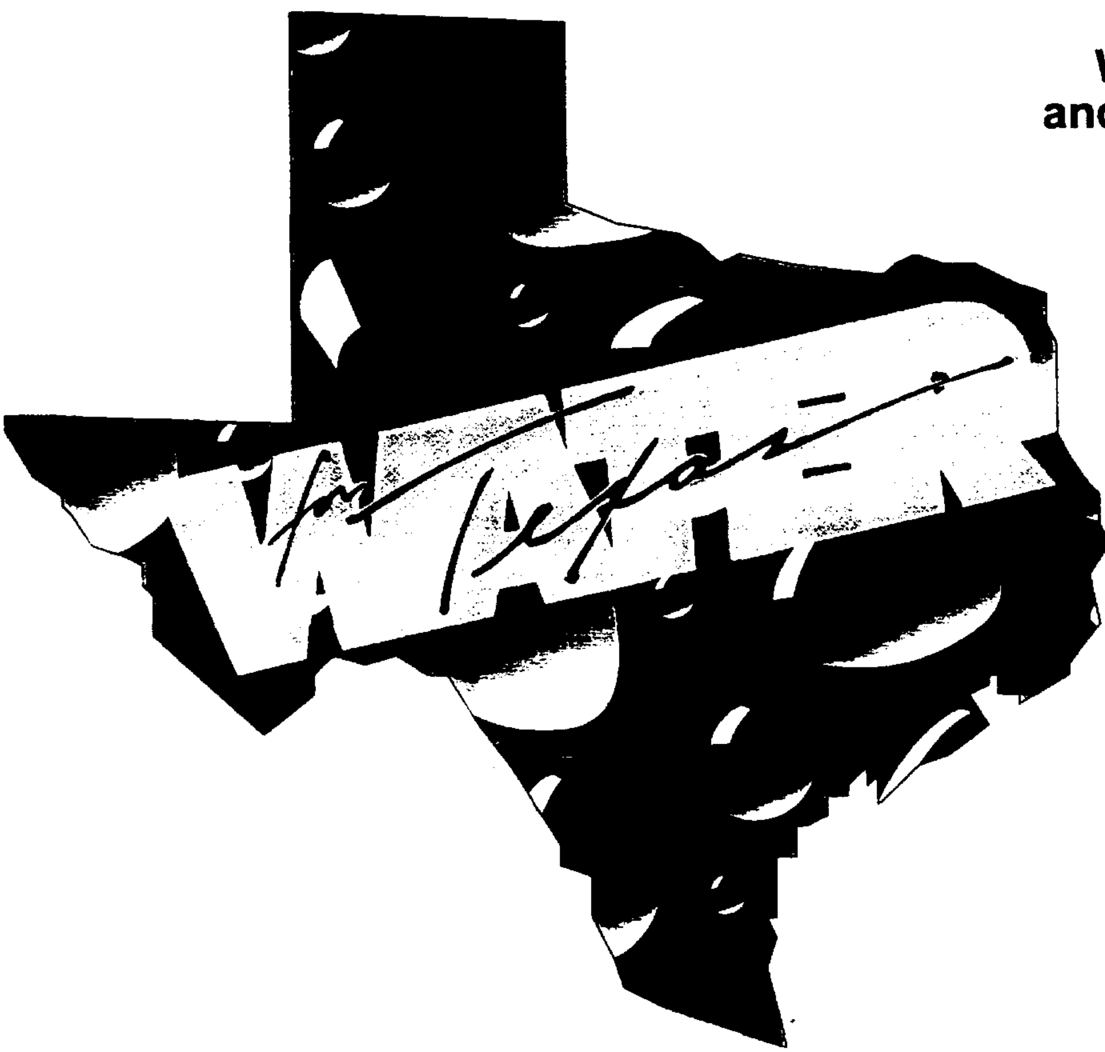
TRANS-TEXAS WATER PROGRAM

West Central Study Area

Phase II

Population, Water Demand, and Water Supply Projections



San Antonio River Authority

San Antonio Water System

Edwards Aquifer Authority

Guadalupe-Blanco River Authority

Lower Colorado River Authority

Bexar Metropolitan Water District

Nueces River Authority

Canyon Lake Water Supply Corporation

Bexar-Medina-Atascosa Counties WCID No. 1

Texas Natural Resource Conservation Commission

Texas Parks and Wildlife Department

Texas Water Development Board

March 1998

HDR

HDR Engineering, Inc.

TRANS-TEXAS WATER PROGRAM

WEST CENTRAL STUDY AREA

PHASE 2

POPULATION, WATER DEMAND, AND WATER SUPPLY PROJECTIONS

San Antonio River Authority
San Antonio Water System
Edwards Aquifer Authority
Guadalupe-Blanco River Authority
Lower Colorado River Authority
Bexar Metropolitan Water District
Nueces River Authority
Canyon Lake Water Supply Corporation
Bexar-Medina-Atascosa Counties WCID No. 1
Texas Natural Resource Conservation Commission
Texas Parks and Wildlife Department
Texas Water Development Board

Herbert W. Grubb
3/26/98

STATE OF TEXAS
DAVID D. DUNN
82630
REGISTERED PROFESSIONAL ENGINEER

3/26/98
Appendix C

HDR
HDR Engineering, Inc.

March 1998

STATE OF TEXAS
KELLY D. PAYNE
82053
REGISTERED PROFESSIONAL ENGINEER

3/26/98

TRANS-TEXAS WATER PROGRAM
WEST CENTRAL STUDY AREA

PHASE 2
POPULATION, WATER DEMAND, AND
WATER SUPPLY PROJECTIONS

TABLE OF CONTENTS

Section **Page**

TABLE OF CONTENTS (CONCLUDED)

LIST OF TABLES

LIST OF TABLES (CONCLUDED)

LIST OF FIGURES

LIST OF FIGURES (CONCLUDED)

Figure **Page**

1.0 INTRODUCTION

In response to the water supply needs of the 32-county West Central Trans-Texas study area (Figure 1-1), the West Central Trans Texas regional water planning program was begun in September of 1993.[1] In Phase 1 studies, the Texas Water Development Board's (TWDB) 1992 high case, with conservation population and water demand projections were used, and 110 individual, standalone water conservation and water supply options were identified and evaluated as to quantity of water produced, unit cost of water, and potential environmental effects. The results of the Phase 1 studies are available for use in selecting water management and water supply options to be included in water supply plans to meet the water needs of the area in future years. The purpose of this report is to provide the most recent population, water demand, and water supply projections for use in water supply planning for the study area.

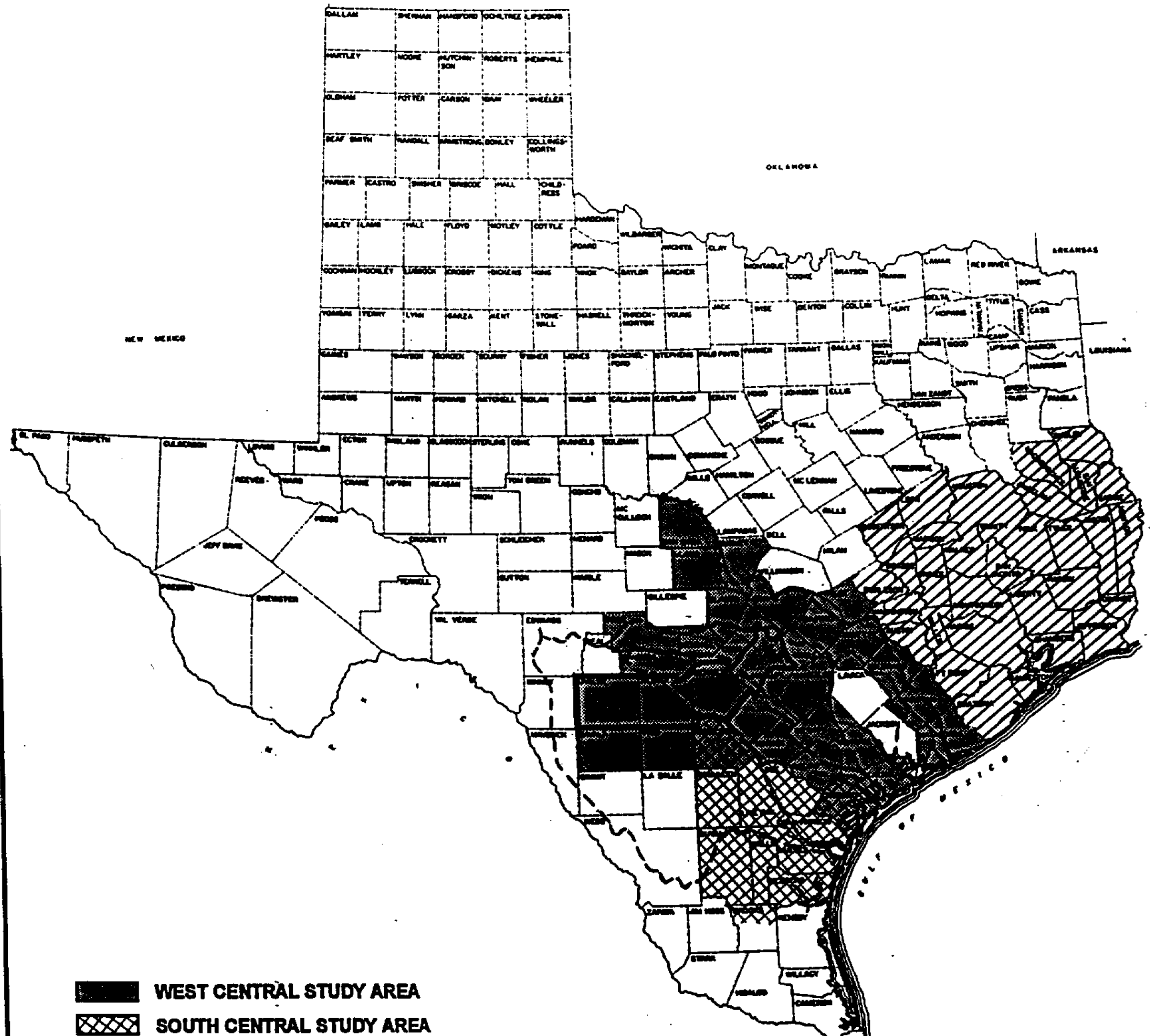
1.1 The Study Area

The West Central Trans-Texas study area includes the following 32 counties:

1. Atascosa	9. Colorado	17. Hays	25. Refugio
2. Bandera	10. Comal	18. Karnes	26. San Saba
3. Bastrop	11. DeWitt	19. Kendall	27. Travis
4. Bexar	12. Fayette	20. Kerr	28. Uvalde
5. Blanco	13. Frio	21. Lee	29. Victoria
6. Burnet	14. Goliad	22. Llano	30. Wharton
7. Caldwell	15. Gonzales	23. Matagorda	31. Wilson
8. Calhoun	16. Guadalupe	24. Medina	32. Zavala

Projections are also provided for all or parts of seven counties of the Nueces Basin (Dimmitt, Edwards, Kinney, LaSalle, Maverick, Red, and Webb) in order to have complete information about the Nueces Basin, even though these counties are not included in the West Central Trans-Texas Study Area. The 32-county study area, along with the South Central and Southeast study areas is shown in Figure 1-1. Population of the 32-county area was 2.5 million in 1990 and is projected to be 6.4 million in 2050.

[1] "Water for Texas--Trans-Texas Water Program Description," Texas Water Development Board, Austin, Texas, June 1992.



WEST CENTRAL STUDY AREA
SOUTH CENTRAL STUDY AREA
SOUTHEAST STUDY AREA
EDWARDS AQUIFER AUTHORITY AREA
RIVER BASIN BOUNDARY

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

STUDY AREA

HDR

HDR Engineering, Inc.

FIGURE 1-1

The Edwards Aquifer area is the area specified in Senate Bill (SB) 1477 and includes all of Bexar, Medina, and Uvalde counties, and parts of Atascosa, Comal, Caldwell, Hays, and Guadalupe counties (Figure 1-1).[2] This area depends upon the Edwards Aquifer for municipal, industrial, and irrigation water. The population of the Edwards Aquifer area (Figure 1-1) was 1.36 million in 1990 and is projected to be 3.60 million in 2050.

In addition to supplying the people and economy of San Antonio and neighboring areas, the Edwards Aquifer is home to several endangered or threatened species and is the source of water for Comal and San Marcos Springs. The aquifer cannot meet the growing needs for water and, at the same time, supply adequate spring flows for endangered species, as well as downstream needs of the environment and water rights holders.

Areas outside of the Edwards Aquifer area within the Nueces, San Antonio, Guadalupe, and intervening Coastal Basins, and in the Lower Colorado and adjacent Coastal Basins to the east are also growing and in need of water planning. These areas depend upon the Carrizo and other aquifers, and upon surface water for their supplies.

1.2 Objectives

The objectives of this West Central Trans-Texas Study are as follows:

1. Present the TWDB 1996 consensus water planning population and water demand projections for the 32-county West Central study area, plus seven additional Nueces Basin counties. The projections will be tabulated by county and city within county for the following subareas of the West Central Study Area: (1) The Edwards Aquifer Authority Area, and (2) the Nueces, San Antonio, Guadalupe and Lower Colorado River Basin areas, respectively. For study areas of Bexar, Comal, and Guadalupe Counties, and the Mid-Cities area, projections of "West Central Study Area Phase 2 Report Letter of Intent Analysis," San Antonio River Authority, et al, San Antonio, Texas, October, 1996, will be used. Projections will be shown in ten-year intervals starting in 1990 and ending in 2050. Population will be in numbers of people, and water demand projections will be in acre-feet per year for water use categories: (1) municipal, (2) industrial, (3) steam electric power general, (4) irrigation, (5) mining, (6) livestock, and (7) total water demand.

[2] Senate Bill 1477, Texas Legislature, 1993 Regular Session.

2. Using water supply information contained in the West Central Trans-Texas Phase 1 studies, water supply information of the 32-county West Central Trans-Texas study area will be tabulated for: (1) study area counties listed in objective 1, with counties and parts of counties and cities grouped by river basin subareas for the Nueces, San Antonio, Guadalupe, and Lower Colorado River Basin areas, the Brazos-Colorado, Colorado-Lavaca, Lavaca-Guadalupe, and San Antonio-Nueces Coastal Basin areas, study area counties and parts of counties of the adjacent Brazos and Lavaca Basins; and (2) cities of Bexar, Medina, Uvalde, and parts of Comal, Hays, Guadalupe, and Caldwell Counties located within the Edwards Aquifer Authority regional demand center. Projections will be shown in 10-year intervals starting in 1990 and ending in 2050.

3. Using results of objectives 1 and 2, water demand and water supply projections will be presented in tabular and graphic form, by decade from 1990 through 2050 for the counties, cities, river basins, and Edwards Aquifer Authority areas listed in objectives 1 and 2 above. The summaries will show surpluses and shortages for the water demand and water supply areas and centers.

The projections listed in the objectives will be based upon the following conditions, assumptions, and data:

A. The TWDB 1996 consensus water planning projections to be used are as follows:
   1. Most likely population;
   2. Most likely municipal water demand for below normal precipitation and advanced conservation;
   3. Base oil prices, with conservation for manufacturing;
   4. Series 3 irrigation (aggressive adoption of irrigation technology and a reduction in Federal Farm Programs by one-half);
   5. Steam-Electric power high series;
   6. Mining — TWDB only series;
   7. Livestock — TWDB only series.

B. Assume 450,000 acft/yr pumpage from the Edwards Aquifer for years 1997 through 2007, and 400,000 acft/yr beginning in year 2008.

C. Texas Water Development Board (TWDB) groundwater information for counties of the study area.

D. The quantity of water supply from the Edwards Aquifer will be based on provisions of SB 1477, with pumpage set at 450,000 acft/yr for the period 1997 through 2007, and 400,000 acft/yr beginning in 2008, and the assumption that each entity which obtained water from the Edwards Aquifer in 1990 will have its 1990 pro rata share of Edwards pumpage in future years.

E. The quantity of surface water supply from reservoirs of the study area will be the firm yield of each respective reservoir, as determined by previous studies, and in accordance with water rights permits issued by the Texas Natural Resource Conservation Commission (TNRCC).

