sediment control structures can be very cost effective in selected watersheds. The control of sediment by these NRCS structures can also have water quality benefits for downstream streams and reservoirs.

The Wichita River Basin in Region B could potentially benefit from control structures and land management practices that reduce sediment loading to streams. The Region B Planning Group recommends that the state support both federal and state efforts to rehabilitate existing sediment control structures and encourage funding and support for the construction of new structures in watersheds that would have the greatest benefits.

8.3 Designation of Unique Stream Segments and Reservoir Sites

In accordance with TAC Section 357.8, the Regional Water Planning Group is not required, but may include in the adopted regional water plan, recommendations for river and stream segments of unique ecological value, in addition to unique sites for reservoir construction. Such designation would provide for protection of these specific sites to the extent that a state agency or political subdivision may not obtain a fee title or an easement that would destroy the unique ecological value of the designated stream segment or significantly prevent the construction of a reservoir on a designated site.

8.3.1 Unique Stream Segments

Within Region B, the Texas Parks and Wildlife (TPWD) has suggested that certain stream segments of the Middle Pease River in Cottle County, the Pease River in Foard County, and the Red River from the Wichita/Clay County line upstream through Hardeman County be considered for recommendation as stream and/or river segments of unique value. The TPWD believes that each of these segments satisfy at least one of the designation criteria defined in Senate Bill 1.

Of the stream segments suggested by the TPWD, two are located within areas that currently offer protections and one segment lies in Oklahoma:

- Middle Pease River segment is located in the Matador Wildlife Management Area
- Pease River segment is located in Copper Breaks State Park
- Red River segment is located in Oklahoma

The Region B Water Planning Group is committed to the protection and conservation of unique and sensitive areas within the region. To that end, the consensus of the planning group is that a more comprehensive study with supporting data is necessary to accurately characterize and evaluate the listed stream/river segments or other stream segments in order to determine if it is appropriate to recommend for designation.

There is still some concern as to the impact of the designation and it is not clear what governmental or private activities, other than reservoir construction, might be subject to additional constraints or limitations as a result of designation. It is also not clear what geographic extent might be impacted by the designation. For example, is the entire watershed of the designated stream subject to additional limitations, and how far upstream of the designated stream would limitations apply? The Region B Water Planning Group suggests that the Legislature may wish to clarify their intent regarding the designations.

8.3.2 Reservoir Sites

It is generally recognized that studies over the last 40 years have identified perhaps the last remaining reservoir site within Region B in which the water quality of the watershed is adequate for municipal use.

This site known as the Ringgold Reservoir site is located on the Little Wichita River in Clay County, approximately one half mile upstream from the confluence with the Red River.

With the potential for an estimated increase in water supply yield for Region B of approximately 27,000 acre-feet per year, it is the consensus of the Regional Water Planning Group that this identified site could reasonably be needed to meet regional water needs beyond the 50-year planning period.

8.4 Discussion of Regulatory and Legislative Actions

To facilitate the orderly development, management, and conservation of water resources within the region, and to assist the region in preparing for and responding to drought conditions, the Region B Water Planning Group believes that the regulatory agencies and legislature should consider certain actions relating to water quality and funding issues which affect Region B.

8.4.1 Regulatory Review of Nitrate MCL

In Region B, there are a number of small user groups which utilize water with nitrate levels in excess of 10 mg/l. For the most part this supply is their only source of water, and advanced treatment for the removal of nitrates is very costly. Presently these systems employ bottled water programs for customers that may be sensitive to nitrate concentrations (pregnant women and infants). This program is considered an interim measure by TCEQ until the system can comply with the nitrate standards.

It is the consensus of the Region B Water Planning Group that the regulatory agency review its MCL standards for smaller systems which have no cost effective means to comply with the current nitrate MCL of 10 mg/l, and consider funding new studies to determine the health effects of nitrates in drinking water.

In addition, the planning group requests that the regulatory agencies consider bottled water programs as a long-term strategy to meet the nitrate water quality standards, or alternatively simply provide for a waiver process.

8.4.2 Funding for Comprehensive Studies

In preparing the Region B Water Plan there are several regional water planning, management, and conservation related issues which will require additional funding for data collection and administrative activities in order to adequately assess their viability or feasibility as a cost effective management strategy for Region B. For example, additional funds are needed to further evaluate and cost-share in the implementation of brush management programs in an effort to increase water yields, to identify and designate unique stream segments and/or reservoir sites for protection of these areas, and to implement various other chloride control measures and wastewater reuse programs throughout Region B.

8.4.3 Conservation

Region B supports the efforts of the state-appointed Water Conservation Task Force, and encourages the practices of water conservation within the region and state. The Regional Water Planning Group also recognizes the differences in water use and needs among water users and different regions. Region B encourages the Legislature to allow each region to establish realistic, appropriate, and voluntary water conservation goals for the region. These goals should only be established after sufficient data have been collected on water use using consistent data reporting. The use of the measurement of gallons per capita per day is appropriate only for residential water use or as a guideline for historical trends for a single entity. Region B does not support state mandated requirements or goals.

8.5 Summary of Regional Recommendations

In accordance with 31 TAC 357.7 (a)(9), 31 TAC 357.8, and 31 TAC 357.9, the following recommendations are proposed to facilitate the orderly development, management, and conservation of the water resources available within Region B:

- It is recommended that the Chloride Control Project on the Wichita River and the Pease River be made a regional priority in order to enhance the water quality of Lake Kemp and Lake Diversion, and reclaim those lakes as a viable cost effective short term and long term regional water supply source.

- Based on the results of the Lake Kemp and Lake Arrowhead brush management studies, it is recommended that the state consider providing adequate funding to implement brush management and other land stewardship programs in an attempt to increase watershed yields.

- Region B recommends that no segments be designated as "Unique Stream/River Segments" or "Unique Reservoir Sites" at this time. Pending the results of comprehensive studies and clarification of the significance and impacts of designation, the Regional Water Planning Group may consider designations within the region in the future.

- It is recommended that the state regulatory agencies consider allowing continued long-term use of bottled water programs, and/or providing a waiver for small user groups that can demonstrate they have no reasonable cost-effective means to comply with the current nitrate MCL of 10 mg/l.

- It is recommended that the state fund the development, implementation, and evaluate the necessary management strategies adopted as part of this regional plan. This includes strategies identified to meet a specific need, as well as general strategies to increase water supply in the region.

- It is recommended that the Legislature support the grass-roots regional water planning process enacted by Senate Bill 1 and strongly encourages the process be continued with adequate state funding for all planning efforts including administrative activities and data collection.

- It is recommended that the state continue to fund agricultural water use data collection and agricultural water use management/conservation projects.

- Senate Bill 1 requires future projects to be consistent with the approved regional water plan to be eligible for TWDB funding and TCEQ permitting. It is recommended that surface water uses that will not have a significant impact on the region's water supply and water supply projects that do not involve the development of or connection to a new water source should be deemed consistent with the regional water plan even though not specifically recommended in the plan.

- The Region B Planning Group recommends that the state support both federal and state efforts to rehabilitate existing sediment control structures and encourage funding and support for the construction of new structures in watersheds that would have the greatest benefits.

- With regards to conservation it is recommended that the Legislature allow each region to establish realistic, appropriate, and voluntary water conservation goals as opposed to being forced to comply with a state mandated requirement.

- Region B recommends that the gallons per capita per day (gpcd) calculation of water use be based on residential water use only.

CHAPTER 9

REGIONAL WATER PLANNING GROUP B

REPORT TO LEGISLATURE ON WATER INFRASTRUCTURE FUNDING RECOMMENDATIONS

REPORT TO LEGISLATURE ON

WATER INFRASTRUCTURE FUNDING RECOMMENDATIONS

TEXAS STATE SENATE BILL 1

REGION B

9.0 Introduction

Senate Bill 2 of the 77th Texas Legislature included an Infrastructure Financing Report (IFR) to be incorporated into the regional water planning process. This IFR includes information on the costs and funding capabilities of the entities with preferred water management strategies recommended during this planning cycle. The purpose of this update is to:

- Determine the number of water user groups with identified needs for additional water supplies that will be unable to pay for their water infrastructure needs without some form of outside financial assistance;
- Determine how much of the infrastructure costs in the regional water plan cannot be paid for solely using local utility revenue sources;
- Determine financing options proposed by political subdivisions to meet future water infrastructure needs (including the identification of any state funding sources considered);
- Determine what role(s) the RWPGs propose for the state in financing the recommended water supply projects; and
- Provide policy recommendations concerning suitable alternatives for financing water infrastructures in Texas.

The two essential elements to the IFR are; (1) surveys and (2) RWPG policy recommendations on the State's role in financing water infrastructure projects.

9.1 Identification of Needs

As described in Chapter 4, water supply needs in Region B were identified for three different categories: quantity, quality, and reliability. The quantity category includes nine water user groups which were identified to have projected shortages totaling 37,124 acre-feet per year by 2060. In addition, seven municipal and manufacturing water user groups were identified as having projected safe supply shortages. Safe supply is defined as being able to meet the projected demands plus 20 percent of the demand.

The quality category includes those water user groups which have been identified as being dependent on water which does not meet primary drinking water standards and those water user groups who are dependent on high chloride supplies from Lake Kemp for agricultural use.

The reliability category includes those water user groups with physical system limitations and/or limitations in available supplies as compared to contracted peak demands. Table 9-1 shows the 19 water user groups identified with one or more of the need categories.

Table 9-1
Water Users with Identified Needs

		Water Supply Needs		
User	**County**	**Quantity**	**Quality**	**Reliability**
County Other	Archer	X		
Lakeside City	Archer	X		
Irrigation	Archer	X	X	
County Other	Baylor			X
Seymour	Baylor			X
County Other	Clay	X	X	
Byers	Clay	X	X	
Irrigation	Clay	X	X	
County Other	Montague	X		
Bowie	Montague	X		
Mining	Montague	X		
Electra	Wichita	X		
Irrigation	Wichita	X	X	
Iowa Park	Wichita	X		X
Wichita Falls	Wichita	X		
County Other	Wilbarger		X	
Manufacturing	Wilbarger	X		
Steam Electric Power	Wilbarger	X		
Vernon	Wilbarger	X		

9.2 Recommended Water Management Strategies

Water management strategies were developed for each of the 19 water user groups shown in Table 9-1, with input from each respective water user group. Conservation was a primary strategy for each of the water user groups indicating a need. However, in all cases it was evident that conservation alone would not meet the projected needs. Therefore, other strategies were developed based on the entities' need and supply availability and are further detailed in Sections 4.2.2 through 4.2.6 of this plan. In some cases multiple strategies for the water user group were developed and presented as preferred and alternative strategies. However, for the purpose of the IFR, only the preferred strategies were considered.

In addition to the individual water user group strategies developed, the Area B Regional Water Planning Group adopted a regional strategy which would benefit many of the water user groups in the planning area whether they indicated a need or not. This strategy is the Wichita River Basin Chloride Control Project. This project has been a major factor in area water planning for several years and once completed would result in the volume of water available for municipal and industrial purposes throughout the region as well as make the water available for a broader range of agricultural activities. A more detailed description of the project can be found in Section 4.2.7 of this plan.

The Wichita River Basin Chloride Control Project is a regional project dependent upon 100 percent federal funding and has been in development for more than 50 years. It was not included in the list of individual water user group strategies nor is the capital cost of the project included in the projected regional costs.

Water quality is a primary concern for many users in Region B and affects water use options and treatment requirements. For the evaluations of the strategies, it was assumed that the final water product would meet existing state water quality requirements for the specified use.

The total estimated capital cost for infrastructure to meet the identified needs and implement the preferred strategies less the Wichita Basin Chloride Control project is projected to be $124,766,500.

9.3 Infrastructure Financing Surveys for Preferred Water Management Strategies

Infrastructure Financing Surveys were mailed to all user groups that were determined to have a projected water quality and/or water quantity need. Although 19 of the strategies developed were identified as preferred water management strategies, only 13 entities were surveyed for this report due to some aggregate water users such as county-other, irrigation, manufacturing, mining, etc. Of the 13 survey questionnaires mailed, 100 percent were completed and returned. In addition, phone interviews were conducted with some of the entities to obtain a better understanding of the strategy implementation and determine if any conflicts were or are being encountered with each. Copies of the surveys may be viewed in Attachment 9-1.

The following Table 9-2 provides a summary of the water user groups preferred strategies, projected capital costs, proposed funding sources(s), and the amount each water user group is unable to finance internally.

Table 9-2
Preferred Water Management Strategies

Water User Group	Water Management Strategy	Capital Cost	Funding Source	Unable to Pay
Archer Co. Other	Purchase Water from Local Provider	$ 342,500	*	$ 342,500
Lakeside City	Purchase Water from Local Provider	0	NA	0
Baylor WSC / Seymour	Emergency Interconnect Millers Creek Reservoir	673,000	**	–
Clay Co. Other	Purchase Water from Local Provider	342,500	*	342,500
City of Byers	Purchase Water from Local Provider	0	NA	NA
Charlie WSC	Nitrate Removal Plan	165,000	NA	NA
Montague Co. Other	Develop Trinity and Other Aquifer Supplies	1,710,000	*	1,710,000
City of Bowie	Wastewater Reuse	895,000	Cash Reserves-15% State Programs-85%	760,750
Montague Co. Mining	Purchase Water from Local Provider	409,000	*	409,000
City of Electra	Purchase Water from Local Provider	7,500,000	Bonds-22%, USDA Grant-43%, USDA Loan-35%	0
City of Iowa Park	Purchase Water from Local Provider	2,210,000	Other-100%	0

Water User Group	Water Management Strategy	Capital Cost	Funding Source	Unable to Pay
City of Wichita Falls	Wastewater Reuse	48,700,000	Bonds-100%	0
City of Vernon	Develop Seymour Aquifer Supplies	1,355,500	Cash Reserves-100%	0
Wilbarger Co. Other/ Lockett Water System	Purchase Water from Local Provider	1,272,000	Federal-50% and State-50%	1,272,000
Wilbarger Co. Other/ Hinds-Wildcat Water System	Nitrate Removal Plant	412,000	NA	412,000
Wilbarger Co. Manufacturing	Purchase Water from Local Provider	180,000	Cash Reserves-100%	0
Archer, Clay, Wichita Co. Irrigation and Wilbarger Co. SEP	Increase Water Conservation Pool at Lake Kemp	100,000	Federal-100%	100,000
Wilbarger Co. SEP and Wichita Co. Irrigation	Enclose Canal Laterals in Pipe	58,500,000	Federal-33%, State Programs-33%, Other Grants-34%	58,500,000
		$ 124,766,500		**$ 63,848,750**

* = Entities not surveyed due to aggregate users. It is assumed that individual entities will be unable to fund strategies.
** = Entity unsure on the implementation of the water management strategy selected by the planning group.
NA = Entities with strategies that do not require capital, but were surveyed to discuss annual costs.

9.4 Financing Policy Recommendations

Based on comments received from various water user groups, other entities, and the general public during this planning cycle, and keeping in line with the 2002 Infrastructure Financing Report, the Area B Regional Water Planning Group recommends:

> "The state funds the development and the implementation of the management strategies adopted as part of this Regional Water Plan. This includes strategies identified to meet a specific need as well as general strategies to increase water supply in the region."

The Regional Water Planning Group believes that this recommendation can be accomplished through the Texas Water Development Board's current programs with proper direction and financial appropriations from the legislature.

INFRASTRUCTURE FINANCING

SURVEYS

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **Baylor WSC** **Capital Cost:** **$ 673,000.00**

Water Management Strategy Name: **Emergency Interconnect with Millers Creek Reservoir**

Implementation Date: ______________________

1. ***Are you planning to implement the recommended projects/strategies?***

☐ YES ☐ NO ***(Not sure at this time)***

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

____

____

____

If 'yes', how do you plan to finance the proposed ***<u>total cost of capital improvements</u>*** ***identified by your Regional Water Planning Group?***

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %_________ Cash Reserves
☐ %_________ Bonds
☐ %_________ Bank Loans
☐ %_________ Federal Government Programs
☐ %_________ State Government Programs
☐ %_________ Other____________________
% ________ **TOTAL** *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

____

____

____

[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.

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **Red River Authority of Texas** **Capital Cost:** **$ 77,500,000**

Water Management Strategy Name: **Chloride Control Project**

Implementation Date: **Project Implementation Dependent on Availability of Federal Funds**

1. ***Are you planning to implement the recommended projects/strategies?***

☒YES ☐NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

___

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %________Cash Reserves
☐ %________Bonds
☐ %________Bank Loans
☒ %___100___Federal Government Programs
☐ %________State Government Programs
☐ %________Other________
%___100___TOTAL *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

Original agreement between the Federal Governments and the State of Texas called for the Chloride Control Project to be funded at 100 percent by the Federal Government. Currently the U.S. Corps of Engineers is awaiting funding to be appropriated by congress.

[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.*

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **Charlie Water Supply Corp.** **Capital Cost:** **$ 165,000**

Water Management Strategy Name: **Construct Nitrate Removal Plant**

Implementation Date: ______________________

1. ***Are you planning to implement the recommended projects/strategies?***

☐ YES ☒ NO

If 'no,'describe how you will meet your future water needs. *(Use an additional page if necessary.)*

Charlie Water Supply Corporation purchases treated surface water from Wichita Falls and blends with well water. We are in compliance for nitrates.

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

- ☐ %_________ Cash Reserves
- ☐ %_________ Bonds
- ☐ %_________ Bank Loans
- ☐ %_________ Federal Government Programs
- ☐ %_________ State Government Programs
- ☐ %_________ Other____________________
- **%** ________ **TOTAL** *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

____

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[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.

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: City of Iowa Park **Capital Cost:** $ 2,210,000.00

Water Management Strategy Name: Purchase Additional Water from Wichita Falls

Implementation Date: November 2005

1. ***Are you planning to implement the recommended projects/strategies?***

☒ YES ☐ NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

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If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %____________ Cash Reserves

☐ %____________ Bonds

☐ %____________ Bank Loans

☐ %____________ Federal Government Programs

☐ %____________ State Government Programs

☒ %____100____ Other **Certificates of Obligation**

% 100 TOTAL *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

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[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.

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **City of Lakeside City** **Annual Cost:** **$ 4,887**

Water Management Strategy Name: **Purchase Additional Water from Wichita Falls**

Implementation Date: **Unknown**

1. ***Are you planning to implement the recommended projects/strategies?***

☐ YES ☒ NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

Depends on Growth

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %_________ Cash Reserves
☐ %_________ Bonds
☐ %_________ Bank Loans
☐ %_________ Federal Government Programs
☐ %_________ State Government Programs
☐ %_________ Other____________________
% ________ TOTAL *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

[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.*

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **City of Vernon** **Capital Cost:** **$ 1,000,000**

Water Management Strategy Name: **Develop Additional Groundwater Supply — *(Purchase Additional Water Rights for the Wanderers Creek Well Field)***

Implementation Date: **2006**

1. ***Are you planning to implement the recommended projects/strategies?***

☒YES ☐NO

If 'no,'describe how you will meet your future water needs. *(Use an additional page if necessary.)*

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If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %___100___Cash Reserves
☐ %________Bonds
☐ %________Bank Loans
☐ %________Federal Government Programs
☐ %________State Government Programs
☐ %________Other______________
%___100___TOTAL *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

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[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.*

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: City of Vernon **Capital Cost:** $ 7,586,300

Water Management Strategy Name: Develop Additional Groundwater Supply — *(Construction of Parallel Transmission Line to Odell / Winston Well Fields)*

Implementation Date: 2015

1. ***Are you planning to implement the recommended projects/strategies?***

☒YES ☐NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

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If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %____________Cash Reserves
☐ %____100____Bonds
☐ %____________Bank Loans
☐ %____________Federal Government Programs
☐ %____________State Government Programs
☐ %____________Other____________________
%____100____TOTAL *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

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[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.

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **City of Vernon** **Capital Cost:** **$ 7,586,300**

Water Management Strategy Name: **Develop Additional Groundwater Supply —** ***(Construction of Parallel Transmission Line to Odell / Winston Well Fields)***

Implementation Date: **2015**

1. ***Are you planning to implement the recommended projects/strategies?***

☒YES ☐NO

If 'no,'describe how you will meet your future water needs. *(Use an additional page if necessary.)*

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If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %____________Cash Reserves
☐ %____100____Bonds
☐ %____________Bank Loans
☐ %____________Federal Government Programs
☐ %____________State Government Programs
☐ %____________Other____________________
%____100____TOTAL *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

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[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.*

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **City of Vernon** **Capital Cost:** **$ 7,586,300**

Water Management Strategy Name: **Develop Additional Groundwater Supply —** ***(Construction of Parallel Transmission Line to Odell / Winston Well Fields)***

Implementation Date: **2015**

1. ***Are you planning to implement the recommended projects/strategies?***

☒YES ☐NO

If 'no,'describe how you will meet your future water needs. *(Use an additional page if necessary.)*

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If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %____________Cash Reserves
☐ %____100____Bonds
☐ %____________Bank Loans
☐ %____________Federal Government Programs
☐ %____________State Government Programs
☐ %____________Other____________________
%____100____TOTAL *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

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[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.*

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **City of Vernon** **Capital Cost:** **$ 4,144,500**

Water Management Strategy Name: **Develop Additional Groundwater Supply — *(Wanderers Creek Wells and Transmission Line)***

Implementation Date: **2015**

1. ***Are you planning to implement the recommended projects/strategies?***

☒YES ☐NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

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If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %____________Cash Reserves
☐ %_____100____Bonds
☐ %____________Bank Loans
☐ %____________Federal Government Programs
☐ %____________State Government Programs
☐ %____________Other____________________
%_____100____TOTAL *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

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[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.

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **City of Wichita Falls - Option 1** **Capital Cost:** **$ 48,700,000**

Water Management Strategy Name: **Wastewater Reuse**

Implementation Date: **August 2001**

1. ***Are you planning to implement the recommended projects/strategies?***

☒ YES ☐ NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

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If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %_____ Cash Reserves
☒ % 100 Bonds
☐ %_____ Bank Loans
☐ %_____ Federal Government Programs
☐ %_____ State Government Programs
☐ %_____ Other_____
% 100 TOTAL *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

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[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.

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: City of Wichita Falls - Option 2 **Capital Cost:** $ 319,746,000

Water Management Strategy Name: Construct Lake Ringgold

Implementation Date: N/A

1. ***Are you planning to implement the recommended projects/strategies?***

☐ YES ☒ NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

The City of Wichita Falls has met its future needs by implementing the development of Lake Kemp and the implementation of wastewater effluent reuse.

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %_________ Cash Reserves
☐ %_________ Bonds
☐ %_________ Bank Loans
☐ %_________ Federal Government Programs
☐ %_________ State Government Programs
☐ %_________ Other____________________
% ________ **TOTAL** *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

[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.

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **City of Bowie - Option 1** **Capital Cost:** **$ 1,367,000.00**

Water Management Strategy Name: **Develop Groundwater Supply**

Implementation Date: ____________________

1. ***Are you planning to implement the recommended projects/strategies?***

☐ YES ☒NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

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If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:
1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %____________ Cash Reserves
☐ %____________ Bonds
☐ %____________ Bank Loans
☐ %____________ Federal Government Programs
☐ %____________ State Government Programs
☐ %____________ Other____________________
% ___________ **TOTAL** *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

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[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.*

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: City of Bowie - Option 2 **Capital Cost:** $ 895,000

Water Management Strategy Name: Wastewater Reuse

Implementation Date: 2010

1. ***Are you planning to implement the recommended projects/strategies?***

☒ YES ☐NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

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If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:
1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☒	% 15	Cash Reserves
☐	% ____	Bonds
☐	% ____	Bank Loans
☐	% ____	Federal Government Programs
☒	% 85	State Government Programs
☐	% ____	Other ____
	% 100	**TOTAL** *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

Texas Water Development Board Loan, TCDP Grant, USDA Grant, ORCA Grant, and Other Sources Available

[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.*

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **City of Byers** **Annual Cost:** **$ 8,200**

Water Management Strategy Name: **Purchase Additional Water from Dean Dale WSC**

Implementation Date: **January 2007**

1. ***Are you planning to implement the recommended projects/strategies?***

☒ YES ☐ NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

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If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:
1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☒ %__100__Cash Reserves
☐ %______Bonds
☐ %______Bank Loans
☐ %______Federal Government Programs
☐ %______State Government Programs
☐ %______Other__________
% __100__TOTAL *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

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[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.*

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **City of Electra** **Capital Cost:** **$ 7,500,000**

Water Management Strategy Name: **Purchase Water from Wichita Falls**

Implementation Date: **Summer / Fall 2006**

1. ***Are you planning to implement the recommended projects/strategies?***

☒ YES ☐NO

If 'no,'describe how you will meet your future water needs. *(Use an additional page if necessary.)*

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If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐	%____	Cash Reserves
☒	% 22	Bonds
☐	%____	Bank Loans
☒	% 43	Federal Government Programs **(Grant from USDA)**
☐	%____	State Government Programs
☒	% 35	Other **USDA Loan**
	% 100	**TOTAL** *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

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[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.*

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **Hinds Wildcat Water System - 1** **Capital Cost:** **$ 412,000**

Water Management Strategy Name: **Construct Nitrate Removal Plant**

Implementation Date: **Dependent upon Availability of Grant Funds**

1. ***Are you planning to implement the recommended projects/strategies?***

☐ YES ☒ NO *(When Grant Funds Become Available)*

If 'no,'describe how you will meet your future water needs. *(Use an additional page if necessary.)*

Continue Current TCEQ Compliance Agreement which includes furnishing bottled water to infants and pregnant women. Will install when grant funds become available.

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %_________ Cash Reserves
☐ %_________ Bonds
☐ %_________ Bank Loans
☐ %_________ Federal Government Programs
☐ %_________ State Government Programs
☐ %_________ Other____________________
% ________ **TOTAL** *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

No specific programs have been identified to date.

[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.*

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: Hinds Wildcat Water System - 2 **Capital Cost:** $ 655,000

Water Management Strategy Name: Purchase Water from Vernon

Implementation Date: N/A

1. ***Are you planning to implement the recommended projects/strategies?***

☐ YES ☒ NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

Continue Current TCEQ Compliance Agreement which includes furnishing bottled water to infants and pregnant women.

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %_________ Cash Reserves
☐ %_________ Bonds
☐ %_________ Bank Loans
☐ %_________ Federal Government Programs
☐ %_________ State Government Programs
☐ %_________ Other____________________
% ________ **TOTAL** *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

[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.

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **Lockett Water System-Option 1** **Capital Cost:** **$ 412,000**

Water Management Strategy Name: **Construct Nitrate Removal Plant**

Implementation Date: **N/A**

1. ***Are you planning to implement the recommended projects/strategies?***

☐ YES ☒ NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

Continue Current TCEQ Compliance Agreement which includes furnishing bottled water to infants and pregnant women.

If 'yes', how do you plan to finance the proposed total cost of capital improvements identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %_________ Cash Reserves
☐ %_________ Bonds
☐ %_________ Bank Loans
☐ %_________ Federal Government Programs
☐ %_________ State Government Programs
☐ %_________ Other____________________
% ________ **TOTAL** *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

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[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.

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **Lockett Water System-Option 2** **Capital Cost:** **$ 1,272,000**

Water Management Strategy Name: **Purchase Water from Vernon**

Implementation Date: **When Financing Can Be Arranged**

1. ***Are you planning to implement the recommended projects/strategies?***

☒ YES *(When grant funds become available)* ☐NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

____

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %________Cash Reserves
☐ %________Bonds
☐ %________Bank Loans
☒ %___50___Federal Government Programs
☒ %___50___State Government Programs
☐ %________Other________________
% __100__ TOTAL *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

No specific programs have been identified to date.

[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.

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **Wichita Co. Water Improvement District No. 2** **Capital Cost:** **$ 58,500,000**

Water Management Strategy Name: **Irrigation Canal Improvements**

Implementation Date: **Present to 2040**

1. ***Are you planning to implement the recommended projects/strategies?***

☐ YES ☒ NO

If 'no,'describe how you will meet your future water needs. *(Use an additional page if necessary.)*

___

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☐ %____ Cash Reserves
☐ %____ Bonds
☐ %____ Bank Loans
☒ % 33 Federal Government Programs
☒ % 33 State Government Programs
☒ % 34 Other **Grants**
% 100 **TOTAL** *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

Wichita County Water Improvement District No. 2 is working cooperatively with landowners to place portions of irrigation system in pipe. Grants will be pursued in the future to help fund the project. It is the intent of the District to utilize a portion of the conservation savings to help fund the necessary improvements.

[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.*

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **Wichita Co. Water Improvement District No. 2** **Capital Cost:** **$ 100,000**

Water Management Strategy Name: **Lake Kemp Improvements**

Implementation Date: **Within the next two years (2006 - 2007)**

1. ***Are you planning to implement the recommended projects/strategies?***

☒ YES ☐ NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

- ☐ %______ Cash Reserves
- ☐ %______ Bonds
- ☐ %______ Bank Loans
- ☒ % 100 Federal Government Programs
- ☐ %______ State Government Programs
- ☐ %______ Other______

% 100 TOTAL *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

Reallocation Study and Sedimentation Study to be funded with Federal Funds.

[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.

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision:	**Wilbarger County - Manufacturing**	**Capital Cost:**	**$ 50,000**

Water Management Strategy Name: **Purchase Water from Vernon—** ***(Purchase Additional Water Rights for Schmoker Well Field)***

Implementation Date: **2007**

1. ***Are you planning to implement the recommended projects/strategies?***

☒YES ☐NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

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If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

- ☒ %___100___Cash Reserves
- ☐ %________Bonds
- ☐ %________Bank Loans
- ☐ %________Federal Government Programs
- ☐ %________State Government Programs
- ☐ %________Other____________
- **%___100___TOTAL** *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

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[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.

Please complete the following to assist with the implementation of your identified water needs.

Political Subdivision: **Wilbarger County - Manufacturing** **Capital Cost:** **$ 910,200**

Water Management Strategy Name: **Purchase Water from Vernon— *(Develop of Additional Rights for the Schmoker Well Field)***

Implementation Date: **2009**

1. ***Are you planning to implement the recommended projects/strategies?***

☒YES ☐NO

If 'no,' describe how you will meet your future water needs. *(Use an additional page if necessary.)*

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If 'yes', how do you plan to finance the proposed <u>total cost of capital improvements</u> identified by your Regional Water Planning Group?

Please indicate:

1. Funding source(s)by checking the corresponding box(es) and
2. Enter the percent share of the total cost to be met by each funding source.

☒ %__100__Cash Reserves

☐ %______Bonds

☐ %______Bank Loans

☐ %______Federal Government Programs

☐ %______State Government Programs

☐ %______Other__________

%__100__TOTAL *(Sum should equal 100%)*

If state government programs are to be utilized for funding, indicate the programs and the provisions of those programs.

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[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.

CHAPTER 10

REGIONAL WATER PLANNING GROUP B

ADOPTION OF PLAN

PLAN ADOPTION AND PUBLIC PARTICIPATION
TEXAS STATE SENATE BILL 1
REGION B

10.1 Introduction

This section describes the plan approval process for the Region B Water Plan and the efforts made to encourage public participation in the planning process.

The Regional Water Planning Group - Area B (RWPG-B) agreed that public outreach and education were of paramount importance if a regional water plan was to be developed that accurately represented the regional area. To this end, a public education and outreach strategy was prepared with the goal to insure that all water users and the public were informed of each meeting and the progress of the plan's development, given an opportunity to present and discuss their concerns, and participate in the planning process.

10.2 Regional Water Planning Group

As required by Senate Bill 1 regional water planning groups were formed to guide the planning process. These groups were comprised of representatives of specific interests:

- General public
- Counties
- Municipalities
- Industrial
- Agricultural
- Environmental
- Small businesses
- Electric generating utilities
- River authorities
- Water districts
- Water utilities

Table 10-1 below lists the 17 members of the Region B Water Planning Group, the interests they represent, their organizations, and their counties.