F. The quantity of dependable surface water supplies from run-of-river water rights permits will be calculated for study area counties of the Nueces and Guadalupe-San Antonio River Basins using the existing Nueces and Guadalupe-San Antonio River Basin models developed by HDR Engineering, Inc.[3] These computations will be based upon Edwards Aquifer pumpage of 400,000 acft/yr. Dependable supplies of surface water from run-of-river permits for counties of the Lower Colorado River Basin will be tabulated from computer model results that were prepared by the Lower Colorado River Authority for use in the North Central Trans-Texas (NCTT) study.[4]

[3] HDR Engineering, Inc. et al, "Regional Water Supply Planning Study-Phase I, Nueces River Basin," Nueces River Authority et al, Uvalde, Texas, May, 1991, and HDR Engineering, Inc. et al, " Guadalupe-San Antonio River Basin Recharge Enhancement Study," Edwards Underground Water District, San Antonio, Texas, September, 1993.
[4] "Colorado River Base Case Availability," Unpublished tables, Lower Colorado River Authority, Austin, Texas, June 1997.

(This page intentionally left blank)

2.0 POPULATION AND WATER DEMAND PROJECTIONS

The purposes of this section are to present the Texas Water Development Board's (TWDB) 1996 consensus population and water demand projections for the 32-county West Central study area, as stated in Section 1.2. Projections are shown in 10-year intervals beginning with 1990 and ending in 2050. Population is shown in numbers of people; water demand is shown in acft per year (one acre-foot is 325,851 gallons) for each of the following list of water use categories: (1) municipal, (2) industrial, (3) steam-electric power generation, (4) irrigation, (5) mining, (6) livestock, and (7) total water demand.

2.1 Population Projections

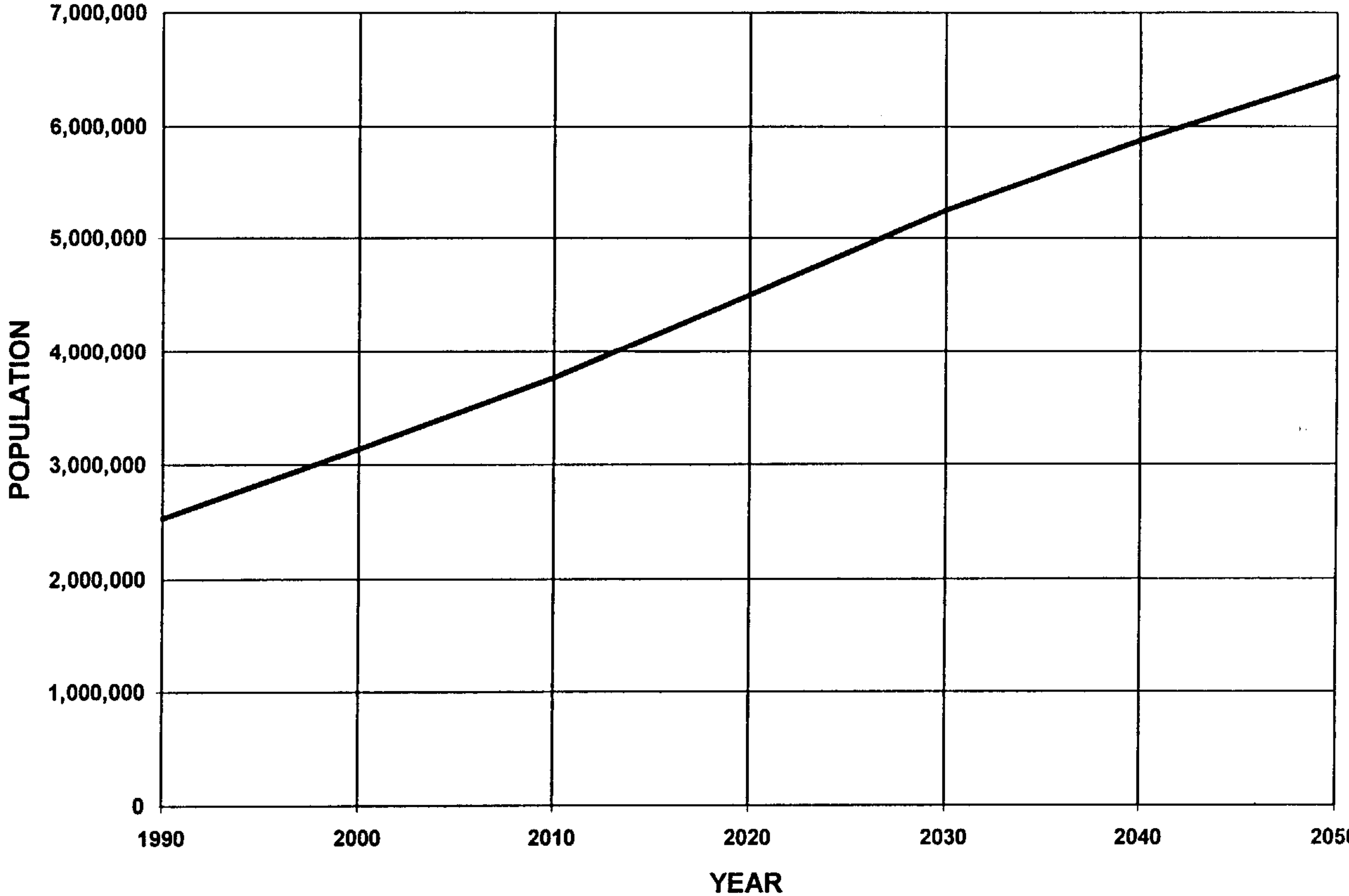
TWDB 1996 consensus projections are shown in tabular and graphic form for: (1) the 32-county study area, including cities of each county, (2) the Edwards Aquifer Area (including cities of Bexar, Medina, Uvalde, and parts of Comal, Hays, Guadalupe and Caldwell counties) and (3) the Nueces, San Antonio, Guadalupe, and Lower Colorado River Basin areas.

2.1.1 Population Projections for the 32-County Study Area

The population of the 32-county study area was reported at 2.53 million in 1990 (Table 2-1) and is projected to be 3.15 million in 2000, 4.50 million in 2020, and 6.44 million in 2050 (Table 2-1 and Figure 2-1). The compound annual growth rate of this projection is 1.57 percent. The TWDB projections of the State of Texas population is from 16,986,510 in 1990 to 36,587,631 in 2050, having a compound annual growth rate of 1.287 percent. At 1.57 percent, the 32-county study area growth rate is about 22 percent higher than that projected for the State. For the 1990-2050 projection period, the 32 county study area population increases from 14.89 percent of the State total in 1990 to 17.6 percent of the State total in 2050.

The population of those parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties that are located in the Nueces River Basin was 19,880 in 1990 and is projected at 39,779 in 2050 (Table 2-1).

Table 2-1							
Population Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
		Projections					
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
Atascosa	30,533	35,893	41,807	47,587	52,911	57,037	59,560
Bandera	10,562	14,947	17,801	21,754	24,413	27,397	30,745
Bastrop	38,263	47,917	59,430	71,679	83,583	90,915	98,331
Bexar	1,185,394	1,474,512	1,776,965	2,130,820	2,491,291	2,817,680	3,081,381
Blanco	5,972	7,468	8,998	10,667	11,910	12,549	12,418
Burnet	22,677	28,055	34,010	40,536	45,936	47,834	49,810
Caldwell	26,392	32,158	37,872	43,279	47,086	47,220	47,355
Calhoun	19,053	21,893	23,809	25,968	28,180	30,504	33,255
Colorado	18,383	20,028	21,054	22,221	23,204	24,014	24,630
Comal	51,832	79,378	106,558	144,869	187,464	226,133	267,843
DeWitt	18,840	20,217	21,180	22,340	23,550	24,773	26,030
Fayette	20,095	22,611	25,213	28,714	32,190	35,847	40,437
Frio	13,472	15,421	17,356	18,993	19,918	20,733	21,343
Goliad	5,980	6,408	6,784	7,089	7,161	7,368	7,892
Gonzales	17,205	17,817	18,647	19,305	19,405	19,843	20,292
Guadalupe	64,873	86,668	111,437	140,370	176,873	203,201	235,139
Hays	65,614	88,614	117,201	145,619	180,349	219,637	250,091
Karnes	12,455	14,578	14,835	16,322	17,460	18,457	19,353
Kendall	14,589	17,129	19,752	22,435	25,007	27,906	31,140
Kerr	36,304	44,162	51,085	59,209	66,982	71,611	73,461
Lee	12,854	14,133	15,586	16,984	18,144	19,408	20,812
Llano	11,631	12,887	13,372	14,538	14,800	15,361	16,745
Matagorda	36,928	41,018	45,805	51,008	56,834	63,211	70,902
Medina	27,312	33,349	38,069	42,299	44,945	46,969	49,556
Refugio	7,976	8,421	8,844	9,110	9,081	9,020	8,896
San Saba	5,401	5,497	5,470	5,419	5,247	5,144	4,989
Travis	576,407	744,080	892,047	1,096,329	1,288,441	1,413,420	1,550,521
Uvalde	23,340	26,466	29,756	32,788	35,595	38,087	40,565
Victoria	74,361	81,909	89,539	96,977	104,205	111,710	120,836
Wharton	39,955	42,673	46,218	49,845	53,608	57,491	61,759
Wilson	22,650	26,578	30,757	34,597	36,953	39,332	42,972
Zavala	12,162	13,619	14,584	15,117	15,789	16,770	18,203
Total	2,529,465	3,146,504	3,761,841	4,504,787	5,248,515	5,866,582	6,437,262
Dimmitt*	10,385	12,023	13,874	15,738	17,844	20,049	22,478
Edwards*	704	820	914	978	1040	1082	1123
Kinney*	489	552	611	651	582	502	433
LaSalle*	5254	6092	6748	7285	7562	7854	8034
Maverick*	341	422	489	542	583	642	726
Real*	2297	2413	2475	2532	2584	2637	2690
Webb*	410	1337	1832	2399	3135	3311	4295
Total*	19,880	23,659	26,943	30,125	33,330	36,077	39,779
Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case.							
*Not in West Central Trans-Texas study area; includes only part of county located in Nueces Basin.							
Note: Texas population in 1990 was 16,986,510. TWDB projections of Texas population in year 2000 is 20,220,182, and in 2050 is 36,587,631 (1.287% compound annual growth rate).							



TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

POPULATION PROJECTIONS 32 COUNTY WEST CENTRAL STUDY AREA

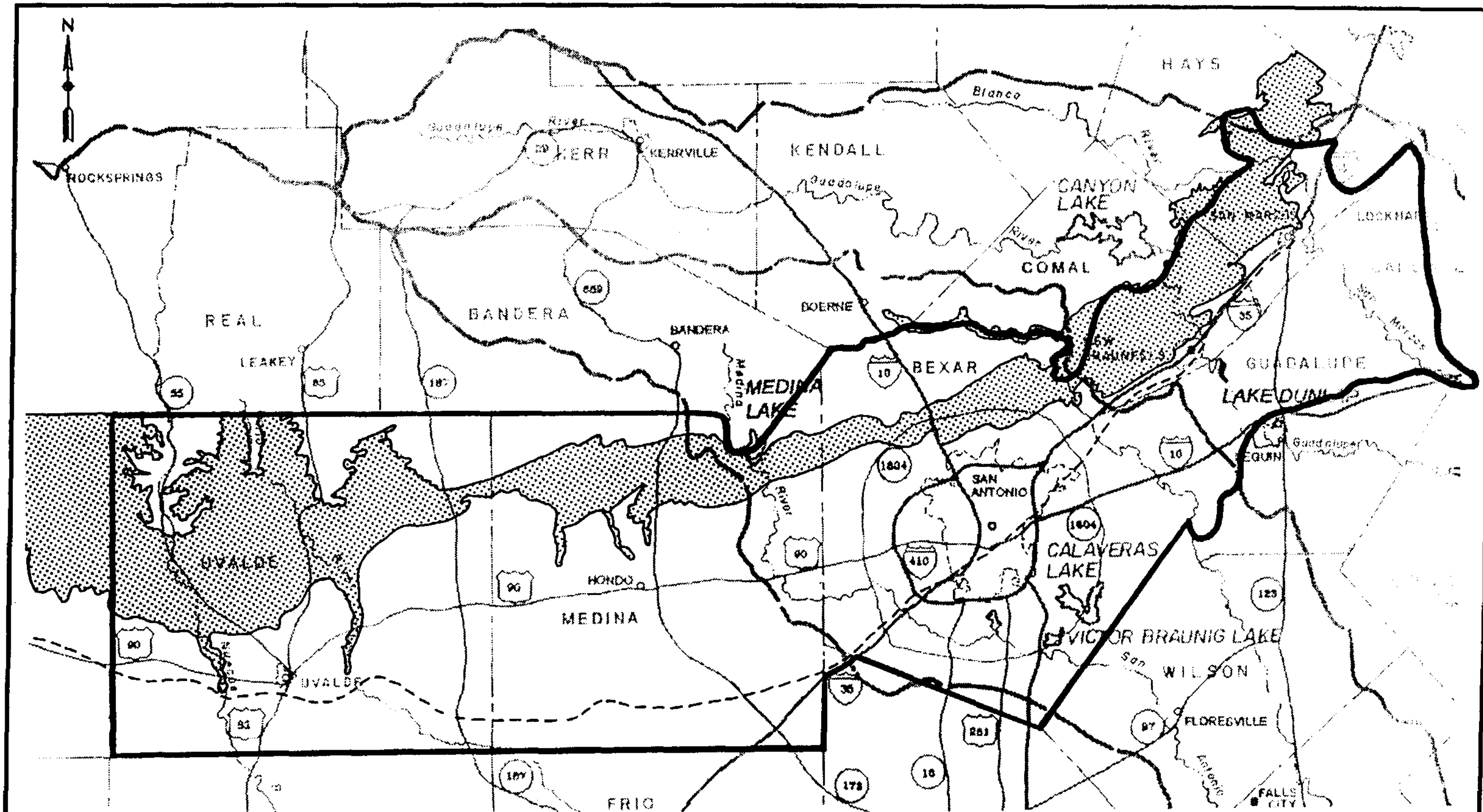
HDR Engineering, Inc.

FIGURE 2-1

(This page intentionally left blank)

2.1.2 Population Projections for the Edwards Aquifer Area Counties and Cities

The Edwards Aquifer area referenced here is the area specified in Senate Bill 1477, Texas Legislature, 73rd Session (1993), and includes all of the areas of Bexar, Medina, and Uvalde Counties, and parts of Atascosa, Comal, Caldwell, Hays, and Guadalupe Counties (Figure 2-2). Population projections for the portions of the counties and cities located within the Edwards Aquifer area are shown in Table 2-2 and Figure 2-3. The population of the Edwards Aquifer area was 1,360,937 in 1990 and is projected to be 3,602,473 in 2050. The compound annual growth rate of this area for the 1990-2050 projection period is 1.63 percent, which is about 3.8 percent higher than the 1.57 percent rate for the 32-county study area (Table 2-2).



Source: The Texas Water Development Board

Legend
- Edwards Aquifer Authority Boundary
- Basin Divide
- Edwards Aquifer Recharge Zone
- "Bad Water" Line

0 10 20 Miles
Scale

HDR
HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

EDWARDS AQUIFER AUTHORITY AREA

FIGURE 2-2

Table 2-2
Population Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

Basin/County/City/Rural	Total in 1990	Projections 2000	2010	2020	2030	2040	2050
ATASCOSA COUNTY (part)							
Nueces Basin							
Lytle	1,567	2,312	2,718	3,113	3,477	3,762	4,070
BEXAR COUNTY (all)							
San Antonio Basin							
San Antonio	935,933	1,137,369	1,360,669	1,621,857	1,886,190	2,125,314	2,394,753
Balcones Heights	3,022	3,437	3,791	4,182	4,455	4,734	5,030
Terrell Hills	4,592	5,120	5,417	5,810	5,970	5,969	5,968
Olmos Park	2,161	2,438	2,669	2,920	3,086	3,253	3,429
Helotes	1,535	2,045	2,600	3,251	3,937	4,295	4,686
Leon Valley	9,581	12,455	12,704	12,577	12,748	12,919	13,694
Alamo Heights	6,502	7,039	7,391	7,759	7,868	7,959	8,051
Converse	8,887	13,658	20,424	27,634	35,537	42,763	51,458
Fair Oaks Ranch	1,640	2,318	3,070	3,952	4,899	5,762	6,777
Kirby	8,326	10,039	11,992	14,276	16,584	18,672	21,023
Live Oak Water Public Utility	10,023	12,439	15,199	18,430	21,756	24,774	28,211
Schertz (Part)	414	607	807	951	1,021	1,176	1,417
Schertz (Outside City) Estimated	3,165	4,111	5,026	6,383	7,767	8,926	10,330
Shavano Park	1,708	2,097	2,425	2,687	2,784	2,917	3,056
St. Hedwig	1,443	1,843	2,425	3,107	3,837	4,503	5,285
Universal City	13,057	15,992	19,452	23,502	27,658	31,426	35,707
Continued Next Page							

Table 2-2 continued

Basin/County/City/Rural	Total in 1990	Projections 2000	2010	2020	2030	2040	2050
Windcrest (WC&ID No. 10)	5,331	5,818	6,160	6,520	6,665	6,796	6,930
Castle Hills(BMWD)	4,198	4,967	5,328	5,667	5,778	5,742	5,706
Somerset(BMWD)	1,144	1,251	1,314	1,361	1,321	1,280	1,240
Hill Country/HollywPark(BMWD)	3,879	4,956	5,887	6,988	8,003	8,947	10,009
BMWD(Subdvisions) Estimated	108,988	125,751	167,041	207,920	245,492	284,585	307,993
Remainder of County	47,114	94,672	109,906	136,408	169,774	195,454	141,708
Total	1,182,643	1,470,422	1,771,697	2,124,142	2,483,130	2,808,166	3,072,461
MEDINA COUNTY (all)							
Nueces Basin							
Devine	3,928	4,524	4,921	5,310	5,515	5,686	5,862
Hondo	6,018	7,032	7,880	8,782	9,268	9,574	9,890
Lytle	340	382	402	425	435	448	461
Natalia	1,216	1,703	1,909	2,126	2,244	2,318	2,394
Rural	10,379	12,861	14,972	16,662	17,839	18,817	20,231
Subtotal	21,881	26,502	30,084	33,305	35,301	36,843	38,838
San Antonio Basin							
Castroville	2,159	2,632	2,950	3,289	3,469	3,583	3,701
Lacoste	1,021	1,426	1,789	2,092	2,307	2,463	2,630
Rural	2,251	2,789	3,246	3,613	3,868	4,080	4,387
Subtotal	5,431	6,847	7,985	8,994	9,644	10,126	10,718
Total	27,312	33,349	38,069	42,299	44,945	46,969	49,556

Continued Next Page

Table 2-2 continued

Basin/County/City/Rural		Total in 1990	Projections 2000	2010	2020	2030	2040	2050
UVALDE COUNTY (all)								
Nueces Basin								
Sabinal		1,584	1,880	2,184	2,460	2,737	2,976	3,236
Uvalde		14,729	17,296	20,398	23,185	25,997	28,558	31,371
Rural		7,027	7,290	7,174	7,143	6,861	6,553	5,958
	Total	23,340	26,466	29,756	32,788	35,595	38,087	40,565
COMAL COUNTY (part)								
Guadalupe Basin								
Garden Ridge		1,450	2,301	3,157	4,352	5,686	6,903	8,380
New Braunfels		27,091	38,126	49,873	65,003	82,894	95,424	109,848
Rural	(0.08 of Co. rural)	1,698	2,272	3,119	4,399	5,760	7,206	8,702
Subtotal		30,239	42,699	56,149	73,754	94,340	109,533	126,930
San Antonio Basin								
Schertz (Part)		129	210	325	484	627	891	1,187
Rural	(0.026 0f Co rural)	613	738	1,014	1,430	1,872	2,342	2,828
Subtotal		742	948	1,339	1,914	2,499	3,233	4,015
	Total	30,981	43,647	57,488	75,667	96,839	112,766	130,945
HAYS COUNTY (part)								
Guadalupe Basin								
Kyle		2,225	2,427	2,574	2,803	3,167	3,702	4,327
San Marcos		28,743	33,751	40,281	47,370	56,741	68,141	81,831
Rural	(0.26 0f Co rural)	5,127	8,180	11,667	15,012	18,979	23,312	25,713
	Total	36,095	44,358	54,522	65,185	78,887	95,155	111,871

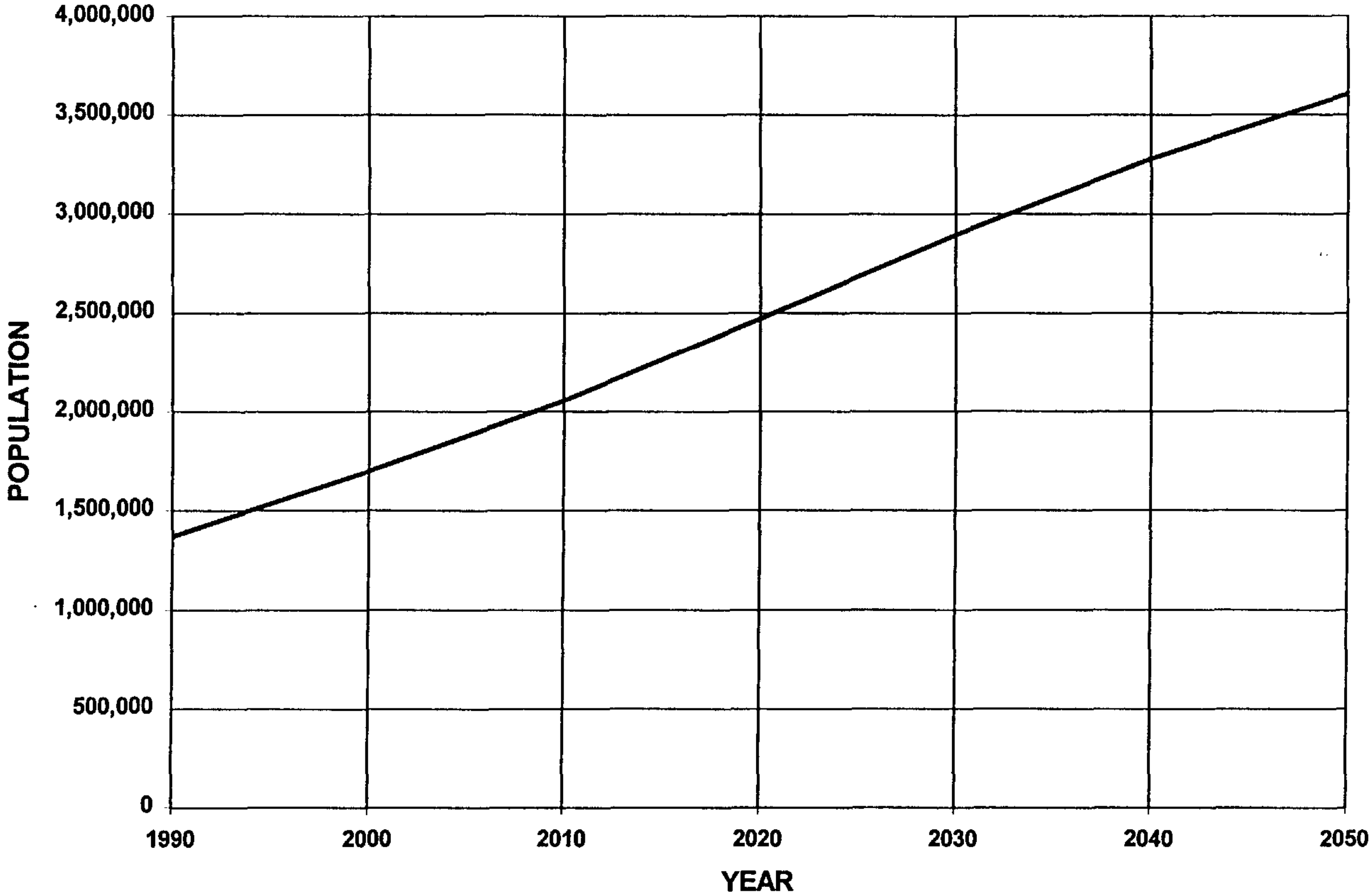
Continued Next Page

Table 2-2 continued

Basin/County/City/Rural		Total in 1990	Projections 2000	2010	2020	2030	2040	2050
GUADALUPE COUNTY (part)								
Guadalupe Basin								
New Braunfels (part)		243	278	334	414	592	657	729
Rural	(0.66 of Co rural)	21,373	24,838	33,890	42,618	53,857	59,839	67,185
Subtotal		21,616	25,116	34,224	43,032	54,449	60,496	67,914
San Antonio Basin								
Cibolo		1,757	3,840	4,490	5,830	6,710	7,780	8,420
Schertz	(Part)	10,012	12,894	18,720	24,890	32,574	42,421	55,231
Rural		5,832	11,659	14,562	17,623	22,270	24,744	27,782
Subtotal		17,601	28,393	37,772	48,343	61,554	74,945	91,433
	Total	39,217	53,509	71,996	91,375	116,003	135,441	159,347
CALDWELL COUNTY (part)								
Guadalupe Basin								
Lockhart		9,205	11,108	13,218	15,229	16,649	16,751	16,854
Luling		4,661	5,026	5,130	5,146	5,131	4,829	4,545
Rural	(0.50 of Co rural)	5,916	7,568	9,221	10,818	11,952	12,110	12,259
	Total	19,782	23,702	27,569	31,193	33,732	33,690	33,658
Edwards Aquifer Area Total*		1,360,937	1,697,764	2,053,815	2,465,762	2,892,609	3,274,036	3,602,473

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case.
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.

◇◇◇◇



HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

POPULATION PROJECTIONS
EDWARDS AQUIFER AREA

FIGURE 2-3

(This page intentionally left blank)

2.1.3 Population Projections for River Basins and Adjacent Areas

The 32-county West Central Study Area contains all or parts of the Nueces, San Antonio, Guadalupe, and Lower Colorado River Basins, however, parts of some study area counties are located in areas adjacent to one or more of these river basins. In addition, some study area counties are located in two or more study area river basins. For purposes of making projections of water demands for each individual river basin, it is necessary to sum the population and water demand projections of the counties and parts of counties located within each river basin as well as adjacent areas that depend upon each basin, respectively. In this section, the river basin and adjacent area population projections are presented. Water demand projections for these areas are presented in Section 2.2.3.

The population projections for the counties of the West Central Study Area that are located within the Nueces, San Antonio, Guadalupe, and Lower Colorado Basins, respectively, were summed and are shown in Table 2-3 and Figure 2-4. The population projections of the counties of the Nueces Basin that are included in the 32-county study area (Uvalde, Medina, Zavala, Frio, Atascosa, and parts of Bexar, Wilson and Karnes counties) are shown on row 1 of Table 2-3 (i.e., 105,607 in 1990, and 190,834 projected in 2050). The population of the 7-county area (parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties) of the Nueces Basin that are included here for information purposes, was 19,880 in 1990, and is projected at 39,779 (Table 2-3).

In the case of the San Antonio Basin, the basin totals are shown as follows: 1,270,884 in 1990, with 3,331,113 projected for 2050. The population of areas adjacent to the San Antonio Basin (the part of Goliad County that is located in the adjacent San Antonio-Nueces Coastal Basin) that is included in the 32-county study is shown to total 450 in 1990, with a projection to 2050 of 587 (Table 2-3 and Figure 2-4).

In 1990, the population of the Guadalupe Basin was 302,409 and is projected at 824,550 in 2050 (Table 2-3). For the Guadalupe Basin, the part of Victoria County located in the adjacent Lavaca-Guadalupe Coastal Basin plus Refugio and Calhoun counties were tabulated and included

Table 2-3 Population Projections for River Basins--32-County West Central Trans-Texas Study Area Trans-Texas Water Program							
		Projections					
River Basin	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
NUECES							
Study Area In-Basin[1]	105,607	123,877	141,003	156,991	170,405	181,967	190,834
7-County Adj. Area[2]	19,880	23,659	26,943	30,125	33,330	36,077	39,779
SAN ANTONIO							
Total In-Basin	1,270,884	1,585,794	1,910,695	2,291,649	2,678,667	3,032,625	3,331,113
Adj. Area[3]	450	476	505	527	532	547	587
Study Area Subtotal	1,271,334	1,586,270	1,911,200	2,292,176	2,679,199	3,033,172	3,331,700
GUADALUPE							
Total In-Basin	302,409	376,518	456,574	549,599	653,361	739,799	824,550
Adj. Area[4]	48,076	53,562	57,980	62,510	66,814	71,207	76,605
Study Area Subtotal	350,485	430,080	514,554	612,109	720,175	811,006	901,155
LOWER COLORADO							
Total In-Basin	706,715	901,517	1,079,653	1,316,511	1,539,747	1,689,580	1,849,297
Adj. Coastal Area[5]	73,250	79,802	87,426	95,563	104,333	113,681	124,451
Area Subtotal	779,965	981,319	1,167,079	1,412,074	1,644,080	1,803,261	1,973,748
Adj. Inland Area[6]	22,074	24,958	28,005	31,437	34,656	37,176	39,825
Study Area Subtotal	802,039	1,006,277	1,195,084	1,443,511	1,678,736	1,840,437	2,013,573
Study Area Subtotal[7]	2,507,391	3,121,546	3,733,836	4,473,350	5,213,859	5,829,406	6,397,437
Study Area Total	2,529,465	3,146,504	3,761,841	4,504,787	5,248,515	5,866,582	6,437,262

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case.

[1]Counties of Nueces Basin included in study area (Uvalde, Medina, Zavala, Frio, Atascosa and parts of Bexar, Wilson, and Karnes Counties).

[2] Parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties of the Nueces Basin, but not included in the West Central Trans-Texas study area.

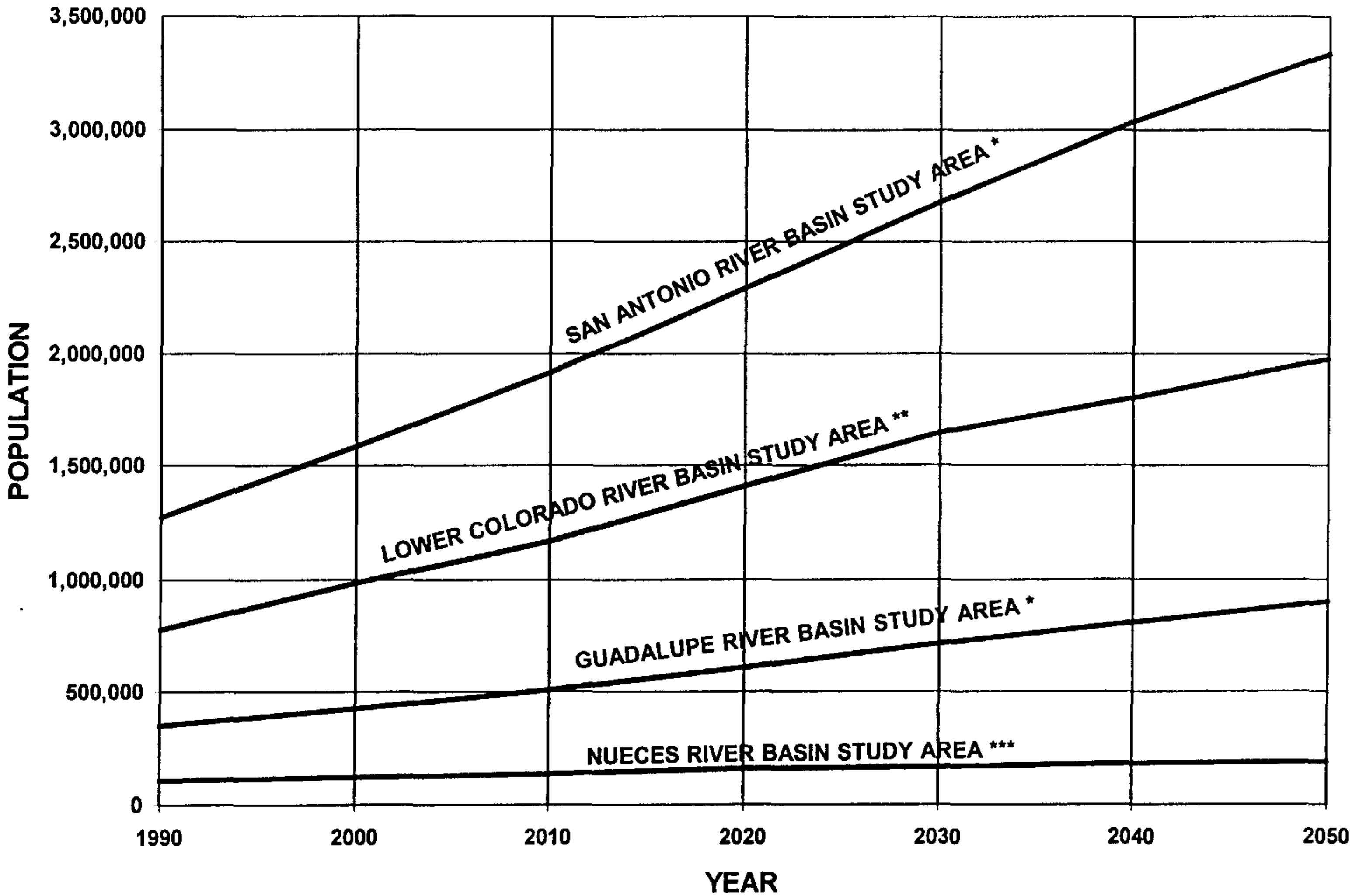
[3] Part of Goliad County located in adjacent San Antonio -Nueces Coastal Basin.