Table 10-1

Regional Water Planning Group - Area B			
Name	**Organization**	**Interest**	**County**
Jimmy Banks	Wichita County WID #2	Water District	Wichita
Mark Barton	American Electric Power	Electric Utility	Wilbarger
J. K. (Rooter) Brite	Rancher	Environmental	Montague/All
Mayor Kelly Couch	City of Vernon	Municipal	Wilbarger
Curtis W. Campbell	Red River Authority of Texas	River Authority	All
Paul Hawkins		Public	Wilbarger
Tommy Holub	Baylor County WSC	Water Utility	Baylor
Dr. Norman Horner	Midwestern State University	Environmental	Wichita/All
Dale Hughes	W.T. Waggoner Estate	Agriculture	Wilbarger
Joe Johnson Jr.	Stephens Engineering	Industry	Wichita
Mayor Robert Kincaid	City of Crowell	Municipal	Foard
Judge Kenneth Liggett	Clay County	County	Clay
Mike McGuire	Rolling Plains Groundwater Conservation District	Groundwater District	Baylor
Judge Kenneth McNabb	Hardeman County	County	Hardeman
Dean Myers	Bowie Industries, Inc.	Small Business	Montague
Wilson Scaling	Scaling Ranch	Agriculture	Clay
Kay Yeager	City of Wichita Falls	Municipal	Wichita

The RWPG-B Planning Board unanimously pledged to support the interest of the entire region as the primary objective in meeting the needs of the region as a whole. During the first round of planning there was an extensive public education and participation program that included drought contingency planning workshops with local water suppliers, numerous civic group and local presentations, surveys of water users in the region, as well as planning group meetings, public hearings, and an internet web site. For this update, the public education and participation program consists of:

- Planning Group Meetings and Hearings
- Regional Newsletters – Summer 2002 and Winter 2003
- Internet Web Site
- Coordination with Wholesale Water Providers and Water User Groups
- Implementation of the Water Plan

10.3 Planning Group Meetings

The RWPG-B held 19 open public meetings and hearings from February 13, 2001 through December 15, 2005 with personal invitations going to each category of interest groups and water use entities within the region, including a current agenda for each meeting and encouraging attendance and participation in the process. The RWPG Board participated actively as a group during each meeting, relying upon information provided by its consultant group and appeared to be well informed on all matters concerning the regional planning area. A list of the public meeting dates and locations held is shown in Table 10-2.

Representatives from the Texas Water Development Board, the Texas Commission on Environmental Quality, the Texas Department of Agriculture, and the Texas Parks and Wildlife Department were regularly in attendance and other agencies were periodically represented and offered presentations. Some of these were agencies such as the U.S. Army Corps of Engineers, and State and Federal Legislators representing the local districts within the regional planning area. All meetings were posted in accordance with the Texas Open Meeting's Law, Article 6252-17, Section 3a, VATCS and 31 TAC, Section 357.12(a)(5).

During each meeting, a presentation of materials, discoveries, and relevant issues were provided for discussion and deliberation prior to receiving a vote on any specific measures, action, or strategies to be taken on the part of the RWPG-B. Members of the public were given an opportunity to participate in discussions of individual agenda items, as well as to provide public comments prior to the close of each meeting. Minutes were prepared of all meetings and filed with the secretary and the Texas Water Development Board.

Table 10-2

Region B Planning Group Meetings and Public Hearings		
DATE	**EVENT**	**LOCATION**
February 13, 2001	RWPG-B Board Meeting	Nortex RPC–Wichita Falls
July 25, 2001	Cancelled	
August 22, 2001	RWPG-B Board Meeting	Nortex RPC–Wichita Falls
November 14, 2001	RWPG-B Board Meeting	Nortex RPC–Wichita Falls
February 27, 2002	RWPG-B Board Meeting	N TX Rehab Center – WF
March 27, 2002	RWPG-B Public Hearing	N TX Rehab Center – WF
March 27, 2002	RWPG-B Board Meeting	N TX Rehab Center – WF
August 21, 2002	Cancelled	
October 16, 2002	RWPG-B Board Meeting	Nortex RPC–Wichita Falls
May 21, 2003	RWPG-B Board Meeting	N TX Rehab Center – WF
July 23, 2003	RWPG-B Board Meeting	Nortex RPC–Wichita Falls
October 8, 2003	RWPG-B Board Meeting	Nortex RPC–Wichita Falls
February 17, 2004	RWPG-B Board Meeting	Nortex RPC–Wichita Falls
August 18, 2004	RWPG-B Board Meeting	Nortex RPC–Wichita Falls
November 17, 2004	RWPG-B Board Meeting	Nortex RPC–Wichita Falls
February 16, 2005	RWPG-B Board Meeting	Nortex RPC–Wichita Falls
March 16, 2005	RWPG-B Board Meeting	Nortex RPC–Wichita Falls
May 4, 2005	RWPG-B Board Meeting	Nortex RPC–Wichita Falls
July 6, 2005	RWPG-B Public Hearing	MSU–Shawnee Theater
August 25, 2005	RWPG-B Board Meeting	Nortex RPC–Wichita Falls
November 16, 2005	Cancelled	
December 15, 2005	RWPG-B Board Meeting	N TX Rehab Center – WF

10.4 Media Communications

The RWPG-B Board members promoted numerous media coverage events of issues pending before the board in an effort to encourage public involvement and heighten awareness of concerns vital to the regional planning area. Several newspaper articles were published discussing issues specific to the region and regional water planning process.

The RWPG-B newsletter was mailed to over 250 persons on two separate occasions throughout the planning area in an effort to keep the region informed of current activities.

The Times and Record News (TRN) was invited to each meeting and attended most which produced good summary coverage of agenda items being considered together with actions taken by the RWPG Board.

10.5 Internet Web Page

An Internet Web Page was designed and is hosted by the RWPG's management agency, the Red River Authority of Texas. It is used to disseminate information about the water resources within the region and to publish notices of meetings, hearings, and issues being considered and addressed by the RWPG Planning Board.

The web pages are maintained and updated at least quarterly, or as needed, to publicize current information of interest and solicit input from the viewers. The web site is located at www.rra.dst.tx.us/rwpg and is available on a 24-hour basis.

The web site contains numerous links to other pages of common interest for the viewer and begins with a front page that includes a publications library, regional data inventories, names and addresses of the Regional Planning Board, public events calendar, enabling legislation (SB-1), maps of the region, and a place for written comments to the RWPG-B.

10.6 Public Hearings and Other Public Meetings

The RWPG-B conducted one public hearing on the scope of work for the regional water plan, and another public hearing to receive comments on the Initially Prepared Water Plan for Region B. Comments, both oral and written, were transcribed from the hearing and filed with the secretary and the TWDB. The RWPG also maintains a complete record of all hearings and public meetings at the office of its management agency, the Red River Authority of Texas. The first hearing was held on March 27, 2002, and the second on July 6, 2005 at Midwestern State University. The Initially Prepared Water Plan for Region B was adopted on May 4, 2005 by a unanimous vote of the RWPG-B Board. In addition to each member, copies of the Initially Prepared Water Plan were mailed to 11 county clerks and 13 libraries throughout the region for public review.

Additionally, the RWPG Board appointed a Technical Advisory Committee (TAC) comprised of three board members, representatives of the consultant group, the public and invited guests of various expertise for review of technical materials and matters to which the RWPG Board would ultimately have to decide upon. The TAC also qualified the consultant group and recommended selection to the RWPG Board. During the Regional Water Plan development process, the TAC met and evaluated alternatives for recommendations to the RWPG Board and discussed proposed water management strategies with the affected water use entities prior to consideration for adoption by the RWPG Board.

The TAC was instrumental in reducing confusion of sensitive matters and neutralizing controversial issues before being considered by the RWPG Board. The process was very successful and was a useful means of keeping the RWPG Board well informed concerning forthcoming matters that could develop into potentially volatile situations.

10.7 Regional Water Plan Implementation Issues

Implementation issues identified for the *Region B Water Plan* include: 1) financial issues associated with paying for the proposed capital improvements, 2) identification of the governing authorities for general regional strategies such as land stewardship, recharge enhancement and weather modification, 3) public acceptance of selected strategies, and 4) public participation in water conservation measures that were assumed in this plan.

Financial Issues

It is assumed that the entities for which strategies were developed will utilize existing financial resources, incur debt through bond sales and/or receive state-supported financial assistance. Most likely the funding of identified strategies will increase the cost of water to the customers. The economic feasibility to implement the strategies will depend on the cost increases the customer base can assume. Some strategies may not be able to be implemented without state assistance. The funding mechanisms for entities with shortages are identified as part of the Infrastructure Financing Survey. The results of this survey are incorporated in this plan as Chapter 9.

Governing Authorities

In Region B there is an identified governing authority for each of the preferred strategies discussed in Chapter 4. However, for general strategies, such as land stewardship or weather modification, no governing authority has been identified. As part of the feasibility of these strategies for Region B, a governing authority will need to be identified to implement such strategies.

Public Acceptance

The public has expressed concerns regarding using wastewater effluent for municipal supplies. Reuse strategies are proposed to meet demands for the City of Wichita Falls and the City of Bowie. While the final treated water supply from this strategy will meet or exceed the city's current water quality, the perception persists that the water would be of lesser quality. To gain public acceptance of wastewater reuse strategies for municipal use, additional public educational programs may be needed.

Public Participation

The recommended strategies developed for this plan include a significant level of conservation to be implemented over the planning period. These assumed demand reductions were applied to municipal water uses. Some of the demand reductions will occur simply through improvements in technology. However, a moderate level of public participation is required to fully realize the expected conservation. If the conservation is less than expected, then there may be additional shortages that were not identified in this plan.

APPENDIX A

REGIONAL WATER PLANNING GROUP B

WATER USER GROUP SUMMARIES

Water User Group:	Archer City - Archer						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population	1,848	2,022	2,200	2,345	2,390	2,307	2,223
Water Demand (ac-ft/yr)	232	333	343	356	357	341	328
Current Supply - contract w/ Wichita Falls (ac-ft/yr)	291	291	291	291	291	291	291
Current Supply - Archer City Lake (ac-ft/yr)	314	314	314	314	314	314	314
Supply - Demand (ac-ft/yr)	373	272	262	249	248	264	277
Required Safe Supply (ac-ft/yr)	278	400	412	427	428	409	394
Safe Supply Shortage (ac-ft/yr)	327	206	194	178	177	196	212
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	County-Other - Archer						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	497	544	591	632	643	621	597
Water Demand (ac-ft/yr)	69	513	465	499	525	480	474
Current Supply - contracts w/ Wichita Falls (ac-ft/yr)	224	224	224	224	224	224	224
Current supply - Lake Megargel	0	0	0	0	0	0	0
Other Aquifer - Red Basin	103	103	103	103	103	103	103
Other Aquifer - Brazos Basin	24	20	8	7	7	7	7
Other Aquifer - Trinity Basin	4	4	4	4	4	4	4
Supply - Demand (ac-ft/yr)	286	-162	-126	-161	-187	-142	-136
Required Safe Supply (ac-ft/yr)	83	616	558	599	630	576	569
Safe Supply Shortage (ac-ft/yr)	268	-269	-223	-265	-296	-242	-235
Recommended 2006 Plan Strategy	Conservation, Purchase water from local provider						

Water User Group:	Holliday - Archer						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	1,632	1,786	1,943	2,071	2,110	2,038	1,963
Water Demand (ac-ft/yr)	245	249	258	266	267	255	246
Current Supply - Wichita Falls (ac-ft/yr)	294	299	310	319	320	306	295
Supply - Demand (ac-ft/yr)	49	50	52	53	53	51	49
Required Safe Supply (ac-ft/yr)	294	299	310	319	320	306	295
Safe Supply Shortage (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Lakeside City - Archer						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	984	1,077	1,172	1,249	1,272	1,228	1,183
Water Demand (ac-ft/yr)	125	166	163	173	169	161	155
Current Supply - Wichita Falls (ac-ft/yr)	196	196	196	196	196	196	196
Supply - Demand (ac-ft/yr)	71	30	33	23	27	35	41
Required Safe Supply (ac-ft/yr)	150	199	196	208	203	193	186
Safe Supply Shortage (ac-ft/yr)	46	-3	0	-12	-7	3	10
Recommended 2006 Plan Strategy	Conservation, Increase supply from Wichita Falls						

Water User Group:	Wichita Valley WSC - Archer						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	2,736	2,994	3,258	3,472	3,538	3,416	3,291
Water Demand (ac-ft/yr)	184	347	356	351	343	329	316
Current Supply- Wichita Falls System (ac-ft/yr)	419	410	405	406	402	390	379
Current Supply- Sales from Iowa Park (ac-ft/yr)	163	159	157	158	156	152	147
Supply - Demand (ac-ft/yr)	398	222	206	212	216	213	211
Required Safe Supply (ac-ft/yr)	221	416	427	421	412	395	379
Safe Supply Shortage (ac-ft/yr)	361	153	135	142	147	147	147
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Windthorst WSC - Archer						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	1,157	1,266	1,378	1,468	1,496	1,444	1,392
Water Demand (ac-ft/yr)	351	198	205	203	202	199	196
Current Supply - raw water - Wichita Falls (ac-ft/yr)	353	355	359	363	366	367	369
Supply - Demand (ac-ft/yr)	2	157	154	160	164	168	173
Required Safe Supply (ac-ft/yr)	421	238	246	244	242	239	235
Safe Supply Shortage (ac-ft/yr)	-69	118	113	119	123	128	134
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Irrigation - Archer						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	1,971	3,500	3,400	3,300	3,200	3,100	3,100
Current Supply- Lake Kemp (ac-ft/yr)	6,070	3,484	3,117	2,754	2,398	2,047	1,723
Current Supply- Run-of-river	7	7	7	7	7	7	7
Supply - Demand (ac-ft/yr)	4,106	-9	-276	-539	-795	-1,046	-1,370
Recommended 2006 Plan Strategy	Increase water conservation elevation at Lake Kemp, Seasonal Pool, Chloride Control						

Water User Group:	Livestock - Archer						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	2,579	2,711	2,711	2,711	2,711	2,711	2,711
Current Supply stock ponds (ac-ft/yr)	2,320	2,439	2,439	2,439	2,439	2,439	2,439
Current Supply - Other Aquifer - Trinity	182	228	228	228	228	228	228
Current Supply - Other Aquifer - Red	24	30	30	30	30	30	30
Current Supply - Other Aquifer - Brazos	11	14	14	14	14	14	14
Supply - Demand (ac-ft/yr)	-42	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Mining - Archer						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	1	0	0	0	0	0	0
Current Supply - Groundwater (ac-ft/yr)	0	0	0	0	0	0	0
Supply - Demand (ac-ft/yr)	-1	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Steam Electric Power - Archer						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	0	0	0	0	0	0	0
Current Supply - Lake Kemp (ac-ft/yr)	0	0	0	0	0	0	0
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	County-Other - Baylor						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	1,185	1,173	1,166	1,156	1,147	1,141	1,133
Water Demand (ac-ft/yr)	215	277	264	229	226	222	221
Current Supply - Seymour Aquifer - Brazos (ac-ft/yr)	340	340	340	340	340	340	340
Current Supply - Seymour Aquifer - Red (ac-ft/yr)	80	80	80	80	80	80	80
Supply - Demand (ac-ft/yr)	205	143	156	191	194	198	199
Required Safe Supply (ac-ft/yr)	258	332	317	275	271	266	265
Safe Supply Shortage (ac-ft/yr)	82	8	23	65	69	74	75
Recommended 2006 Plan Strategy	Emergency connection to Miller's Creek Reservoir (NCTMWA)						

Water User Group:	Irrigation - Baylor						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	736	685	666	646	626	607	607
Current Supply - Run-of-river	17	17	17	17	17	17	17
Current Supply - Seymour Aquifer (Brazos) (ac-ft/yr)	1,837	1,837	1,837	1,837	1,837	1,837	1,837
Current Supply - Seymour Aquifer (Red) (ac-ft/yr)	375	375	375	375	375	375	375
Supply - Demand (ac-ft/yr)	1,493	1,544	1,563	1,583	1,603	1,622	1,622
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	**Livestock - Baylor**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	999	953	953	953	953	953	953
Current Supply Stock ponds (ac-ft/yr)	899	899	899	899	899	899	899
Current Supply - Seymour Aquifer - Basin	55	55	55	55	55	55	55
Current Supply - Seymour Aquifer - Red	55	55	55	55	55	55	55
Supply - Demand (ac-ft/yr)	10	56	56	56	56	56	56
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	**Mining - Baylor**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	39	21	10	5	0	0	0
Current Supply - Seymour Aquifer (ac-ft/yr)	47	47	47	47	47	47	47
Supply - Demand (ac-ft/yr)	8	26	37	42	47	47	47
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	**Seymour - Baylor**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	2,908	2,692	2,569	2,378	2,206	2,089	1,933
Water Demand (ac-ft/yr)	554	611	548	504	460	432	387
Current Supply - Seymour Aquifer (ac-ft/yr)	747	747	747	747	747	747	747
Supply - Demand (ac-ft/yr)	193	136	199	243	287	315	360
Required Safe Supply (ac-ft/yr)	665	733	658	605	552	518	464
Safe Supply Shortage (ac-ft/yr)	82	14	89	142	195	229	283
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Byers - Clay						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	517	534	550	546	524	491	459
Water Demand (ac-ft/yr)	69	83	81	78	73	64	64
Current Supply - Sales from Dean Dale (ac-ft/yr)	0	45	45	45	45	45	45
Current Supply - Seymour Aquifer (ac-ft/yr)	91	44	44	44	44	44	44
Supply - Demand (ac-ft/yr)	22	6	8	11	16	25	25
Required Safe Supply (ac-ft/yr)	83	100	97	94	88	77	77
Safe Supply Shortage (ac-ft/yr)	8	-11	-8	-5	1	12	12
Recommended 2006 Plan Strategy	Conservation, purchase additional treated water from Dale Dean WSC						

Water User Group:	County-Other - Clay						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	4,142	4,282	4,402	4,377	4,194	3,938	3,680
Water Demand (ac-ft/yr)	585	892	872	855	772	610	535
Current Supply - Contracts w/ Wichita Falls (ac-ft/yr)	420	420	420	420	420	420	420
Current Supply - Seymour Aquifer (ac-ft/yr)	55	55	55	55	55	55	55
Current Supply - Other Aquifer - Red (ac-ft/yr)	300	300	300	300	300	300	300
Current Supply - Other Aquifer - Trinity (ac-ft/yr)	72	72	72	72	72	72	72
Supply - Demand (ac-ft/yr)	262	-45	-25	-8	75	237	312
Required Safe Supply (ac-ft/yr)	702	1,070	1,046	1,026	926	732	642
Safe Supply Shortage (ac-ft/yr)	73	-223	-199	-179	-79	115	205
Recommended 2006 Plan Strategy	Conservation, Purchase treated water from local provider, Nitrate removal treatment for Charlie WSC						

Water User Group:	Dean Dale WSC - Clay						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	2,081	2,151	2,212	2,199	2,108	1,978	1,849
Water Demand (ac-ft/yr)	217	230	224	218	206	199	192
Current Supply - Contracts w/ Wichita Falls (ac-ft/yr)	300	247	241	235	226	218	208
Current Supply - Seymour Aquifer (ac-ft/yr)	107	107	107	107	107	107	107
Supply - Demand (ac-ft/yr)	190	124	124	124	127	126	123
Required Safe Supply (ac-ft/yr)	260	276	269	262	247	239	230
Safe Supply Shortage (ac-ft/yr)	147	78	79	80	86	86	85
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Henrietta - Clay						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	3,264	3,374	3,470	3,448	3,306	3,103	2,900
Water Demand (ac-ft/yr)	526	720	701	677	638	592	553
Current Supply - Run-of-river (ac-ft/yr)	912	912	912	912	912	912	912
Supply - Demand (ac-ft/yr)	386	192	211	235	274	320	359
Required Safe Supply (ac-ft/yr)	631	864	841	812	766	710	664
Safe Supply Shortage (ac-ft/yr)	281	48	71	100	147	202	249
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Irrigation - Clay						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population							
Water Demand (ac-ft/yr)	1,993	3,900	3,800	3,700	3,600	3,500	3,500
Current Supply - Lake Kemp (ac-ft/yr)	1,540	1,547	1,333	1,130	940	762	641
Current supply - Run-of-river	1,809	1,809	1,809	1,809	1,809	1,809	1,809
Current Supply - Seymour Aquifer (ac-ft/yr)	287	287	287	287	287	287	287
Current Supply - Other Aquifer (ac-ft/yr)	250	250	250	250	250	250	250
Supply - Demand (ac-ft/yr)	1,893	-7	-121	-224	-314	-392	-513
Recommended 2006 Plan Strategy	Increase water conservation elevation at Lake Kemp, Seasonal Pool, Chloride Control						

Water User Group:	Livestock - Clay						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population							
Water Demand (ac-ft/yr)	1,936	2,191	2,191	2,191	2,191	2,191	2,191
Current Supply Stock Ponds (ac-ft/yr)	1,742	1,982	1,982	1,982	1,982	1,982	1,982
Current Supply Other Aquifer - Red (ac-ft/yr)	175	175	175	175	175	175	175
Current Supply Other Aquifer - Trinity (ac-ft/yr)	25	25	25	25	25	25	25
Current Supply Seymour Aquifer (ac-ft/yr)	20	20	20	20	20	20	20
Supply - Demand (ac-ft/yr)	26	11	11	11	11	11	11
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Mining - Clay						
	2000	2010	2020	2030	2040	2050	2060
Population							
Water Demand (ac-ft/yr)	310	222	198	184	180	180	180
Current Supply Red Run-of-River	1	1	1	1	1	1	1
Current Supply Other Aquifer	6	6	6	6	6	6	6
Current Supply Seymour Aquifer (ac-ft/yr)	502	502	502	502	502	502	502
Supply - Demand (ac-ft/yr)	199	287	311	325	329	329	329
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Petrolia - Clay						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)	782	808	831	826	792	743	695
Water Demand (ac-ft/yr)	93	95	92	90	84	73	73
Current Supply - Lake Petrolia (ac-ft/yr)	67	67	67	67	67	67	67
Current Supply - Seymour Aquifer (ac-ft/yr)	70	70	70	70	70	70	70
Supply - Demand (ac-ft/yr)	44	42	45	47	53	64	64
Required Safe Supply (ac-ft/yr)	112	114	110	108	101	88	88
Safe Supply Shortage (ac-ft/yr)	25	23	27	29	36	49	49
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	**Windthorst WSC - Clay**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	220	227	234	232	223	209	195
Water Demand (ac-ft/yr)	67	36	35	32	30	29	27
Current Supply - Sales Wichita Falls (ac-ft/yr)	67	65	61	57	54	53	51
Supply - Demand (ac-ft/yr)	0	29	26	25	24	24	24
Required Safe Supply (ac-ft/yr)	80	43	42	38	36	35	32
Safe Supply Shortage (ac-ft/yr)	-13	22	19	19	18	18	19
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	County-Other - Cottle						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	406	399	398	385	370	357	350
Water Demand (ac-ft/yr)	198	79	76	76	73	71	69
Current Supply Other Aquifer (ac-ft/yr)	200	200	200	200	200	200	200
Supply - Demand (ac-ft/yr)	2	121	124	124	127	129	131
Required Safe Supply (ac-ft/yr)	238	95	91	91	88	85	83
Safe Supply Shortage (ac-ft/yr)	-38	105	109	109	112	115	117
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Irrigation - Cottle						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population							
Water Demand (ac-ft/yr)	4,201	4,301	4,172	4,047	3,925	3,808	3,808
Current Supply Blaine Aquifer (ac-ft/yr)	4,525	4,525	4,525	4,525	4,525	4,525	4,525
Current Supply Run of River (ac-ft/yr)	11	11	11	11	11	11	11
Supply - Demand (ac-ft/yr)	335	235	364	489	611	728	728
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Livestock - Cottle						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population							
Water Demand (ac-ft/yr)	499	387	387	387	387	387	387
Current Supply Seymour Aquifer (ac-ft/yr)	47	47	47	47	47	47	47
Current Supply Stock Ponds (ac-ft/yr)	449	449	449	449	449	449	449
Supply - Demand (ac-ft/yr)	-3	109	109	109	109	109	109
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Mining - Cottle						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population							
Water Demand (ac-ft/yr)	23	25	27	28	30	30	30
Current Supply Blaine Aquifer (ac-ft/yr)	23	25	27	28	30	30	30
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Paducah - Cottle						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population	1,498	1,458	1,455	1,384	1,304	1,233	1,193
Water Demand (ac-ft/yr)	247	316	300	277	256	239	232
Current Supply - Blaine Aquifer (ac-ft/yr)	532	532	532	532	532	532	532
Supply - Demand (ac-ft/yr)	285	216	232	255	276	293	300
Required Safe Supply (ac-ft/yr)	296	379	360	332	307	287	278
Safe Supply Shortage (ac-ft/yr)	236	153	172	200	225	246	254
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	County-Other - Foard						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)	481	477	485	463	426	402	367
Water Demand (ac-ft/yr)	103	116	114	110	102	97	89
Current Supply Greenbelt Reservoir (ac-ft/yr)	68	68	68	68	68	68	68
Current Supply Seymour Aquifer (ac-ft/yr)	113	113	113	113	113	113	113
Supply - Demand (ac-ft/yr)	78	65	67	71	79	84	92
Required Safe Supply (ac-ft/yr)	124	139	137	132	122	116	107
Safe Supply Shortage (ac-ft/yr)	57	42	44	49	59	65	74
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Crowell - Foard						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)	1,141	1,137	1,145	1,121	1,081	1,055	1,017
Water Demand (ac-ft/yr)	251	277	264	252	241	233	224
Current Supply Greenbelt Reservoir (ac-ft/yr)	301	332	317	302	289	280	269
Supply - Demand (ac-ft/yr)	50	55	53	50	48	47	45
Required Safe Supply (ac-ft/yr)	301	332	317	302	289	280	269
Safe Supply Shortage (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Irrigation - Foard						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	3,889	4,829	4,684	4,543	4,407	4,275	4,275
Current Supply Seymour Aquifer (ac-ft/yr)	5,232	5,232	5,232	5,232	5,232	5,232	5,232
Current Supply Blaine Aquifer (ac-ft/yr)	23	23	23	23	23	23	23
Supply - Demand (ac-ft/yr)	1,366	426	571	712	848	980	980
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Livestock - Foard						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	279	289	289	289	289	289	289
Current Supply Seymour Aquifer (ac-ft/yr)	28	38	38	38	38	38	38
Current Supply Stock Ponds (ac-ft/yr)	251	251	251	251	251	251	251
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Mining - Foard						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	22	24	24	25	26	27	27
Current Supply Seymour Aquifer (ac-ft/yr)	22	24	24	25	26	27	27
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	**Chillicothe - Hardeman**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	798	796	795	791	786	780	769
Water Demand (ac-ft/yr)	151	117	109	106	102	100	98
Current Supply Greenbelt Reservoir (ac-ft/yr)	76	61	55	53	51	50	49
Current Supply Seymour Aquifer (ac-ft/yr)	80	80	80	80	80	80	80
Supply - Demand (ac-ft/yr)	5	24	26	27	29	30	31
Required Safe Supply (ac-ft/yr)	181	140	131	127	122	120	118
Safe Supply Shortage (ac-ft/yr)	-26	0	4	6	9	10	11
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	**County-Other - Hardeman**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	904	888	877	842	797	747	652
Water Demand (ac-ft/yr)	220	172	164	153	144	136	120
Current Supply Greenbelt Reservoir (ac-ft/yr)	210	210	210	210	210	210	210
Current Supply Seymour Aquifer (ac-ft/yr)	35	35	35	35	35	35	35
Supply - Demand (ac-ft/yr)	25	73	81	92	101	109	125
Required Safe Supply (ac-ft/yr)	264	206	197	184	173	163	144
Safe Supply Shortage (ac-ft/yr)	-19	39	48	61	72	82	101
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Irrigation - Hardeman						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	5,330	4,849	4,704	4,563	4,426	4,293	4,293
Current Supply Blaine Aquifer (ac-ft/yr)	5,200	5,200	5,200	5,200	5,200	5,200	5,200
Current Supply Run-of-river	116	116	116	116	116	116	116
Current Supply Seymour Aquifer (ac-ft/yr)	150	150	150	150	150	150	150
Supply - Demand (ac-ft/yr)	136	617	762	903	1,040	1,173	1,173
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Livestock - Hardeman						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	480	480	480	480	480	480	480
Current Supply Seymour Aquifer (ac-ft/yr)	198	198	198	198	198	198	198
Current Supply Stock Ponds (ac-ft/yr)	288	288	288	288	288	288	288
Supply - Demand (ac-ft/yr)	6	6	6	6	6	6	6
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Manufacturing - Hardeman						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)							
Water Demand (ac-ft/yr)	23	374	398	424	452	480	480
Current Supply Greenbelt Reservoir (ac-ft/yr)	28	449	478	509	542	576	576
Supply - Demand (ac-ft/yr)	5	75	80	85	90	96	96
Required Safe Supply (ac-ft/yr)	28	449	478	509	542	576	576
Safe Supply Shortage (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Mining - Hardeman						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)							
Water Demand (ac-ft/yr)	111	3	3	2	2	2	2
Current Supply - Other Local Supply (ac-ft/yr)	7	7	7	7	7	7	7
Supply - Demand (ac-ft/yr)	-104	4	4	5	5	5	5
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	**Quanah - Hardeman**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	3,022	2,981	2,954	2,863	2,746	2,617	2,371
Water Demand (ac-ft/yr)	565	543	510	491	453	426	386
Current Supply Greenbelt Reservoir (ac-ft/yr)	678	652	612	589	544	511	463
Supply - Demand (ac-ft/yr)	113	109	102	98	91	85	77
Required Safe Supply (ac-ft/yr)	678	652	612	589	544	511	463
Safe Supply Shortage (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	**Steam Electric Power - Hardeman**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	879	1,000	1,000	1,000	1,000	1,000	1,000
Current Supply Lake Pauline/ Groesbeck Crk (ac-ft/yr)	1,284	1,284	1,284	1,284	1,284	1,284	1,284
Supply - Demand (ac-ft/yr)	405	284	284	284	284	284	284
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	County-Other - King						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)	356	385	424	424	389	369	332
Water Demand (ac-ft/yr)	194	127	137	131	117	109	103
Current Supply Blaine Aquifer (ac-ft/yr)	190	190	190	190	190	190	190
Current Supply Other Aquifer - Dickens Co. (ac-ft/yr)	86	86	86	86	86	86	86
Current Supply Other Aquifer - Brazos (ac-ft/yr)	4	7	8	7	7	6	6
Supply - Demand (ac-ft/yr)	86	156	147	152	166	173	179
Required Safe Supply (ac-ft/yr)	233	152	164	157	140	131	124
Safe Supply Shortage (ac-ft/yr)	47	131	120	126	143	151	158
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Irrigation - King						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)							
Water Demand (ac-ft/yr)	241	20	20	20	20	20	20
Current Supply Blaine Aquifer (ac-ft/yr)	241	241	241	241	241	241	241
Supply - Demand (ac-ft/yr)	0	221	221	221	221	221	221
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	**Livestock - King**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	387	771	771	771	771	771	771
Current Supply Other Aquifer (ac-ft/yr)	28	28	28	28	28	28	28
Current Supply Blaine Aquifer (ac-ft/yr)	49	49	49	49	49	49	49
Current Supply Stock Ponds (ac-ft/yr)	348	694	694	694	694	694	694
Supply - Demand (ac-ft/yr)	38	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Bowie - Montague						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)	5,219	5,305	5,389	5,423	5,436	5,440	5,449
Water Demand (ac-ft/yr)	824	1,027	987	966	952	941	943
Current Supply Amon Carter (ac-ft/yr)	1,414	1,303	1,234	1,172	1,112	1,056	997
Supply - Demand (ac-ft/yr)	590	276	247	206	160	115	54
Required Safe Supply (ac-ft/yr)	989	1,232	1,184	1,159	1,142	1,129	1,132
Safe Supply Shortage (ac-ft/yr)	425	71	49	13	-31	-73	-134
Recommended 2006 Plan Strategy	Conservation, Wastewater Reuse						

Water User Group:	County-Other - Montague						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)	9,802	10,339	10,867	11,080	11,165	11,187	11,244
Water Demand (ac-ft/yr)	999	1,307	1,372	1,389	1,400	1,384	1,389
Current Supply Amon Carter (ac-ft/yr)	170	222	233	236	238	235	236
Current Supply Trinity Aquifer (ac-ft/yr)	200	200	200	200	200	200	200
Current Supply Lake Nocona (ac-ft/yr)	40	52	55	56	56	55	56
Current Supply Other Aquifer (ac-ft/yr)	700	700	700	700	700	700	700
Supply - Demand (ac-ft/yr)	111	-133	-184	-197	-206	-194	-197
Required Safe Supply (ac-ft/yr)	1,199	1,568	1,646	1,667	1,680	1,661	1,667
Safe Supply Shortage (ac-ft/yr)	-89	-394	-458	-475	-486	-470	-475
Recommended 2006 Plan Strategy	Purchase water from local provider						