[4] Part of Victoria County located in adjacent Lavaca-Guadalupe Coastal Basin, plus all of Refugio and Calhoun Counties.

[5] Parts of Colorado, Matagorda, and Wharton Counties located in adjacent coastal basins, and obtain a part of their water supply from the Colorado River.

[6] Parts of Burnet, Bastrop, and Lee Counties located in the adjacent Brazos Basin.

[7] Does not include parts of Burnet, Bastrop, and Lee counties located in the adjacent Brazos Basin.



* In basin plus adjacent areas that obtain water from the basin.

** In basin plus adjacent coastal areas that obtain water from the Colorado Basin. Does not include parts of study area counties located in the Brazos Basin.

*** Includes only study area counties of the Nueces Basin.

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

POPULATION PROJECTIONS RIVER BASIN STUDY AREAS

FIGURE 2-4

as a separate element, since Calhoun County obtains water from the Guadalupe Basin, and Victoria and Refugio counties may need water from the Guadalupe Basin in the future. The population for the areas adjacent to the Guadalupe were 48,076 in 1990 and are projected to be 76,605 in 2050 (Table 2-3 and Figure 2-4).

The population of the Lower Colorado Basin was 706,715 in 1990 and is projected to increase to 1,849,297 in 2050 (Table 2-3). The population for areas adjacent to the Lower Colorado Basin are also shown in Table 2-3. Those parts of counties located in coastal basins adjacent to the Lower Colorado Basin (i.e., Colorado, Wharton, and Matagorda) had a 1990 population of 73,250. Projected 2050 population of these counties is 124,451 (Table 2-3 and Figure 2-4).

The 32-county study area total population in 1990 was 2,529,465 and is projected at 4,504,787 in 2020, and 6,437,262 in 2050 (Table 2-3).

2.2 Water Demand Projections

Texas Water Development Board's 1996 Consensus Water Plan water demand projections, "most likely case" with advanced conservation, are tabulated for the counties and are shown in tabular and graphic form for: (1) the 32-county study area, (2) the Edwards Aquifer area (Bexar, Medina, Uvalde, Comal, Hays, and parts of Guadalupe, and Caldwell Counties), and (3) the Nueces, San Antonio, Guadalupe, and Lower Colorado River Basin areas included within the study area. Projections are shown for each of the major water-using categories, as follows: (1) municipal, (2) manufacturing, (3) steam-electric power generation, (4) irrigation, (5) mining, (6) livestock, and (7) total of (1) through (6). Each type of water use is explained below, together with a brief description of projection methods, procedures, and data.

<u>Municipal Water Use</u>

Municipal water use includes freshwater for drinking, food preparation, dishwashing, bathing, toilet flushing, laundry, lawn watering, private and public swimming pools, hot tubs, restaurants, car washes, commercial laundries, office, service, hotel, motel, and retail building bathrooms and air conditioning, fire protection, fountains, public parks, sports centers, aquariums, zoos, and street washing. Municipal water must meet safe drinking standards as specified by Federal and State laws and regulations.

The municipal water demand projection for an area (city, county, other) for any future date is computed by the following formula:

$$MWD = \frac{gpcd(P)(365)}{325{,}851}$$

Where MWD = Number of acft of municipal water needed for 1 year;
gpcd = Number of gallons of water used per person per day during the year;
P = Projected population of the area in the projection year;
365 = Number of days in 1 year; and
325,851 = Number of gallons of water in 1 acre-foot.

For purposes of making projections of future municipal water demands, TWDB has conducted an annual survey of cities, and public and private water districts and authorities since the mid-1960's. In the annual survey, each respondent reports the quantities of water that have been obtained from each respective water source and supplied to municipal-type customers. From the water use reports of the cities, TWDB has computed an annual per capita water use, in gallons per person per day, for each city, for average and below normal precipitation, and for average and advanced water conservation. In this report, the advanced water conservation projection was used.

Industrial Water Use

Industrial water use includes freshwater used by industries for processing raw materials, including cooling of manufacturing processes, on-site electric power generation for use in the manufacturing plants, cleaning and waste removal, grounds maintenance, sanitation, pollution control, internal transportation, and in some cases, such as food and beverage manufacture, is included as part of the finished product.

As is done for cities, TWDB conducts an annual water use survey of business establishments of the major water using industries of Texas (petroleum refining, petrochemicals, inorganic chemicals, cement and concrete, steel, nonferrous smelters, construction machinery, pulp, paper and paperboard, food and beverages, and electronics). From the survey data, the quantity of freshwater used by each industry sector of a county is computed for the projections starting point (1990). Projections are made of quantities of water needed at future decadal points by applying estimated growth rates of each respective industry. Industrial water conservation effects are included by using projected recirculation and technology improvements coefficients for the projection period, which reduces the projected quantities obtained when growth rates are applied to the starting point water use data mentioned above.

Steam-Electric Power Water Use

Steam-electric power generation plants use freshwater for condenser cooling, boiler feed make-up, sanitation, grounds maintenance, and pollution control. Consumptive use typically ranges from one-third to one-half gallon of water for each kilowatt-hour of electricity produced, however, from 20 to 60 gallons of water must be circulated through the power plant condensers for each kilowatt-hour of electricity produced. The electric power industry uses both once-through and recirculation methods of operation. In the TWDB projections, each power plant is treated separately, and the projections are in terms of consumptive water use as opposed to total flows.

Annual water use surveys of electric power utilities provide TWDB with quantities of water used annually at each steam-electric power plant. These data, together with projections of additional generating units, and additional electric power plants form the basis for computing projections of quantities of water needed for electric power generation. It is important to note that TWDB projections of steam-electric power generation water needs are tied to projections of population growth; i.e., it is assumed that electric power generation capacity will be added as needed in order to meet the needs of the population projected for each area of the state. (Note: In some cases, electric power may be obtained from neighboring areas, with the required water supplies being provided at the power generation site).

Irrigation Water Use

The application of freshwater to land to grow crops is irrigation water use. The TWDB projection based upon aggressive adoption of irrigation technology, and a reduction in Federal Farm Programs by one-half were used in this report.

For water planning purposes, TWDB, in cooperation with the Texas State Soil and Water Conservation Board and the U.S. Natural Resource Conservation Service's County Work Units, conducts a field survey of irrigation water use every five years. The 1989 survey is the basis for making estimates of the quantities of irrigation water used in each county in which irrigation was done in 1990. The irrigation survey involves locating irrigation acreages on individual county maps, site visits to representative irrigation tracts, and checking soil conservation farm management plans and irrigation research results in order to determine the quantities of irrigation water used to produce each crop. Through this process, the number of irrigated acreages of each crop within each county is estimated. The acreages, together with estimated quantities of irrigation water used per acre allows the computation of quantities of irrigation water used in the projections starting point year (1990). For the projection period 1990-2050, irrigation water demands are projected by making projections of irrigated acreages at each decadal point in time and the quantity of water needed for each acre, assuming that efficient irrigation technology and methods appropriate at each decade point will be used by irrigation farmers.

Mining Water Use

Freshwater used in the recovery of petroleum, sand, gravel, clay and stone is mining water use. In the case of petroleum production, water is injected into petroleum bearing formations to drive crude oil and natural gas to the wells for pumping to the surface. In the case of sand, gravel, clay, and stone production, water is used to wash and separate materials into usable sizes and simply to remove soil and unusable materials.

TWDB's annual water use surveys include mining establishments. In addition, records of the Texas Railroad Commission are used to determine the quantities of freshwater used in "water flooding operations" for petroleum production. From these survey data and reports, computations are made of the quantities of freshwater used for mining purposes for the projections starting point year (1990). The growth rate (in the case of petroleum production, the direction is downward over the long run in most cases) of each mining activity of each county is projected and applied to the 1990 computed water use in order to obtain projections of quantities of water that will be needed at each decade point of the projection period (2000 - 2050).

Livestock Water Use

Drinking water and water for washing and sanitation of livestock housing and production facilities are needed for farm and ranch animals and poultry.

Livestock and poultry water requirements are estimated from nutritional needs, in gallons per day, for each type of livestock, times the number of each type. Projections are made of the numbers at each decadal point of the projection period for each county. Carrying capacity and the acreages of rangeland are used in making projections for beef cattle, sheep, and goats. Growth rates of dairy and poultry numbers are developed for making projections for these groups. Projections are made for each county by summing the projections for each livestock type.

Total Water Demand

Total water use projected for each subarea (city, county, Edwards Aquifer area, and river basin area) of the study area is the sum of the projected water demands for municipal, industrial, steam-electric power, irrigation, mining, and livestock purposes.

2.2.1 Water Demand Projections for the 32-County Study Area

The TWDB 1996 Consensus water planning projections of water demand with advanced water conservation are shown in tabular and graphic form for the 33-county study area for: (1) municipal, (2) industrial, (3) steam-electric power generation, (4) irrigation, (5) mining, (6) livestock, and (7) total water use.

2.2.1.1 Municipal Water Demand Projections for the 33-County Study Area

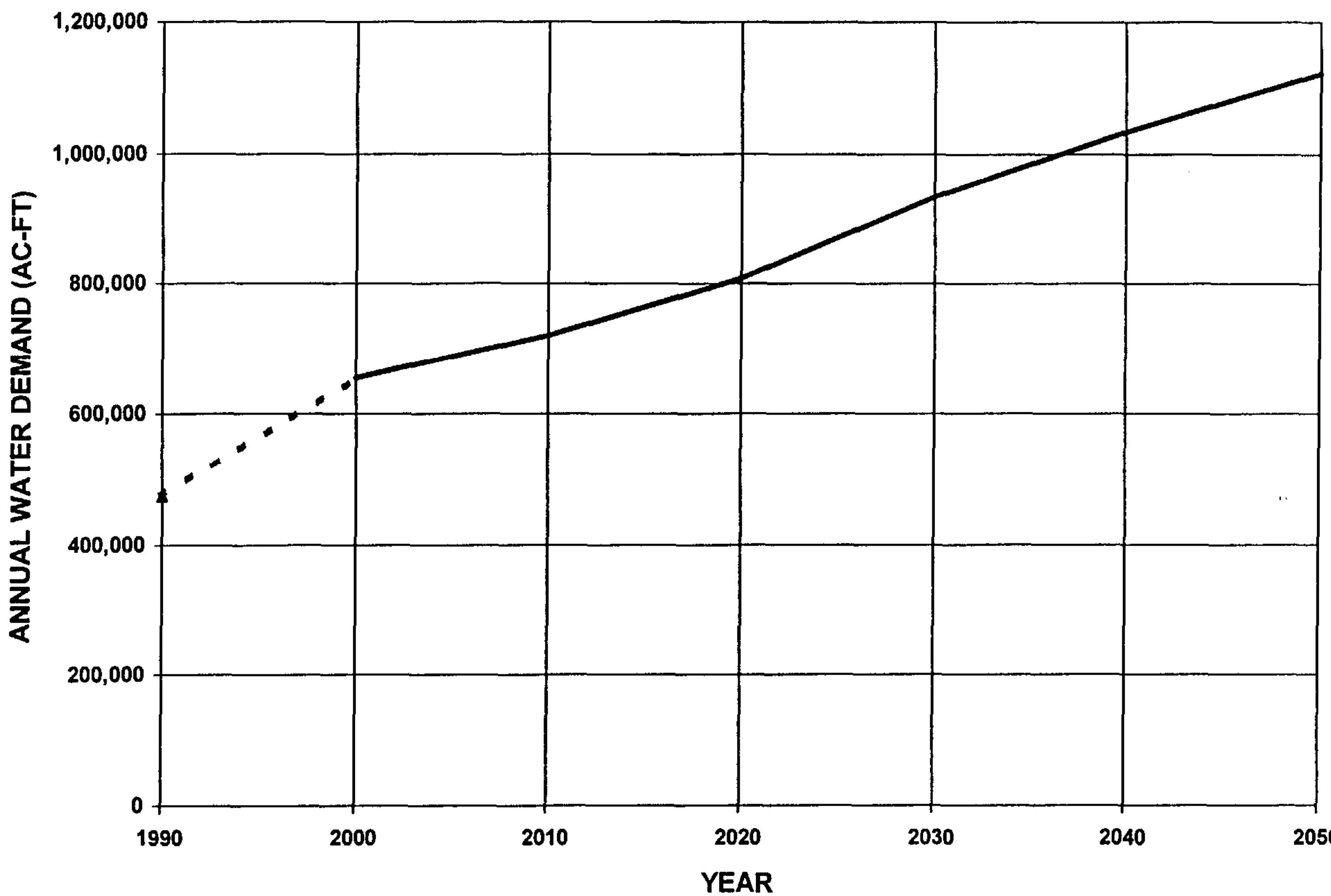
For the 32-County study area, municipal water use in 1990 was 474,326 acft and ranged from 916 acft in Goliad County to 225,626 acft in Bexar County (Table 2-4 and Figure 2-5). The municipal water demand projection, with advanced water conservation is 650,006 acft in 2000, 803,379 acft in 2020 and 1,116,317 acre feet in 2050 (Table 2-4). Projections for the individual counties are a function of the number of people projected for the counties and the per capita water use rates of the respective counties. The individual county projections are displayed in Table 2-4 and for year 2050 range from a low of 917 acft for Goliad County to a high of 531,750 acft for Bexar County. It should be noted that for 1990 the quantities are of actual use, while the projections for 2000 and beyond are for dry year conditions, with advanced water conservation. Since 1990 was not a dry year, the per capita use is lower than that which was used in the projections, thus the point for 1990 is not located on the projections curve of Figure 2-5.

Table 2-4							
Municipal Water Demand Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
	Use in	**Projections**					
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
Atascosa	5,670	7,245	7,641	8,004	8,807	9,378	9,835
Bandera	1,445	1,830	1,911	2,108	2,332	2,576	2,848
Bastrop	6,247	8,196	9,215	10,340	11,870	12,799	13,747
Bexar	225,626	306,064	338,626	381,015	439,753	493,694	531,750
Blanco	904	1,147	1,221	1,305	1,416	1,463	1,444
Burnet	3,526	4,303	4,691	5,118	5,714	5,892	6,079
Caldwell	4,931	5,802	6,106	6,388	6,787	6,709	6,648
Calhoun	3,911	4,396	4,440	4,537	4,877	5,253	5,724
Colorado	2,927	3,072	2,958	2,911	3,015	3,099	3,172
Comal	10,415	18,587	22,780	28,687	36,569	43,590	51,227
DeWitt	3,556	3,614	3,470	3,400	3,535	3,688	3,841
Fayette	3,395	3,632	3,682	3,870	4,271	4,703	5,242
Frio	3,045	3,510	3,615	3,670	3,813	3,933	4,024
Goliad	916	928	891	858	856	868	917
Gonzales	3,832	3,879	3,729	3,613	3,589	3,628	3,684
Guadalupe	9,627	15,357	17,802	20,696	25,780	29,447	34,088
Hays	11,709	16,652	19,661	22,428	27,207	32,695	37,279
Karnes	2,187	2,586	2,401	2,436	2,564	2,682	2,776
Kendall	2,130	2,571	2,697	2,836	3,136	3,476	3,855
Kerr	5,926	8,327	9,076	9,841	10,870	11,376	11,616
Lee	2,991	3,121	3,170	3,230	3,416	3,626	3,864
Llano	2,488	2,797	2,630	2,600	2,591	2,669	2,850
Matagorda	5,225	5,852	5,927	6,105	6,661	7,317	8,091
Medina	5,254	7,112	7,312	7,467	7,832	8,074	8,398
Refugio	1,227	1,328	1,275	1,220	1,198	1,177	1,150
San Saba	1,272	1,599	1,457	1,336	1,281	1,241	1,201
Travis	114,809	172,439	191,815	222,192	259,493	281,465	308,421
Uvalde	5,278	6,710	7,074	7,317	8,019	8,618	9,271
Victoria	11,545	13,013	13,146	13,382	14,178	15,056	16,116
Wharton	6,218	6,544	6,417	6,440	6,800	7,209	7,669
Wilson	3,745	5,019	5,257	5,455	5,744	6,066	6,570
Zavala	2,349	2,774	2,694	2,574	2,652	2,753	2,920
Total	474,326	650,006	714,787	803,379	926,626	1,026,220	1,116,317
Dimmitt*	2,202	2,930	3,162	3,387	3,833	4,307	4,833
Edwards*	106	108	108	107	111	113	116
Kinney*	60	124	127	125	110	95	81
LaSalle*	1,233	1,372	1,391	1,392	1,422	1,459	1,486
Maverick*	42	61	64	65	69	74	84
Real*	500	559	525	509	521	534	551
Webb*	51	241	304	371	481	504	649
Total*	4,194	5,395	5,681	5,956	6,547	7,086	7,800

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

MUNICIPAL WATER DEMAND PROJECTIONS
32 COUNTY WEST CENTRAL STUDY AREA

FIGURE 2-5

(This page intentionally left blank)

2.2.1.2 Industrial Water Demand Projections for the 32-County Study Area

Industrial water use in the study area in 1990 was reported at 82,981 acft and is projected to increase to 227,912 acft in 2050 (Table 2-5 and Figure 2-6). Industrial water use is concentrated in the coastal counties of Calhoun, Victoria, and Matagorda, and along the I-35 corridor (Bexar, Comal, Guadalupe, and Travis Counties). Seven of the study area counties do not have any projected industrial water use (Table 2-5). In 1990, the heavy water using industries of Calhoun,Victoria, and Matagorda counties were operating at much less than full capacity due to sluggish economic conditions. Thus, reported water use was below normal. As economic conditions improved, water use increased to that needed to return idle capacity to production. This is reflected in the projections and explains a part of the large increase in the industrial water demand projections between 1990 and 2000.

2.2.1.3 Steam-Electric Power Water Demand Projections for the 32-County Study Area

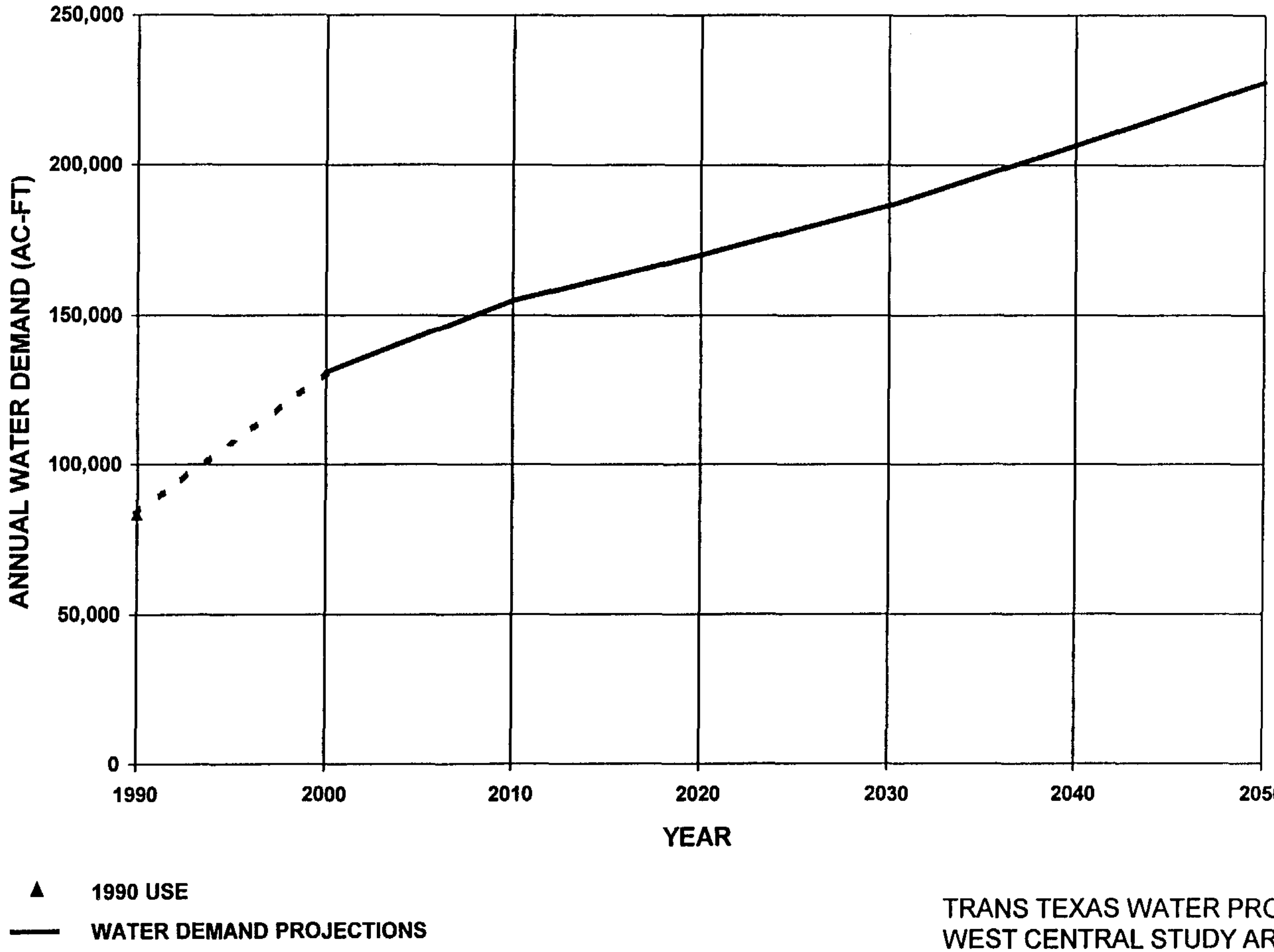
Steam-electric power generation is located in 11 of the 32-study area counties, with the larger plants located in Bexar, Matagorda, Goliad, and Fayette Counties. Consumptive use by power plants in 1990 was 101,169 acft (Table 2-6 and Figure 2-7). Projected consumptive use of water for steam-electric power generation in 2050 is 208,500 acft (Table 2-6). It is important to note that total volume of water required for circulation in steam-electric power plants is perhaps 50 times that which is consumed by evaporation. It is further useful to note that treated municipal wastewater can and is being used in Bexar County for electric power generation.

Table 2-5							
Industrial Water Demand Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
	Use in	**Projections**					
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
Atascosa	0	0	0	0	0	0	0
Bandera	0	11	13	15	16	19	22
Bastrop	27	33	40	48	57	67	78
Bexar	14,049	16,805	19,682	22,359	24,935	28,264	31,697
Blanco	0	0	0	0	0	0	0
Burnet	1,116	1,246	1,377	1,514	1,655	1,800	1,947
Caldwell	0	0	0	0	0	0	0
Calhoun	24,539	63,026	77,588	85,949	95,240	105,236	115,958
Colorado	1,078	1,150	1,224	1,297	1,369	1,438	1,508
Comal	3,248	3,450	3,487	3,548	3,799	4,071	4,351
DeWitt	91	108	126	146	170	195	223
Fayette	32	37	44	50	55	63	71
Frio	0	0	0	0	0	0	0
Goliad	0	0	0	0	0	0	0
Gonzales	865	929	992	1,043	1,083	1,160	1,231
Guadalupe	1,661	1,883	2,102	2,248	2,385	2,590	2,797
Hays	293	381	445	507	564	620	677
Karnes	270	296	320	331	340	356	383
Kendall	2	2	3	4	4	5	6
Kerr	28	30	33	36	38	41	44
Lee	5	6	7	8	9	11	12
Llano	0	0	0	0	0	0	0
Matagorda	6,807	7,366	7,876	8,059	8,179	8,696	9,193
Medina	286	302	319	339	361	384	411
Refugio	0	0	0	0	0	0	0
San Saba	0	0	0	0	0	0	0
Travis	6,243	7,209	8,104	8,743	9,494	10,385	11,600
Uvalde	557	600	643	675	700	759	817
Victoria	20,032	24,115	28,446	31,157	33,670	37,900	42,201
Wharton	396	442	486	521	554	596	637
Wilson	50	61	72	85	99	115	134
Zavala	1,306	1,407	1,507	1,582	1,642	1,780	1,914
Total	82,981	130,895	154,936	170,264	186,418	206,551	227,912
Dimmitt*	3	11	11	12	13	14	15
Edwards*	0	0	0	0	0	0	0
Kinney*	0	0	0	0	0	0	0
LaSalle*	0	0	0	0	0	0	0
Maverick*	0	0	0	0	0	0	0
Real*	0	0	0	0	0	0	0
Webb*	0	0	0	0	0	0	0
Total	3	11	11	12	13	14	15

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).



TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

HDR Engineering, Inc.

INDUSTRIAL WATER DEMAND PROJECTIONS 32 COUNTY WEST CENTRAL STUDY AREA

FIGURE 2-6

Table 2-6

Steam-Electric Power Water Demand Projections--32 County West Central Trans-Texas Study Area

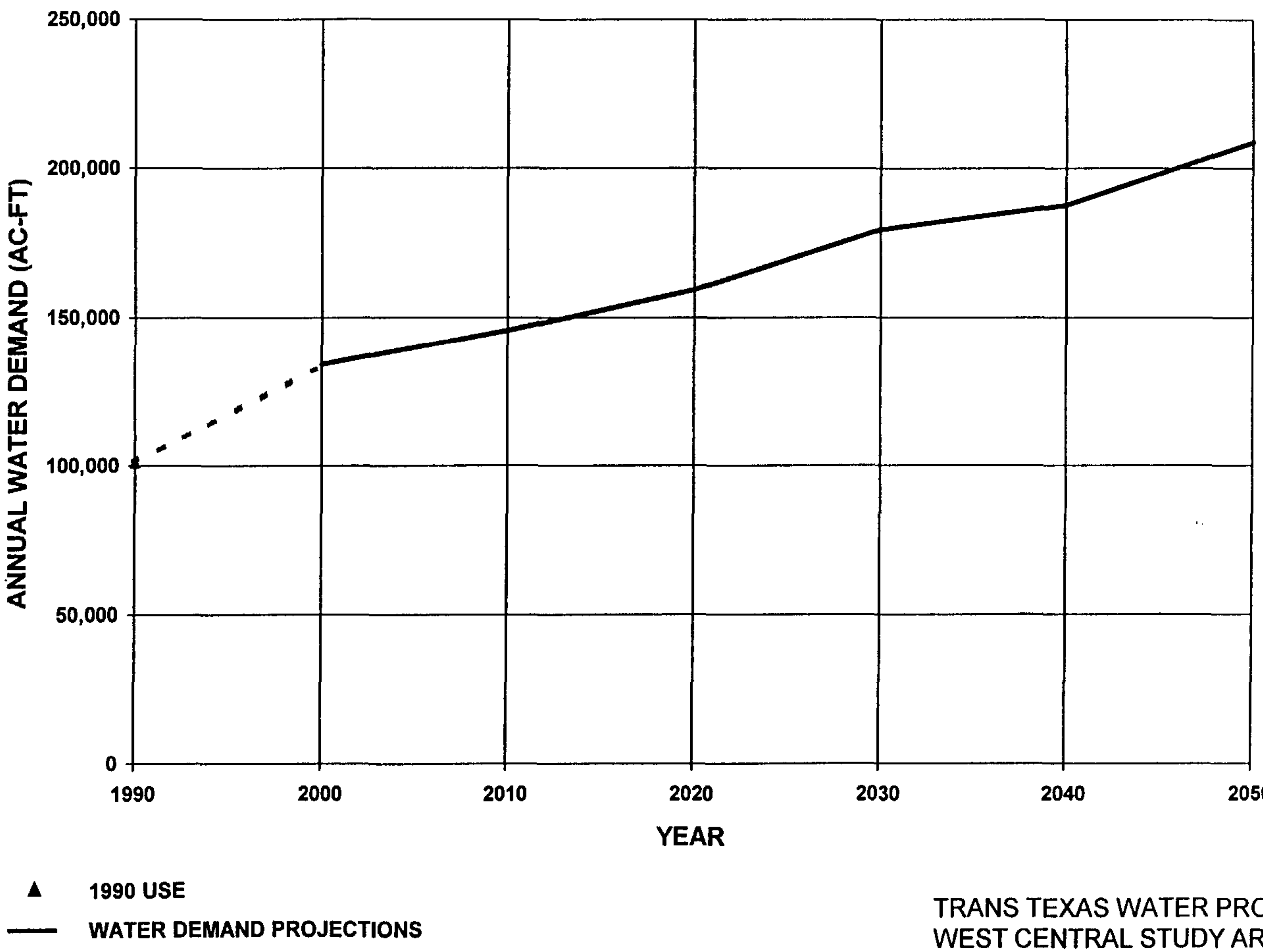
Trans-Texas Water Program

County	Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Atascosa	6,036	12,000	12,000	12,000	12,000	15,000	22,000
Bandera	0	0	0	0	0	0	0
Bastrop	2,967	4,500	8,000	8,000	8,000	8,000	8,000
Bexar	24,263	36,000	36,000	40,000	45,000	50,000	56,000
Blanco	0	0	0	0	0	0	0
Burnet	0	0	0	0	0	0	0
Caldwell	0	0	0	0	0	0	0
Calhoun	62	100	100	100	100	100	100
Colorado	0	0	0	0	0	0	0
Comal	0	0	0	0	0	0	0
DeWitt	0	0	0	0	0	0	0
Fayette	11,701	15,000	20,000	25,000	40,000	40,000	45,000
Frio	38	400	400	400	400	400	400
Goliad	12,165	15,000	15,000	20,000	20,000	20,000	20,000
Gonzales	0	0	0	0	0	0	0
Guadalupe	0	0	0	0	0	0	0
Hays	0	0	0	0	0	0	0
Karnes	0	0	0	0	0	0	0
Kendall	0	0	0	0	0	0	0
Kerr	0	0	0	0	0	0	0
Lee	0	0	0	0	0	0	0
Llano	937	1,000	2,000	2,000	2,000	2,000	2,000
Matagorda	35,915	35,000	35,000	35,000	35,000	35,000	35,000
Medina	0	0	0	0	0	0	0
Refugio	0	0	0	0	0	0	0
San Saba	0	0	0	0	0	0	0
Travis	6,198	7,000	7,000	7,000	7,000	7,000	10,000
Uvalde	0	0	0	0	0	0	0
Victoria	887	8,000	10,000	10,000	10,000	10,000	10,000
Wharton	0	0	0	0	0	0	0
Wilson	0	0	0	0	0	0	0
Zavala	0	0	0	0	0	0	0
Total	101,169	134,000	145,500	159,500	179,500	187,500	208,500
Dimmitt*	0	0	0	0	0	0	0
Edwards*	0	0	0	0	0	0	0
Kinney*	0	0	0	0	0	0	0
LaSalle*	0	0	0	0	0	0	0
Maverick*	0	0	0	0	0	0	0
Real*	0	0	0	0	0	0	0
Webb*	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).



TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

HDR Engineering, Inc.

STEAM-ELECTRIC POWER WATER DEMAND PROJECTIONS 32 COUNTY WEST CENTRAL STUDY AREA

FIGURE 2-7

(This page intentionally left blank)

2.2.1.4 Irrigation Water Demand Projections for the 32-County Study Area

Irrigation is done in practically all of the counties of the study area, with large acreages, and consequently large quantities of water used in the coastal counties (Wharton, Matagorda, Colorado, and Calhoun), the Winter Garden area (Zavala, Frio, and Uvalde Counties), the western Edwards Aquifer area (Bexar, Medina, and Uvalde Counties), and in Atascosa and Wilson Counties (Table 2-7). The sources of irrigation water for the coastal counties are diversions from the Colorado, Guadalupe, and San Antonio rivers and groundwater from the Gulf Coast Aquifer. The sources for the Winter Garden area are the Edwards and Carrizo Aquifers, with small quantities from the Nueces River. The sources for Bexar and Medina counties are the Edwards Aquifer and Medina and Diversion Lakes (the Medina River). Uvalde County irrigation is supplied from the Edwards Aquifer. Atascosa and Wilson County irrigation is supplied largely from the Carrizo Aquifer, with some water obtained from streams which flow through the counties. Irrigation water for other counties of the study area is obtained from both ground and surface water sources.