Water User Group:	Irrigation - Montague						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	60	297	297	297	297	297	297
Current Supply Trinity Aquifer - Trinity (ac-ft/yr)	179	179	179	179	179	179	179
Current Supply Trinity Aquifer - Red (ac-ft/yr)	5	5	5	5	5	5	5
Current Supply Other Aquifer - Trinity (ac-ft/yr)	60	60	60	60	60	60	60
Current Supply Lk Nocona (ac-ft/yr)	100	100	100	100	100	100	100
Current Supply Red Run-of-River Wtr Rt 5605 (ac-ft/yr)	47	47	47	47	47	47	47
Supply - Demand (ac-ft/yr)	331	94	94	94	94	94	94
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Livestock - Montague						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	1,501	1,850	1,850	1,850	1,850	1,850	1,850
Current Supply Trinity Aquifer - Trinity (ac-ft/yr)	79	79	79	79	79	79	79
Current Supply Other Aquifer - Red (ac-ft/yr)	106	106	106	106	106	106	106
Current Supply Stock ponds (ac-ft/yr)	1,351	1,665	1,665	1,665	1,665	1,665	1,665
Supply - Demand (ac-ft/yr)	35	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Manufacturing - Montague						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)							
Water Demand (ac-ft/yr)	6	9	12	15	19	24	24
Current Supply Lake Nocona (ac-ft/yr)	7	11	14	18	23	29	29
Supply - Demand (ac-ft/yr)	1	2	2	3	4	5	5
Required Safe Supply (ac-ft/yr)	7	11	14	18	23	29	29
Safe Supply Shortage (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Mining - Montague						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)							
Water Demand (ac-ft/yr)	627	505	481	473	477	490	490
Current Supply Other Aquifer (ac-ft/yr)	248	248	248	248	248	248	248
Current Supply Trinity Aquifer (ac-ft/yr)	80	80	80	80	80	80	80
Current Supply Amon Carter	66	64	61	59	56	54	51
Current Supply Run-of-River (ac-ft/yr)	0	0	0	0	0	0	0
Supply - Demand (ac-ft/yr)	-233	-113	-92	-86	-93	-108	-111
Recommended 2006 Plan Strategy	Purchase water from local provider						

Water User Group:	**Nocona - Montague**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	3,198	3,321	3,442	3,491	3,510	3,515	3,528
Water Demand (ac-ft/yr)	484	693	681	671	664	657	660
Current Supply Lake Nocona (ac-ft/yr)	1,113	1,097	1,091	1,086	1,081	1,076	1,075
Supply - Demand (ac-ft/yr)	629	404	410	415	417	419	415
Required Safe Supply (ac-ft/yr)	581	832	817	805	797	788	792
Safe Supply Shortage (ac-ft/yr)	532	265	274	281	284	287	283
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	**Saint Jo - Montague**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	898	898	898	898	898	898	898
Water Demand (ac-ft/yr)	210	99	101	98	97	96	96
Current Supply Trinity Aquifer (ac-ft/yr)	211	211	211	211	211	211	211
Supply - Demand (ac-ft/yr)	1	112	110	113	114	115	115
Required Safe Supply (ac-ft/yr)	252	119	121	118	116	115	115
Safe Supply Shortage (ac-ft/yr)	-41	92	90	93	95	96	96
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Burkburnett - Wichita						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)	10,927	11,465	11,949	12,269	12,436	12,553	12,647
Water Demand (ac-ft/yr)	1,273	1,843	1,820	1,816	1,809	1,806	1,819
Current Supply Seymour Aquifer (ac-ft/yr)	916	916	916	916	916	916	916
Current Supply Wichita System (ac-ft/yr)	1,437	1,433	1,411	1,390	1,364	1,343	1,343
Supply - Demand (ac-ft/yr)	1,080	506	507	490	471	453	440
Required Safe Supply (ac-ft/yr)	1,528	2,212	2,184	2,179	2,171	2,167	2,183
Safe Supply Shortage (ac-ft/yr)	826	138	143	127	109	92	76
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	County-Other - Wichita						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)	3,056	2,639	2,264	2,015	1,885	1,793	1,721
Water Demand (ac-ft/yr)	318	224	228	226	224	223	223
Current Supply Wichita System (ac-ft/yr)	282	281	275	273	270	269	268
Current Supply Seymour Aquifer (ac-ft/yr)	380	380	380	380	380	380	380
Supply - Demand (ac-ft/yr)	344	437	427	427	426	426	425
Required Safe Supply (ac-ft/yr)	382	269	274	271	269	268	268
Safe Supply Shortage (ac-ft/yr)	281	392	381	381	381	381	380
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Electra - Wichita						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	3,168	3,206	3,240	3,263	3,275	3,283	3,290
Water Demand (ac-ft/yr)	337	575	550	539	531	526	527
Current Supply Lake Electra (ac-ft/yr)	200	195	190	185	180	175	170
Current Supply Seymour Aquifer (ac-ft/yr)	234	234	234	234	234	234	234
Supply - Demand (ac-ft/yr)	97	-146	-126	-120	-117	-117	-123
Required Safe Supply (ac-ft/yr)	404	690	660	647	637	631	632
Safe Supply Shortage (ac-ft/yr)	30	-261	-236	-228	-223	-222	-228
Recommended 2006 Plan Strategy	Conservation, new groundwater wells, purchase water from Wichita Falls (through Iowa Park)						

Water User Group:	Iowa Park - Wichita						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	6,431	6,678	6,900	7,047	7,124	7,178	7,221
Water Demand (ac-ft/yr)	1,232	1,210	1,184	1,176	1,169	1,163	1,170
Current Supply Lk Iowa Park/Lake Gordon (ac-ft/yr)	0	0	0	0	0	0	0
Current Supply NF Buffalo Creek (ac-ft/yr)	232	221	204	187	168	151	141
Current Supply Wichita System (ac-ft/yr)	1,121	1,121	1,121	1,121	1,121	1,121	1,121
Supply - Demand (ac-ft/yr)	121	132	141	132	120	109	92
Required Safe Supply (ac-ft/yr)	1,478	1,452	1,421	1,411	1,403	1,396	1,404
Safe Supply Shortage (ac-ft/yr)	-125	-110	-96	-103	-114	-124	-142
Recommended 2006 Plan Strategy	Increase purchases from Wichita Falls						

Water User Group:	Irrigation - Wichita						
	2000	2010	2020	2030	2040	2050	2060
Population							
Water Demand (ac-ft/yr)	19,556	59,000	58,000	57,000	56,000	55,000	55,000
Current Supply Lk Kemp (ac-ft/yr)	51,374	47,956	42,541	37,109	31,659	26,190	20,638
Current Supply WR #5023(ROR) (ac-ft/yr)	8,850	8,850	8,850	8,850	8,850	8,850	8,850
Current Supply Run-of-river (ac-ft/yr)	325	325	325	325	325	325	325
Current Supply Seymour Aquifer (ac-ft/yr)	1,431	1,431	1,431	1,431	1,431	1,431	1,431
Current Supply Other Aquifer (ac-ft/yr)	179	179	179	179	179	179	179
Supply - Demand (ac-ft/yr)	42,603	-259	-4,674	-9,106	-13,556	-18,025	-23,577
Recommended 2006 Plan Strategy	Increase water conservation elevation at Lake Kemp, Seasonal Pool, Reduce losses in Canal Laterals, Chloride control, Land Stewardship						

Water User Group:	Livestock - Wichita						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)							
Water Demand (ac-ft/yr)	740	740	740	740	740	740	740
Current Supply Seymour Aquifer (ac-ft/yr)	74	74	74	74	74	74	74
Current Supply Stock Ponds (ac-ft/yr)	404	704	704	704	704	704	704
Current Supply Santa Rosa Lake (ac-ft/yr)	300	300	300	300	300	300	300
Supply - Demand (ac-ft/yr)	38	338	338	338	338	338	338
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Manufacturing - Wichita						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)							
Water Demand (ac-ft/yr)	2,292	2,315	2,441	2,558	2,702	2,814	2,814
Current Supply Wichita System (sales from Wichita Falls) (ac-ft/yr)	2,071	2,093	2,214	2,327	2,465	2,572	2,572
Current Supply Wichita System (sales from Burkburnett) (ac-ft/yr)	413	417	439	460	486	507	507
Current Supply North Fork Buffalo (sales from Iowa Park) (ac-ft/yr)	138	139	146	153	162	169	169
Current Supply Seymour Aquifer (ac-ft/yr)	129	129	129	129	129	129	129
Supply - Demand (ac-ft/yr)	458	463	487	511	540	563	563
Required Safe Supply (ac-ft/yr)	2,750	2,778	2,928	3,069	3,242	3,377	3,377
Safe Supply Shortage (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Mining - Wichita						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)							
Water Demand (ac-ft/yr)	29	86	78	70	46	39	39
Current Supply Seymour Aquifer (ac-ft/yr)	29	86	78	70	46	39	39
Current Supply Run-of-River (ac-ft/yr)	0	0	0	0	0	0	0
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Dean Dale WSC - Wichita						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	1,121	1,248	1,362	1,438	1,478	1,506	1,528
Water Demand (ac-ft/yr)	117	134	138	142	145	151	158
Current Supply - Wichita System (ac-ft/yr)	162	170	176	182	191	199	209
Supply - Demand (ac-ft/yr)	45	36	38	40	46	48	51
Required Safe Supply (ac-ft/yr)	140	161	166	170	174	181	190
Safe Supply Shortage (ac-ft/yr)	22	9	10	12	17	18	19
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Steam Electric Power - Wichita						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	262	360	360	360	360	360	360
Current Supply Wichita System (ac-ft/yr)	262	360	360	360	360	360	360
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Wichita Falls - Wichita						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)	104,197	109,663	114,576	117,825	119,525	120,710	121,668
Water Demand (ac-ft/yr)	21,943	23,049	22,015	22,810	22,743	22,700	22,874
Current Supply Wichita System (ac-ft/yr)	27,520	26,440	25,357	24,281	23,187	22,138	21,193
Current Supply Lk Kemp (ac-ft/yr)	10,766	9,672	8,578	7,484	6,389	5,295	4,199
Supply - Demand (ac-ft/yr)	16,343	13,129	12,052	9,153	7,096	5,063	1,810
Required Safe Supply (ac-ft/yr)	26,332	27,659	26,418	27,372	27,292	27,240	27,449
Safe Supply Shortage (ac-ft/yr)	11,955	8,453	7,517	4,393	2,284	193	-2,057
Recommended 2006 Plan Strategy	Conservation, Wastewater Reuse						

Water User Group:	Wichita Valley WSC - Wichita						
	2000	2010	2020	2030	2040	2050	2060
Population (number of persons)	2,764	3,159	3,514	3,749	3,872	3,958	4,027
Water Demand (ac-ft/yr)	186	366	385	378	375	381	386
Current Supply - Wichita System (ac-ft/yr)	584	589	592	592	594	602	608
Current Supply - Sales from Iowa Park (ac-ft/yr)	167	171	173	172	174	178	183
Supply - Demand (ac-ft/yr)	565	394	380	386	393	399	405
Required Safe Supply (ac-ft/yr)	223	439	462	454	450	457	463
Safe Supply Shortage (ac-ft/yr)	361	150	130	138	144	145	145
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	County-Other - Wilbarger						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	3,016	3,140	3,273	3,287	3,221	3,064	2,883
Water Demand (ac-ft/yr)	510	479	486	481	466	440	426
Current Supply Seymour Aquifer Sales from Vernon	280	280	280	280	280	280	280
Current Supply Seymour Aquifer	275	275	275	275	275	275	275
Current Supply Lk Electra	30	30	30	30	30	30	30
Current Supply Greenbelt Reservoir	6	6	6	6	6	6	6
Current Supply Red Run-of-River	115	115	115	115	115	115	115
Supply - Demand (ac-ft/yr)	196	227	220	225	240	266	280
Required Safe Supply (ac-ft/yr)	612	575	583	577	559	528	511
Safe Supply Shortage (ac-ft/yr)	94	131	123	129	147	178	195
Recommended 2006 Plan Strategy	Purchase water from Vernon and nitrate removal						

Water User Group:	Irrigation - Wilbarger						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	28,527	18,499	17,944	17,406	16,884	16,377	16,377
Current Supply Seymour Aq (ac-ft/yr)	26,055	26,055	26,055	26,055	26,055	26,055	26,055
Current Supply Run-of-river (ac-ft/yr)	779	779	779	779	779	779	779
Supply - Demand (ac-ft/yr)	-1,693	8,335	8,890	9,428	9,950	10,457	10,457
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Livestock - Wilbarger						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	1,066	1,797	1,797	1,797	1,797	1,797	1,797
Current Supply Seymour Aquifer (ac-ft/yr)	180	180	180	180	180	180	180
Current Supply Stock Ponds (ac-ft/yr)	959	1,617	1,617	1,617	1,617	1,617	1,617
Supply - Demand (ac-ft/yr)	73	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Manufacturing - Wilbarger						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	841	849	904	971	1,087	1,206	1,206
Current Supply Seymour Aquifer Sales from Vernon	841	849	904	971	1,087	1,206	1,206
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Required Safe Supply (ac-ft/yr)	1,009	1,019	1,085	1,165	1,304	1,447	1,447
Safe Supply Shortage (ac-ft/yr)	-168	-170	-181	-194	-217	-241	-241
Recommended 2006 Plan Strategy	Purchase water from Vernon						

Water User Group:	**Mining - Wilbarger**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	28	23	24	24	24	24	24
Current Supply Seymour Aquifer (ac-ft/yr)	10	10	10	10	10	10	10
Current Supply Beaver Creek (ac-ft/yr)	30	30	30	30	30	30	30
Supply - Demand (ac-ft/yr)	12	17	16	16	16	16	16
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	**Steam Electric Power - Wilbarger**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	8,700	12,000	16,000	20,000	20,000	20,000	20,000
Current Supply Lk Kemp (ac-ft/yr)	20,000	20,000	18,189	15,868	13,547	11,226	8,903
Supply - Demand (ac-ft/yr)	11,300	8,000	2,189	-4,132	-6,453	-8,774	-11,097
Recommended 2006 Plan Strategy	Increase water elevation at Lake Kemp, Seasonal Pool, Chloride control, Reduce losses in Canal Laterals						

Water User Group:	**Vernon - Wilbarger**						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	11,660	12,139	12,655	12,706	12,451	11,844	11,144
Water Demand (ac-ft/yr)	2,795	2,671	2,659	2,627	2,519	2,383	2,229
Current Supply Seymour Aquifer (ac-ft/yr)	2,859	2,851	2,796	2,729	2,613	2,494	2,494
Supply - Demand (ac-ft/yr)	64	180	137	102	94	111	265
Required Safe Supply (ac-ft/yr)	3,354	3,205	3,191	3,152	3,023	2,860	2,675
Safe Supply Shortage (ac-ft/yr)	-495	-354	-395	-423	-410	-366	-181
Recommended 2006 Plan Strategy	Conservation, Develop additional groundwater supplies						

Water User Group:	Olney - Young						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	3,396	3,429	3,504	3,509	3,469	3,418	3,386
Water Demand (ac-ft/yr)	609	707	685	667	647	631	625
Current Supply Wichita System (ac-ft/yr)	273	288	288	288	288	288	288
Current Supply Lk Olney/Cooper (ac-ft/yr)	618	655	655	655	655	655	655
Supply - Demand (ac-ft/yr)	282	236	258	276	296	312	318
Required Safe Supply (ac-ft/yr)	731	848	822	800	776	757	750
Safe Supply Shortage (ac-ft/yr)	160	95	121	143	167	186	193
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	County-Other - Young						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)	558	562	576	579	572	562	556
Water Demand (ac-ft/yr)	127	83	83	83	83	83	83
Current Supply Lk Olney/Cooper (ac-ft/yr)	152	100	100	100	100	100	100
Supply - Demand (ac-ft/yr)	25	17	17	17	17	17	17
Required Safe Supply (ac-ft/yr)	152	100	100	100	100	100	100
Safe Supply Shortage (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Livestock - Young						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	0	320	321	321	321	321	321
Current Supply Stock ponds (ac-ft/yr)	0	321	321	321	321	321	321
Supply - Demand (ac-ft/yr)	0	1	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

Water User Group:	Irrigation - Young County						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Population (number of persons)							
Water Demand (ac-ft/yr)	0	15	15	15	15	15	15
Current Supply Lk Olney/Cooper (ac-ft/yr)	0	15	15	15	15	15	15
Supply - Demand (ac-ft/yr)	0	0	0	0	0	0	0
Recommended 2006 Plan Strategy	None Identified						

APPENDIX B

REGIONAL WATER PLANNING GROUP B

PLAN COMMENTS AND RESPONSES

TWDB COMMENTS

September 28, 2005

RECEIVED
OCT 05 2005
BY:

Mr. Curtis Campbell
Red River Authority
900 Eighth Street, Suite 520
Wichita Falls, TX 76301-6894

Re: Texas Water Development Board Comments for Region B's Regional Water Planning Group Initially Prepared Plan, Contract No. 2002-483-452

Dear Mr. Campbell:

Texas Water Development Board (TWDB) staff completed a review of the Initially Prepared Plan (IPP) submitted June 1, 2005 on behalf of the Region B Regional Water Planning Group. The two sets of attached comments ("A" addresses the IPP, and "B" the electronic database) follow a format similar to those used in developing the prior regional plans, including:

- Level 1: Comments and questions that must be satisfactorily addressed in order to meet statutory, agency rule, and/or contract requirements; and
- Level 2: Comments and suggestions for consideration that may improve the readability and overall understanding of the regional plan.

Also, the TWDB's statutory requirement for review of potential interregional conflict will not be completed until all applicable data and information has been provided by any potentially affected planning group. TWDB's streamflow assessment, based on full implementation of the region's IPP, will be provided under separate cover.

Title 31, Texas Administrative Code (TAC) §357.11(b) requires the regional water planning group to consider timely agency and public comment. Section 357.10(a)(3) of the TAC requires the final adopted plan include summaries of all timely written and oral comments received, along with a response explaining any resulting revisions or why changes are not warranted.

These comments are based on an extensive review by staff with varied expertise and specialties. If you have questions, please contact Temple McKinnon at (512) 475-2057.

Sincerely,

William F. Mullican III
Deputy Executive Administrator
Office of Planning

Attachments

c w/atts.: Mr. Kerry D. Maroney, P.E., Biggs & Mathews, Inc.

Attachment A

Region B Regional Water Plan

LEVEL 1. Comments and questions *must be satisfactorily addressed* in order to meet statutory, agency rule, and/or contract requirements.

<u>Executive Summary</u>

1. Page ES-3, Table ES-2; page 1-5, Table 1-6; page 1-20, Table 1-15 and Attachment 2-1, Table A-5: As with nearly all year 2000 water use amounts in the plan, the 2000 water use amounts included for cities and non-city water utilities are not TWDB approved amounts. Please correct by using the TWDB approved amounts. *[Title 31, Texas Administrative Code (TAC) §357.7(a)(1)(B)]*

USER	COUNTY	RIVER	IPP 2000 Demand	TWDB 2000 Demand
Archer City	Archer	RED	321	232
Holliday	Archer	RED	240	245
Lakeside City	Archer	RED	159	125
Seymour	Baylor	BRAZOS	692	554
Byers	Clay	RED	85	69
Henrietta	Clay	RED	732	526
Petrolia	Clay	RED	96	93
Paducah	Cottle	RED	343	247
Crowell	Foard	RED	293	250
Chillicothe	Hardeman	RED	124	151
Quanah	Hardeman	RED	580	565
Guthrie	King	RED	77	N/A
Bowie	Montague	TRINITY	1,063	824
Montague	Montague	RED	55	N/A
Nocona	Montague	RED	703	484
Saint Jo	Montague	TRINITY	110	210
Burkburnett	Wichita	RED	1,849	1,273
Electra	Wichita	RED	598	337
Iowa Park	Wichita	RED	1,250	1,232
Wichita Falls	Wichita	RED	23,053	21,942
Vernon	Wilbarger	RED	2,697	2,795
Olney	Young	BRAZOS	737	609
Windthorst WSC	Archer	RED	233	351
Wichita Valley	Archer	RED	206	184

WSC				
Dean Dale WSC	Clay	RED	275	217
Wichita Valley WSC	Wichita	RED	485	186
Dean Dale WSC	Wichita	RED	69	117

2. Page ES-5, Table ES-4; page 2-4, Table 2-2; and page 2-5. Figure 2-3: The year 2000 water use amounts for the six major categories of water use in the region do not match the TWDB approved water use estimates. In addition, the total municipal demand projections and the total demand projections differ from the TWDB approved numbers. Please correct by using the TWDB approved estimates, as follows. *[Title 31, TAC §357.7(a)(1)(B)]*

Water Use Category	As Presented in Table 2-2 and Figure 2-3	TWDB Water Use Estimates, Year 2000
MFG	3,266	3,162
PWR	9,460	9,841
MIN	1,176	1,190
IRR	102,121	66,504
STK	12,489	10,464
MUN	41,255	37,422
TOTAL	169,767	169,572

•Municipal Demand Projections (Table ES-4, Table 2-2 and Figure 2-3)

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	41,255	40,965	39,659	40,200	39,667	38,963	38,695
TWDB	37,422	40,964	39,655	40,196	39,664	38,962	38,696

•Total Demand Projections (Table ES-4 and Table 2-2)

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	169,767	171,165	171,810	174,365	171,961	169,420	169,152
TWDB	128,583	171,164	171,806	174,361	171,958	169,419	169,153

Chapter 1: Description of the Region

1. Page 1-16, paragraph 1: The year 2000 steam-electric power generation use is cited as 9,460 acre-feet. The TWDB approved estimated amount is 9,841 acre-feet. Please revise. *[Title 31, TAC §357.7(a)(1)(B)]*

2. Page 1-19, Figure 5: The year 2000 water use is illustrated in the chart as being greater than

160,000 acre-feet. The TWDB approved estimated amount is 128,583. Please revise. *[Title 31, TAC §357.7(a)(1)(B)]*

Chapter 2: Population and Water Use Projections

3. Page 2-1, paragraph 2: The per-capita municipal water use in the year 2000 is cited as being 182 gpcd. The correct figure is 165 gpcd (population = 201,970, municipal water use = 37,422 acre-feet). Please use correctly calculated gpcd of 165. *[Title 31, TAC §357.7(a)(1)(B)]*

4. Page 2-6, paragraph 2 and page 2-7, Figure 2-4: The year 2000 municipal water use is cited as 41,255 acre-feet; the TWDB approved amount for that year is 37,422 acre-feet. The year 2060 municipal water demand is cited as 38,695 acre-feet; the approved demand projection is 38,696. Please revise. *[Title 31, TAC §357.7(a)(1)(B)]*

5. Page 2-8, paragraph 2: The year 2000 manufacturing water use is cited as 3,266 acre-feet; the TWDB approved estimate for that year is 3,162 acre-feet. Please revise. *[Title 31, TAC §357.7(a)(1)(B)]*

6. Page 2-9, Table 2-3: The year 2000 manufacturing water use is cited as 3,266 acre-feet and not the TWDB approved estimate for that year which is 3,162 acre-feet. The year 2000 steam-electric power (PWR) water use is cited as 9,460 acre-feet and not the TWDB approved estimate for that year which is 9,841 acre-feet. The year 2000 mining water use is cited as 1,176 acre-feet and not the TWDB approved estimate for that year which is 1,190 acre-feet. Please revise. *[Title 31, TAC §357.7(a)(1)(B)]*

7. Page 2-9, paragraph 1: The year 2000 steam-electric power generation water use is cited as 9,460 acre-feet and not the TWDB approved estimate for that year which is 9,841 acre-feet. Please revise. *[Title 31, TAC §357.7(a)(1)(B)]*

8. Page 2-10, paragraph 2: The year 2000 mining water use is cited as 1,176 acre-feet and not the TWDB approved estimate for that year which is 1,190 acre-feet. Please revise. *[Title 31, TAC §357.7(a)(1)(B)]*

9. Page 2-11, paragraph 1, Figure 2-6 and Table 2-4: The year 2000 irrigation water use is cited and illustrated as 102,121 acre-feet and not the TWDB approved estimate for that year which is 66,504 acre-feet. The year 2000 livestock (STK) water use is cited and illustrated as 12,489 acre-feet and not the TWDB approved estimate for that year which is 10,464 acre-feet. Please revise. *[Title 31, TAC §357.7(a)(1)(B)]*

Attachment 2-1

10. Table A-2 and Table A-3: The population projections for several non-city water utilities are different than the TWDB approved Water User Group projections. The Windthorst WSC is missing from Clay County although a population was approved for the Water User Group. Please revise by using the TWDB approved population projections for the applicable Water Supply

Corporations, as follows. *[Title 31, TAC §357.5(d)(1)&(2)]*

•Windthorst WSC, Archer County, Red River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	1,040	1,050	1,192	1,200	1,200	1,200	1,175
TWDB	1,157	1,266	1,378	1,468	1,496	1,444	1,392

•Wichita Valley WSC, Archer County, Red River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	1,328	1,373	1,634	1,650	1,660	1,660	1,600
TWDB	2,736	2,994	3,258	3,472	3,538	3,416	3,291

•Dean Dale WSC, Clay County, Red River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	1,919	2,116	2,245	2,300	2,300	2,300	2,300
TWDB	2,081	2,151	2,212	2,199	2,108	1,978	1,849

•Windthorst WSC, Clay County, Red River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	-	-	-	-	-	-	-
TWDB	220	227	234	232	223	209	195

•Wichita Valley WSC, Wichita County, Red River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	3,072	3,227	3,416	3,461	3,461	3,461	3,461
TWDB	2,764	3,159	3,514	3,749	3,872	3,958	4,027

•Dean Dale WSC, Wichita County, Red River Basin

Source	P2000	P2010	P2020	P2030	P2040	P2050	P2060
IPP	531	529	561	575	575	575	575
TWDB	1,121	1,248	1,362	1,438	1,478	1,506	1,528

11. Table A-6 and Table A-7: The water demand projections for several non-city water utilities are different than the approved Water User Group projections. The Windthorst WSC is missing from Clay County although a water demand was approved for the Water User Group. Please revise by using the TWDB approved water demand projections for the applicable Water Supply Corporations as follows. *[Title 31, TAC §357.5(d)(1)&(2)]*

•Windthorst WSC, Archer County, Red River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	233	234	240	235	232	228	223
TWDB	351	198	205	203	202	199	196

•Wichita Valley WSC, Archer County, Red River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	206	206	232	228	225	223	215
TWDB	184	347	356	351	343	329	316

•Dean Dale WSC, Clay County, Red River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	275	288	290	288	280	280	280
TWDB	217	230	224	218	206	199	192

•Windthorst WSC, Clay County, Red River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	-	-	-	-	-	-	-
TWDB	67	36	35	32	30	29	27

•Wichita Valley WSC, Wichita County, Red River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	485	507	509	501	493	487	487
TWDB	186	366	385	378	375	381	386

•Dean Dale WSC, Wichita County, Red River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	69	76	72	72	71	70	70
TWDB	117	134	138	142	145	151	158

12. Table A-7: "Wichita Co. Other" is missing from this table although it was in the population table several pages earlier (Table A-3). Please include data on "Wichita Co. Other" in Table A-7. *[Title 31, TAC §357.5(d)(1)&(2), §357.7(a)(1)(B)]*

13. Table A-8 and A-9: In Table A-8 and A-9, a number of the water use category totals have incorrect year 2000 water use estimates. Some of the differences appear to be due to a shift of water-use amounts between river basins. While this shifting of use and demand amounts between basins within a single county can be done within the currently approved TWDB projections, TWDB staff should be notified of the region's desire to shift use/demand so that changes can be made in the DB07 online database. Please revise, or coordinate with TWDB staff and provide relevant data in a tabular, electronic format to ensure that the plan is consistent with the online database. *[Title 31, TAC §357.5(d)(1)&(2), §357.7(a)(1)(B)]*

County	River Basin	Data Category	Table A-8 and A-9 2000 Water Use	TWDB 2000 Water Use
ARCHER	RED	IRR	3,600	1,971
ARCHER	BRAZOS	STK	136	129
BAYLOR	RED	IRR	205	213
BAYLOR	BRAZOS	MIN	32	39
BAYLOR	BRAZOS	IRR	502	523

CLAY	RED	IRR	4,000	1,993
FOARD	RED	MIN	23	22
FOARD	RED	IRR	4,978	3,889
FOARD	RED	STK	289	279
HARDEMAN	RED	MFG	347	23
HARDEMAN	RED	PWR	1,000	879
HARDEMAN	RED	MIN	3	111
HARDEMAN	RED	IRR	4,999	5,330
MONTAGUE	RED	MFG	7	6
MONTAGUE	RED	IRR	59	12
MONTAGUE	TRINITY	IRR	238	48
WICHITA	RED	MFG	2,172	2,292
WICHITA	RED	PWR	360	262
WICHITA	RED	MIN	134	29
WICHITA	RED	IRR	60,000	19,556
WILBARGER	RED	MFG	740	841
WILBARGER	RED	PWR	8,100	8,700
WILBARGER	RED	MIN	24	28
WILBARGER	RED	IRR	19,071	28,527
WILBARGER	RED	STK	1,797	1,066
YOUNG	BRAZOS	IRR	10	0
YOUNG	BRAZOS	STK	300	0
YOUNG	TRINITY	IRR	5	0
YOUNG	TRINITY	STK	20	0

14. **Table A-8 and A-9:** In Table A-8 and A-9, a number of the water demand category totals have incorrect water demand projections. Some of the differences appear to be due to a shift of demand amounts between river basins. While this shifting of demand amounts between basins but within a single county can be done within the current TWDB approval, TWDB staff should be notified of the region's desire to shift use/demand so that changes can be made in the DB07 online database. Please revise, or coordinate with TWDB staff and provide relevant data in a tabular, electronic format to ensure that the plan is consistent with the online database. *[Title 31, TAC §357.5(d)(1)&(2), §357.7(a)(1)(B)]*

•Livestock, Archer County, Red River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	2,279	2,279	2,279	2,279	2,279	2,279	2,279
TWDB	2,165	2,277	2,277	2,277	2,277	2,277	2,277

•Livestock, Archer County, Trinity Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	296	296	296	296	296	296	296
TWDB	284	298	298	298	298	298	298

•Livestock, Baylor County, Brazos Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	357	357	357	357	357	357	357
TWDB	370	353	353	353	353	353	353

•Livestock, Baylor County, Red River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	596	596	596	596	596	596	596
TWDB	629	600	600	600	600	600	600

•Livestock, Clay County, Red River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	1,951	1,951	1,951	1,951	1,951	1,951	1,951
TWDB	1,741	1,972	1,972	1,972	1,972	1,972	1,972

•Livestock, Clay County, Trinity River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	240	240	240	240	240	240	240
TWDB	194	219	219	219	219	219	219

•Mining, Clay County, Red River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	304	219	195	181	177	177	177
TWDB	306	219	195	180	176	176	176

•Mining, Clay County, Trinity River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	4	3	3	3	3	3	3
TWDB	4	3	3	4	4	4	4

•Livestock, King County, Brazos River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	283	283	283	283	283	283	283
TWDB	143	285	285	285	285	285	285

•Livestock, King County, Red River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	488	488	488	488	488	488	488
TWDB	244	486	486	486	486	486	486

•Livestock, Montague County, Red River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	1,057	1,057	1,057	1,057	1,057	1,057	1,057
TWDB	856	1,054	1,054	1,054	1,054	1,054	1,054

•Livestock, Montague County, Trinity River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	793	793	793	793	793	793	793
TWDB	645	796	796	796	796	796	796

•Mining, Montague County, Red River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	609	489	467	461	467	480	480
TWDB	609	491	467	459	463	476	476

•Mining, Montague County, Trinity River Basin

Source	2000	D2010	D2020	D2030	D2040	D2050	D2060
IPP	18	16	14	12	10	10	10
TWDB	18	14	14	14	14	14	14

Chapter 3: Evaluation of Current Water Supplies

15. The plan needs to verify that the regional water plan protects water contracts, option agreements or special water resources. [*Title 31, TAC §357.5(e)(3)*]

16. Provide information on the effects of the plan on navigation. *[Title 31, TAC §357.5(e)(8)]*

17. Please provide the following information:
    a. list of reservoirs with storage capacity updated to 2000 and 2060 conditions
    b. version of WAM used to calculate the firm yield of Lake Amon G Carter

18. Include Wholesale Water Provider (City of Wichita Falls) allocations by category of use and by county and river basin, and demands and contractual obligations to Table 3-14. *[Title 31, TAC §357.7(a)(3)(B)]*

19. Page 3-22, Table 3-8 or 3-11: Table 3-13 lists 1,379 acre feet per year from 2010 to 2060 for groundwater availability in Young County, but does not indicate where the supply is from. Provide the source of this water. *[Contract Exhibit "B," Section 3.2.2]*

Chapter 4: Identification, Evaluation and Selection of Water Management Strategies

20. Provide a quantification of environmental impacts of all water management strategies evaluated in the planning process, including: pipeline construction to provide water supply to areas of water need; increasing the conservation pool elevation of Lake Kemp (page 4-42 and 43); and strategies involving construction of a nitrate removal treatment plant (i.e., Charlie Water Supply Corporation, page 4-17; and Hinds-Wildcat and Lockett Water Systems, page 4-38). Quantified environmental impact of strategies in text should correspond to quantification provided in Attachment 4-1. *[Title 31, TAC §357.7(a)(8)(A)(ii) and Contract Exhibit "B," 4.2.8. c]]*

21. Document adjustments to water management strategies for appropriate environmental flow needs including increasing the conservation pool elevation of Lake Kemp and Lake Ringgold. *[Title 31, TAC §357.5(e)(1), §357.5(l)]*

22. Document that irrigation water conservation strategies were considered for all irrigation needs. *[Title 31, TAC §357.7(a)(7(A)]*

23. Report costs of water management strategies evaluated in discounted present value using guidance in *Contract Exhibit "B," Section 4.2.9.*

24. Pages 4-27 through 4-38: Report the impacts to agricultural and natural resources for the water management strategy evaluations for Byers, Lakeside City, and Wichita Falls. *[Title 31, TAC §357.7(a)(8)(A)(iii)]*

<u>Attachment 4-2</u>

25. Pages 1-25, Detailed Cost Estimates: Based on the information as presented, it is not clear if all required project costs have been determined including power cost estimates and pumping plants or booster pumps were included in development of cost estimates of water management strategies. Please ensure and verify if all required costs were included in the appropriate estimates. *[Contract Exhibit "B," Section 4.2.9]*

<u>Attachment 4-4</u>

26. Improvements to the security of the canal system are not directly addressed and the potential amount of water saved by each technical strategy is not explicitly quantified. Please further discuss improvements to the canal system and quantify water savings as stated in the scope of work. *[Contract Scope of Work, Task 4SF.10, and Title 31, TAC §357.5(e)(4)&(5)]*

27. The canal environmental study does not include prepared GIS maps of the canal system with information on soils, geology, hydrology, and land use as stated in the scope of work. Please include in the report. *[Contract Scope of Work, Item-10]*

28. Please provide estimates of water saved and implementation costs of all water conservation water management strategies. *[Title 31, TAC §357.7(a)(8)(i)]*

29. It is not evident that alternative strategies for implementing the preferred technical alternatives were identified in the environmental study of Attachment 4-4 and in the subsequent water management strategy development in Chapter 4. The scope of work also stated that funding sources were to be identified and these are not apparent. Provide this information. *[Contract Scope of Work, Task-16]*

30. Provide the results of investigating seasonal changes in water. *[Contract Scope of Work, Tasks-28]*

31. Provide a description of the process used to identify potentially feasible water management strategies approved by the planning group. *[Title 31, TAC §357.5(e)(4)]*

Appendix A

32. Year 2000 supplies presented in the WUG summaries in Appendix A do not match data presented in the DB07, the online database. Please reconcile this data so that data in the plan is consistent with information in the database. *[Title 31, TAC §357.7(a)(3)(A)(i)&(ii)]*

33. Archer Co-Other supplies for the Brazos and Trinity basins appear switched in DB07 and plan text. Montague Co-Other and Mining supplies are not split by basin in the text of Appendix A. Please reconcile this data so that data in the plan is consistent with information in the database. *[Title 31, TAC §357.7(a)(3)(A)(iv)]*

34. DB07: The supplies and needs for Dean Dale WSC in Clay County do not match those entered into DB07. Please reconcile this data so that data in the plan is consistent with information in the database. *[Title 31, TAC §357.7(a)(4)(A)(ii)]*

LEVEL 2—Comments and suggestions to be considered to clarify or help enhance the plan.