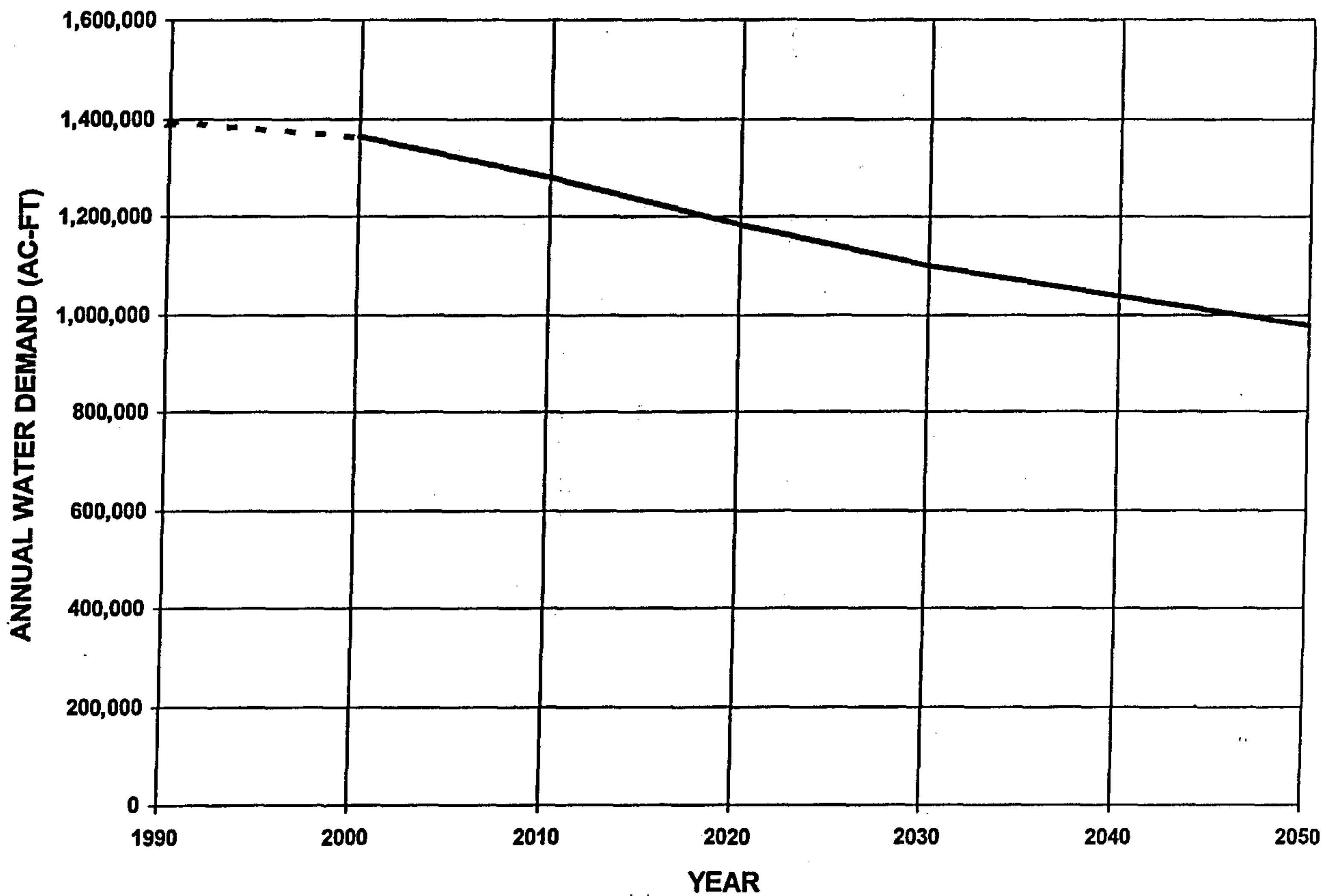
In 1990, irrigation water use in the study area from all sources was estimated at 1,393,123 acft (Table 2-7 and Figure 2-8). Irrigation water demand is projected to decline to 1.38 million acft in 2000, 1.19 million acft in 2020, and 987,648 in 2050. The projected decline is anticipated to occur due to improved application efficiency, canal lining and pipeline installation to reduce losses between the river bank diversion points and the fields, and reduced federal farm programs for some irrigated crops.

Table 2-7							
Irrigation Water Demand Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
	Use in	**Projections**					
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
Atascosa	47,208	45,415	43,691	42,032	40,436	38,900	37,423
Bandera	290	277	265	254	243	232	222
Bastrop	645	559	484	419	363	314	272
Bexar	37,012	40,003	36,879	35,320	33,827	32,397	31,026
Blanco	483	457	432	409	387	366	346
Burnet	300	292	285	277	270	263	257
Caldwell	1,375	1,215	1,073	948	837	739	653
Calhoun	35,421	26,822	22,747	19,950	17,673	16,132	15,028
Colorado	216,480	204,222	189,784	168,881	150,767	140,108	130,205
Comal	479	459	440	421	404	387	370
DeWitt	285	256	229	206	185	166	148
Fayette	400	372	345	321	298	277	258
Frio	83,233	79,688	76,294	73,045	69,933	66,955	64,103
Goliad	685	560	458	374	306	250	205
Gonzales	3,540	3,019	2,574	2,195	1,871	1,596	1,361
Guadalupe	2,646	2,501	2,364	2,234	2,111	1,996	1,886
Hays	320	316	312	308	305	301	297
Karnes	2,034	1,818	1,624	1,451	1,297	1,159	1,035
Kendall	380	364	348	333	319	305	292
Kerr	850	822	796	770	745	721	697
Lee	283	273	264	255	246	238	230
Llano	1,122	1,092	1,064	1,036	1,008	982	956
Matagorda	195,542	180,708	168,521	149,698	136,030	126,853	118,298
Medina	157,380	166,623	154,910	148,259	141,895	135,803	129,974
Refugio	0	0	0	0	0	0	0
San Saba	5,734	5,502	5,279	5,065	4,859	4,663	4,474
Travis	800	731	667	609	557	508	464
Uvalde	140,669	135,067	129,689	124,524	119,566	114,804	110,233
Victoria	13,699	10,783	8,488	6,681	5,259	4,140	3,259
Wharton	319,209	331,308	309,071	282,082	257,978	240,662	224,510
Wilson	13,697	12,071	10,638	9,376	8,263	7,282	6,419
Zavala	110,922	122,307	119,831	116,220	111,543	107,055	102,747
Total	1,393,123	1,375,901	1,289,845	1,193,953	1,109,781	1,046,553	987,648
Dimmitt*	11,185	10,551	10,199	9,932	9,828	9,432	9,026
Edwards*	0	0	0	0	0	0	0
Kinney*	201	192	184	176	168	161	154
LaSalle*	7,292	7,063	6,841	6,626	6,418	6,217	6,021
Maverick*	5,269	5,060	4,861	4,669	4,485	4,308	4,138
Real*	872	834	798	763	729	698	667
Webb*	0	0	0	0	0	0	0
Total	24,819	23,700	22,883	22,166	21,628	20,816	20,006

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall, aggressive adoption of irrigation technology, and reduction in federal farm programs by one-half.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).



▲ 1990 USE

— WATER DEMAND PROJECTIONS

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

IRRIGATION WATER DEMAND PROJECTIONS 32 COUNTY WEST CENTRAL STUDY AREA

FIGURE 2-8

(This page intentionally left blank)

2.2.1.5 Mining Water Demand Projections for the 32-County Study Area

Mining is done in all of the counties, with the largest quantities of water use in Colorado, Wharton, Victoria, Travis, Bexar and Williamson Counties (Table 2-8). Estimated mining water use in 1990 was 45,928 acft, with projected use for the period 2010 to 2030 dropping to a range of 35,736 to 41,629 acft per year (Table 2-8 and Figure 2-9). The decline is due to a projected decline in water flooding for petroleum recovery. The 1996 consensus projections, with conservation, at year 2050 is 41,629 acft. The growth in mining after 2030 is due to growth in sand, gravel, and limestone quarrying in the San Antonio and Austin areas.

2.2.1.6 Livestock Water Demand Projections for the 32-County Study Area

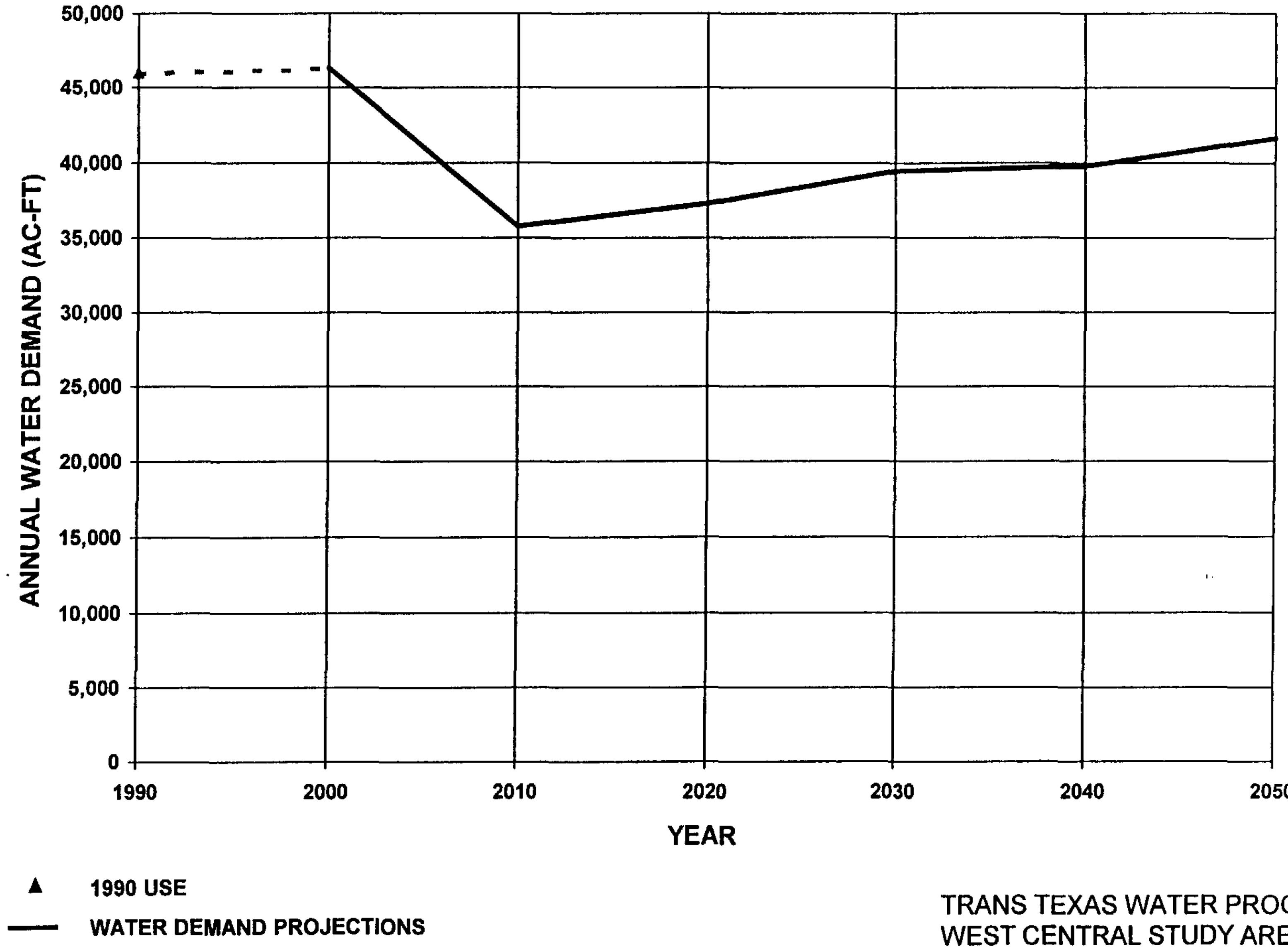
Livestock production is done throughout the study area, with the predominant activity being grazing of beef and goats. Poultry production is concentrated in Gonzales County. Estimated livestock water use in 1990 was 36,367 acft with projections of 40,177 for 2000 through 2050 (Table 2-9 and Figure 2-10). The TWDB projection method for livestock water requirements estimates the maximum grazing capacity for rangeland in each county and computes the quantity of water needed by livestock for this grazing capacity. Thus, in areas where range livestock production predominates, the projection reaches its upper limit and is held constant thereafter.

Table 2-8							
Mining Water Demand Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
	Use in	**Projections**					
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
Atascosa	945	1,740	1,680	1,751	1,842	1,948	2,068
Bandera	20	25	25	26	27	27	27
Bastrop	16	56	46	38	33	34	43
Bexar	1,591	4,963	4,936	5,201	5,406	5,645	5,962
Blanco	0	13	9	5	1	0	0
Burnet	936	1,013	987	1,006	1,028	1,058	1,091
Caldwell	27	21	16	10	4	0	0
Calhoun	1	20	15	9	5	2	2
Colorado	31,967	20,486	11,378	12,334	13,473	14,926	16,677
Comal	946	5,570	5,464	5,628	5,796	3,590	2,224
DeWitt	129	161	106	70	50	44	44
Fayette	7	29	22	21	10	6	3
Frio	313	150	63	32	16	7	3
Goliad	0	17	12	6	3	0	0
Gonzales	21	41	37	33	29	29	30
Guadalupe	8	196	198	200	202	207	213
Hays	0	96	90	72	56	37	28
Karnes	187	155	65	27	18	10	4
Kendall	0	13	9	5	1	0	0
Kerr	73	176	122	110	103	102	105
Lee	0	30	21	13	5	1	0
Llano	65	143	112	99	95	92	95
Matagorda	250	299	256	245	242	242	249
Medina	120	143	128	128	129	132	136
Refugio	77	44	26	19	11	4	4
San Saba	86	172	133	124	123	122	126
Travis	2,288	4,880	4,746	5,246	5,791	6,407	7,116
Uvalde	399	444	428	499	576	666	777
Victoria	2,409	2,578	2,028	1,732	1,714	1,720	1,862
Wharton	2,650	2,374	2,431	2,502	2,568	2,641	2,720
Wilson	281	193	105	62	39	30	20
Zavala	116	97	42	25	8	2	0
Total	45,928	46,338	35,736	37,278	39,404	39,731	41,629
Dimmitt*	506	1,003	817	906	916	926	950
Edwards*	0	0	0	0	0	0	0
Kinney*	0	0	0	0	0	0	0
LaSalle*	0	0	0	0	0	0	0
Maverick*	184	80	40	20	10	5	3
Real*	0	0	0	0	0	0	0
Webb*	0	0	0	0	0	0	0
Total*	690	1,083	857	926	926	931	953

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall, and advanced water conservation.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).



TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

HDR Engineering, Inc.

MINING WATER DEMAND PROJECTIONS 32 COUNTY WEST CENTRAL STUDY AREA

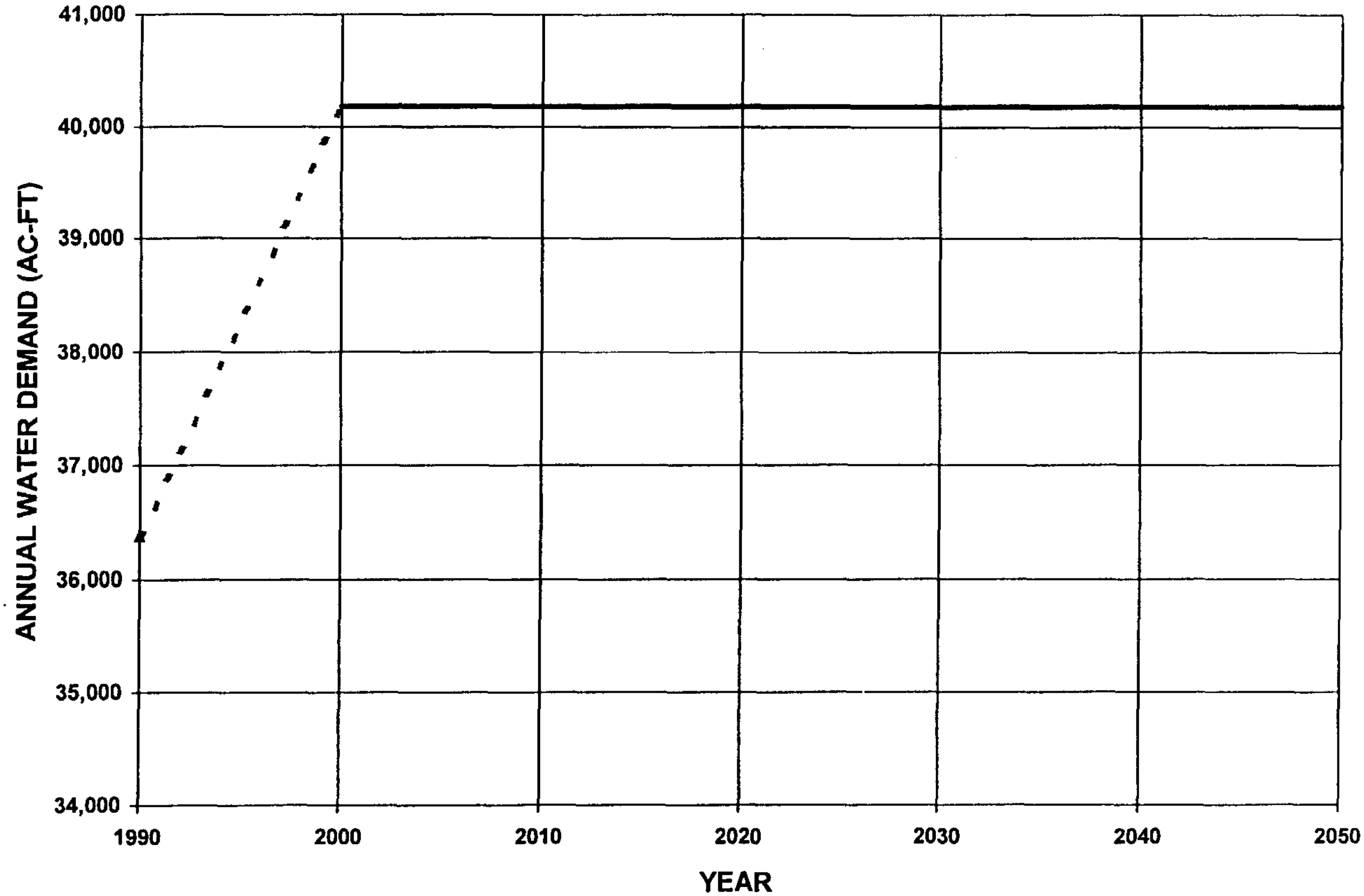
FIGURE 2-9

Table 2-9 Livestock Water Demand Projections--32 County West Central Trans-Texas Study Area Trans-Texas Water Program							
	Use in	Projections					
County	1990	2000	2010	2020	2030	2040	2050
	acft	acft	acft	acft	acft	acft	acft
Atascosa	1,613	1,808	1,808	1,808	1,808	1,808	1,808
Bandera	325	333	333	333	333	333	333
Bastrop	1,431	1,525	1,525	1,525	1,525	1,525	1,525
Bexar	1,376	1,487	1,487	1,487	1,487	1,487	1,487
Blanco	553	670	670	670	670	670	670
Burnet	820	794	794	794	794	794	794
Caldwell	816	835	835	835	835	835	835
Calhoun	291	304	304	304	304	304	304
Colorado	1,395	1,447	1,447	1,447	1,447	1,447	1,447
Comal	316	356	356	356	356	356	356
DeWitt	1,840	1,896	1,896	1,896	1,896	1,896	1,896
Fayette	2,036	2,619	2,619	2,619	2,619	2,619	2,619
Frio	1,097	1,192	1,192	1,192	1,192	1,192	1,192
Goliad	884	1,208	1,208	1,208	1,208	1,208	1,208
Gonzales	4,108	5,064	5,064	5,064	5,064	5,064	5,064
Guadalupe	1,031	1,132	1,132	1,132	1,132	1,132	1,132
Hays	676	484	484	484	484	484	484
Karnes	1,371	1,339	1,339	1,339	1,339	1,339	1,339
Kendall	389	512	512	512	512	512	512
Kerr	382	526	526	526	526	526	526
Lee	1,398	1,711	1,711	1,711	1,711	1,711	1,711
Llano	908	689	689	689	689	689	689
Matagorda	1,120	1,023	1,023	1,023	1,023	1,023	1,023
Medina	1,560	1,914	1,914	1,914	1,914	1,914	1,914
Refugio	563	407	407	407	407	407	407
San Saba	1,121	1,200	1,200	1,200	1,200	1,200	1,200
Travis	942	906	906	906	906	906	906
Uvalde	994	1,494	1,494	1,494	1,494	1,494	1,494
Victoria	1,271	1,398	1,398	1,398	1,398	1,398	1,398
Wharton	1,213	1,118	1,118	1,118	1,118	1,118	1,118
Wilson	1,813	1,905	1,905	1,905	1,905	1,905	1,905
Zavala	714	881	881	881	881	881	881
Total	36,367	40,177	40,177	40,177	40,177	40,177	40,177
Dimmitt*	795	621	621	621	621	621	621
Edwards*	228	254	254	254	254	254	254
Kinney*	261	283	283	283	283	283	283
LaSalle*	988	1,077	1,077	1,077	1,077	1,077	1,077
Maverick*	526	527	527	527	527	527	527
Real*	196	146	146	146	146	146	146
Webb*	880	477	477	477	477	477	477
Total*	3,874	3,385	3,385	3,385	3,385	3,385	3,385

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall, and advanced water conservation.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

LIVESTOCK WATER DEMAND PROJECTIONS
32 COUNTY WEST CENTRAL STUDY AREA

FIGURE 2-10

(This page intentionally left blank)

2.2.1.7 Total Water Demand Projections for the 32-County Study Area

In previous sections, projections of future water demands have been tabulated for each of the major water using functions of the 32-county area; i.e., municipal, industrial, steam-electric power generation, irrigation, mining, and livestock water. In this section, the totals of all uses projected for each county are shown along with the sum for the 32-counties (Table 2-10).

Water use in 1990 was 2,133,894 acft for the 32-county area, with 15.5 percent in Wharton County, 14 percent in Bexar County, 12 percent in each of Matagorda and Colorado counties, 7.5 percent in Medina County, 6.7 percent in Uvalde County, 6.0 percent in Travis County, and 5.2 percent in Zavala County (Table 2-10). The TWDB 1996 consensus water planning projection of water demand for below normal precipitation with advanced conservation for the 32-county area is approximately 2.37 million acft in 2000, 2.39 million acft in 2020, and 2.61 million acft in 2050 (Table 2-10 and Figure 2-11).

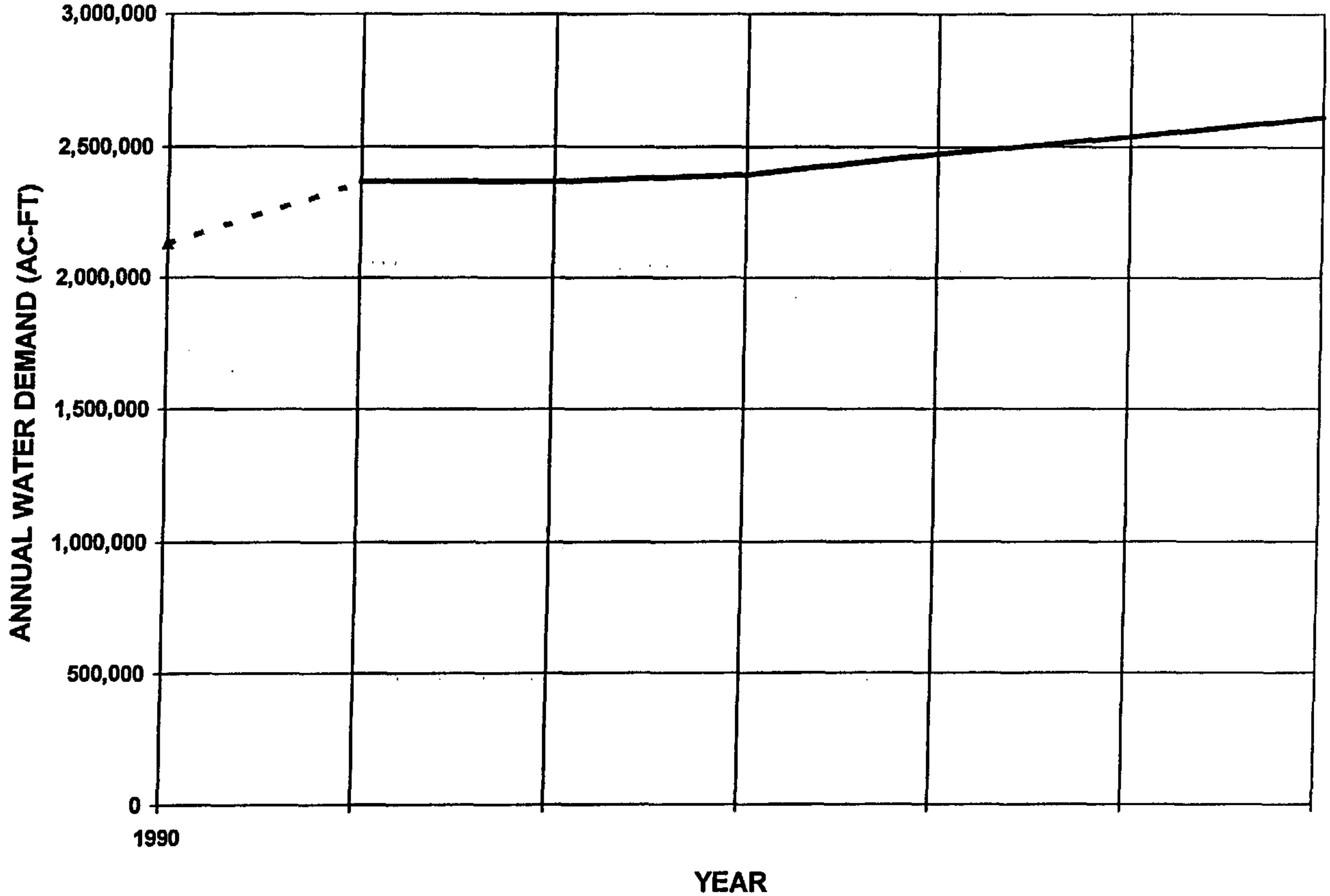
Table 2-10							
Total Water Demand Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
	Use in	**Projections**					
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
Atascosa	61,472	68,208	66,820	65,595	64,893	67,034	73,134
Bandera	2,080	2,476	2,547	2,736	2,951	3,187	3,452
Bastrop	11,333	14,869	19,310	20,370	21,848	22,739	23,665
Bexar	303,917	405,322	437,610	485,382	550,408	611,487	657,922
Blanco	1,940	2,287	2,332	2,389	2,474	2,499	2,460
Burnet	6,698	7,648	8,134	8,709	9,461	9,807	10,168
Caldwell	7,149	7,873	8,030	8,181	8,463	8,283	8,136
Calhoun	64,225	94,668	105,194	110,849	118,199	127,027	137,116
Colorado	253,847	230,377	206,791	186,870	170,071	161,018	153,009
Comal	15,404	28,422	32,527	38,640	46,924	51,994	58,528
DeWitt	5,901	6,035	5,827	5,718	5,836	5,989	6,152
Fayette	17,571	21,689	26,712	31,881	47,253	47,668	53,193
Frio	87,726	84,940	81,564	78,339	75,354	72,487	69,722
Goliad	14,650	17,713	17,569	22,446	22,373	22,326	22,330
Gonzales	12,366	12,932	12,396	11,948	11,636	11,477	11,370
Guadalupe	14,973	21,069	23,598	26,510	31,610	35,372	40,116
Hays	12,998	17,929	20,992	23,799	28,616	34,137	38,765
Karnes	6,049	6,194	5,749	5,584	5,558	5,546	5,537
Kendall	2,901	3,462	3,569	3,690	3,972	4,298	4,665
Kerr	7,259	9,881	10,553	11,283	12,282	12,766	12,988
Lee	4,677	5,141	5,173	5,217	5,387	5,587	5,817
Llano	5,520	5,721	6,495	6,424	6,383	6,432	6,590
Matagorda	244,859	230,248	218,603	200,130	187,135	179,131	171,854
Medina	164,600	176,094	164,583	158,107	152,131	146,307	140,833
Refugio	1,867	1,779	1,708	1,646	1,616	1,588	1,561
San Saba	8,213	8,473	8,069	7,725	7,463	7,226	7,001
Travis	131,280	193,165	213,238	244,696	283,241	306,671	338,507
Uvalde	147,897	144,315	139,328	134,509	130,355	126,341	122,592
Victoria	49,843	59,887	63,506	64,350	66,219	70,214	74,836
Wharton	329,686	341,786	319,523	292,663	269,018	252,226	236,654
Wilson	19,586	19,249	17,977	16,883	16,050	15,398	15,048
Zavala	115,407	127,466	124,955	121,282	116,726	112,471	108,462
Total	2,133,894	2,377,318	2,380,981	2,404,551	2,481,906	2,546,732	2,622,184
Dimmitt*	14,691	15,116	14,810	14,858	15,211	15,300	15,445
Edwards*	334	362	362	361	365	367	370
Kinney*	522	599	594	584	561	539	518
LaSalle*	9,513	9,512	9,309	9,095	8,917	8,753	8,584
Maverick*	6,021	5,728	5,492	5,281	5,091	4,914	4,752
Real*	1,568	1,539	1,469	1,418	1,396	1,378	1,364
Webb*	931	718	781	848	958	981	1,126
Total*	33,580	33,574	32,817	32,445	32,499	32,232	32,159

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall, and advanced water conservation.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).

◇◇◇



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

TOTAL WATER DEMAND PROJECTIONS
32 COUNTY WEST CENTRAL STUDY AREA
FIGURE 2-11

(This page intentionally left blank)

2.2.2 Water Demand Projections for the Edwards Aquifer Area

The TWDB 1996 consensus water planning municipal water demand projections are shown in tabular form for cities and counties of the Edwards Aquifer area, as defined in Senate Bill 1477, 1993 Texas Legislature (Figure 2-1). The projections are also shown in tabular and graphic form for counties of the Edwards Aquifer area for industrial, steam-electric power, irrigation, mining, livestock, and total water demand. Only the municipal water demand projections are available at the city level.

2.2.2.1 Municipal Water Demand Projections for Cities and Counties of the Edwards Aquifer Area

In 1990, reported municipal water use in cities and rural areas of the Edwards Aquifer area was 259,568 acft (Table 2-11 and Figure 2-12). Projected municipal water demand for the area, under dry weather conditions, with advanced water conservation, is 354,705 acft in 2000, 442,906 acft in 2020, and 626,492 acft in 2050 (Table 2-11 and Figure 2-12). The projections for individual cities can be seen in Table 2-11.