Executive Summary

35. Page ES-3, Tables ES-1 and 1-1: Include Young County in the summary tables.

36. Page ES-22: Clarify what constituent is discussed in the last recommendation on the page. (It is assumed to be nitrate.)

37. Page ES-5, paragraph 1 and Chapter 2, page 2-3, paragraph 2: The final sentence on the page states that one acre foot of water equals 325,829 gallons. The correct number of gallons in one acre foot of water is 325,851.

38. Page ES-6, Table ES-5; ES-9, Table ES-6, Table ES-7; ES-10, Table ES-8, Table ES-9; ES-21, Table ES-14: Consider adding units "(acre-feet per year)" in the title of the tables.

Chapter 1: Description of the Region

39. Page 1-28, Table 1-15 and Attachment 2-1, Table A-6, A-7, A-8, and A-9: The quantitative column in Table 1-15 is labeled "2000 DEMAND AF/YR". The term "demand" has generally been used in the state and regional water plans to indicate an estimated future water use. Historical usage would be described as "2000 WATER USE AF/YR". Suggest changing the column title to differentiate the table and figures from those in the 2001 Region B Water Plan (also entitled Table 1-15).

40. Page 1-28, Table 1-15 and Attachment 2-1, Tables A-2, A-3, A-6 and A-7, Red River Authority Systems: Eleven of the systems listed in Table 1-15 are part of the Red River Authority and are designated with the suffix WSD, indicating the status of a Water Supply District. These systems are not districts, but rather Public Water Systems (PWS) owned by the Red River Authority. Consider using the official Public Water System's official name on file at the Texas Commission on Environmental Quality (TCEQ) or in some way indicating the ownership by the Red River Authority. This will allow users of the plan to link systems listed in the plan with TCEQ records.

Table 1-15 Name	PWS Name From TCEQ
Arrowhead Lake WSD	Arrowhead Lake Lots Water System
Arrowhead Ranch WSD	Lake Arrowhead Ranch Estates **(Note: designated as Inactive by TCEQ)**
Foard Co. WSD	Foard County Extension
Goodlett WSD	RRA Goodlett Water System
Medicine Mound WSD	RRA Medicine Mound Water System
Quanah NE WSD	RRA Northeast Quanah Water System
S Quanah WSD	RRA South Quanah Original Water System
Ringgold WSC	RRA Ringgold WSC
Box Com. WSD	RRA Box Community Water System
Farmers Valley WSD	RRA Farmers Valley Water System
Hinds Com. WSD	RRA Hinds Wildcat Water System
Lockett WSD	RRA Lockett Water System

41. Page 1-28, Table 1-15 and Attachment 2-1, Tables A-2, A-3, A-6 and A-7, Montague Water Systems: Listed in Montague County are three water systems: Montague WSC, Oak Shores WSC, and Sunset WSC. The WSC suffix indicates that these are Water Supply Corporations. This is incorrect. Each of these is a separate Public Water System owned by the investor-owned utility, Montague Water Systems (CCN # - 11779). Consider changing the name to the Public Water System (PWS) name on file with the Texas Commission on Environmental Quality (TCEQ).

Table 1-15 Name	PWS Name From TCEQ
Montague WSC	Montague Water System
Oak Shores WSC	Oak Shores Water System
Sunset WSC	Sunset Water System

42. Page 1-28, Table 1-15 and Attachment 2-1, Tables A-2, A-3, A-6 and A-7, Additional Water Systems and Communities – As mentioned in two previous comments, it is suggested that the names of some of the small water systems be changed to more accurately reflect their organization and to allow better reference to Texas Commission on Environmental Quality records as follows:

•Margaret WSD (Foard County, Red River Basin) – is not a Water Supply District, but rather refers to the unincorporated community of Margaret in north central Foard County. The area does border the Thalia WSC, so any service to community members by the WSC should be noted.

•Dumont WSD (King County, Red River Basin) – is not a Water Supply District, but rather

refers to the unincorporated community of Dumont in the northwestern corner of King County.
•Horseshoe Bend WSC (Wichita County, Red River Basin) – is not a Water Supply Corporation but rather a Public Water System (CCN # - 11672, PWS # - 2430013) entitled "Horseshoe Bend Estates Homeowners Association".
•Odell WSC (Wilbarger County, Red River Basin) – is not a Water Supply Corporation, but rather refers to the unincorporated community of Odell in extreme northwestern Wilbarger County.

Table 1-15 Name	Suggested Name
Margaret WSD	Community of Margaret
Dumont WSD	Community of Dumont
Horseshoe Bend WSC	Horseshoe Bend Estates HOA
Odell WSC	Community of Odell

43. Page 1-23, paragraph 4, sentence 3: Consider referencing "Game fish present in the study area," instead of "Fish species present in the study area" as only game species listed while other fish species are present in the region.

Chapter 2: Population and Water Use Projections

44. Page 2-12, Table 2-5: The first column in the table is entitled "WUGS". Three of the customers of the City of Wichita Falls are not Water User Groups: Scotland, Red River Authority, and Friberg-Cooper WSC. Consider revising the column heading to "Customers" or something similar in order to avoid confusion.

Attachment 2-1 (No Page Numbers)

45. Tables A2, A3, A6 and A7: Please use the TWDB term of 'County-Other' in a manner consistent with other regional water plans and the state water plan. Other terms may be more descriptive when describing areas or populations, such as "unincorporated portion of the county" (953 acre-feet) or "non-system areas" (74 acre-feet). It is very difficult to determine which 'county-other' the plan refers to in later tables, such as Table 4-2 – "Projected Water Shortages for Water User Groups.

Chapter 3: Evaluation of Current Water Supplies

46. Page 3-22, last sentence of the first paragraph: Reconsider statement that "storage values in an unconfined aquifer may be less than storage values of a confined aquifer" considering that Kruseman and de Ridder (1991), among others, state that storage in confined aquifers range from 5E-3 to 5E-5 while storage in an unconfined aquifer normally range from 0.01 to 0.30 (Kruseman, G. P., and de Ridder, N. A., 1991, Analysis and evaluation of pumping test data: International Institute for Land Reclamation and Improvement, Wageningen, Netherlands, publication 47, p. 23).

Chapter 4: Identification, Evaluation and Selection of Water Management Strategies

47. Pages 4-18 and 4-19, Tables 4-9, 4-10-, 4-11 include the data for conservation strategies for individual WUGs. Given that the data has wide variations in the total cost and cost per 1,000 gallons for the strategies utilized, consider providing the details of this analysis, including an analysis for the combination of listed practices (page 4-17) utilized and the resulting aggregated costs of conservation strategies, for each WUG listed. This analysis could be included in Attachment 4-2 along with analysis of other strategies.

    Page 4-18, Table 4-9 and Executive Summary, Page ES-15, Table ES-12:. Ensure that water conservation strategies do not double count the conservation savings implicit in the demands carried over from the 2001 Region B Water Plan.

48. Page 4-28: The City of Electra presently uses a reverse osmosis system to remove nitrate from groundwater. To be consistent with the other write-ups, such as the City of Vernon, consider including this information.

49. Page 4-32, paragraph 5: This paragraph mentions that the maximum supply shortage for the City of Vernon will be 423 acre-feet per year and the safe supply shortage for manufacturing. Then it goes on to state that the total new supply needed is 600 acre-feet per year. The 423 acre-feet cited is from Table 4-3, page 4-5. Consider clarifying the basis for the 600 acre-feet.

50. Page 4-42, paragraph 2: The second sentence in this paragraph states "If the conservation elevation was increased to elevation 1145.5 MSL to compensate for sediment accumulation through year 2000, the supply yield would increase by 15,700 acre-feet per year in 2060." The yield estimate cited is based on year 2000 sediment accumulation. Since additional sediment accumulations will occur by year 2060, it would appear that the increase in yield of 15,700 acre-feet might be questionable for year 2060 conditions. Consider addressing how additional sedimentation would be addressed.

General

51. Table of Contents: Consider referencing the occurrence of tables and figures in the report.

52. In the references section, the links for the Railroad Commission oil and gas data are to the September 2002 data, but the data used are from February 2005. Please consider updating the links.

Attachment B
Region B
DB07-Specific Comments

LEVEL 1. Comments and questions must be satisfactorily addressed in order to meet statutory, agency rule, and/or contract requirements.

REGION-WIDE

Comment: No sources show entry of the methodologies used to determine water availability. Action required- Enter the methodologies used to determine water availabilty for each source in the Sources Module, Methodology Field.

[Contract, Exhibit "B," Section 3.3.1, page 22-23 and page 24]

SOURCES MODULE

Comment: Source requires entry of water right information. Action required- Enter water right information for the following.

[Contract, Exhibit "B," Sections 3.3, page 20 and 3.3.1, page 22]

	DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
1.	3974	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	ARCHER	RED	3402560
			Location on Interface: SOURCE MODULE			
2.	3975	B	BRAZOS RIVER COMBINED RUN-OF-RIVER IRRIGATION	BAYLOR	BRAZOS	3412810
			Location on Interface: SOURCE MODULE			
3.	3973	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	CLAY	RED	3402550
			Location on Interface: SOURCE MODULE			
4.	45	B	RED RIVER COMBINED RUN-OF-RIVER MINING	CLAY	RED	3402720
			Location on Interface: SOURCE MODULE			
5.	49	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	COTTLE	RED	3402500
			Location on Interface: SOURCE MODULE			
6.	3972	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	HARDEMAN	RED	3402540
			Location on Interface: SOURCE MODULE			
7.	55	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	MONTAGUE	RED	3402510
			Location on Interface: SOURCE MODULE			
8.	74	B	TRINITY RIVER COMBINED RUN-OF-RIVER IRRIGATION	MONTAGUE	TRINITY	3408710

Location on Interface: SOURCE MODULE

9.	3984	B	RED RIVER COMBINED RUN-OF-RIVER IOWA PARK/GORDON	WICHITA	RED	3402010
	Location on Interface: SOURCE MODULE					
10.	3971	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	WICHITA	RED	3402530
	Location on Interface: SOURCE MODULE					
11.	3970	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	WILBARGER	RED	3402520
	Location on Interface: SOURCE MODULE					
12.	3977	B	RED RIVER COMBINED RUN-OF-RIVER MUNICIPAL	WILBARGER	RED	3402570
	Location on Interface: SOURCE MODULE					

Comment: Source availability is overallocated. Action required- Adjust current or future WUG Supply amounts for the following sources so that the sum is equal to or less than the Total Available Supply Volume.

[Contract, Exhibit "B," Section 3.2.1, page 15-16]

	DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
1.	999	B	OTHER AQUIFER	MONTAGUE	RED	16922
	Location on Interface: EDIT SOURCE PAGE- TOTAL AVAILABILE SUPPLY 2010 - 2060					

Comment: For "Other Aquifer" sources, please include the name(s) of the actual aquifer source(s) in the Regional Comments Field. Action required- Enter the name(s) of the actual aquifer source(s) in the Regional Comments Field for the following.

[Contract, Exhibit "B," Section 4.3.2, page 60]

	DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
1.	1007	B	OTHER AQUIFER	ARCHER	BRAZOS	00522
	Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS					
2.	985	B	OTHER AQUIFER	ARCHER	RED	00522
	Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS					
3.	1003	B	OTHER AQUIFER	ARCHER	TRINITY	00522
	Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS					
4.	988	B	OTHER AQUIFER	CLAY	RED	03922
	Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS					
5.	1004	B	OTHER AQUIFER	CLAY	TRINITY	03922
	Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS					
6.	989	B	OTHER AQUIFER	COTTLE	RED	05122
	Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS					
7.	1009	B	OTHER AQUIFER	KING	BRAZOS	13522
	Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS					

8.	997	B	OTHER AQUIFER	KING	RED	13522

Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS

9.	999	B	OTHER AQUIFER	MONTAGUE	RED	16922

Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS

10.	1006	B	OTHER AQUIFER	MONTAGUE	TRINITY	16922

Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS

11.	1001	B	OTHER AQUIFER	WICHITA	RED	24322

Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS

Comment: Total Available Supply 2010-2060 requires data values; data values missing. Action required- Please review to verify that Total Available Supply Volumes are zero for 2010-2060 or correct as necessary.

[Contract, Exhibit "B," Sections 2.2, page 13 and 3.3.1, page 22-23]

	DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
1.	74	B	TRINITY RIVER COMBINED RUN-OF-RIVER IRRIGATION	MONTAGUE	TRINITY	3408710

Location on Interface: EDIT SOURCE PAGE- TOTAL AVAILABILE SUPPLY 2010 - 2060

Comment: System-type sources require entry of the reservoir components and individual firm yields, along with any system gain achieved, in the Regional Comments Field. Action required: Enter the reservoir components and individual firm yields, along with any system gain achieved, in the Regional Comments Field for the following.

[Contract, Exhibit "B," Section 3.3.2, page 24]

	DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
1.	68	B	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	020D0

Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS

2.	65	B	OLNEY-COOPER SYSTEM	RESERVOIR	RED	020B0

Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS

3.	67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: EDIT SOURCE PAGE- REGIONAL COMMENTS

Comment: The County and Basin of the Source does not match the County and Basin listed in the TCEQ water rights database. Action required- Please review and correct as necessary.

[Contract, Exhibit "B," Section 2.2, page 13]

	DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	SHARE REGION
1.	46	B	LITTLE WICHITA RIVER RUN-OF-RIVER	CLAY	RED	3410205152 A	B

Location on Interface: SOURCE MODULE

WUG MODULE

Comment: WUG shows unmet needs. Action required- Please review to confirm.

[Contract, Exhibit "B," Section 4.2.6, page 43]

	DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
1.	208	B	STEAM ELECTRIC POWER	WILBARGER	RED	02100224 4

Location on Interface: WUG MODULE

Comment: Limiting Factor 2010-2060 requires data values; data values missing. Action Required- Enter codes for Limiting Factors for 2010-2060 for the following.

[Contract, Exhibit "B," Sections 2.2, page 13 and 4.3.2, page 62]

	DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
1.	187	B	COUNTY-OTHER	ARCHER	BRAZOS	02075700 5
	DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
	1007	B	OTHER AQUIFER	ARCHER	BRAZOS	00522

Location on Interface: EDIT WUG SUPPLY PAGE- LIMITING FACTOR 2010 - 2060

	DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
2.	165	B	BYERS	CLAY	RED	02083600 0
	DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
	67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: EDIT WUG SUPPLY PAGE- LIMITING FACTOR 2010 - 2060

	DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
3.	177	B	PADUCAH	COTTLE	RED	02044700 0
	DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
	989	B	OTHER AQUIFER	COTTLE	RED	05122

Location on Interface: EDIT WUG SUPPLY PAGE- LIMITING FACTOR 2010 - 2060

	DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
4.	214	B	MINING	HARDEMAN	RED	02100309 9
	DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
	3992	B	OTHER LOCAL SUPPLY	HARDEMAN	RED	99902099

Location on Interface: EDIT WUG SUPPLY PAGE- LIMITING FACTOR 2010 - 2060

5.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
215	B	MINING	MONTAGUE	RED	021003169
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
998	B	TRINITY AQUIFER	MONTAGUE	RED	16928

Location on Interface: EDIT WUG SUPPLY PAGE- LIMITING FACTOR 2010 - 2060

6.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
228	B	IRRIGATION	MONTAGUE	TRINITY	021004169
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
74	B	TRINITY RIVER COMBINED RUN-OF-RIVER IRRIGATION	MONTAGUE	TRINITY	3408710

Location on Interface: EDIT WUG SUPPLY PAGE- LIMITING FACTOR 2010 - 2060

7.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
216	B	MINING	MONTAGUE	TRINITY	021003169
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
75	B	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	08020

Location on Interface: EDIT WUG SUPPLY PAGE- LIMITING FACTOR 2010 - 2060

8.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
3838	B	IRRIGATION	YOUNG	BRAZOS	021004252
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
65	B	OLNEY-COOPER SYSTEM	RESERVOIR	RED	020B0

Location on Interface: EDIT WUG SUPPLY PAGE- LIMITING FACTOR 2010 - 2060

9.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
3837	B	IRRIGATION	YOUNG	TRINITY	021004252
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
65	B	OLNEY-COOPER SYSTEM	RESERVOIR	RED	020B0

Location on Interface: EDIT WUG SUPPLY PAGE- LIMITING FACTOR 2010 - 2060

Comment: For each WUG Supply Source, when the most restrictive limiting factor is reported as code "J", entry of the explicit limitations should be listed in the Regional Comments Field. Action required- Enter or clarify the explicit limitations on each WUG Supply in the Regional Comments Field.

[Contract, Exhibit "B," Section 4.3.2, page 62]

1.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
233	B	LIVESTOCK	ARCHER	BRAZOS	021005005
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
76	B	LIVESTOCK LOCAL SUPPLY	ARCHER	BRAZOS	99712005

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

2.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
162	B	ARCHER CITY	ARCHER	RED	020024000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

3.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
171	B	HOLLIDAY	ARCHER	RED	020280000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

4.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
231	B	LIVESTOCK	ARCHER	RED	021005005
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
43	B	LIVESTOCK LOCAL SUPPLY	ARCHER	RED	99702005

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

5.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
232	B	LIVESTOCK	ARCHER	TRINITY	021005005
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
71	B	LIVESTOCK LOCAL SUPPLY	ARCHER	TRINITY	99708005

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

6.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
235	B	LIVESTOCK	BAYLOR	BRAZOS	021005012
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
77	B	LIVESTOCK LOCAL SUPPLY	BAYLOR	BRAZOS	99712012

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

7.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
234	B	LIVESTOCK	BAYLOR	RED	021005012
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
44	B	LIVESTOCK LOCAL SUPPLY	BAYLOR	RED	99702012

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

8.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
190	B	COUNTY-OTHER	CLAY	RED	020757039
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

9.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
238	B	LIVESTOCK	COTTLE	RED	021005051
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
50	B	LIVESTOCK LOCAL SUPPLY	COTTLE	RED	99702051

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

10.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
193	B	COUNTY-OTHER	FOARD	RED	020757078
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
41	A	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	02050

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

11.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
239	B	LIVESTOCK	FOARD	RED	021005078
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
51	B	LIVESTOCK LOCAL SUPPLY	FOARD	RED	99702078

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

12.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
240	B	LIVESTOCK	HARDEMAN	RED	021005099
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
52	B	LIVESTOCK LOCAL SUPPLY	HARDEMAN	RED	99702099

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

13.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
201	B	MANUFACTURING	HARDEMAN	RED	021001099
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
41	A	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	02050

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

14.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
242	B	LIVESTOCK	KING	BRAZOS	021005135
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
78	B	LIVESTOCK LOCAL SUPPLY	KING	BRAZOS	99712135

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

15.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
195	B	COUNTY-OTHER	KING	RED	020757135
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
1780	O	OTHER AQUIFER	DICKENS	RED	06322

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

16.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
241	B	LIVESTOCK	KING	RED	021005135
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
54	B	LIVESTOCK LOCAL SUPPLY	KING	RED	99702135

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

17.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
202	B	MANUFACTURING	MONTAGUE	RED	021001169
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
64	B	FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	02210

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

18.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
245	B	LIVESTOCK	WICHITA	RED	021005243
DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
58	B	LIVESTOCK LOCAL SUPPLY	WICHITA	RED	99702243

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

19.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
3840	B	LIVESTOCK	YOUNG	BRAZOS	021005252
DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
3946	B	LIVESTOCK LOCAL SUPPLY	YOUNG	BRAZOS	99712252

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

20.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
176	B	OLNEY	YOUNG	BRAZOS	020441000
DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

21.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
3839	B	LIVESTOCK	YOUNG	TRINITY	021005252
DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
3947	B	LIVESTOCK LOCAL SUPPLY	YOUNG	TRINITY	99708252

Location on Interface: EDIT WUG SUPPLY PAGE- REGIONAL COMMENTS

Comment: WUG Supply Source requires entry of water right information. Action required- Enter water right information for the following.

[Contract, Exhibit "B," Section 4.3.2, page 61]

1.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
162	B	ARCHER CITY	ARCHER	RED	020024000
DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

2.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
185	B	COUNTY-OTHER	ARCHER	RED	020757005
DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

3.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
171	B	HOLLIDAY	ARCHER	RED	020280000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

4.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
219	B	IRRIGATION	ARCHER	RED	021004005
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
3974	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	ARCHER	RED	3402560

Location on Interface: WUG MODULE

68	B	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	020D0

Location on Interface: WUG MODULE

5.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
173	B	LAKESIDE CITY	ARCHER	RED	020894000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

6.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
2998	B	WICHITA VALLEY WSC	ARCHER	RED	024395000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
70	B	NORTH FORK BUFFALO CREEK LAKE/RESERVOIR	RESERVOIR	RED	02170

Location on Interface: WUG MODULE

67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

7.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
3000	B	WINDTHORST WSC	ARCHER	RED	024402000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

8.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
221	B	IRRIGATION	BAYLOR	BRAZOS	021004012
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
3975	B	BRAZOS RIVER COMBINED RUN-OF-RIVER IRRIGATION	BAYLOR	BRAZOS	3412810

Location on Interface: WUG MODULE

9.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
165	B	BYERS	CLAY	RED	020836000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

10.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
190	B	COUNTY-OTHER	CLAY	RED	020757039
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

11.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
2996	B	DEAN DALE WSC	CLAY	RED	024087000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

12.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
222	B	IRRIGATION	CLAY	RED	021004039
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
3973	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	CLAY	RED	3402550

Location on Interface: WUG MODULE

68	B	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	020D0

Location on Interface: WUG MODULE

13.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
210	B	MINING	CLAY	RED	021003039

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
45	B	RED RIVER COMBINED RUN-OF-RIVER MINING	CLAY	RED	3402720

Location on Interface: WUG MODULE

14.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
3001	B	WINDTHORST WSC	CLAY	RED	024402000

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

15.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
223	B	IRRIGATION	COTTLE	RED	021004051

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
49	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	COTTLE	RED	3402500

Location on Interface: WUG MODULE

16.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
193	B	COUNTY-OTHER	FOARD	RED	020757078

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
41	A	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	02050

Location on Interface: WUG MODULE

17.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
167	B	CROWELL	FOARD	RED	020144000

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
41	A	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	02050

Location on Interface: WUG MODULE

18.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
166	B	CHILLICOTHE	HARDEMAN	RED	020110000

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
41	A	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	02050

Location on Interface: WUG MODULE

19.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
194	B	COUNTY-OTHER	HARDEMAN	RED	020757099
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
41	A	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	02050

Location on Interface: WUG MODULE

20.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
225	B	IRRIGATION	HARDEMAN	RED	021004099
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
3972	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	HARDEMAN	RED	3402540

Location on Interface: WUG MODULE

21.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
201	B	MANUFACTURING	HARDEMAN	RED	021001099
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
41	A	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	02050

Location on Interface: WUG MODULE

22.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
179	B	QUANAH	HARDEMAN	RED	020488000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
41	A	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	02050

Location on Interface: WUG MODULE

23.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
206	B	STEAM ELECTRIC POWER	HARDEMAN	RED	021002099
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
66	B	PAULINE/GROESBECK LAKE/RESERVOIR	RESERVOIR	RED	02400

Location on Interface: WUG MODULE

24.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
197	B	COUNTY-OTHER	MONTAGUE	RED	020757169
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
64	B	FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	02210

Location on Interface: WUG MODULE

25.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
227	B	IRRIGATION	MONTAGUE	RED	021004169

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
55	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	MONTAGUE	RED	3402510

Location on Interface: WUG MODULE

64	B	FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	02210

Location on Interface: WUG MODULE

26.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
202	B	MANUFACTURING	MONTAGUE	RED	021001169

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
64	B	FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	02210

Location on Interface: WUG MODULE

27.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
215	B	MINING	MONTAGUE	RED	021003169

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
75	B	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	08020

Location on Interface: WUG MODULE

28.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
175	B	NOCONA	MONTAGUE	RED	020433000

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
64	B	FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	02210

Location on Interface: WUG MODULE

29.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
163	B	BOWIE	MONTAGUE	TRINITY	020069000

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
75	B	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	08020

Location on Interface: WUG MODULE

30.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
198	B	COUNTY-OTHER	MONTAGUE	TRINITY	020757169
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
75	B	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	08020

Location on Interface: WUG MODULE

31.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
228	B	IRRIGATION	MONTAGUE	TRINITY	021004169
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
74	B	TRINITY RIVER COMBINED RUN-OF-RIVER IRRIGATION	MONTAGUE	TRINITY	3408710

Location on Interface: WUG MODULE

32.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
216	B	MINING	MONTAGUE	TRINITY	021003169
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
75	B	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	08020

Location on Interface: WUG MODULE

33.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
164	B	BURKBURNETT	WICHITA	RED	020086000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

34.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
199	B	COUNTY-OTHER	WICHITA	RED	020757243
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

35.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
2997	B	DEAN DALE WSC	WICHITA	RED	024087000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

36.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
168	B	ELECTRA	WICHITA	RED	020187000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
63	B	ELECTRA CITY LAKE/RESERVOIR	RESERVOIR	RED	02150

Location on Interface: WUG MODULE

37.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
172	B	IOWA PARK	WICHITA	RED	020297000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
70	B	NORTH FORK BUFFALO CREEK LAKE/RESERVOIR	RESERVOIR	RED	02170

Location on Interface: WUG MODULE

67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

38.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
229	B	IRRIGATION	WICHITA	RED	021004243
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
68	B	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	020D0

Location on Interface: WUG MODULE

3971	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	WICHITA	RED	3402530

Location on Interface: WUG MODULE

39.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
245	B	LIVESTOCK	WICHITA	RED	021005243
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
69	B	SANTA ROSA LAKE/RESERVOIR	RESERVOIR	RED	02120

Location on Interface: WUG MODULE

40.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
203	B	MANUFACTURING	WICHITA	RED	021001243
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
70	B	NORTH FORK BUFFALO CREEK LAKE/RESERVOIR	RESERVOIR	RED	02170

Location on Interface: WUG MODULE

67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

41.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
207	B	STEAM ELECTRIC POWER	WICHITA	RED	021002243
DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

42.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
184	B	WICHITA FALLS	WICHITA	RED	020654000
DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
68	B	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	020D0

Location on Interface: WUG MODULE

67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

43.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
2999	B	WICHITA VALLEY WSC	WICHITA	RED	024395000
DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
70	B	NORTH FORK BUFFALO CREEK LAKE/RESERVOIR	RESERVOIR	RED	02170

Location on Interface: WUG MODULE

67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

44.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
200	B	COUNTY-OTHER	WILBARGER	RED	020757244
DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
63	B	ELECTRA CITY LAKE/RESERVOIR	RESERVOIR	RED	02150

Location on Interface: WUG MODULE

41	A	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	02050

Location on Interface: WUG MODULE

3977	B	RED RIVER COMBINED RUN-OF-RIVER MUNICIPAL	WILBARGER	RED	3402570

Location on Interface: WUG MODULE

45.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
230	B	IRRIGATION	WILBARGER	RED	021004244
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
3970	B	RED RIVER COMBINED RUN-OF-RIVER IRRIGATION	WILBARGER	RED	3402520

Location on Interface: WUG MODULE

46.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
208	B	STEAM ELECTRIC POWER	WILBARGER	RED	021002244
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
68	B	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	020D0

Location on Interface: WUG MODULE

47.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
2994	B	COUNTY-OTHER	YOUNG	BRAZOS	020757252
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
65	B	OLNEY-COOPER SYSTEM	RESERVOIR	RED	020B0

Location on Interface: WUG MODULE

48.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
3838	B	IRRIGATION	YOUNG	BRAZOS	021004252
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
65	B	OLNEY-COOPER SYSTEM	RESERVOIR	RED	020B0

Location on Interface: WUG MODULE

49.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
176	B	OLNEY	YOUNG	BRAZOS	020441000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
65	B	OLNEY-COOPER SYSTEM	RESERVOIR	RED	020B0

Location on Interface: WUG MODULE

67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WUG MODULE

50.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
2995	B	COUNTY-OTHER	YOUNG	TRINITY	020757252
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
65	B	OLNEY-COOPER SYSTEM	RESERVOIR	RED	020B0

Location on Interface: WUG MODULE

51.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
3837	B	IRRIGATION	YOUNG	TRINITY	021004252
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
65	B	OLNEY-COOPER SYSTEM	RESERVOIR	RED	020B0

Location on Interface: WUG MODULE

Comment: WUG Supply comments indicate purchase of water, but seller information is blank. Action required- Enter seller information for the following.

[Contract, Exhibit "B," Sections 2.2, page 13 and 4.3.2, page 62]

1.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
2998	B	WICHITA VALLEY WSC	ARCHER	RED	024395000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
70	B	NORTH FORK BUFFALO CREEK LAKE/RESERVOIR	RESERVOIR	RED	02170

Location on Interface: EDIT WUG SUPPLY PAGE- CONTRACT?

2.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
165	B	BYERS	CLAY	RED	020836000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: EDIT WUG SUPPLY PAGE- CONTRACT?

3.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
193	B	COUNTY-OTHER	FOARD	RED	020757078
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
41	A	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	02050

Location on Interface: EDIT WUG SUPPLY PAGE- CONTRACT?

4.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
201	B	MANUFACTURING	HARDEMAN	RED	021001099
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
41	A	GREENBELT LAKE/RESERVOIR	RESERVOIR	RED	02050

Location on Interface: EDIT WUG SUPPLY PAGE- CONTRACT?

5.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
202	B	MANUFACTURING	MONTAGUE	RED	021001169
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
64	B	FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	02210

Location on Interface: EDIT WUG SUPPLY PAGE- CONTRACT?

6.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
203	B	MANUFACTURING	WICHITA	RED	021001243
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
70	B	NORTH FORK BUFFALO CREEK LAKE/RESERVOIR	RESERVOIR	RED	02170

Location on Interface: EDIT WUG SUPPLY PAGE- CONTRACT?

7.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
2999	B	WICHITA VALLEY WSC	WICHITA	RED	024395000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
70	B	NORTH FORK BUFFALO CREEK LAKE/RESERVOIR	RESERVOIR	RED	02170

Location on Interface: EDIT WUG SUPPLY PAGE- CONTRACT?

8.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
200	B	COUNTY-OTHER	WILBARGER	RED	020757244
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
63	B	ELECTRA CITY LAKE/RESERVOIR	RESERVOIR	RED	02150

Location on Interface: EDIT WUG SUPPLY PAGE- CONTRACT?

1000	B	SEYMOUR AQUIFER	WICHITA	RED	24304

Location on Interface: EDIT WUG SUPPLY PAGE- CONTRACT?

1002	B	SEYMOUR AQUIFER	WILBARGER	RED	24404

Location on Interface: EDIT WUG SUPPLY PAGE- CONTRACT?

9.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
204	B	MANUFACTURING	WILBARGER	RED	021001244
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
1002	B	SEYMOUR AQUIFER	WILBARGER	RED	24404

Location on Interface: EDIT WUG SUPPLY PAGE- CONTRACT?

Comment: WUG Supply 2010-2060 requires entry of data value; data values missing. Action Required- Please review to verify that WUG Supply Volumes are zero for 2010-2060 or correct as necessary.

[Contract, Exhibit "B," Sections 2.2, page 13 and 4.3.2, page 62]

1.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
177	B	PADUCAH	COTTLE	RED	020447000
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
989	B	OTHER AQUIFER	COTTLE	RED	05122

Location on Interface: EDIT WUG SUPPLY PAGE- SUPPLY VOLUME 2010 - 2060

2.

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
228	B	IRRIGATION	MONTAGUE	TRINITY	021004169
DBSOID	**SOURCE REGION**	**SOURCE NAME**	**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
74	B	TRINITY RIVER COMBINED RUN-OF-RIVER IRRIGATION	MONTAGUE	TRINITY	3408710

Location on Interface: EDIT WUG SUPPLY PAGE- SUPPLY VOLUME 2010 - 2060

WWP MODULE

Comment: Contract Field requires entry of data value, data values missing. Action required- Enter "C" in "Contract Or Non-Contract Demand" Field for the following.

[Contract, Exhibit "B," Sections 2.2, page 13 and 5.3.2, page 75]

	DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
1.	67	B	WICHITA FALLS CITY OF	1041	B	HOLLIDAY	ARCHER	RED
	Location on Interface: EDIT WWP CUSTOMER PAGE- CONTRACT OR NON-CONTRACT DEMAND							
2.	67	B	WICHITA FALLS CITY OF	1037	B	WINDTHORST WSC	ARCHER	RED
	Location on Interface: EDIT WWP CUSTOMER PAGE- CONTRACT OR NON-CONTRACT DEMAND							
3.	67	B	WICHITA FALLS CITY OF	1040	B	IOWA PARK	WICHITA	RED
	Location on Interface: EDIT WWP CUSTOMER PAGE- CONTRACT OR NON-CONTRACT DEMAND							
4.	67	B	WICHITA FALLS CITY OF	1088	B	MANUFACTURING	WICHITA	RED

Location on Interface: EDIT WWP CUSTOMER PAGE- CONTRACT OR NON-CONTRACT DEMAND

5.	67	B	WICHITA FALLS CITY OF	1026	B	PLEASANT VALLEY	WICHITA	RED

Location on Interface: EDIT WWP CUSTOMER PAGE- CONTRACT OR NON-CONTRACT DEMAND

6.	67	B	WICHITA FALLS CITY OF	1089	B	STEAM ELECTRIC POWER	WICHITA	RED

Location on Interface: EDIT WWP CUSTOMER PAGE- CONTRACT OR NON-CONTRACT DEMAND

7.	67	B	WICHITA FALLS CITY OF	1086	B	WICHITA FALLS	WICHITA	RED

Location on Interface: EDIT WWP CUSTOMER PAGE- CONTRACT OR NON-CONTRACT DEMAND

8.	67	B	WICHITA FALLS CITY OF	1030	B	WICHITA VALLEY WSC	WICHITA	RED

Location on Interface: EDIT WWP CUSTOMER PAGE- CONTRACT OR NON-CONTRACT DEMAND

9.	67	B	WICHITA FALLS CITY OF	1038	B	OLNEY	YOUNG	BRAZOS

Location on Interface: EDIT WWP CUSTOMER PAGE- CONTRACT OR NON-CONTRACT DEMAND

Comment: WWP Supply Source requires entry of water right information. Action required- Enter water right information for the following.

[Contract, Exhibit "B," Section 5.3.4, page 76]

1.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1031	B	ARCHER CITY	ARCHER	RED

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

2.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1036	B	ARCHER COUNTY MUD #1	ARCHER	RED

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

3.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1041	B	HOLLIDAY	ARCHER	RED
DBSOID	**SOURCE REGION**	**SOURCE NAME**			**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM			RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

4.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1039	B	LAKESIDE CITY	ARCHER	RED
DBSOID	**SOURCE REGION**	**SOURCE NAME**			**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM			RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

5.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1035	B	SCOTLAND	ARCHER	RED
DBSOID	**SOURCE REGION**	**SOURCE NAME**			**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM			RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

6.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1037	B	WINDTHORST WSC	ARCHER	RED
DBSOID	**SOURCE REGION**	**SOURCE NAME**			**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM			RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

7.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1034	B	DEAN DALE WSC	CLAY	RED
DBSOID	**SOURCE REGION**	**SOURCE NAME**			**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM			RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

8.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1032	B	RED RIVER AUTHORITY	CLAY	RED
DBSOID	**SOURCE REGION**	**SOURCE NAME**			**SOURCE COUNTY**	**SOURCE BASIN**	**SOURCE ID**
67	B	WICHITA SYSTEM			RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

9.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1042	B	BURKBURNETT	WICHITA	RED

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

10.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1043	B	DEAN DALE WSC	WICHITA	RED

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

11.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1028	B	FRIBERG COOPER WSC	WICHITA	RED

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

12.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1040	B	IOWA PARK	WICHITA	RED

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

13.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1088	B	MANUFACTURING	WICHITA	RED

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

14.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1026	B	PLEASANT VALLEY	WICHITA	RED

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

15.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1089	B	STEAM ELECTRIC POWER	WICHITA	RED

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

16.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1086	B	WICHITA FALLS	WICHITA	RED

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
68	B	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	020D0

Location on Interface: WWP MODULE

67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

17.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1030	B	WICHITA VALLEY WSC	WICHITA	RED

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

18.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1038	B	OLNEY	YOUNG	BRAZOS

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: WWP MODULE

Comment: WWP Supply Source is not marked as an Interbasin Transfer yet basins are not the same. Action required- Please review and correct as necessary.

[Contract, Exhibit "B," Section 5.3.8, page 80]

1.

DBWWPID	WWP REGION	WWP NAME	DBCUSTID	CUST RWPG	CUSTOMER NAME	CUSTOMER COUNTY	CUSTOMER BASIN
67	B	WICHITA FALLS CITY OF	1038	B	OLNEY	YOUNG	BRAZOS

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

Location on Interface: EDIT WWP CUSTOMER SUPPLY PAGE- IBT?

WMS MODULE

Comment: WMS is recommended in the WUG Module but not recommended in the WWP Module. Action required- Please review and correct, where appropriate, so that WUG and WWP data match for the following.

[Contract, Exhibit "B," Section 2.2, page 13]

1. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
101	B	CONSTRUCT LAKE RINGGOLD	NO INFRASTRUCTURE	NEW SURFACE WATER OR NEW GROUNDWATER SOURCE	B12RINGD

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
4121	B	RINGGOLD LAKE/RESERVOIR	RESERVOIR	RED	02600

WUG(S)

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
184	B	WICHITA FALLS	WICHITA	RED	020654000

Location on Interface: WMS MODULE

Comment: WMS Project Name denotes sale of water but seller information is blank. Action required- Enter seller information for the following.

[Contract, Exhibit "B," Section 2.2, page 13]

1. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
92	B	PURCHASE WATER FROM LOCAL PROVIDER	PIPELINE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	B03LOCPROV

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
64	B	FARMERS CREEK/NOCONA LAKE/RESERVOIR	RESERVOIR	RED	02210

WUG(S)

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
197	B	COUNTY-OTHER	MONTAGUE	RED	020757169

Location on Interface: WMS MODULE

215	B	MINING	MONTAGUE	RED	021003169

Location on Interface: WMS MODULE

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

WUG(S)

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
187	B	COUNTY-OTHER	ARCHER	BRAZOS	020757005
		Location on Interface: WMS MODULE			
186	B	COUNTY-OTHER	ARCHER	TRINITY	020757005
		Location on Interface: WMS MODULE			
190	B	COUNTY-OTHER	CLAY	RED	020757039
		Location on Interface: WMS MODULE			
191	B	COUNTY-OTHER	CLAY	TRINITY	020757039
		Location on Interface: WMS MODULE			

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
75	B	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	08020

WUG(S)

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
198	B	COUNTY-OTHER	MONTAGUE	TRINITY	020757169
		Location on Interface: WMS MODULE			

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
1002	B	SEYMOUR AQUIFER	WILBARGER	RED	24404

WUG(S)

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
200	B	COUNTY-OTHER	WILBARGER	RED	020757244
		Location on Interface: WMS MODULE			
204	B	MANUFACTURING	WILBARGER	RED	021001244
		Location on Interface: WMS MODULE			

2. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
91	B	PURCHASE WATER FROM LOCAL PROVIDER	NO INFRASTRUCTURE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	B02LOC PROV

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

WUG(S)

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
165	B	BYERS	CLAY	RED	02083600 0

Location on Interface: WMS MODULE

3. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
275	B	PURCHASE WATER FROM LOCAL PROVIDER	PIPELINE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	B03.1LO CPR

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
1002	B	SEYMOUR AQUIFER	WILBARGER	RED	24404

WUG(S)

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
200	B	COUNTY-OTHER	WILBARGER	RED	02075724 4

Location on Interface: WMS MODULE

Comment: WMS WUG Supply Source is not marked as an Interbasin Transfer yet basins are not the same. Action required- Please review and correct as necessary.

[Contract, Exhibit "B," Section 4.3.5, page 65-66]

1. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
92	B	PURCHASE WATER FROM LOCAL PROVIDER	PIPELINE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	B03LOC PROV

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

WUG(S)

DBWUGID	WUG REGION	WUG NAME	WUG COUNTY	WUG BASIN	WUG ID
187	B	COUNTY-OTHER	ARCHER	BRAZOS	020757005

Location on Interface: EDIT WUG WMS PAGE- IBT?

Comment: Capital Cost data is duplicated in the WUG and WWP modules. Action required- Please delete either the WUG capital costs or WWP capital costs for the following to correct the redundancy. Also, please review all other costs to verify that duplication of costs has not occurred.

[Contract, Exhibit "B," Sections 4.3.5, page 67 and 5.3.8, page 81]

1. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
101	B	CONSTRUCT LAKE RINGGOLD	NO INFRASTRUCTURE	NEW SURFACE WATER OR NEW GROUNDWATER SOURCE	B12RIN GD

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
4121	B	RINGGOLD LAKE/RESERVOIR	RESERVOIR	RED	02600

WUG(S)

WUG ID	WUG REGION	WUG NAME
020654000	B	WICHITA FALLS

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

WUG ID	WUG REGION	WUG NAME
020654000	B	WICHITA FALLS

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

2. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
90	B	MUNICIPAL CONSERVATION	NO INFRASTRUCTURE	CONSERVATION	B01CON

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
2422	B	CONSERVATION	WICHITA	RED	3802243

WUG(S)

WUG ID	WUG REGION	WUG NAME
020654000	B	WICHITA FALLS

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

WUG ID	WUG REGION	WUG NAME
020654000	B	WICHITA FALLS

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

3. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
99	B	WASTEWATER REUSE	PIPELINE, WATER TREATMENT PLANT, AND OTHER	REUSE	B10WWR

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

WUG(S)

WUG ID	WUG REGION	WUG NAME
020654000	B	WICHITA FALLS

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

WUG ID	WUG REGION	WUG NAME
020654000	B	WICHITA FALLS

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

Comment: WMS Annual Cost 2010-2060 requires entry of data values; data values missing. Action required- Enter WMS Annual Costs for 2010-2060 or review to confirm that annual costs are zero.

[Contract, Exhibit "B," Sections 2.2, page 13 and either 4.3.5, page 66 or 5.3.8 page 80]

1. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
101	B	CONSTRUCT LAKE RINGGOLD	NO INFRASTRUCTURE	NEW SURFACE WATER OR NEW GROUNDWATER SOURCE	B12RIN GD

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
4121	B	RINGGOLD LAKE/RESERVOIR	RESERVOIR	RED	02600

WUG(S)

WUG ID	WUG REGION	WUG NAME
020654000	B	WICHITA FALLS

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

2. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
93	B	DEVELOP TRINITY AQUIFER SUPPLIES	OTHER INFRASTRUCTURE	NEW SURFACE WATER OR NEW GROUNDWATER SOURCE	B04TRIN GW

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
1005	B	TRINITY AQUIFER	MONTAGUE	TRINITY	16928

WUG(S)

WUG ID	WUG REGION	WUG NAME
020069000	B	BOWIE

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

3. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
97	B	ENCLOSE CANAL LATERALS IN PIPE	PIPELINE	CONSERVATION	B08CAN AL

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
68	B	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	020D0

WUG(S)

WUG ID	WUG REGION	WUG NAME
021004243	B	IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

021002244 B STEAM ELECTRIC POWER

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

4. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
95	B	INCREASE WATER CONSERVATION POOL AT LAKE KEMP	NO INFRASTRUCTURE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	B06KEMP

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
68	B	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	020D0

WUG(S)

WUG ID	WUG REGION	WUG NAME
021004005	B	IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

021004039 B IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

021004243 B IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

021002244 B STEAM ELECTRIC POWER

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

5. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
96	B	SEASONAL CONSERVATION POOL	NO INFRASTRUCTURE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	B07KEMP

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
68	B	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	020D0

WUG(S)

WUG ID	WUG REGION	WUG NAME
021004005	B	IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

021004039 B IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

021004243 B IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

021002244 B STEAM ELECTRIC POWER

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

6. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
99	B	WASTEWATER REUSE	PIPELINE, WATER TREATMENT PLANT, AND OTHER	REUSE	B10WWR

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
75	B	AMON G. CARTER LAKE/RESERVOIR	RESERVOIR	TRINITY	08020

WUG(S)

WUG ID	WUG REGION	WUG NAME
020069000	B	BOWIE

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

Comment: Capital Cost field requires entry of data value; data values missing. Action required- Enter Capital Cost values for the following or review to confirm that capital costs are zero.

[Contract, Exhibit "B," Sections 2.2, page 13 and either 4.3.5, page 67 or 5.3.8, page 81]

1. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
90	B	MUNICIPAL CONSERVATION	NO INFRASTRUCTURE	CONSERVATION	B01CON

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
2548	B	CONSERVATION	ARCHER	BRAZOS	3812005

WUG(S)

WUG ID	WUG REGION	WUG NAME
020757005	B	COUNTY-OTHER

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
2384	B	CONSERVATION	ARCHER	RED	3802005

WUG(S)

WUG ID	WUG REGION	WUG NAME
020757005	B	COUNTY-OTHER

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
2495	B	CONSERVATION	ARCHER	TRINITY	3808005

WUG(S)

WUG ID	WUG REGION	WUG NAME
020757005	B	COUNTY-OTHER

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
2392	B	CONSERVATION	CLAY	RED	3802039

WUG(S)

WUG ID	WUG REGION	WUG NAME
020757039	B	COUNTY-OTHER

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
2497	B	CONSERVATION	CLAY	TRINITY	3808039

WUG(S)

WUG ID	WUG REGION	WUG NAME
020757039	B	COUNTY-OTHER

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
2520	B	CONSERVATION	MONTAGUE	TRINITY	3808169

WUG(S)

WUG ID	WUG REGION	WUG NAME
020069000	B	BOWIE

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
2422	B	CONSERVATION	WICHITA	RED	3802243

WUG(S)

WUG ID	WUG REGION	WUG NAME
020187000	B	ELECTRA

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

020297000	B	IOWA PARK

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

020654000	B	WICHITA FALLS

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
2423	B	CONSERVATION	WILBARGER	RED	3802244

WUG(S)

WUG ID	WUG REGION	WUG NAME
020623000	B	VERNON

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

2. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
91	B	PURCHASE WATER FROM LOCAL PROVIDER	NO INFRASTRUCTURE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	B02LOC PROV

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

WUG(S)

WUG ID	WUG REGION	WUG NAME
020836000	B	BYERS

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

WUG ID	WUG REGION	WUG NAME
020894000	B	LAKESIDE CITY

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

3. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
96	B	SEASONAL CONSERVATION POOL	NO INFRASTRUCTURE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	B07KEM P

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
68	B	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	020D0

WUG(S)

WUG ID	WUG REGION	WUG NAME
021004005	B	IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

WUG ID	WUG REGION	WUG NAME
021004039	B	IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

021004243 B IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

021002244 B STEAM ELECTRIC POWER

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

Comment: All costs listed are zero. Action required- Enter Capital and/or Annual Costs for the following or review to confirm that all costs are zero.

[Contract, Exhibit "B," Section 4.2.9, page 52-55]

1. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
96	B	SEASONAL CONSERVATION POOL	NO INFRASTRUCTURE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	B07KEMP

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
68	B	KEMP-DIVERSION LAKE/RESERVOIR SYSTEM	RESERVOIR	RED	020D0

WUG(S)

WUG ID	WUG REGION	WUG NAME
021004005	B	IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

021004005 B IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

021004039 B IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

021004039 B IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

021004243 B IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

021004243 B IRRIGATION

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

021002244 B STEAM ELECTRIC POWER

Location on Interface: EDIT WUG WMS PAGE- WUG CAPITAL COST

021002244 B STEAM ELECTRIC POWER

Location on Interface: EDIT WUG WMS PAGE- WUG WMS ANNUAL COST 2010 - 2060

Comment: WMS is recommended in the WUG Module but not recommended in the WWP Module. Action required- Please review and correct, where appropriate, so that WUG and WWP data match for the following.

[Contract, Exhibit "B," Section 2.2, page 13]

1. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
101	B	CONSTRUCT LAKE RINGGOLD	NO INFRASTRUCTURE	NEW SURFACE WATER OR NEW GROUNDWATER SOURCE	B12RINGD

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
4121	B	RINGGOLD LAKE/RESERVOIR	RESERVOIR	RED	02600

WWP(S)

DBWWPID	WWP REGION	WWP NAME
67	B	WICHITA FALLS CITY OF

Location on Interface: WMS MODULE

Comment: Capital Cost data is duplicated in the WUG and WWP modules. Action required- Please delete either the WUG capital costs or WWP capital costs for the following to correct the redundancy. Also, please review all other costs to verify that duplication of costs has not occurred.

[Contract, Exhibit "B," Sections 4.3.5, page 67 and 5.3.8, page 81]

1. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
101	B	CONSTRUCT LAKE RINGGOLD	NO INFRASTRUCTURE	NEW SURFACE WATER OR NEW GROUNDWATER SOURCE	B12RINGD

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
4121	B	RINGGOLD LAKE/RESERVOIR	RESERVOIR	RED	02600

WWP(S)

DBWWPID	WWP REGION	WWP NAME
67	B	WICHITA FALLS CITY OF

Location on Interface: EDIT WWP WMS PAGE- WWP CAPITAL COST

67	B	WICHITA FALLS CITY OF

Location on Interface: EDIT WWP WMS PAGE- WWP WMS ANNUAL COST 2010 - 2060

2. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
90	B	MUNICIPAL CONSERVATION	NO INFRASTRUCTURE	CONSERVATION	B01CON

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
2422	B	CONSERVATION	WICHITA	RED	3802243

WWP(S)

DBWWPID	WWP REGION	WWP NAME
67	B	WICHITA FALLS CITY OF

Location on Interface: EDIT WWP WMS PAGE- WWP CAPITAL COST

DBWWPID	WWP REGION	WWP NAME
67	B	WICHITA FALLS CITY OF

Location on Interface: EDIT WWP WMS PAGE- WWP WMS ANNUAL COST 2010 - 2060

3. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
99	B	WASTEWATER REUSE	PIPELINE, WATER TREATMENT PLANT, AND OTHER	REUSE	B10WWR

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
67	B	WICHITA SYSTEM	RESERVOIR	RED	020A0

WWP(S)

DBWWPID	WWP REGION	WWP NAME
67	B	WICHITA FALLS CITY OF

Location on Interface: EDIT WWP WMS PAGE- WWP CAPITAL COST

DBWWPID	WWP REGION	WWP NAME
67	B	WICHITA FALLS CITY OF

Location on Interface: EDIT WWP WMS PAGE- WWP WMS ANNUAL COST 2010 - 2060

Comment: WMS Annual Cost 2010-2060 requires entry of data values; data values missing. Action required- Enter WMS Annual Costs for 2010-2060 or review to confirm that annual costs are zero.

[Contract, Exhibit "B," Sections 2.2, page 13 and either 4.3.5, page 66 or 5.3.8 page 80]

1. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
101	B	CONSTRUCT LAKE RINGGOLD	NO INFRASTRUCTURE	NEW SURFACE WATER OR NEW GROUNDWATER SOURCE	B12RINGD

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
4121	B	RINGGOLD LAKE/RESERVOIR	RESERVOIR	RED	02600

WWP(S)

DBWWPID	WWP REGION	WWP NAME
67	B	WICHITA FALLS CITY OF

Location on Interface: EDIT WWP WMS PAGE- WWP WMS ANNUAL COST 2010 - 2060

Comment: Capital Cost field requires entry of data value; data values missing. Action required- Enter Capital Cost values for the following or review to confirm that capital costs are zero.

[Contract, Exhibit "B," Sections 2.2, page 13 and either 4.3.5, page 67 or 5.3.8, page 81]

1. PROJECT

DBPROJECTID	PROJECT REGION	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID
90	B	MUNICIPAL CONSERVATION	NO INFRASTRUCTURE	CONSERVATION	B01CON

SOURCE

DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
2422	B	CONSERVATION	WICHITA	RED	3802243

WWP(S)

DBWWPID	WWP REGION	WWP NAME
67	B	WICHITA FALLS CITY OF

Location on Interface: EDIT WWP WMS PAGE- WWP CAPITAL COST

LEVEL 2. Comments and suggestions that might be considered to clarify or help enhance the plan.

SOURCES MODULE

Comment: Source is not used by any WUGs or WWPs. Action required- Please review to confirm or correct as necessary.

[Contract, Exhibit "B," Section 2.2, page 13]

	DBSOID	SOURCE REGION	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID
1.	3976	B	RED RIVER RUN-OF-RIVER INDUSTRIAL	CLAY	RED	3460205140

Location on Interface: SOURCE MODULE

2.	997	B	OTHER AQUIFER Location on Interface: SOURCE MODULE	KING	RED	13522
3.	3984	B	RED RIVER COMBINED RUN-OF-RIVER IOWA PARK/GORDON Location on Interface: SOURCE MODULE	WICHITA	RED	3402010

PUBLIC AND AGENCY COMMENTS

REGIONAL WATER PLANNING GROUP – AREA B COMMENTS

A summary of the comments regarding the Initially Prepared Water Plan for Area B received at the Public Hearing on July 6, 2005 are as follows:

Mr. Curtis W. Campbell expressed his appreciation to Mr. Kerry D. Maroney for the presentation and all the work that had gone into the preparation of this Plan. Both men asked for oral and/or written comments on the Plan, and stated that written comments would be accepted until September 15, 2005. Mr. Campbell then introduced Ms. Penny Miller of Wichita Falls, who had signed up to make an oral statement.

Ms. Penny Miller stated that as a resident of Wichita Falls she had been involved with various organizations that have studied water policy within the State of Texas, especially Region B during the past two years. She expressed her appreciation of the work that has been done on the Plan, the tremendous amount of information available for the public, and the watershed management approach that the region took. Of primary significance to Ms. Miller was the water conservation portion of the Plan. She noted the four municipal conservation efforts brought out including the dependence of public and school education, the cost of purchasing water, reduction of water through water audits, and passive clothes washer rules. Ms. Miller's opinion was that the Plan suggested that water conservation was just supposed to magically happen. She said that methods of implementation to encourage people to use less water must be addressed. She also stated that nothing was mentioned for industry, irrigation, agriculture, or any other category other than municipal. Ms. Miller disagreed that the suggestion that the gallons per day calculation of water use be based on residential use only. She remarked that was not appropriate, although easy to measure. When looking at water conservation strategies overall and the impact of water use within the region, all ways to measure water should be used.

Although Ms. Miller was the only person to sign up to make oral comments, Mr. Campbell asked if there was anyone else who would like to make a comment regarding the Water Plan at this time. He assured the audience that all comments, both oral and written, would be addressed in the final Plan. Mr. Campbell then solicited any questions from the audience.

Ms. Roberta Sund of Lakeside City asked what the term "seasonal conservation pools" as listed under strategies meant. Ms. Simone F. Kiel replied that right now the Wichita irrigation district was operating under the seasonal pool, which runs from April through October, when allowable to contain water above their current permitted conservation level, which are the months used for irrigation. Mr. Jimmy Banks stated there had not been enough rainfall to put them into that level. Ms. Kiel explained that it allows them during high rainfall events to capture that water and use it for irrigation purposes. Ms. Sund also asked why Lakeside City showed a shortage even though it purchased water from the City of Wichita Falls which did not show a shortage. Mr. Maroney replied it was a contractual shortage.

Mr. Mick Baldys of Wichita Falls questioned the population projections and why it indicated a dramatic decrease in 2030. He expressed his concern as an increase in population might not meet the demand. Mr. Maroney explained many of the population projections were put forth by the state data center, and in most cases they just had to accept their projections. He expressed his concern, but also noted that the Plan would be updated every five years, which should keep it on track. Region B also figured its water availability using the safe-supply method.

Mr. Scott Taylor of the City of Wichita Falls asked how was the amount of conservation volume determined and how was the price for that conservation determined. Ms. Kiel stated that she had the figures but would rather get back with him so that her calculations were correct. However, she said it was based on population using the best management practice guidelines as developed by the Water Conservation Task Force.

Mr. Keith Spears of Vernon asked when referred to purchasing water from local providers, were local land owners taken into consideration and if so at what cost per thousand gallons. Mr. Maroney stated that he did not; a local provider would not necessarily be a land owner. It would probably fall under additional groundwater supply. When he asked what that price might be, Mr. Maroney stated that in the West Texas area, the amount was 60¢ to 80¢ per thousand.

Ms. Jennifer Ellis of Austin asked why several counties showed several levels of strategies when the most economical would be conservation. Mr. Maroney replied he did not want to be totally dependent upon water conservation, although it was a noble effort. The alternatives were listed in case water conservation was not sufficient to meet the needs.

Mr. Campbell expressed his appreciation in being associated with this Board and consultants for the work they had performed. He then thanked them for their attendance at the Public Hearing.

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BY:

September 15, 2005

Mr. Curtis W. Campbell, Chairman
Region B Water Planning Group
900 8th Street
Hamilton Building, Suite 520
Wichita Falls, Texas 76301-6894

Submitted via Fax: 940-723-8531

Re: Comments on Initially Prepared Region B Water Plan- June 2005

Dear Chairman Campbell and Region B Planning Group Members:

The National Wildlife Federation, Lone Star Chapter of the Sierra Club, and Environmental Defense appreciate the opportunity to provide written comments on the Initially Prepared Region B Water Plan. We consider the development of comprehensive water plans to be a high priority for ensuring a healthy and prosperous future for Texas. We recognize and appreciate the contributions that you have made towards that goal. As you know, our organizations have provided, either individually or collectively, periodic input during the process of developing the plan. These written comments will build upon those previous comments in an effort to contribute to making the regional plan better for all residents of Region B and for all Texans.

We recognize that the Initially Prepared Plan is subject to revision prior to adoption, and is subject to continued revision in the future, and provide these comments with such revisions in mind. Our organizations appreciate the amount of effort that has gone into developing the Initially Prepared Plan for Region B. Your consideration of these comments will be appreciated.

I. BACKGROUND AND OVERVIEW

Our organizations support a comprehensive approach to water planning in which all implications of water use and development are considered. Senate Bills 1 and 2 (SB 1, SB 2), and the process they established, have the potential to produce a major, positive change in the way Texans approach water planning. In order to fully realize that potential, water plans must provide sufficient information to ensure that the likely impacts and costs of each potential water management strategy are described and considered. Only with that information can regional planning groups ensure compliance with the overarching requirement that "strategies shall be selected so that cost effective water management strategies which are consistent with long-term protection of the state's water resources, agricultural resources, and natural resources are adopted." 31 TAC § 357.7 (a)(9). Complying with this charge is essential in order to develop true plans that are likely to be implemented as opposed to a list of potential, but expensive and damaging, projects. Comprehensive regional water plans have the potential to provide clear and effective guidance for development of water supplies within the region.

This document includes two types of comments. We consider the extent to which the Initially Prepared Plan complies with the requirements established by SB1 and SB 2 and by the Texas Water Development Board (TWDB) rules adopted to implement those statutes. In addition, our comments address important aspects of policy that might not be controlled by specific statutes or rules.

We do recognize that the financial resources available to the planning group are limited, which may restrict the ability of the group to fully address some issues as much as you would like. These comments are provided in the spirit of an ongoing dialogue intended to make the planning process as effective as possible. We strongly support the state's water planning process and we want the Regional Water Plans and the State Plan to be comprehensive templates that can be endorsed by all Texans.

A one-page summary of key comments follows this page. Each of these is further explained in the following sections. Section II of the letter summarizes key principles that inform our comments and how they relate to the Initially Prepared Plan (IPP). The last section of the letter, Section III, consists of page-specific comments on the Initially Prepared Plan.

SUMMARY TABLE OF KEY COMMENTS

Area	Comment	Solution
Planning Basis	1) The IPP's planning basis of aiming to supply 20% more than projected 2060 municipal demand ("safe supply") results in including an excess of water supply strategies that are unnecessary. 2) Using "safe yield" as a basis for determining reservoir water supply results in including an excess of water supply strategies that are unnecessary.	To be consistent with planning requirements, the region should plan for projected demand, and eliminate unnecessary projects that are included as a result of inflated demand.
Maximizing Water Efficiency	The IPP: (1) fails to identify a goal for municipal water usage rates in the region, (2) doesn't correctly account for savings from passive conservation laws that will take effect as a result of federal law, (3) falls short in adopting a significant water conservation package for municipal water user groups, (4) falls short of potential for agriculture/irrigation conservation (5) does not consider conservation as a supply strategy for manufacturing or stream electric. (6) The Chloride Control Project is recommended to increase supply before water efficiency measures have been maximized.	The plan should be revised to correct all these problems through improved treatment of water efficiency measures.
Drought Management	The IPP is based on fully meeting even non-essential water needs during the drought of record and, in doing so, fails to comply with applicable requirements for implementing drought management measures.	The plan should be revised to incorporate drought management as a water management strategy for entities required to prepare drought management plans.
Environmental Flows and Protection of Agricultural and Natural Resources	The IPP fails to include a sufficient required quantitative analyses of the environmental impacts of the proposed water management strategies, particularly as it relates to environmental flows, and fails to demonstrate consistency with long-term protection of agricultural and natural resources.	The revised plan should include such analyses.
Groundwater/ Spring flow	1) The IPP does not adequately characterize current aquifer or spring conditions or trends. 2) The IPP does not include a clear groundwater management policy. 3) The IPP does not include information about any regulatory limits to pumping from the Groundwater Conservation Districts in the region.	The plan should be revised to address these deficiencies.

II. KEY PRINCIPLES

A. Maximize Water Efficiency

We strongly believe that improved efficiency in the use of water must be pursued to the maximum extent reasonable. New provisions included in SB 2 and TWDB rules since the first round of planning mandate strengthened consideration of water efficiency. Potentially damaging and expensive new supply sources simply should not be considered unless, and until, all reasonable efforts to improve efficiency have been exhausted. In fact, that approach is now mandated. Consistent with TWDB's rules for water planning, we consider water conservation measures that improve efficiency to be separate and distinct from reuse projects. We do agree that reuse projects merit consideration. However, the implications of those projects are significantly different than for water efficiency measures and must be evaluated separately.

The Texas Water Code, as amended by SB1 and SB 2, along with the TWDB guidelines, establish stringent requirements for consideration and incorporation of water conservation and drought management. As you know, Section 16.053 (h)(7)(B), which was added after completion of the first round of regional planning, prohibits TWDB from approving any regional plan that doesn't include water conservation and drought management measures at least as stringent as those required pursuant to Sections 11.1271 and 11.1272 of the Water Code. In other words, the regional plan must incorporate at least the amount of water savings that are mandated by other law.[1]

In addition, the Board's guidelines require the consideration of more stringent conservation and drought management measures for all other water user groups with water needs. Consistent with the TWDB rules, our comments treat water conservation and drought management as separate issues from reuse. Section 31 TAC § 357.7 (a)(7)(A) of the TWDB rules sets out detailed requirements for evaluation of water management strategies consisting of "water conservation practices." Section 357.7(a)(7)(B) addresses water management strategies that consist of drought management measures. The separate evaluation of water management strategies that rely on reuse is mandated by 31 TAC § 357.7 (a)(7)(C).

Both water efficiency and reuse merit consideration, but they must be evaluated independently in determining what mix of approaches to include in a regional plan. Under the right circumstances, reuse is an appropriate water management option, but it does not increase the actual efficiency of water use. Water is a finite resource. In order to meet the water needs of a growing population while ensuring the long-term protection of the state's natural resources and agricultural resources, we must use water as efficiently as possible. We certainly acknowledge the progress made by Region B in incorporating water conservation into the 2005 Initially Prepared Plan as compared to the 2001 version of the plan. However, much more progress is possible and needed

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[1] This is a common-sense requirement. We certainly should not be basing planning on an assumption of less water conservation than the law already requires. TWDB guidelines also recognize the water conservation requirements of Section 11.085 for interbasin transfers and require the inclusion of the "highest practicable levels of water conservation and efficiency achievable" for entities for which interbasin transfers are recommended as a water management strategy.

B. Limit Nonessential Use During Drought

Drought management measures aimed at reducing demands during periods of unusually dry conditions are important components of good water management. As noted above, Senate Bill 2 and TWDB rules mandate consideration and inclusion in regional plans of reasonable levels of drought management as water management strategies. It just makes sense to limit some nonessential uses of water during times of serious shortage instead of spending hefty sums of money to develop new supply sources simply to meet those nonessential demands. Because drought management measures are not included as water management strategies, the Initially Prepared Plan does not comply with applicable requirements.

C. Plan to Ensure Environmental Flows

Designing and selecting new water management strategies that minimize negative impacts on environmental flows is critically important. New rules applicable to this round of planning require a quantitative analysis of environmental impacts of water management strategies[2] in order to ensure a more careful consideration of those impacts. However, this is only one aspect of planning to meet environmental flow needs.

If existing water rights, when used as projected, would cause serious disruption of environmental flows resulting in harm to natural resources, merely minimizing additional harm from new strategies would not produce a water plan that is consistent with long-term protection of natural resources or that would protect the economic activities that rely on those natural resources.

Accordingly, environmental flows should be recognized as a water demand and plans should seek to provide reasonable levels of environmental flows. Environmental flows provide critical economic and ecological services that must be maintained to ensure consistency with long-term protection of water resources and natural resources.

We were unable to locate sufficient quantitative analysis of environmental impacts of the proposed water management strategies and do not believe that the Initially Prepared Plan demonstrates consistency with long-term protection of natural resources or agricultural resources.

D. Minimize New Reservoirs

Because of the associated adverse impacts, new reservoirs should be considered only after existing sources of water, including water efficiency and reuse, are utilized to the maximum extent reasonable. When new reservoirs are considered, adverse impacts to regional economies and natural resources around the reservoir site must be minimized. Reservoir development must be shown to be consistent with long-term protection of the state's water, agricultural, and natural resources. We acknowledge that the Initially Prepared Plan does not include a proposed major reservoir project.

[2] The rules require that each potentially feasible water management strategy must be evaluated by including a quantitative reporting of "environmental factors including effects on environmental water needs, wildlife habitat, cultural resources, and effect of upstream development on bays, estuaries, and arms of the Gulf of Mexico." 31 TAC § 357.7 (a)(8)(A)(ii).

E. Manage Groundwater Sustainably
Wherever possible, groundwater resources should be managed on a sustainable basis. Mining groundwater supplies will, in many instances, adversely affect surface water resources and constitute a tremendous disservice to future generations of Texans. Although the discussion is somewhat confusing, we are under the impression that the regional plan generally supports a sustainable management approach for groundwater supplies. We support that approach and believe that it is necessary in order to demonstrate consistency with long-term protection of the state's water resources, natural resources, and agricultural resources.

F. Facilitate Short-Term Transfers
Senate Bill 1 directs consideration of voluntary and emergency transfers of water as a key mechanism for meeting water demands. Water Code Section 16.051 (d) directs that rules governing the development of the state water plan shall give specific consideration to "principles that result in the voluntary redistribution of water resources." Similarly, Section 16.053 (e)(5)(H) directs that regional water plans must include consideration of "voluntary transfers of water within the region using, but not limited to, regional water banks, sales, leases, options, subordination agreements, and financing arrangements…." Thus, there is a clear legislative directive that the regional planning process must include strong consideration of ways to facilitate voluntary transfers of existing water rights within the region, particularly on a short-term basis, as a way to meet drought demands.

In addition, emergency transfers are intended as a way to address serious water shortages for municipal purposes. They are a way to address short-term problems without the expense and natural resource damage associated with development of new water supplies. Water Code Section 16.053 (e)(5)(I), as added by SB 1, specifically directs that emergency transfers of water, pursuant to Section 11.139 of the Water Code, are to be considered, including by providing information on the portion of each non-municipal water right that could be transferred without causing undue damage to the holder of the water right. Thus, the water planning process is intended as a way to facilitate voluntary transfers, particularly as a means to address drought situations, by collecting specific information on rights that might be transferred on such a basis and by encouraging a dialogue between willing sellers and willing buyers on that approach. It appears that the potential may exist for some such transfers within the planning area. For example, it appears that both Lake Wichita and Lake Iowa Park might hold potential for some limited transfers. However, we were unable to locate sufficient information to assess that potential or otherwise find the required information about such potential transfers.

III. PAGE-SPECIFIC COMMENTS
For ease of tracking, we have identified each page-specific comment with a number in brackets.

CHAPTER 1: Description of Region

Section 1.3 Water Use Demand Centers
[1] Table 1-6 on page 1-5 should include a column of gallons-per-capita-per-day usage rates for each of the regional demand centers in order to provide a numerical relationship between the population figures and the municipal water use figures listed, and to provide some basis for

comparison of municipal usage rates and conservation potential across the region. It would also be helpful to include a totals row in this table.

Section 1.4 Water Supply and Use
[2] Page 1-6: There appears to be an unexplained redundancy in the Chloride Control Project that removes dissolved solids and chlorides in Lake Kemp and the reverse osmosis plant currently being constructed by the City of Wichita Falls to treat water from Lake Kemp to deal with high dissolved solids and chlorides levels. That reverse osmosis plant likely would obviate the need for chloride control to produce drinking water for Wichita Falls.

[3] Page 1-7: It would be helpful to add a totals row to Table 1-7.

[4] Page 1-9 to 1-14: For Charts 1-12, it would be much more illustrative to break the period of record into pre- and post-major development (meaning water project development) time periods in order to better understand flow changes. Providing a good baseline for consideration of environmental flow changes is essential for evaluating impacts of individual water management strategies and for assessing the consistency of the plan with long-term protection of the state's natural resources.

[5] Page 1-15: The information included here on the aquifers and springs in Region B is extremely superficial. This text appears to be a duplicate of that provided in 2001. It is disappointing to see no obvious effort to build on the information included in the 2001 Region B Plan. Given the revisions to the governing statutes and TWDB rules to require specific consideration of the role of springs in protecting natural resources, this lack of attention is troubling. The Initially Prepared Plan should explain what definition was used in determining the absence or presence of major springs for purposes of resource protection. *See* 31 TAC § 357.7 (a)(1)(D). A spring that is not major for water supply purposes may nevertheless be a major spring in terms of importance for protecting natural resources. Discussion of this issue is required by that section of the rules and to provide sufficient information to support a finding that the regional plan is consistent with long-term protection of the state's water resources and natural resources. See Texas Water Code Section 16.053 (h)(7)(C).

[6] Page 1-22: In Table 1-12, it would be helpful to have a totals column in order to get a more complete picture of region-wide land use.

Section 1.8 Ecology and Wildlife
[7] Page 1-23: Because they are important indicators of river system health, it is good to see mention of freshwater mussels and minnow species native to the region. However, for this information to be truly meaningful, those issues should be considered in assessing the impacts of recommended water management strategies and the overall implications of the plan for consistency with long-term protection of natural resources.

[8] Page 1-23: More information is needed on the wetlands of the region. There is no discussion of the wetland complexes that are important to migrating birds. Information should be provided about significant wetlands associated with specific seeps or springs and with rivers or streams because those are the wetlands with the greatest potential to be affected by water management decisions. Such information would provide a baseline against which to assess proposed water management strategies. Again, it constitutes information needed to assess the implications of the plan for consistency with long-term protection of natural resources and to provide a meaningful quantitative evaluation of potentially feasible water management strategies.

[9] Page 1-24: The information provided on the wildlife and the endangered and threatened species of the region also has limited utility. Again, it would be much more useful if it were to highlight species occurring in habitats dependent on seeps and springs or rivers and streams. Those are the habitats and the species most likely to be affected by water management decisions. This constitutes information needed to assess long-term impacts on natural resources and to perform a meaningful quantitative evaluation of potentially feasible water management strategies.

Section 1.9 Summary of Existing Local or Regional Water Plans

[10] Page 1-25: Water conservation and drought management planning are very important components of good water management and of the planning process. Unfortunately, the information contained in Table 1-14 is now quite dated. Updated information should be provided. Some non-municipal water users also are required to develop water conservation and drought contingency plans. That information also should be provided

It is unfortunate that the new requirements to establish quantified 5-year and 10-year goals in water conservation and drought contingency plans did not go into effect until May of this year. As a result, we certainly understand that the planning group was not able to fully incorporate those goals into its water management strategies. We do urge the planning group to provide for the review of as many of those revised plans as possible, particularly for the larger water user groups such as the City of Wichita Falls, to ensure that the adopted regional plan includes at least the level of water conservation and drought management called for in those updated plans.

Section 1.10 Summary of Recommendations

[11] Page 1-26: If Region B will have adequate supplies throughout the planning period, then why is the Chloride Control Project recommended as a regional water supply project? The purpose of the water planning process is certainly not to fully utilize all available water resources.

Section 1.11 Identification of Known Threats to Agriculture or Natural Resources

[12] Page 1-26: This discussion is far too general. There is no discussion of groundwater drawdown and associated affects to water quality, wells and springflows. There is no discussion of changes to natural instream flow conditions as compared to historic flows. As acknowledged on page 1-23, both mussel and minnow species are experiencing problems. There is no discussion of the impacts of impounding high chlorine waters from the Chloride Control Project. The loss of stream flows from those diversions likely would adversely affect some aquatic species. No mention is made of threats to agriculture resources.

TWDB may not approve a regional plan unless it is able to make an affirmative finding that the regional plan is consistent with long-term protection of the state's natural resources. See Texas

Water Code Section 16.053 (h)(7)(C). Without information provided on these issues, the Initially Prepared Plan simply does not provide the information necessary to support such a finding.

Sections 1.12 Water Providers in Region B and 1.13 Wholesale Providers in Region B
[13] Page 1-27 to 1-29: Although there is some information in Table 1-15 about some municipal Water Users in Region B, this section is sorely lacking in providing the information necessary to get a comprehensive picture of the water providers of Region B. Some of the major providers are listed in the text, but there is no information given about who they provide water to or how much water they provide to whom and for what use. There is also no information on who provides water for irrigation, manufacturing, electrical power, livestock or mining. In order to have a complete picture of all the water providers and users of Region B, and to determine what rules are applicable to various providers and users, this information is necessary.

CHAPTER 2: Population and Water Use Projections

Section 2.1 Region B Overview
[14] Page 2-1: The discussion about the rural nature of the region affecting projecting water conservation savings to be achieved through implementation of the plumbing fixtures code is confusing. State requirements affect the water efficiency of devices that are available for sale. Although it may well be true that a slower rate of new home construction or remodeling in some rural areas may delay full realization of those savings, fixtures in existing homes also will be replaced overtime. As a result, at least by 2060, the savings still can be expected to be realized.

[15] Page 2-1: For the purpose of transparency in the planning process, it should be mentioned in the text that Region B filed a formal request to change the water demand figures issued by TWDB, why this change was requested, and specifically what changes were made as a result of the request being approved by TWDB.

Section 2.3.1 Total Region B Water Use
[16] Page 2-3: It is stated here that one acre-foot of water is equivalent to 325,829 gallons. The TWDB publication _Water for Texas_- State Water Plan 1997 indicates that an acre-foot is equal to 325,851 gallons. Although likely not significant in the big picture, the discrepancy is confusing.

[17] Page 2-4: The figures and total listed in Table 2-2 for all Year 2000 water use categories vary significantly from those listed by TWDB as the 2006 Regional Water Plan Total Water Demand Projections for Year 2000. The total demand for Year 2000 reported by TWDB is 128,583 ac-ft and that in table 2-2 is 169,767. The TWDB figures suggest that the water consumption for the region is predicted to increase over the planning period, especially from Year 2000 to Year 2010, rather than remain approximately level as the IPP suggests. Again, the discrepancy should be explained. The same issue arises on page 2-6 and in Figure 2-4.

Section 2.3.4 Steam-Electric Power Generation
[18] Page 2-9: This demand appears to be potentially overstated. Water demand for steam electric power generation is projected to increase 125% during the planning period. By contrast, water demand for municipal use is projected to remain basically flat (with about a 10% increase in population) and for manufacturing water use is projected to increase about 40%. Given the

likelihood that these are the primary categories of use that would drive demand for electrical power, some additional explanation of the projected water demand is needed.

We recognize that these projections likely came from the Texas Water Development Board. The planning group may not be able to change them, but it could, and should, provide further explanation for this seemingly anomalous projected growth in water demand. We also note that the TWDB projections, as we understand them, include a projected .5% increase per year in per capita energy demand. Given advances in energy efficiency and escalating fuel prices, we question the reasonableness of the assumption of such continued escalation in per person use of electricity.

Attachment 2-1 Water Use Tables

[19] Table A-5: The water demand figures in this table for Year 2000 are inconsistent with the demand figures listed in Appendix A's Water User Group Summary tables for Archer City-Archer, Holliday-Archer, Lakeside City-Archer, Seymour-Baylor, Byers-Clay, Henrietta-Clay, Petrolia-Clay, Paducah-Cottle, Crowell-Foard, Chillicothe-Hardeman, Quanah-Hardeman, Bowie-Montague, Nocona-Montague, Saint Jo-Montague, Burkburnett-Wichita, Electra-Wichita, Iowa Park-Wichita, Wichita Falls-Wichita, Vernon-Wilbarger, and Olney-Young. It appears that the water user group summary tables were not updated to reflect changes to the TWDB water demand figures made by Region B, adopted 7/23/03.

[20] Tables A-6 to A-9: These tables also include many inconsistencies with their corresponding tables in Appendix A. It appears that the water user group summary tables were not updated to reflect changes to the TWDB water demand figures made by Region B, adopted 7/23/03.

CHAPTER 3: Evaluation of Current Water Supplies

Section 3.1.2 Sedimentation and Impacts to Reservoir Yields

[21] Page 3-11: The predicted sedimentation rate for Lake Kemp is very high. It appears that the projection is based on a 1976 study undertaken just after the lake was built. Given the extent of the predicted impact and the significance of the lake as a water supply, we believe that a sedimentation survey would be appropriate. As noted in Section 8.2.5, such a study has been initiated but not completed because of low water levels. It seems appropriate to note the pending study in this section. An assessment of sedimentation that has actually occurred since 1973 would give a much better basis for predicting future sedimentation rates. Obtaining updated information on sedimentation rates should be assigned a high priority in the regional plan.

Section 3.2.2 Groundwater Availability and Recharge

[22] Page 3-21: The IPP states that "mining of storage is not included in the groundwater availability estimates for the Seymour." On that same page, the IPP states that "[n]o recoverable storage from the Blaine Aquifer was included in the availability estimates." We support the apparent decision to adopt aquifer availability figures for the Seymour and Blaine Aquifers based on recharge, but in addition, we urge the planning group to include an allowance for protection of springs and seeps that contribute to surface flow .

[23] Page 3-22: The discussion on page 3-22 of the basis for determining availability from the Trinity Aquifer is quite confusing and needs to be clarified. Again, we urge the planning group to include an allowance for protection of springs and seeps that contribute to surface flow in determining groundwater availability.

[24] We urge the planning group to adopt a true sustained yield approach to groundwater management. It appears that the Initially Prepared Plan may advocate such an approach, but it is rather unclear. A sustained yield approach will provide groundwater of reasonable quantity and quality for many generations to come. Considering the importance of groundwater supplies to the people, agricultural resources and natural resources of Region B, this approach is needed. In addition, a sustained yield approach is needed in order to demonstrate that the regional plan is consistent with long-term protection of the state's water resources, agricultural resources and natural resources. *See* Tex. Water Code § 16.053 (h)(7)(C).

[25] Page 3-18 and 3-24: There are some statements in this section about determining groundwater availability:

> "Generally, groundwater supply is the supply available with acceptable long-term impacts to water levels. These impacts may vary with users and locations." (page 3-1), and
>
> "The average annual groundwater availability is the amount of water that could be reasonably developed from the aquifer. It is comprised of the annual effective recharge plus the amount of water that can be recovered annually from storage over a specified period without causing excessive drawdown or irreversible harm, such as subsidence or water quality deterioration." (page 3-19).

However, concerning how to determine groundwater availability, the TWDB guidance directs the planning group to:

> Calculate the largest annual amount of water that can be pumped from a given aquifer without violating the most restrictive physical or regulatory or policy conditions limiting withdrawals, under drought-of-record conditions. Regulatory conditions refer specifically to any limitations on pumping withdrawals imposed by groundwater conservation districts through their rules and permitting programs.

Based on this guidance, our understanding of groundwater availability determinations are that the region is to consider each of three different types of limiting conditions (physical, regulatory, and policy) and base availability determinations on the most restrictive. Thus, for example, pumping limits established by a Groundwater Conservation District may establish a regulatory condition that is more restrictive than physical conditions, such as subsidence or intrusion of poor quality water, and more restrictive than policy decisions, such as planned aquifer depletion. Conversely, a planning group's groundwater management policy of balancing withdrawals with a percentage of recharge might impose the most restrictive limit.

We are unable to locate in the text a clear groundwater management policy or a description of applicable regulatory conditions. Although there are two Groundwater Conservation Districts in Region B (Tri-County GCD in Hardeman and Foard Counties and the Rolling Plains GCD in Baylor County), neither entity, nor their regulatory conditions, are mentioned.

A clear explanation of the basis used in determined groundwater availability is needed. We request that the IPP be revised to include information on the regulatory, policy and physical conditions present for each groundwater source and which one served to establish the most restrictive limit that was then used to determine availability.

Section 3.4 System Operation and Reliability
[26] Page 3-25 to 3-26: It is stated in the text that "the region may be entering a new drought period that may surpass the historical drought of record and the firm yield may overestimate the available water supply." and that "This [safe yield] analysis [which assumes a one-year supply of water is reserved in the reservoirs at all times] has been commonly used for water resource planning in this region in the past." However, the text does not clearly state if this IPP calculates water availability on safe yield or firm yield for reservoirs. Whether this built-in cushion against future demands is included in the IPP is important information and needs to be made abundantly clear.

CHAPTER 4: Identification, Evaluation, and Selection of Water Management Strategies

Section 4.1.1 Evaluation of Safe Supply
[27] Page 4-4: It is stated that the Region B Water Planning Group decided to base water demand for municipal and manufacturing water user groups based on a "safe supply" approach, which is defined as being able to meet projected demands plus an additional 20 percent of demand. The "safe supply" approach is applied in addition to use of the "safe yield" calculation for area reservoirs. In addition, in the identification of supplies to be planned for, the "maximum need" was calculated by adding the highest need total for each water user group, regardless of decade of occurrence. For example, if one user group had a 100 acre-foot need in 2010 but that need was projected to disappear by 2030 and another user group had a 100 acre-foot need in 2030, the "maximum need" is listed as 200 acre-feet. In some instances, it may not be possible to offset the new supplies between the user groups, but it others it might. It does not appear that potential was assessed. It should be.

According to Table 4-3, the use of the "safe supply" calculation results in planning for the development of an additional 4,401 acre-feet of water for 2060. A totals row should be added to Table 4-3. With the addition of the "maximum need" calculation, the additional supply planned for would total 4,994 acre-feet.

There are at least four significant problems with the "safe supply" approach:

- The approach is **directly inconsistent with TWDB's rules** directing that the planning process be based on population and demand projections approved by TWDB. *See* 31 TAC § 357.5 (d). Region B's planning is based on 20% more than the approved projections.

- Region B's decision to reject the basic premise of using an agreed-upon planning target **undermines the value of the planning process**. The ongoing nature of the planning process involves successive plan revisions every five years. The very reason that plans are updated every five years is to allow for adjustments on an incremental basis. If recommended projects aren't moving forward when a future plan is adopted, recommendation of different strategies may be appropriate at that time. Similarly, if population and demand projections have changed at that point, appropriate adjustments in recommendations should be made. Planning should be based on the best demand projections currently available.

- Water is a limited resource in the state. It must be shared equitably. Using common assumptions for planning across all planning regions is one way to help achieve that equity. **If all regions plan consistently, then no one region should end up using state money or permits to develop or implement a plan that calls for laying claim to an undue portion of the state's limited water resources.** Nor does a possible future drought worse than the drought of record justify planning for excess supply. In fact, SB 1 is quite specific in directing the use of the "drought of record" as the appropriate target for planning. *See* Tex. Water Code Ann. § 16.053 (e)(4).

- **Region B's approach completely discounts the role of drought management.** As noted elsewhere in these comments, Region B failed to include drought management as a water management strategy. Thus, Region B bases all of its planning on always having a 20% surplus of supply in place to meet even the most non-essential demand during a recurrence of critical drought conditions. That results in the investment of money for supply sources that are projected to be needed, if at all, extremely rarely. The planning group never considers whether it might make more sense economically to spend money on drought management. Various forms of drought management are required by law and they will result in lowering water demands during drought periods. In addition, more expansive forms of drought management could be employed. For example, a voluntary program might be used that would involve dry-year options. During drought conditions, municipalities could pay farmers not to irrigate so that the water would be available for municipal uses. The farmers would be paid from funds the municipality saved by not having to develop a new water supply. Also, other than the initial fee to purchase the option, the larger expenses are incurred only when a serious drought occurs. This type of approach has been used to a limited degree in the Edwards Aquifer.

The "safe supply" approach stated in the Initially Prepared Plan for planning for demand in excess of projections does not meet regulatory requirements, undermines the planning process, is not equitable, and will waste money.

Section 4.2.1 Evaluation Procedures
[28] Page 4-15: To suggest that providing a quantitative assessment of environmental factors is fulfilled by assigning each strategy a low, medium or high impact rating is unacceptable. The text goes on to say that "[i]f a strategy is selected, a more detailed environmental evaluation may be

required." Although it is true that more detailed analyses are required during various permitting or funding processes, that does not satisfy planning requirements. The purpose of requiring a quantitative assessment of environmental factors for each water management strategy being considered is to use that information in making the decision of which water management strategy to recommend. The planning process is designed to foster a careful comparison of potential strategies so that cost-effective and environmentally appropriate approaches are recommended. *See* 31 TAC § 357.5 (e)(4). A meaningful quantitative assessment is necessary in order to ensure long-term protection of state's water resources, natural resources, and agricultural resources.

[29] Page 4-16: There is reference here to Attachment 4-1 at the end of the chapter, which is "an evaluation of the potentially feasible strategies in Region B." and Attachment 4-2 which is the associated costs for each strategy. However, water conservation is totally absent from both these attachments. Providing a comparison of the impacts and costs for water conservation is necessary for illustrating the advantages of more aggressive water conservation measures and for ensuring a more balanced comparison of available strategies. It also is expressly required by Section 357.7 (a)(8)(E) of the TWDB rules. Moreover, one of the basic tenets of regional water planning is that all potentially feasible water management strategies are evaluated "so that the most cost effective water management strategies which are environmentally sensitive are considered and adopted unless the regional water planning group demonstrates that adoption of such strategies is not appropriate." 31 TAC § 357.5 (e)(4). Water conservation must be given equal attention to other water management strategies when evaluating supply options to ensure compliance with that basic requirement.

Section 4.2 Conservation

[30] Page 4-18: The text notes that most of the projected savings from water conservation actually are associated with accounting for the impacts of federal requirements for improved efficiency for clothes washers. Certainly, it is important to account for those savings in order to have accurate projections and the planning group deserves credit for doing so. However, **savings from clothes washer efficiency will also occur in Byers, Lakeside City, and Montague County-Other categories, regardless of current per capita use rates.** They wash clothes too. **Accordingly, Table 4-9 should be revised to account for those savings.**

[31] Page 4-18: If most of the water savings resulting from the Region B water conservation package is from passive clothes washer replacement, the savings should occur fairly evenly over the decades. That does not appear to be the case, particularly for Vernon and Wichita Falls. Those entities are shown as achieving a large percentage of the total savings in one or two decades. That seems counterintuitive and should be explained.

[32] Footnote 1 to Table 4-9 is confusing. It states that no savings are assumed as resulting directly from water audits because savings are associated with system improvements occurring as a result of the audits. However, it is not clear if savings from any system improvements are included in the Table 4-9 totals. It is not reasonable to assume that system audits will identify leaks that will go completely unaddressed. Some amount of savings from system audits, including improvements, should be included and the amounts should be clearly explained.

[33] Information is needed about the water savings associated with each of the individual practices included in the "recommended municipal conservation package." What savings are assumed to occur as a result of the "public and school education" practice? Similarly, the amount of savings projected to occur as a result of the "water conservation pricing" practice should be stated. These "active" strategies should be explained and the savings calculated separately from the "passive" strategy of clothes washer efficiency. The savings from active strategies will happen only with deliberate implementation action. Accordingly, it is important to have clear information about the action that is needed.

[34] Page 4-19: Table 4-11 lists projected costs for municipal water conservation strategies. Some information is needed about the basis for these cost estimates.

Section 4.2.3 Municipal Water Strategies

[35] Page 4-26: In discussing the environmental impacts of the reuse option for the City of Bowie, the IPP fails even to acknowledge the issue of impacts to instream flows. A quantitative analysis of potentially feasible strategies including "effects on environmental water needs" is expressly required by Section 357.7(a)(8)(A)(ii) of the Texas Water Development Board's rules. There is a passing reference under other headings on a "low to moderate effect on the receiving stream." This may be intended to address the environmental flow issue. However, some quantitative information about the extent of those flows and the comparative extent of the reuse is required. There simply is not adequate information provided to assess the significance of the potential impacts.

[36] Page 4-36: The discussion of potential environmental impacts of the options considered for the City of Wichita Falls is highly inadequate. Both of these are large-scale projects with corresponding potential for large-scale impacts. A quantitative analysis of potentially feasible strategies including environmental factors such as "effects on environmental water needs" is expressly required by Section 357.7(a)(8)(A)(ii) of the Board's rules. That quantitative analysis is lacking. No information is provided about the stream reaches that would be affected. No quantitative information is provided about the potential impacts on flows.

[37] Page 4-43: The evaluation of potential impacts on environmental factors for the canal system improvements and the raising of the Lake Kemp conservation pool are highly inadequate. Conversion to a closed pipeline system undoubtedly would impact natural resources in the area because the canals provide a water source and aquatic habitat. Some discussion of those impacts is required. Similarly, raising the conservation pool would affect flows downstream of Lake Kemp. The IPP simply does not provide sufficient information to allow for an informed assessment of those impacts.

These comments on canal system improvements and raising the Lake Kemp conservation pool are not intended as criticisms of these two underlying strategies. They both may hold great promise. However, more information is needed. In particular, a new sedimentation survey is needed before a reasonable assessment of the appropriateness of raising the conservation pool on Lake Kemp can be undertaken. In fact, without such a survey, serious legal questions would arise about the availability of the option of raising the conservation pool and the impacts on downstream water rights.

Section 4.2.7 Regional Water Strategy
Chloride Control Project
[38] Page 4-45: As we understand this project, it does not meet a water supply need. If the regional planning group does intend to include this as a water management strategy for meeting a water need, it requires further explanation. In addition, more quantitative information about the potential impacts is required. The discussion on pages 4-53 and 4-54 provides a useful summary of environmental issues. However, that discussion is wholly lacking in quantitative information. Presumably, that quantitative information is available in the referenced environmental impact studies and should be summarized here.

[39] We also so encourage the evaluation of an alternate approach that relies on land stewardship measures to help address both water quality and quantity issues in Lake Kemp. Certainly brush control often is a part of land stewardship but the concept is much broader than just brush control. Information about land stewardship practices can be found at the Texas Wildlife Association website: http://www.texas-wildlife.org/PDFs/Stewardship%20II%20-%209.5.04-WEB1.pdf. The IPP discusses and endorses land stewardship at pages 8-3 and 8-4. However, that discussion is heavily focused on brush management and the potential for yield enhancement. Brush management certainly has a place in water management in Texas, but it must be undertaken carefully. We believe that a strong and broad land stewardship program also has the potential to yield great benefits in terms of controlling sedimentation rates for area reservoirs.

[40] Omission from Chapter 4: As required by 357.7 (a)(7)(B) of TWDB's rules, **drought management is a water management strategy that must be evaluated**. That provision, along with Section 16.053 (h)(7)(B) also requires that drought management be included as a water management strategy for each entity required to prepare a drought management plan pursuant to Section 11.1272 of the Water Code.

Although the planning group may decide, provided it documents the basis for that decision, not to include drought management as a water management strategy *beyond* those measures specifically required by Section 11.1272, it must *at least* include the Section 11.1272 level of drought management as a water management strategy. **SB2 made inclusion of drought management measures at least at the level required by Section 11.1272 a mandatory prerequisite for approval by TWDB of a regional water plan.** See Tex. Water Code Ann. § 16.053 (h)(7)(B). The initially prepared plan does not comply with that requirement. **For each entity required to prepare a drought contingency plan pursuant to Section 11.1272, the water plan must include a water management strategy reflecting the drought period savings from that drought plan.**

CHAPTER 5: Impacts of Selected Water Management Strategies on Key Parameters

Section 5.3 Impacts of Region B Water Management Strategies on Key Water Quality Parameters
[41] Page 5-8: Water conservation is missing from the list of preferred water management strategies. It certainly is true that water conservation measures generally will not have significant adverse impacts. However, it is important that the plan note the absence of such impacts. As

acknowledged elsewhere in the Initially Prepared Plan and in TWDB rules, water conservation is a water management strategy. Providing a comparable discussion of impacts for water conservation is necessary for illustrating the advantages of more aggressive water conservation measures and for ensuring a more balanced comparison of available strategies. It also is expressly required by Section 357.7 (a)(8)(E) of the TWDB rules. One of the basic tenets of regional water planning is that all potentially feasible water management strategies are evaluated "so that the cost effective water management strategies which are environmentally sensitive are considered and adopted unless the regional water planning group demonstrates that adoption of such strategies is not appropriate." 31 TAC § 357.5 (e)(4). Information about the environmental sensitivity of water conservation measures is necessary to ensure compliance with that basic requirement.

CHAPTER 7: Description of How the Regional Water Plan is Consistent with Long-Term Protection of the State's Water Resources, Agricultural Resources, and Natural Resources

[42] One of the key changes that SB2 made to the water planning process was to create a specific statutory criterion mandating that a regional water plan may not be approved by TWDB unless it is shown to be consistent with long-term protection of the state's water resources, agricultural resources, and natural resources. The Initially Prepared Plan devotes just over five pages to the discussion of that consistency. Although we certainly acknowledge that quality of discussion is more important than quantity, both are lacking here.

CHAPTER 8: Recommendations Including Unique Stream Segments, Unique Reservoir Sites, and Legislative and Regional Policy Issues

Section 8.2 Discussion of Regional Issues

[43] Page 8-2: It is stated that "it is the intention of the RWPG that surface water uses that will not have a significant impact on the region's water supply and water supply projects that do not involve the development of or connection to a new water source are deemed consistent with the regional water plan even though not specifically recommended in the plan." In concept, we understand the rationale behind this statement. However, it is problematic. Increased use of existing water sources also have the potential for significant impacts and must be separately assessed as part of the planning process. On the other hand, minor projects such as repair of treatment plants, storage tanks, and the like should not require such a review. We are not aware, however, that those types of projects have been held up as a result of consistency issues. We do support the creation of an expedited amendment process for regional plans to allow carefully defined "minor amendments" to be made through simplified procedures.

Section 8.2.1 Chloride Control Project

[44] Page 8-2: It is stated that the "Chloride Control Project on the Wichita and Pease Rivers is a water management strategy with high regional support." This is a subjective statement and neglects to mention that both the U.S. Fish and Wildlife Service and the Texas Parks and Wildlife Department have both formally expressed concerns over the environmental impacts of the CCP.

Section 8.3.1 Unique Stream Segments

[45] Page 8-7: It is stated that it is not clear what governmental or private activities, other than reservoir construction, might be subject to additional constraints or limitations as a result of designation of unique stream segments, and it is not clear what geographic extent might be impacted by the designation, and therefore, Region B Water Planning Groups suggests that the Legislature may wish to clarify their intent regarding designations. The Texas Legislature acted definitively in expressly limiting the legal effect of such designations: "This designation solely means that a state agency or political subdivision of the state may not finance the actual construction of a reservoir in a specific river or stream segment designated by the legislature under this subsection." Tex. Water Code Ann. § 16.053 (f). It is difficult to imagine how that language could be made more clear other than by stating that it only means that one thing. The regional group has the latitude to recommend the extent of the river or stream segment recommended for designation.

Section 8.3.2 Reservoir Sites

[46] Page 8-7 and 8-8: Although it is stated in the Summary of Regional Recommendations on page 8-10 that no unique reservoir sites are being formally recommended at this time, the Ringgold Reservoir Site and its estimated water supply are mentioned in this section. We believe such designations should proceed carefully and support the planning group's decision not to recommend designation. Because there are private property concerns inherent in unique reservoir site designations, any recommended designation that might be considered in the future should include enough information about the boundaries of the area proposed for designation to allow a landowner to know if his or her property would fall within the area.

Section 8.5 Summary of Regional Recommendations

[47] Page 8-11: The basis for the recommendation that the gallons per capita per day (gpcd) calculation of water use be based on residential use is unclear. This recommendation conflicts with the evaluation and recommendation of the Water Conservation Implementation Task Force on this issue. In addition, using only residential use to calculate gpcd would be a poor measurement of per person water use because it wouldn't include the water we each use in our workplaces and other public places we spend much of our time, such as restaurants, hospitals, etc. There are significant opportunities for water conservation in all of these venues, so to not include them in gpcd measurements allows no means for comparing the implementation and effectiveness of these.

[48] A concern was raised at one of the planning group's public meetings that the gpcd measurement wasn't fair to Region B because some people use municipal water supplies to fill their cow troughs, and cows use more water than people. However, a comparison of gpcd water usage rates in Region B's more rural areas to the largest urban area (see below), indicates that water use in the urban area is significantly higher. Thus, the use of municipal supplies for small-scale livestock watering does not appear to be a major factor. In addition, there is no particular reason to believe the issue is so unique to Region B that it skews any potential comparison.

Year 2000				
Water User Group	Population	% of Region's Population	Municipal Demand (ac-ft/yr)	Gallons per Capita per Day

Wichita Falls-Municipal	104,197	51.6%	23,053	198 GPCD
Rest of Region B-Municipal	97,773	48.4%	18,202	166 GPCD

CHAPTER 10: Adoption of Plan

Section 10.6 Public Participation

[49] Page 10-6: The public hearings held to date by Region B have been scheduled during normal business hours and have had poor public turn-out. It is often difficult for people to take time off from work to attend public hearings. We would encourage the Planning Group to consider holding future public hearings outside of typical business hours to try to boost attendance at these important events.

[50] Page 10-6: Although the three-member Technical Advisory Committee could be seen as beneficial because they neutralized controversial issues before they were brought to the RWPG, the existence of such a group can also work against the intended nature of an effective public process. The RWPGs were intentionally set up to include representatives from many different walks of life so that each can bring their unique perspective and point-of-view to the table in discussing issues concerning this shared resource. If the TAC performs the function of making decisions before they are brought before the RWPG, then this has the effect of limiting the discussion by the RWPG and the consideration of different points of view that might be aired if allowed to occur in the context of the larger group. As a result, there was often very little discussion of many issues presented to the RWPG, perhaps in part because most decisions had a forgone conclusion. In addition, because the meetings of the Technical Advisory Committee were not announced to the public, there was no opportunity for public involvement in the discussion or decisions of the TAC.

Thank you for your consideration of these comments and please feel free to contact us if you have any questions. We look forward to a continuing positive dialogue with the planning group during this and future planning cycles.

Sincerely,

Myron J Hess　　Mary E. Kelly　　Ken Kramer

Myron Hess
National Wildlife Federation

Mary Kelly
Environmental Defense

Ken Kramer
Sierra Club, Lone Star Chapter

cc: Temple McKinnon, Region B liaison, TWDB
Bill Mullican, TWDB
Kevin Ward, TWDB
Mark Howell, Region B liaison, TPWD
Cindy Loeffler, TPWD

Kerry Maroney, Biggs & Mathews, Inc.
Simone Kiel, Freese and Nichols, Inc.
Rex Hunt, Alan Plummer Associates, Inc.
Peggy Glass, Alan Plummer Associates, Inc.

TEXAS PARKS & WILDLIFE

RECEIVED
SEP 2 6 2005
BY:

September 13, 2005

Mr. Curtis W. Campbell
RBWPG Chairman
900 8th Street, Suite 520
Hamilton Building
Wichita Falls, Texas 76301-6894

Dear Mr. Campbell:

Thank you for the opportunity to review and comment on the 2005 Initially Prepared Regional Water Plan (IPP) for Region B. Texas Parks and Wildlife (TPW) acknowledges the time, money and effort required to produce the regional water plan as mandated by Senate Bill 1 of the 75th Legislature. A number of positive steps have been taken since the first planning cycle to advance the issue of environmental protection. For example, the regional water planning groups were faced with a new requirement under 31 TAC §357.7(a)(8)(A), to perform a "quantitative reporting of environmental factors including effects on environmental water needs, wildlife habitat, cultural resources, and effect of upstream development on bays, estuaries, and arms of the Gulf of Mexico" when evaluating water management strategies. TPW recognizes that each region's unique natural resources, water management strategies and funding limitations dictated the level of quantitative analysis for each regional plan. Nonetheless, TPW feels strongly that quantification of environmental impacts is a critical step in planning for our state's future water needs while also protecting environmental resources.

TPW staff has reviewed the IPP to determine if the following questions were addressed:

- Does the plan include a quantitative reporting of environmental factors including the effects on environmental water needs, habitat?
- Does the plan include a description of natural resources and threats to natural resources due to water quantity or quality problems?
- Does the plan discuss how these threats will be addressed?
- Does the plan describe how it is consistent with long-term protection of natural resources?
- Does the plan include water conservation as a water management strategy? Reuse?
- Does the plan recommend any stream segments be nominated as ecologically unique?

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- If the plan includes strategies identified in the 2000 regional water plan, does it address concerns raised by TPW at that time?

According to the Region B IPP the region will have adequate water supplies throughout the planning period. The IPP relies heavily on conservation measures to reduce municipal water waste. These include compliance with the State Water Efficiency Plumbing Act and the use of more efficient washing machines in the future. TPW encourages Region B to also consider land stewardship (brush control/management) as an additional means of conserving water that may also benefit wildlife habitat. Reuse is also included as a water management strategy. Wichita Falls expects to treat some of their effluent for irrigation use on city parks and golf courses beginning in 2007. The Red River Chloride Control Project (RRCCP) is also recommended as a strategy to address the heavy dissolved solid and chloride concentrations in the western portions of the region. TPW has expressed concerns in the past regarding this project but we support the following statement from the IPP: "the effectiveness and environmental impacts of the project will be evaluated as the CCP facilities are completed and operating within the Wichita River Basin." The IPP does not specify what actions may be taken if the effectiveness or environmental impacts do not meet expectations.

In general the Region B IPP does not include a quantitative reporting of environmental factors including the effects on environmental water needs and habitat. However the IPP does include a description of natural resources including threats to those natural resources such as declines to springflows, grasslands and native fauna. The IPP does not include a description of how natural resources will be protected, with the exception of impacts associated with the RRCCP, which are to be addressed by the project's monitoring and mitigation plan. For areas in the Region where groundwater is the primary source of water supply, emphasis should be placed on protecting springs that support fish and wildlife.

It is disappointing that the plan does not recommend nomination of any stream segments as ecologically unique. The IPP states that the planning group is committed to the protection and conservation of unique and sensitive areas within the region and would like a more comprehensive study with supporting data to accurately characterize and evaluate candidate stream segments. TPW is available to assist with this effort.

Please be assured that TPW will continue to work with the region to explore all possibilities to meet future water supply needs and assure the ecological health of the region's aquatic resources.

Sincerely,

Larry D. McKinney, Ph.D.
Director of Coastal Fisheries

LDM:CL:dh

PENNY MILLER
1700 Tanglewood Drive
Wichita Falls, TX 76309

Mr. Curtis W. Campbell, Chairman
Red River Authority of Texas
900 8th Street, Hamilton Building, Suite 520
Wichita Falls, TX 76301-6894

September 4, 2005

Dear Mr. Campbell and Members of the Region B Water Planning Group:

Please accept these written comments concerning the Draft Region B Water Plan, June 2005.

Overall, I am of the opinion that Regional Water Planning should incorporate a broad watershed management strategy. In many respects, the draft plan makes a stab at this, although there are some areas which could use some improvement.

Congratulations to the Planning Board for developing a detailed plan—it is obvious a great deal of work went into this effort. I also commend the Board for its emphasis on water conservation as the primary recommendation for water users to meet Region B's water needs. (pg 1-26, section 1.9)

I am in agreement with the recommendations in Chapter IV, concerning improving conservation in the lateral canals.

There are some specific areas I have concerns and/or questions. These specific concerns are:

- Lack of a coherent water conservation strategy
- The recommendation that water use measurements include only municipal uses
- Lack of consideration of impact on wildlife.

More in-depth comments in each area follow:

Lack of a more coherent water conservation strategy

Although the Plan rightly cites water conservation measures as the main way to meet water use goals, the Plan itself indicates "Generally water conservation was not included in the projected demands for non-municipal water uses in Region B." (p. 4-16, Section 4.2.1) In other words, the entire focus of water conservation is on municipal uses, which is not the primary use of water in Region B.

The Plan indicated that water conservation best practices had been evaluated and the four selected by the Planning Group were (pg 4-17, Section 4.2.2):
- Public and School Education
- Reduction of Unaccounted for Water through Water Audits

- Water Conservation Pricing
- Passive Clothes Washer Rules

Of these strategies, the passive clothes washer rules are mandated by the federal government. Water audits and water conservation pricing will be helpful. All of the municipal water use reduction envisioned in the Plan is due entirely to passive clothes washer rules and plumbing code changes made by the state.

I was disappointed that there was not more emphasis on what measures the Group intended to use to meet water conservation "goals." There seemed to be an underlying assumption that water conservation would take care of itself through the school systems and general awareness that is supposed to develop, presumably through the actions of someone who is never defined. The other leg of the water conservation plan lies in the required changes mandated by the state and federal government. I have serious doubts that these actions by themselves will have the needed impact on behavior in this area. As in any other endeavor, responsibility not assigned means that no one is accountable.

Having worked with the public school systems, the expectation that they will spend the time to incorporate good water conservation awareness or that the awareness will translate into the home environment completely lacks the awareness that the schools are very focused on teaching the curriculum needed for the students to pass the tests that the schools are graded on. Water conservation is not part of those tests.

The Planning Group needs to identify responsibility or take responsibility on itself to raise awareness. A possibility would be to develop a coalition of agencies and individuals with an interest in this issue who can help water agencies develop strategies for water conservation awareness.

The Recommendation that Water Use Measurements Include Only Municipal Uses

I disagree with the recommendation of the Plan (pg. 8-11) that the gallons per capita per day (GPCD) calculation of water use be based upon residential water use only UNLESS an alternate measure is created which will offer a method to track other water uses. What is not measured is not done.

The GPCD measurement only measures municipal water use as it is, which is inadequate, but probably the best compromise that could be reached at State level. To water the measurement down further will make it easier for this area to look good compared to other areas, but will leave out important information. The measurement will be useful within Region B to compare over time as water conservation activities take place.

Lack of Consideration of Impact on Wildlife

Although the Plan discusses the wildlife in Region B (pg 1-22) and "environmental factors" was one of the decision criteria for choosing water conservation strategies (pg 4-14), there is no discussion in the Plan concerning water for the environment. It was properly acknowledged that this is an important area, especially for migration of birds. Various water development options were listed with an impact of low, medium, or high impact on the environment, without clear explanation of what these ratings mean. There is also no clear discussion of how the Region plans to maintain wetlands, sufficient in-stream flows, and water quality for wildlife. What concerns are there? It appears there are none, but our stream flows are of concern for fishing, recreation and habitat maintenance. It does not appear the Regional Planning Group adequately addressed these areas of concern.

Thank you for taking my comments into consideration as the Regional Plan is finalized.

Sincerely,

PMiller

Penny Miller

Copies to:

Senator Craig Estes
Representative David Farabee

Transcribed from original letter, as attached.

Regional Water Planning Group – B,

I have attended two regular meetings, also the July 6 meeting. It's so good to hear of the thinking, analyzing, consulting, etc., concern such an important subject and the effort to include so many different interested parties. Thanks.

My concerns – when I heard of the lateral lines – the miles (?) The water must travel from lakes to treatment plants – the condition of those and the amount of water lost – I know it's economics – money – but – !

So much of such a burden falls to Wichita Falls and County because of location of the lakes and their purposes. But so <u>many</u> of the outlying communities depend of those lakes – and I'm speaking as a resident of one of those communities and I see and hear nothing of using existing water wisely (conservation!) Unless there is a drought and lawn watering, car washing is limited. I feel not enough is being said about that anywhere – as we are afraid people will resent being "asked" to do such – but we need to realize there's just so much water – there's not "locating" any more – only using wisely what we have.

The words, "establish realistic, appropriate, and voluntary water conservation goals" <u>are</u> appropriate, but we, as general public, need to be encouraged and educated on the importance.

Thanks –

I'm sorry the last legislative session with the bill, "Environmental Flow Protection", was not successful, because those guys "down river don't realize what" brush control", could do and the state should be involved in it!

Sincerely,

Pam McKay
513 W. Omega
Henrietta, TX 76365

Regional Water Planning Group - B

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SEP 14 2005

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Sincerely
Pam McKay
513 W. Omega
Henrietta TX 76365

RESPONSES

December 5, 2005

Curtis W. Campbell, Chairman
Regional Water Planning Group – Area B
Red River Authority of Texas
900 8th Street
Hamilton Building, Suite 520
Wichita Falls, TX 76301-6894

RE: Comments/Responses to Initially Prepared Plan (IPP)
For Region B Regional Water Planning Area
Contract No. 2002-483-452

In accordance with the Texas Water Development Board (TWDB) requirements set forth in TAC Section 357.10 (a)(3) the Regional Water Planning Group (RWPG) Region B should consider approving certain revisions in the IPP based on the TWDB's written comments and other Public/Agency comments received relative to the IPP.

TWDB Comments – Letter Dated September 28, 2005

Executive Summary

1. Comment: The 2000 water use amounts for cities and non-city water utilities are not TWDB approved amounts.

Response: The 2000 water use demands in the IPP have been changed to match the TWDB numbers.

2. Comment: The year 2000 water use for six major categories, the total municipal demand projections and the total demand projections do not match TWDB numbers.

Response: The 2000 water use numbers in the IPP has been changed to match the TWDB numbers.

Chapter 1: Description of the Region

1. Comment: The year 2000 steam-electric power use number does not match the TWDB approved amount.

Response: The IPP 2000 steam-electric power use number has been changed to match the TWDB approved amount.

2. Comment: The year 2000 water use illustrated in the Chart Pg. 1-19, Fig. 5 does not match TWDB amount.

Response: The chart has been changed to match the TWDB number.

<u>Chapter 2: Population and Water Use Projections</u>

3. Comment: The per capita municipal water use for the year 2000 should be 165 not 182.

Response: The IPP has been changed to show 165.

4. Comment: The year 2000 and year 2060 municipal water demand does not match the approved TWDB number.

Response: The IPP has been changed to match the TWDB numbers for 2000 and 2060.

5. Comment: The year 2000 manufacturing water use does not match approved TWDB number.

Response: The IPP has been changed to match the TWDB number.

6. Comment: The year 2000 manufacturing water use, steam electric water use, and mining water use do not match the approved TWDB numbers.

Response: The IPP has been changed to match the TWDB numbers.

7. Comment: The year 2000 steam-electric water use does not match the approved TWDB number.

Response: The IPP has been changed to match the TWDB number.

8. Comment: The year 2000 mining water use does not match the approved TWDB use amount.

Response: The IPP year 2000 mining water use has been changed to match the approved TWDB number.

9. Comment: The year 2000 irrigation water use and the year 2000 livestock water use does not match approved TWDB amounts.

Response: The IPP year 2000 irrigation and livestock water use numbers have been changed to match approved TWDB numbers.

<u>Attachment 2-1</u>

10. Comment: In Table A-2 & A-3 the population projections for several non-city utilities differ from TWDB approved projections. Also Windthorst WSC is missing from Clay County.

Response: The population projections have been revised to match TWDB numbers and Windthorst WSC have been added to Clay County as requested.

11. Comment: In Tables A-6 and A-7 the water demand projections for several non-city utilities differ from the TWDB approved projections. Also Windthorst WSC is missing from Clay County.

Response: The water demands have been revised to match TWDB numbers as requested, and Windthorst WSC has been added.

12. Comment: "Wichita Co. Other" is missing from Table A-7.

Response: As requested "Wichita Co. Other" has been included in Table A-7.

13. Comment: In Tables A-8 & A-9 a number of water use category totals have incorrect year 2000 water use estimates.

Response: As requested, the year 2000 water use estimates in Tables A-8 & A-9 have been revised to match approved TWDB water demands.

14. Comment: In Tables A-8 & A-9 a number of water demand category totals have incorrect water demand projections.

Response: As requested, the water demand category totals have been revised to match the approved TWDB demand projections.

Chapter 3: Evaluation of Current Supplies

15. Comment: The plan needs to verify that the regional water plans protects water contracts, option agreements or special water resources.

Response: The plan protects water contracts, option agreements and special water resources. The list of contracts in Region B is shown on Table 3-5. These contracts were considered during the evaluation of current water supplies. An acknowledgment of the reservoirs that are designated as special resources in Region B have been added to Section 3.1 and/or 3.1.1.

16. Comment: Provide information on the effects of the plan on navigation.

Response: A brief description of the navigation activities in Region B will be added to Chapter 1. The effects of the plan on navigation will be addressed in Chapter 7.

17. Comment: Please provide the following information.

a. List of reservoirs with updated storage capacities.
Response: The list of reservoirs in Region B with updated storage-capacities is shown in Table 3-3 of the Initially Prepared Plan. In addition, the storage capacity for Greenbelt Reservoir in Region A was also updated for supply analysis in the Region B plan. No changes will be made to final plan based on this comment.

b. Version of WAM used to calculate yield of Amon Carter.
Response: The Trinity WAM was used to determine the yield of Amon Carter Lake. The original Trinity WAM does not have the correct permitted storage capacity. Amon Carter has a permitted storage capacity of 28,589 acre-feet. The Trinity WAM shows only 20,050 acre-feet. The yield of Amon Carter Lake in the Region B IPP considered the permitted storage capacity of 28,589 acre-feet in determining 2000 and 2060 storage conditions. No changes will be made to final plan based on this comment.

18. Comment: Include wholesale water provider allocations by category of use, county and river basin, and demands and contractual obligations to Table 3-14.

Response: Demands and contractual obligations on Wichita Falls are shown in Table 2-5. Distributions of supplies listed in Table 3-14 by category of use, county and river basin are included in the DB07 database. The comparison of supplies and demands for wholesale water providers is shown on Table 4-4 in Section 4.1.2. No changes will be made to final plan based on this comment.

19. Comment: Table 3-13 lists groundwater supplies available to Young County, but does not identify the source. Provide source of this water.

Response: Table 3-13 is a summary table of all supplies available to water user groups, not groundwater supplies. The supplies to users in Young County include water from Olney/Cooper Lake, local livestock supplies, and purchased water from Wichita Falls. No change in the plan will be made based on this comment.

Chapter 4: Identification, Evaluation and Selection of Water Management Strategies

20. Comment: Provide a quantification of environmental impacts.

Response: Attachment 4-1 has been expanded to include a summary table that lists the environmental categories considered during the evaluation. This table includes the total number of acres impacted by each water management strategy. The text has been modified as needed to correspond to the evaluation presented in Attachment 4-1.

21. Comment: Document adjustments to water management strategies to account for environmental flow needs.

Response: Lake Ringgold was evaluated using the WAM with releases under the Consensus method to determine the yield. Environmental releases are not required for the Lake Kemp strategy since this strategy will not require a new water right. Increasing the conservation elevation at Lake Kemp to compensate for storage reduction due to sedimentation will not increase the permitted storage of the lake. There should be no additional impacts to streamflows downstream of Lake Kemp. This discussion will be added to the Lake Kemp strategy in Chapter 4.

22. Comment: Document that irrigation conservation water management strategies were considered for all irrigation needs.

Response: The irrigation shortages in Region B are associated with the irrigation district that supplies water from Lake Kemp. Irrigation conservation strategies for supplies from a canal distribution system are limited to strategies that conserve water from the system. The canal study showed that losses in the main canals are small. Enclosing the canal laterals in pipe is a conservation strategy recommended in Region B. The reference to consideration of conservation for irrigation and steam electric power needs is on page 4-18 of the IPP. No changes will be made to final plan based on this comment.

23. Comment: Report costs of water management strategies in discounted present value.

Response: Discounted present value of strategy costs are calculated automatically in the DB07 database. Exhibit B, page 55, states "Discounted values will be automatically calculated on the web-based database application forms and based on the annual costs for each WMS as reported by the Planning Group." According to TWDB staff, this requirement will be completed by the TWDB. No changes will be made to final plan based on this comment.

24. Comment: Report impacts to agricultural and natural resources for strategies for Byers, Lakeside City and Wichita Falls

Response: These impacts are shown in Attachment 4-1 and have been added to the text in Chapter 4.

Attachment 4-2

25. Comment: Clarify that all cost components were included in the development of costs.

Response: Additional information on the cost methodology used in developing costs has been added to Attachment 4-2. All components necessary for the water management strategies were included in the cost calculations.

Attachment 4-4

26. Comment: Address security of the canal system and water savings.

Response: Improvements to canal security are addressed in the Conclusions and Recommendations chapter of the report. Protection of the canal from livestock intrusion and public dumping are continuing issues at the canal that need to be addressed. The report recommends fencing, as necessary, to limit access by livestock and public education to minimize public dumping in the canal. Water savings will be realized through canal system piping improvements, addressed in the Conclusions and Recommendations chapter of the report.

27. Comment: The canal study does not include prepared GIS maps for the canal system.

Response: The required maps are included in the final Regional Water Plan Update.

28. Comment: Provide estimates of water saved and implementation costs for conservation strategies.

Response: Conservation savings associated with the canal system are discussed in Section 4.2.5 and Attachment 4-4.

29. Comment: It is not evident that alternative strategies for implementing the preferred technical alternatives were identified in the study of Attachment 4-4. Also funding sources were not apparent.

Response: The canal study examined numerous areas of potential water losses and found that the primary source of water loss is in the laterals to the main canal. Prior efforts to line laterals or limit losses by alternative means were investigated and found to be unsuccessful. The piping of the laterals was found to be the most viable approach to water conservation in the canal system, as was explained in Attachment 4-4. The canal study was supplemented to address potential funding sources for canal system improvements. Conservation savings associated with the canal system are discussed in Section 4.2.5 and Attachment 4-4.

30. Comment: Provide results of seasonal pool for Lake Kemp.

Response: The seasonal pool is included as a recommended strategy for Lake Kemp, and was discussed on page 4-42 of the IPP. Additional discussion on the available yield has been added to Chapter 4.

31. Comment: Provide a description of process used to identify potentially feasible strategies.

Response: The process for screening and selecting potentially feasible water management strategies were discussed and approved by the Region B RWPG. This discussion has been added to Section 4.2.

Appendix A:

32. Comment: Year 2000 supplies in Appendix A do not match TWDB-approved numbers.

Response: Region B has coordinated with the TWDB staff and no changes will be made to the report.

33. Comment: Archer County-Other supplies appear to be switched for the Brazos and Trinity Basins.

Response: The values in the DB07 database were corrected.

34. Comment: Dean Dale WSC in Clay County data differ in Appendix A from the DB07.

Response: The data values in Appendix A were corrected..

LEVEL 2 – TWDB COMMENTS

Executive Summary

35. Comment: Include Young County in the Summary Tables, Page ES-3, Tables ES-1 and 1-1.

Response: Young County has been included in the Tables ES-1 and 1-1.

36. Comment: Clarify the constituent discussed in the last recommendation on page ES-22.

Response: The constituent discussed is nitrates and has been noted in the recommendation.

37. Comment: Correct the statement regarding one-acre foot of water to read 325,851 gallons shown on Page ES-5 and Chapter 2 page 2-3.

Response: The volume for one-acre foot has been corrected to state 325,851.

38. Comment: Consider adding unit "acre-feet per year" in the title of tables ES-5, ES-9, ES-6, ES-7, ES-10, ES-8, ES-9, ES-21, and ES-14, Page ES-6.

Response: The titles of each table has been modified to show "acre-feet per year".

Chapter 1: Description of Region

39. Comment: Suggest changing column title to "2000 Water Use AF/YR" for Table 1-15, Page 1-28 and Attachment 2-1, Table A-6, A-7, A-8, and A-9.

Response: The titles have been changed to "2000 Water Use AF/YR.

40. Comment: Consider using the term "Water System" for Red River Authority systems in instead of WSD, Table 1-15, Pg. 1-28 and Tables A-2, A-3, A-6, and A-7, Attachment 2-1.

Response: Red River Authority systems have been labeled as "System" or "Water System" instead of WSD.

41. Comment: Consider changing Montague WSC, Oak Shores WSC, and Sunset WSC to "Water System". Page 1-28, , Table 1-15 and Attachment 2-1, Tables A-2, A-3, A-6, and A-7.

Response: WSC has been changed to "Water System".

42. Comment: Consider changing names of some of the small water systems to accurately reflect the organization names, as shown on Page 1-28, Table 1-15 and Attachment 2-1, Tables A-2, A-3, A-6, and A-7.

Response: Water System names have been changed to match names suggested by TWDB.

43. Comment: Consider referencing "Game Fish present in the study area" instead of "Fish Species present in the study area" on page 1-23.

Response: Comment noted, but no change in plan due to this comment.

Chapter 2: Population and Water Use Projections

44. Comment: Consider revising the column heading to "Customers" on Table 2-5, Page 2-12.

Response: Column heading has been changed to "Customers".

Attachment 2-1:

45. Comment: Consider using term "County Other" in a manner consistent with other regional plans and state water plans.

Response: Region B prefers to leave the Table A-2, A-3, A-6, and A-7 as shown. No change will be made to these tables relative to this comment.

Chapter 3: Evaluation of Current Water Supplies

46. Comment: Reconsider statement about storage in unconfined and confined aquifers.

Response: Statement has been deleted.

Chapter 4: Identification, Evaluation, and Selection of Water Management Strategies

47. Comment: Consider including additional information on conservation strategies.

Response: A detailed explanation of the savings calculations and cost has been added as attachment to Chapter 4.

48. Comment: Consider including information that the City of Electra uses a reverse osmosis system to remove nitrates, Page 4-28.

Response: Information has been included.

49. Comment: Clarify basis for City of Vernon needed supply of 600 acre-feet per year.

Response: The needed water supply should be 664 acre-feet per year and has been corrected.

50. Comment: Explain the impacts of sedimentation on the strategy for Lake Kemp that increases the conservation pool elevation.

Response: Additional discussion on the storage volumes over time has been added to the discussion of this strategy in Section 4.2.5.

General

51. Comment: Consider referencing the occurrence of tables and figures in the Table of Contents.

Response: After due consideration, no changes will be made in the plan Table of Contents.

52. Comment: Consider updating the links for the Railroad Commission oil and gas data (references) to February 5, 2005.

Response: Railroad Commission links reference has been updated.

TWDB DB07 COMMENTS – LEVEL 1

Region-Wide

1. Comment: No sources show entry of the methodologies used for water availability.

Response: Methodology for water availability has been added.

Sources Module

2. Comment: Add water rights to aggregated run-of-the-river rights.

Response: Water right numbers will be added to aggregated run-of-the river supplies in the DB07 source module. If there are more than 10 water rights for one aggregated source, the water rights will be provided to the TWDB in a table. Water rights for run-of-the-river supplies identified in Table 3-6 will be updated. Water rights for run-of-the-river supplies in the Trinity and Brazos basins will be added to Table 3-6.

3. Comment: Source availability for "Other Aquifer" in Montague County is over allocated.

Response: Source availability for other aquifers is based on historical pumpage. We have adjusted the supplies upward to reflect the new demand on the aquifer.

4. Comment: Enter name of Other Aquifer

Response: Subsequent correspondence from the TWDB clarified that only those individual formations that are known and are important local resources should be added to the database. For "Other Aquifer" designations in Region B, the requested information is not readily available. No changes will be made to the final plan based on this comment.

5. Comment: Data values missing

Response: Data is correct. The values are "0".

6. Comment: Enter individual reservoir yield for systems in the Regional Comments Field.

Response: The Kemp-Diversion system is operated as a system and individual yields were not assessed. The Olney-Cooper System is a twin lake system. Individual yields were not assessed. Individual yields were assessed for the Wichita system. This information has been included in the Region B water plan.

7. Comment: County and Basin of the Source do not match the TCEQ database.

Response: The water right type has been corrected. The water right number used in the Source ID code is the Certificate of Adjudication 5152.

WUG Module

8. Comment: Unmet needs for Wilbarger SEP.

Response: Supplies from strategies were adjusted to meet need.

9. Comment: Missing limiting factors.

Response: Limiting factors have been added to all supply sources.

10. Comment: Add additional information for limiting factor J to regional comments.

Response: Limiting factors have been adjusted. Comments will be added as needed.

11. Comment: WUG supply source requires entry of water rights data.

Response: Water rights data are included in the source module. Information for the WUGs can be obtained from the source module.

12. Comment: Enter seller information.

Response: This has been added.

13. Comment: Verify that WUG supply volumes are "0".

Response: These values are "0".

WWP Module

14. Comment: Complete field for "Contract or Non-Contract Demand".

Response: This field was completed.

15. Comment: WWP Supply Source requires water right information.

Response: Water right data will be added to the source in the source module. Information for the WWP module can be obtained from the source module.

16. Comment: Verify supplies from Wichita Falls to Olney are an interbasin transfer.

Response: This is an interbasin transfer and the DB07 has been corrected.

17. Comment: Lake Ringgold is identified as a recommended strategy for Wichita Falls in the WUG module, but it is not recommended in the WWP module.

Response: Lake Ringgold is not a recommended strategy and the DB07 has been corrected to reflect this.

18. Comment: Add seller name to water management strategy, "Purchase water from Local Provider".

Response: Seller name has been added at the WUG level.

19. Comment: WUG supply source for water from the Wichita System to Archer County-Other in the Brazos Basin is not marked as an Interbasin Transfer.

Response: This supply has been identified as an interbasin transfer.

20. Comment: Capital Cost data is duplicated for the Lake Ringgold Project, wastewater reuse and conservation for Wichita Falls.

Response: Capital costs were deleted from the WUG module for Lake Ringgold and wastewater reuse, and capital costs were deleted from the WWP module for conservation.

21. Comment: WMS annual cost 2010 – 2060 data values are missing or confirm data values are "0".

Response: All data values are correct. Data values entered as "0" are "0".

22. Comment: WMS capital cost data values are missing or confirm data values are "0".

Response: All data values are correct. Data values entered as "0" are "0".

23. Comment: All cost data listed are "0" for Seasonal Conservation Pool.

Response: All data values are correct. Data values entered as "0" are "0".

24. Comment: Lake Ringgold is identified as a recommended strategy for Wichita Falls in the WUG module, but it is not recommended in the WWP module.

Response: Lake Ringgold is not a recommended strategy and the DB07 has been corrected to reflect this.

25. Comment: Capital Cost data is duplicated for the Lake Ringgold Project, wastewater reuse and conservation for Wichita Falls.

Response: Capital costs were deleted from the WUG module for Lake Ringgold and wastewater reuse, and capital costs were deleted from the WWP module for conservation.

26. Comment: WMS annual cost 2010 – 2060 data values are missing or confirm data values are "0".

Response: All data values are correct. Data values entered as "0" are "0".

27. Comment: WMS capital cost data values are missing or confirm data values are "0".

Response: All data values are correct. Data values entered as “0” are “0”.

Sources Module – Level 2

28. Comment: Source is not used by any WUG or WWP.

Response: The following changes have been made.
Run-of-River Industrial, Clay County: Supply is available according to Red River WAM. There is no manufacturing demand in Clay County. No changes made.
Other Aquifer, King County. This supply has historically been used for livestock. This supply will be considered for livestock use in King County.
Lake Iowa Park and Gordon. The Red River WAM shows a reliable supply from this source, but recent historical data shows this source to be unreliable. The supply available to Iowa Park from this source is “0”. No changes made.

National Wildlife Federation Comments-Letter Dated September 15, 2005

Having considered the Background and Overview information along with the Summary of Key Comments, Key Principles, and Page-Specific Comments, the following responses are being provided:

SUMMARY TABLE OF KEY COMMENTS

1. Comment: Use of "Safe Supply" results in unnecessary water supply strategies.

Response: State regulations (TAC §291.93(3)) require public water utilities to submit a report to the state identifying how the utility intends to meet the projected demands of its service area when the utility reaches 85 percent of its capacity. The regulations also require public water suppliers and wholesale water suppliers to have sufficient supplies to meet the maximum day and/or contractual demands of all their customers. Planning for a surplus of 15 to 20 percent above the demand projections is within reasonable planning guidelines for long-range water supply planning. Consideration of a "safe supply" does not represent an inflated demand. No changes will be made to the final report based on this comment.

2. Comment: Use of "Safe Yield" results in unnecessary water supply strategies.

Response: Region B lies in an area prone to drought. Often reservoir evaporation in the summer months can be greater than the monthly usage. Water providers in Region B operate their reservoir systems with a reserve water capacity. In addition to the concern about drought, the water quality of a reservoir is greatly diminished under very low storage conditions and the ability to use this water is limited. "Safe Yield" represents the supply available to the region under current operations. No changes will be made to the final report based on this comment.

3. Comment: Does not believe the plan maximizes water efficiency.

Response: The Region B Plan includes water conservation strategies as required by Senate Bill 1 and the Texas Water Development Board regulations and guidelines. No changes will be made to the final report based on this comment.

In addition, the Texas Parks and Wildlife Department commented that the IPP relies heavily on conservation measures to reduce the municipal water demand.

4. Comment: The plan does not consider drought management.

Response: Drought contingency strategies are short-term solutions to water shortages caused by drought or other emergencies. The Region B RWPG does not consider drought management strategies as a reliable long-term water supply. No changes will be made to the final report based on this comment.

5. Comment: There is an insufficient quantitative analysis of environmental impacts.

Response: The IPP does include quantitative analysis of the impacts of proposed water management strategies. There are no recommended water management strategies that propose to use additional streamflows, therefore, there are no impacts to environmental flows from water management strategies. No changes will be made to the final report based on this comment.

6. Comment: The IPP does not adequately characterize groundwater and spring flows.

Response: 1) A brief discussion of springs has been added to Section 3.2.1. No springs in Region B are currently used as a significant source of water supply. Groundwater availability in the plan was set at levels that minimize drawdowns to area aquifers, thus minimizing impacts on springs in the region. 2) The Region B RWPG does not set groundwater management policy. This is determined by groundwater conservation districts. 3) The Rolling Plains Groundwater Conservation District was the only district within Region B with an approved management plan at the time the IPP was published. Since then, the management plan for the Tri-County Groundwater Conservation District was approved (August 18, 2005). The Region B plan has been modified to recognize the presence of these two conservation districts. There are no recommended groundwater strategies in the counties with established groundwater conservation districts. Therefore, regulatory limits to pumping do not impact the Region B plan.

KEY PRINCIPLES

1. Comment: Maximize Water Efficiency

Response: The Region B Technical Committee reviewed and discussed water conservation and reuse for water user groups with needs in Region B. The water efficiency measures and recommended reuse represent the economically achievable level of conservation for users in Region B. The Region B water plan recommends several reuse strategies to meet future needs. Consistent with findings of the Water Conservation Implementation Task Force and state law, water reuse is one component of conservation. No changes will be made to the final report based on this comment.

2. Comment: Limit Non-Essential Use during Drought

Response: The Region B RWPG considered drought management measures, and concluded that drought management strategies are interim measures in response to drought and are not a reliable long-term water supply. There are no shortages due strictly to drought identified and drought management as a water management strategy would not resolve long term shortage. No changes will be made to the final report based on this comment.

3. Comment: Plan to Ensure Environmental Flows

Response: Texas Water Development Board regulations governing regional water planning do not require designation of environmental flows as a demand. Projected water use in Region B is expected to remain fairly constant through the 60-year planning period. There are no significant changes in water use that would impact environmental flows in the region. Clarification of how environmental impacts are quantified has been provided in the final Plan Update. Quantified environmental impacts of strategies will correspond to quantification in Attachment 4-1.

4. Comment: Minimize New Reservoirs

Response: Comment noted. No changes will be made to the final report based on this comment.

5. Comment: Manage Groundwater Sustainably.

Response: Comment noted. No changes will be made to the final report based on this comment.

6. Comment: Facilitate Short-Term Transfers

Response: Voluntary redistribution of water resources is considered by Region B through the sale of water from a willing provider to water user group. In general, the Region B RWPG supports voluntary redistribution of water resources and supports such redistributions on a willing buyer/willing seller basis. Emergency transfers are considered short-term strategies and are not appropriate for long-range water supply planning. Lake Wichita and Lake Iowa Park are described on page 3-10 of the Initially Prepared Plan. Lake Iowa Park is owned and operated by the City of Iowa Park and is a source of water for the City. Recent droughts have shown this lake to be unreliable. The Region B water plan does include some water supply from this source to the City of Iowa Park. Lake Wichita is a very shallow lake that is no longer used for water supply. No changes will be made to the final report based on this comment.

PAGE SPECIFIC COMMENTS

Chapter 1: Description of Region

1. Comment: Include column for GPCD usage in Table 1-6 Page 1-5.

Response: Column for GPCD will be added.

2. Comment: Explain redundancy of Chloride Control Project and Wichita Falls reverse osmosis plant for Lake Kemp water.

Response: Lake Kemp water can only be utilized for potable water following reverse osmosis. This process is costly and can be dramatically reduced as the Lake Kemp water quality improves. In addition, Lake Kemp is utilized for irrigation and the better water quality from Kemp would provide for much more efficient use of the water for irrigation purposes. No changes will be made to the final report based on this comment.

3. Comment: Add a "total row" for Table 1-7.

Response: Comment noted, however no change will be made in Table 1-7, Page 1-7.

4. Comment: Modify the Chart 1-12 Page 1-9 to 1-14 to reflect Pre and Post-major development.

Response: These charts were prepared for general information and not for the level of detail being requested. No change to the final plan will be made based on this comment.

5. Comment: Information included on aquifers and springs (Page 1-15) is extremely superficial and is a duplicate of that provided in 2001 Plan.

Response: This information is sufficient to generally describe the Region B water supply. Additional discussion of groundwater supplies is included in Chapter 3. A brief description of springs will be added to Sectin 3.2.1. No changes will be made to Chapter 1.

6. Comment: Add totals column for Table 1-12, Page 1-22.

Response: Comment noted, however no change to the final plan will be made based on this comment.

7. Comment: Issues regarding freshwater mussels and minnow species native to the region, Page 1-23, should be considered in assessing the impacts of water management strategies with long-term protection of natural resources.

Response: Those issues have been considered and modifications to the plan have been made as required.

8. Comment: More information is needed on wetlands of the region on Page 1-23.

Response: The information provided for the level of this plan is sufficient. No change in the final plan will be made based on these comments.

9. Comment: Information provided on wildlife and endangered and threatened species as shown on page 1-24 has limited utility.

Response: This information is sufficient for this level of plan, however, your comment concerning habitats and species most likely to be affected by water management decisions being those dependent on seeps and springs or rivers will be considered when assessing long-term impacts on natural resources.

10. Comment: Updated information should be provided in Table 1-14, Page 1-25.

Response: An attempt will be made to update this Table.

11. Comment: If Region B will have adequate supplies throughout the planning period, then why is the Chloride Control Project recommended as a regional supply project, as noted on Page 1-26.

Response: The Chloride Control Project addresses the water quality of Lake Kemp, which enhances the efficient use of a major water source in Region B.

12. Comment: The discussion in Section 1.11, "Identification of Known Threats to Agriculture or Natural Resources" is far too general.

Response: A general discussion of groundwater drawdown and associated effects on water quality, wells, and spring flows have been added to this section.

13. Comment: The Table 1-15 page 1-27 to 1-29 is insufficient to provide the necessary information to get a comprehensive picture of water providers of Region B.

Response: Table 1-15, Page 1-27 to 1-29 is sufficient in providing a overview of listed water providers in Region B. More specific information is included in Chapters 2 and 3 of the plan. No changes to the final plan will be made based on this comment.

Chapter 2: Population and Water Use Projections

14. Comment: Discussion on Page 2-1 about the rural nature of the region affecting projected water conservation savings is confusing.

Response: Clarification has been included on Page 2-1.

15. Comment: Should discuss in the text on Page 2-1 that Region B filed a formal request to change the water demand figures provided in TWDB.

Response: Some discussion has been included in Section 2.1 regarding the requested water demand changes.

16. Comment: The discrepancy of 325,829 gallons per acre-foot or 325,851 gallons per acre-foot is confusing.

Response: The figure of 325,851 gallons for one-acre foot of water will be utilized in lieu of 325,829 gallons.

17. Comment: There is discrepancies in Table 2-2, Page 2-4 regarding water use.

Response: The discrepancies have been corrected and the TWDB numbers will be utilized.

18. Comment: Demand for Steam-Electric power as shown on Page 2-9 appears to be over-stated.

Response: Based on information received from American Electric Power (AEP) there is an anticipated expansion of the AEP facilities. In addition, there have been serious discussions concerning a new plant in Archer County area. Projections were based on the best available information. No change to the final plan will be made based on this comment.

19. Comment: The water demand figures in Table A-5 for the year 2000 are not consistent with the demand figures listed in Appendix "A".

Response: An attempt has been made to make Table A-5 and Appendix A water demand figures match.

20. Comment: Water demand figures between Tables A-6 to A-9 and Appendix "A" are inconsistent.

Response: An attempt has been made to correct those inconsistencies.

Chapter 3: Evaluation of Current Water Supplies

21. Comment: Advocate a sedimentation survey for Lake Kemp.

Response: Region B agrees that a sedimentation survey is needed for Lake Kemp, and the region recognizes the importance of this water source to meet water needs. A discussion of the impending sedimentation study has been added to Section 3.1.2.

22. Comment: Urges the RWPG to include an allowance for protection of spring flow.

Response: Comment noted. No changes will be made to the final report based on this comment.

23. Comment: Clarify the methodology used to determine groundwater supplies from the Trinity aquifer.

Response: In the last round of planning, the TWDB provided estimates of groundwater availabilities. During the development of the supply data for the IPP, the Trinity GAM was not available at the time to update the availability estimates. The Trinity GAM has been published. Groundwater availability estimates for the Trinity Aquifer in Region B have been updated using the Trinity GAM.

24. Comment: It is unclear whether Region B adopted a sustainable approach to groundwater.

Response: Region B did adopt a sustainable approach to allocating groundwater supplies. However, the Region B RWPG has no regulatory or enforcement authority. In accordance with State law, groundwater pumpage is regulated through groundwater conservation districts. In Region B, there are approved groundwater conservation districts in Baylor, Hardeman and Foard Counties. No changes will be made to the final report based on this comment.

25. Comment: It is unclear whether Region B adopted a sustainable approach to groundwater.

Response: Through approval of the Region B Initially Prepared Plan, the Region B RWPG adopted a sustainable approach to groundwater. The Region B RWPG has no regulatory or enforcement authority to limit groundwater use. In accordance with State law, groundwater pumpage is regulated through groundwater conservation districts. In Region B, there are two approved groundwater conservation districts covering Baylor, Hardeman and Foard Counties. At the time the Initially Prepared Plan was published, only the Rolling Plains Groundwater Conservation District (Baylor County) had a certified groundwater management plan. This plan limits groundwater pumpage to 3 acre-feet per year per acre. The total available groundwater supply in Baylor County does not exceed this production limit. A brief discussion of the groundwater conservation districts in Region B has been added to Chapter 3.

26. Comment: It is unclear whether firm or safe yield was used in the development of the plan.

Response: A statement has been added that the safe yield of the following reservoirs was used for evaluating currently available supplies to water user groups.

27. Comment: Disagree with the use of "safe yield" and "safe supply" approach in the IPP.

Response: Water providers in Region B operate their reservoir systems with a reserve water capacity. In addition to the concern about drought, the water quality of a reservoir is greatly diminished under very low storage conditions and the ability to use this water is limited. “Safe Yield” represents the supply available to the region under current operations.

Water supply planning must consider the most restrictive conditions in assessing available supply and determining when new supplies are needed. In Region B, municipal water supplies are operated with a reserve capacity. Also, State regulations (TAC §291.93(3)) require public water utilities to submit a report to the state identifying how the utility intends to meet the projected demands of its service area when the utility reaches 85 percent of its capacity. The regulations also require public water suppliers and wholesale water suppliers to have sufficient supplies to meet the maximum day and/or contractual demands of all their customers. Planning for a surplus of 15 to 20 percent above the demand projections is within reasonable planning guidelines for long-range water supply planning. Drought management is a temporary strategy in response to a drought worse than the drought of record or emergency water shortages. Drought management is not a strategy for long-term water supplies. No changes will be made to the plan based on this comment.

28. Comment: There is an insufficient quantitative analysis of environmental impacts.

Response: The quantification of environmental impacts in the Region B Water Plan for the types of water management strategies is appropriate for a planning level report. Quantifications are based on available data from previous studies and desktop analyses. There is limited to no data available on the quantifiable impacts for most of the considered projects. An estimate of the number of acres impacted by each strategy has been added to Attachment 4-1. Impacts from water management strategies are assessed following guidelines developed by the Texas Water Development Board. The Region B Plan has been modified to show water supply yields from new reservoir projects assuming streamflow releases are made using the Consensus method, which is designed to mitigate impacts to downstream flows. Further quantifications of potential impacts of recommended water management strategies will be required by the entity pursuing the supply during the permitting process. A back up table for environmental impacts has been added to Attachment 4-1 to clarify the quantification of environmental impacts.

29. Comment: Water conservation is absent from Attachment 4-1 and 4-2 tables.

Response: Conservation has been added to Attachments 4-1 and 4-2.

30. Comment: Add passive clothes washer savings to entities with a gpcd less than 140.

Response: Passive clothes washers have been added to these entities.

31. Comment: Conservation savings are confusing.

Response: An explanation of the savings calculations and costs has been added as an attachment to Chapter 4.

32. Comment: Footnote 1 to Table 4-9 Page 4-18 is confusing.

Response: Clarification regarding potential water savings as the results of a Water Audit has been provided.

33. Comment: More explanation is needed on water savings for the municipal conservation strategies.

Response: An explanation of the savings calculations and costs has been added as an attachment to Chapter 4.

34. Comment: More explanation is needed on costs for the municipal conservation strategies.

Response: An explanation of the savings calculations and costs has been added as an attachment to Chapter 4.

35. Comment: Discussion of environmental impacts associated with the reuse strategy for Bowie is inadequate.

Response: The recommended strategy of wastewater reuse will have no impacts to the water supplies reported in the Region B plan for downstream water users. This is because the analysis required by the TWDB requires the use of Run 3 of the Water Availability Model, which does not include return flows. An assessment of impacts to instream flows would require a daily flow analysis assuming current levels of return flows. This is beyond the scope of regional water planning. It is acknowledged that the reuse of wastewater could have a low to moderate impact to stream flows. No changes to the plan will be made based on this comment.

36. Comment: Discussion of environmental impacts associated with the strategies for Wichita Falls is inadequate.

Response: Additional discussion will be provided with regards to environmental impacts associated with the Wichita Falls Strategies.

37. Comment: a) Discussion of environmental impacts associated with the canal system improvements is inadequate.

Response: The laterals provide aquatic habitat during the growing season when the laterals are used to transport irrigation water to farms. However, during the five months or so that irrigation does not occur, the laterals are dry and do not provide aquatic habitat. The laterals are constructed to feed water to farms by gravity. Therefore, they have been constructed on relatively high ground; terrain that is not generally conducive to supporting wetlands. Because the laterals are man-made, they would not be considered jurisdictional waters in any event. For these reasons, environmental impacts to aquatic habitat and jurisdictional waters (including wetlands) resulting from the enclosure of laterals in pipelines would be expected to be minimal. No changes to the plan will be made based on this comment

Comment: b) Discussion of environmental impacts associated with the conservation pool strategy for Lake Kemp is inadequate.

Response: Raising the conservation elevation at Lake Kemp will have no impact to stream flow downstream of the lake. This is because there will be no changes in the permitted storage in the lake. This strategy does not increase the conservation storage; it simply compensates for reduction in storage due to sedimentation. No changes to the authorized storage will be made. The Corps of Engineers will require a new sedimentation survey before it will approve any changes to the conservation elevation. The impacts from this strategy should be negligible. Additional discussion of this strategy has been added to Chapter 4.

38. Comment: The Chloride Control Project, as discussed beginning on page 4-45, does not meet a water supply need and more quantitative information about the potential impacts is required.

Response: The Chloride Control Project has been identified as a regional strategy, adopted by the RWPG, not as a stand-alone strategy, but as a supplement to the other strategies that depend on the Lake Kemp/Diversion waters. As chloride concentrations are reduced in the source water, the cost of treatment will be reduced and the more efficient use of the water for irrigation will be enhanced. Several environmental impact studies have been completed over the past years and concluded that the Chloride Control Project is an environmentally feasible project. No changes to the final plan will be made based on this comment.

39. Comment: Encourage the evaluation of an alternate approach that relies on land stewardship measures to help address both water quality and quantity issues in Lake Kemp.

Response: Comment noted, with no change in the final plan based on this comment.

40. Comment: Drought management is not evaluated in the Region B IPP.

Response: The Region B RWPG considered drought management measures, and concluded that drought management strategies are interim measures in response to drought and are not a reliable long-term water supply. No changes will be made to the final report based on this comment.

Chapter 5: Impacts of Selected Water Management Strategies on Key Parameters

41. Comment: Water Conservation is missing from the list of preferred water management strategies as shown on Page 5-8.

Response: Water Conservation has been added to the list.

Chapter 7: Description of How the Regional Water Plan is Consistent with Long-Term Protection of the States Water Resources, Agricultural Resources, and Natural Resources

42. Comment: The plan does not adequately address this consistency.

Response: Comment is noted. However, we believe the plan does adequately address this issue, and no change to the final plan will be made based on this comment.

Chapter 8: Recommendations Including Unique Stream Segments, Unique Reservoir Sites, and Legislative and Regional Policy Issues

43. Comment: Concern with the statement on Page 8-2 "It is the intention of the RWPG that surface water uses that will not have a significant impact on the region's water supply and water supply projects that do not involve the development of or connection to a new water source are deemed consistent with the regional water plan though not specifically recommended in the plan".

Response: Comment and concerns are noted, however, no change in the final plan will be made based on this comment.

44. Comment: The statement on page 8-2 "the Chloride Control Project on the Wichita and Pease Rivers is a water management strategy with high regional support" is a subjective statement and neglects to mention that U.S. Fish and Wildlife Service and Texas Parks and Wildlife Department have formally expressed their concerns.

Response: Chapter 8 is intended to be a discussion of Regional policy issues. The statement that the Chloride Control Project has a high degree of regional support is accurate. The US Fish and Wildlife Service and the Texas Parks and Wildlife Department are federal and state agencies, respectively, and their concerns regarding the project are well known. Additional discussion of their positions is not relevant to the subject of this chapter and no change will be made in the plan based on this comment.

45. Comment: Concerns with statements on Page 8-7 regarding clarification of the effect of designating unique stream segments.

Response: The Region B Water Planning Group recognizes that the Texas Legislature clarified its intent with respect to state financing of the construction of a reservoir. However, such clarification does not necessarily preclude State agencies from using the designation in considering the granting of permits. For example, 30 TAC §297.53 (Habitat Mitigation) currently includes the following requirement:

> In its consideration of an application for a new or amended water right to store, take, or divert state water in excess of 5,000 acre-feet per year, the commission shall assess the effects, if

> any, of the granting of the application on fish and wildlife habitats. **The commission shall also consider whether the proposed project would affect river or stream segments of unique ecological value** as identified by the applicable approved regional water plan and designated as such by the Texas Legislature in accordance with Texas Water Code §16.051(3). (emphasis added)

State law would presumably take precedence over a State regulation, but the above example demonstrates the general concern of the Water Planning Group on this issue. Furthermore, given the Legislature's clarification and the fact that there are no new reservoirs currently planned in Region B, the designation of unique stream segments in Region B seems unnecessary at this time and no change in the plan will be made based on this comment.

46. Comment: Though no designation of reservoirs are being recommended as stated on Page 8-7 and 8-8, such designations should proceed carefully and we support the planning groups decision not to recommend designation.

Response: Comment noted with no change in the final plan based on this comment.

47. Comment: The basis for the recommendation that gallons per capita per day (gpcd) calculation of water use as stated on Page 8-11 be based on residential use is unclear.

Response: Utilizing total water use would not provide for a fair comparison across the State. Some areas have more manufacturing, industry, and commercial facilities than other areas and the gpcd values would be skewed for comparison purposes. Your comment is noted, however, no change in the final plan will be made based on this comment.

48. Comment: Use of municipal supplies for small scale livestock watering does not appear to be a major factor.

Response: Comment noted with no change in the final plan based on this comment.

Chapter 10: Adoption of Plan

49. Comment: Encourage the RWPG to consider holding future public hearings outside of typical business hours.

Response: The public hearing on the IPP was held in the evening of July 6, 2005 at 6:00 PM. However, the monthly or quarterly meetings of the RWPG are typically held during normal business hours and have been well attended.

50. Comment: The Technical Advisory Committee could be seen as beneficial, but it could also work against the intended nature of an effective public process.

Response: The Technical Advisory Committee (TAC) has been very beneficial to the RWPG and it should be noted that all information presented to the TAC was also presented to the entire RWPG at a public meeting. There was public notification and public participation at the meetings relative to all information presented to the TAC.

TEXAS PARKS & WILDLIFE COMMENTS – LETTER DATED SEPTEMBER 13, 2005

1. Comment: Texas Parks & Wildlife (TPW) encourages Region B to consider land stewardship as an additional means of conserving water that also may benefit wildlife habitat.

Response: Land Stewardship is a practice that is supported and encouraged by Region B and the RWPG believes it is a benefit to the State's natural resources by improving watershed productivity through increased surface water runoff and groundwater recharge.

2. Comment: TPW has expressed concerns in the past regarding the Chloride Control Project (CCP) but TPW supports the statement from the IPP that states "the effectiveness and environmental impacts of the project will be evaluated as the CCP facilities are completed and operating within the Wichita River Basin".

Response: Several environmental impact studies have been completed regarding the CCP and studies have shown that the project is environmentally feasible.

3. Comment: TPW expressed disappointment that the plan does not recommend nomination of any stream segments as ecologically unique.

Response: Given the fact that there are no new reservoirs currently planned in Region B, the designation of unique stream segments in Region B seems unnecessary at this time.

<u>Pam McKay Comments – Letter Dated September 14, 2005</u>

1. Comment: More emphasis should be placed on using water wisely.

Response: It should be noted that the Region B IPP relies heavily on conservation measures to reduce municipal water waste.

2. Comment: General public needs to be encouraged and educated on the importance of water conservation.

Response: Region B adopted four management practices as part of the IPP to encourage water conservation. These practices included Public and School Education, Reduction of Unaccounted for water, Water Conservation Pricing and Passive Clothes Washer Rules.

<u>Penny Miller Comments – Letter Dated September 4, 2005</u>

1. Comment: Lack of more coherent water conservation strategy.

Response: Water conservation was considered for all water use types with needs. In the development of projected water demands for regional water planning the Texas Water Development Board adjusted the municipal water demands to account for water savings associated with the natural replacement of plumbing fixture with more water efficient fixtures. The demands for the other categories of use that were adopted by the Region B RWPG and the TWDB did not include any adjustments for inherent conservation measures. Additional water savings for each water use category due to conservation is addressed through water management strategies. Conservation strategies are identified in the Region B IPP for municipal, irrigation and steam electric power use. Through the work of the Water Conservation Implementation Task Force, the State has recognized the need to promote awareness for conservation. A water conservation awareness campaign has been recommended to the Legislature. The Region B RWPG supports this recommendation.

2. Comment: Disagrees with the recommendation that gpcd measurements include only residential use.

Response: Currently, gpcd measurements are being used to compare different cities across the state. Variations in commercial, industrial, and institutional water use can result in significant differences in gpcd values. The recommendation to use residential water use for gpcd calculations would provide a more equitable means of comparisons across the state.

3. Comment: Lack of consideration of impacts to wildlife.

Response: Additional detail has been added to Attachment 4-1 to clarify the evaluation of environmental impacts.

James Cantwell Comment – (Phone Comment)

1. Comment: Concerned about the reduction in water supply for the City of Bowie. Water supply shown in 2006 Plan was reduced when compared to the 2001 Plan.

Response: The reduction in water supply for the City of Bowie was based on the use of the Water Availability Model (WAM) that was not used in the 2001 Plan. Bowie did not show a firm need but did show a safe need based on the WAM. No change to the plan will be made based on this comment.

PUBLIC HEARING COMMENTS – JULY 6, 2005

1. Ms. Penny Miller stated that as a resident of Wichita Falls she had been involved with various organizations that have studied water policy within the State of Texas, especially Region B during the past two years. She expressed her appreciation of the work that has been done on the Plan, the tremendous amount of information available for the public, and the watershed management approach that the region took. Of primary significance to Ms. Miller was the water conservation portion of the Plan. She noted the four municipal conservation efforts brought out including the dependence of public and school education, the cost of purchasing water, reduction of water through water audits, and passive clothes washer rules. Ms. Miller's opinion was that the Plan suggested that water conservation was just supposed to magically happen. She said that methods of implementation to encourage people to use less water must be addressed. She also stated that nothing was mentioned for industry, irrigation, agriculture, or any other category other than municipal. Ms. Miller disagreed that the suggestion that the gallons per day calculation of water used be based on residential use only. She remarked that was not appropriate, although easy to measure. When looking at water conservation strategies overall and the impact of water use within the region, all ways to measure water should be used.

Response: Ms. Penny Miller's comments were noted, however it should be noted that the IPP does promote water conservation through public education, water audits, water conservation pricing and Passive Clothes Washer Rules. With regards to gallons per capita per day (GPCD) calculation of water use being based on "residential" use only, it should be noted that this would allow for a fair across the state comparison of GPCD values. No change to the plan will be made based on this comment.

2. Ms. Roberta Sund of Lakeside City asked what the term "seasonal conservation pools" as listed under strategies meant. Ms. Simone F. Kiel replied that right now the Wichita irrigation district was operating under the seasonal pool, which runs from April through October, when allowable to contain water above their current permitted conservation level, which are the months used for irrigation. Mr. Jimmy Banks stated there had not been enough rainfall to put them into that level. Ms. Kiel explained that it allows them during high rainfall events to capture that water and use it for irrigation purposes. Ms. Sund also

asked why Lakeside City showed a shortage even though it purchased water from the City of Wichita Falls which did not show a shortage. Mr. Maroney replied it was a contractual shortage.

3. <u>Mr. Mick Baldys of Wichita Falls</u> questioned the population projections and why it indicated a dramatic decrease in 2030. He expressed his concern as an increase in population might not meet the demand. Mr. Maroney explained many of the population projections were put forth by the state data center, and in most cases they just had to accept their projections. He expressed his concern, but also noted that the Plan would be updated every five years, which should keep it on track. Region B also figured its water availability using the safe-supply method.

4. <u>Mr. Scott Taylor of the City of Wichita Falls</u> asked how was the amount of conservation volume determined and how was the price for that conservation determined. Ms. Kiel stated that she had the figures but would rather get back with him so that her calculations were correct. However, she said it was based on population using the best management practice guidelines as developed by the Water Conservation Task Force. Additional information on the water savings and costs for conservation have been added as an attachment to Chapter 4.

5. <u>Mr. Keith Spears of Vernon</u> asked when referred to purchasing water from local providers, were local land owners taken into consideration and if so at what cost per thousand gallons. Mr. Maroney stated that he did not, a local provider would not necessarily be a land owner. It would probably fall under additional groundwater supply. When he asked what that price might be, Mr. Maroney stated that he was familiar with one system in the West Texas area that paid as much as 60¢ to 80¢ per thousand.

6. <u>Ms. Jennifer Ellis of Austin</u> asked why several counties showed several levels of strategies when the most economical would be conservation. Mr. Maroney replied he did not want to be totally dependent upon water conservation, although it was a noble effort. The alternatives were listed in case water conservation was not sufficient to meet the needs.

If you have any questions regarding the above information, please call me.

Sincerely,

BIGGS & MATHEWS, INC.
FREESE & NICHOLS
ALAN PLUMMER & ASSOC.