Table 2-11
Municipal Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

Basin/County/Water Utility	Total Use in 1990 acft	Projections					
		2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
ATASCOSA COUNTY (part)							
Nueces Basin							
Lytle	336	559	600	635	701	754	811
BEXAR COUNTY (all)							
San Antonio Basin							
San Antonio	166,616	220,405	242,339	272,507	312,695	349,957	391,640
Balcones Heights	538	731	739	759	798	843	885
Terrell Hills	817	1,090	1,056	1,054	1,070	1,063	1,050
Olmos Park	385	519	520	530	553	579	603
Helotes	310	360	387	415	494	534	577
Leon Valley	1,715	2,288	2,135	1,958	1,956	1,954	2,040
Alamo Heights	2,210	2,799	2,732	2,686	2,706	2,728	2,742
Converse	1,213	2,127	2,837	3,529	4,498	5,365	6,456
Fair Oaks Ranch	617	774	894	1,005	1,240	1,452	1,700
Kirby	1,080	1,586	1,693	1,839	2,099	2,343	2,614
Live Oak Water Public Utility	1,221	1,101	1,141	1,389	1,554	1,738	2,200
Schertz (Part)	60	116	140	152	162	186	222
Schertz (Outside City) Estimated	607	819	1,031	1,243	1,455	1,667	1,880
Shavano Park	840	1,088	1,163	1,192	1,232	1,284	1,342
St. Hedwig	187	200	215	230	275	318	367
Universal City	2,323	3,386	3,748	4,186	4,864	5,491	6,200

Continued Next Page

Table 2-11 continued

Basin/County/Water Utility	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Windcrest (WC&ID No. 10)	1,329	1,675	1,663	1,665	1,687	1,713	1,731
Castle Hills(BMWD)	1,311	1,714	1,743	1,765	1,786	1,769	1,751
Somerset(BMWD)	215	220	225	230	235	237	240
Hill Country/HollywPark(BMWD)	2,174	2,395	5,633	2,901	3,307	3,664	4,079
BMWD(Subdvisions) Estimated	20,741	27,999	34,024	39,841	46,235	52,910	56,821
Remainder of County	18,786	31,641	31,341	38,488	47,088	53,853	42,701
Total	225,295	305,033	337,399	379,564	437,989	491,648	529,841
MEDINA COUNTY (all)							
Nueces Basin							
Devine	630	953	943	940	964	987	1,005
Hondo	1,456	2,032	2,092	2,164	2,263	2,327	2,393
Lytle	73	92	89	87	88	90	92
Natalia	294	397	408	422	440	452	464
Rural	1,535	1,961	2,038	2,075	2,197	2,272	2,416
Subtotal	3,988	5,435	5,570	5,688	5,952	6,128	6,370
San Antonio Basin							
Castroville	779	958	985	1,013	1,061	1,092	1,123
Lacoste	229	278	299	300	326	345	365
Rural	258	441	458	466	493	509	540
Subtotal	1,266	1,677	1,742	1,779	1,880	1,946	2,028
Total	5,254	7,112	7,312	7,467	7,832	8,074	8,398

Continued Next Page

Table 2-11 continued

Basin/County/Water Utility		Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
UVALDE COUNTY (all)								
Nueces Basin								
Sabinal		381	510	546	573	632	683	739
Uvalde		3,915	5,173	5,621	5,921	6,610	7,198	7,871
Rural		982	1,027	907	823	777	737	661
	Total	5,278	6,710	7,074	7,317	8,019	8,618	9,271
COMAL COUNTY (part)								
Guadalupe Basin								
Garden Ridge		361	564	672	799	1,038	1,253	1,511
New Braunfels		6,199	10,335	12,570	15,436	19,499	22,447	25,717
Rural	(0.08 of Co. rural)	210	447	554	723	932	1,155	1,393
Subtotal		6,770	11,346	13,796	16,958	21,469	24,855	28,621
San Antonio Basin								
Schertz (Part)		19	40	56	78	100	141	186
Rural	(0.026 0f Co rural)	172	207	243	286	337	422	509
Subtotal		191	247	299	364	437	563	695
	Total	6,961	11,592	14,095	17,322	21,906	25,418	29,316
HAYS COUNTY (part)								
Guadalupe Basin								
Kyle		326	353	337	339	376	435	504
San Marcos		6,321	8,431	9,385	10,453	12,394	14,808	17,691
Rural	(0.26 0f Co rural)	773	1,292	1,635	1,919	2,373	2,861	3,115
	Total	7,420	10,076	11,357	12,711	15,143	18,104	21,310

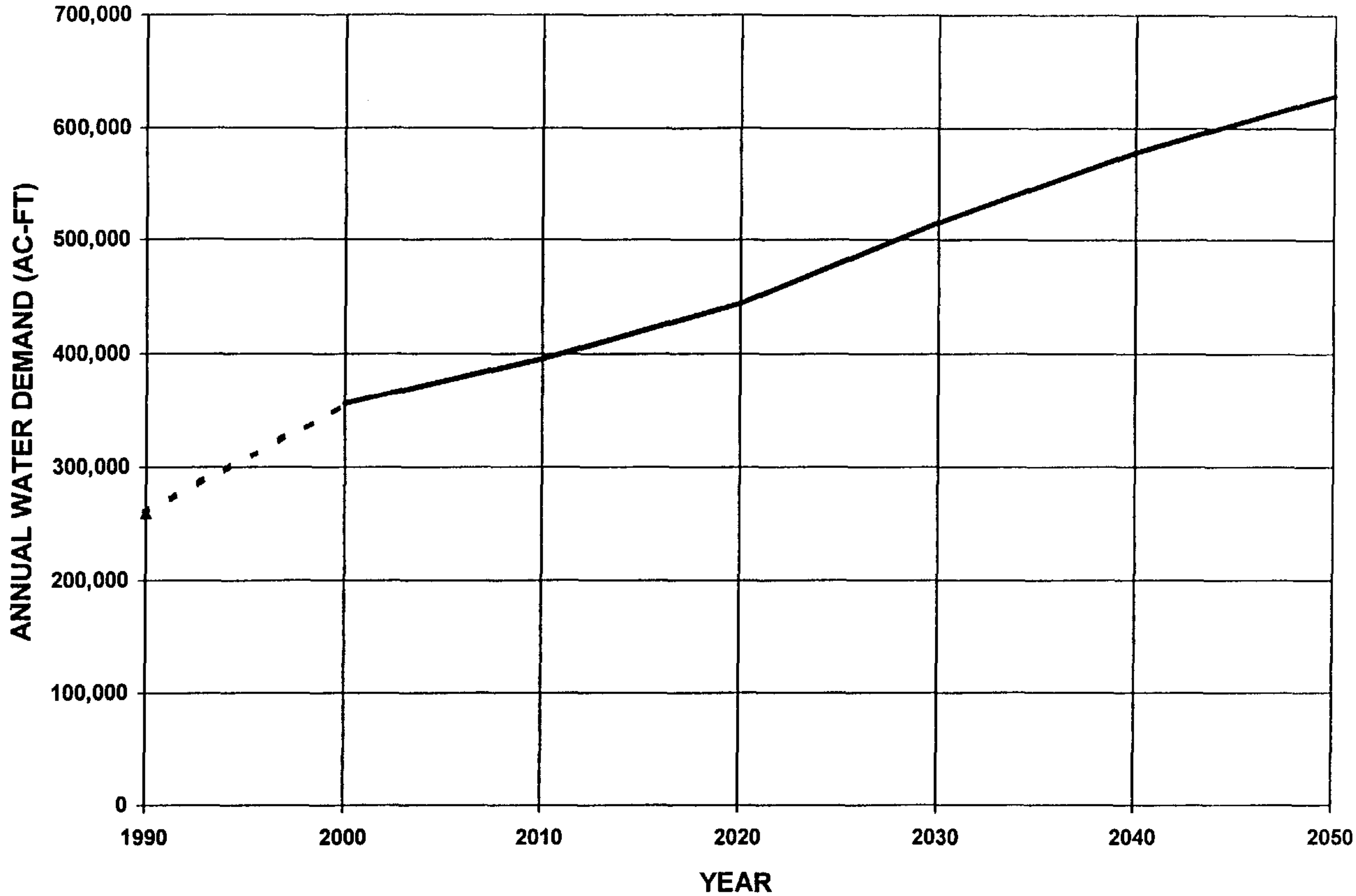
Continued Next Page

Table 2-11 continued

Basin/County/Water Utility		Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
GUADALUPE COUNTY (part)								
Guadalupe Basin								
New Braunfels (part)		55	75	84	98	139	155	171
Rural	(0.66 of Co rural)	2,649	4,257	5,238	6,110	7,601	8,379	9,407
Subtotal		2,704	4,332	5,322	6,208	7,740	8,534	9,578
San Antonio Basin								
Cibolo		178	308	307	313	346	392	424
Schertz	(Part)	1,454	2,680	3,217	3,851	5,016	6,490	8,411
Rural		819	1,807	2,268	2,663	3,308	3,675	4,140
Subtotal		2,451	4,795	5,792	6,827	8,670	10,557	12,975
	Total	5,155	9,127	11,114	13,035	16,410	19,091	22,553
CALDWELL COUNTY (part)								
Guadalupe Basin								
Lockhart		1,816	2,003	2,162	2,303	2,499	2,496	2,492
Luling		1,207	1,306	1,235	1,164	1,149	1,066	1,003
Rural	(0.50 of Co rural)	846	1,186	1,288	1,388	1,491	1,495	1,498
	Total	3,869	4,495	4,685	4,855	5,139	5,057	4,993
Edwards Aquifer Area Total*		259,568	354,705	393,637	442,906	513,139	576,764	626,492

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.

◇◇◇◇



▲ 1990 USE
— WATER DEMAND PROJECTIONS

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

MUNICIPAL WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-12

2.2.2.2 Industrial Water Demand Projections for Counties of the Edwards Aquifer Area

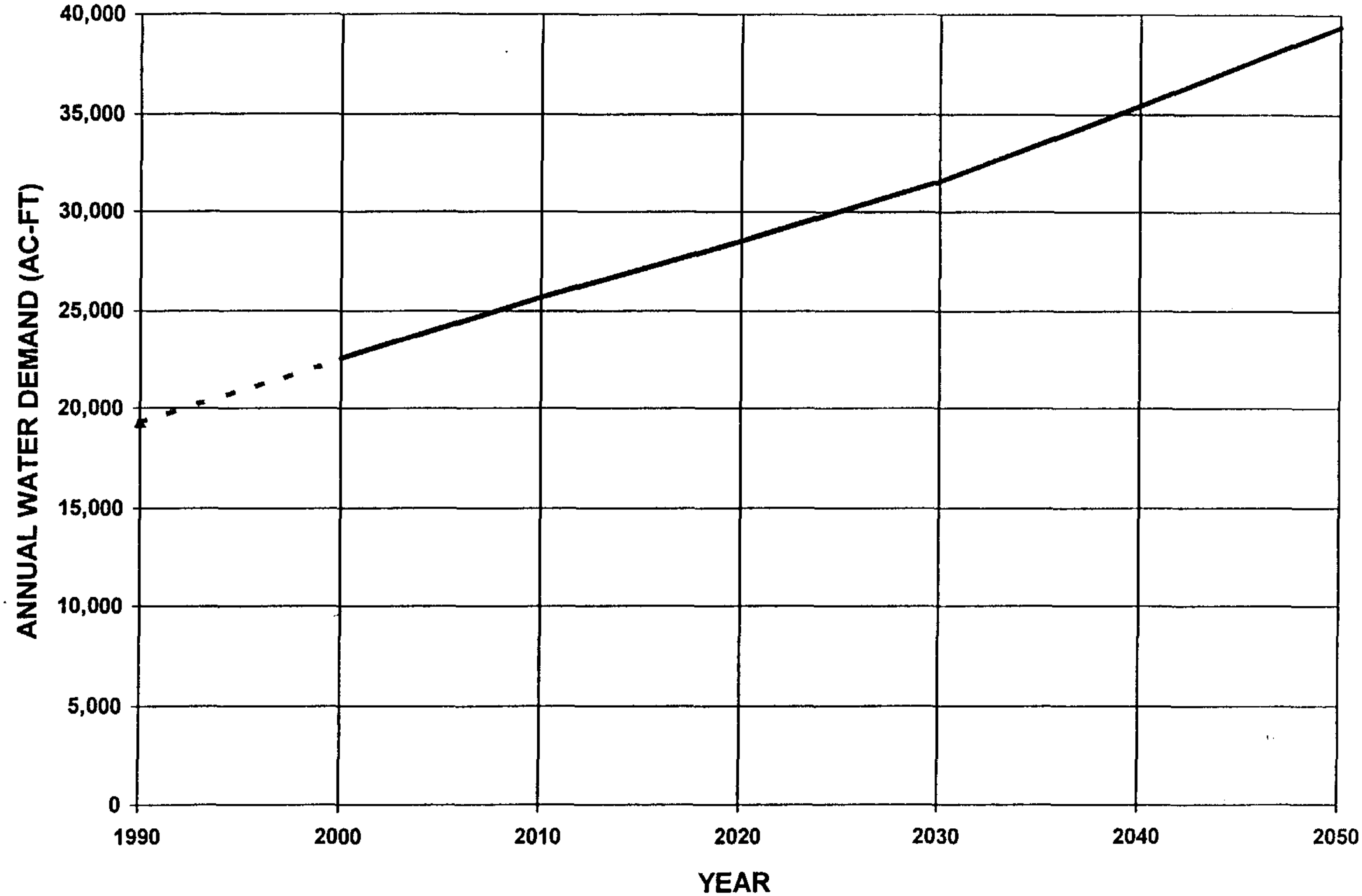
Industrial water use in the Edwards Aquifer area in 1990 was reported at 19,264 acft and is projected to increase to 22,480 acft in 2000, 28,552 acft in 2020, and 39,352 acft in 2050 (Table 2-12 and Figure 2-14). Industrial water use is located primarily in Bexar, Comal, Hays, and Guadalupe counties. However, there is some industrial water use in all the other Edwards Aquifer area counties, except Caldwell. It should be noted that a part of the industrial water use is for electric power generation for use within manufacturing plants (primarily cement plants) located within the area.

Table 2-12
Industrial Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

County	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Atascosa (part)	0	0	0	0	0	0	0
Bexar (all)	14,049	16,805	19,682	22,359	24,935	28,264	31,697
Medina (all)	286	302	319	339	361	384	411
Uvalde (all)	557	600	643	675	700	759	817
Comal (part)	3,248	3,450	3,487	3,548	3,799	4,071	4,351
Hays (part)	293	381	445	507	564	620	677
Guadalupe (part)	831	942	1,051	1,124	1,193	1,295	1,399
Caldwell (part)	0	0	0	0	0	0	0
Total	19,264	22,480	25,627	28,552	31,552	35,393	39,352

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.

*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

INDUSTRIAL WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-13

2.2.2.3 Steam-Electric Power Water Demand Projections for Counties of the Edwards Aquifer Area

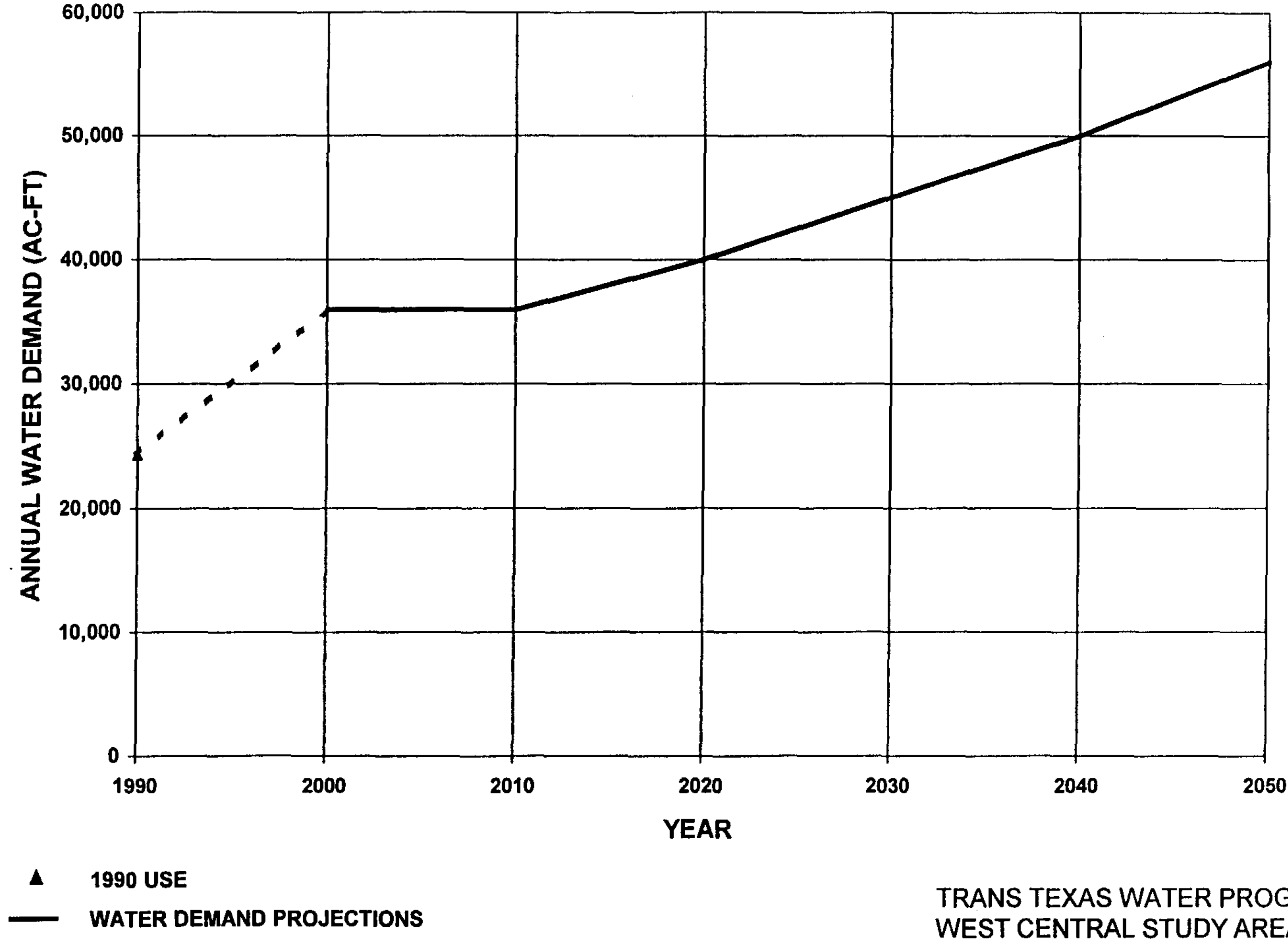
The only steam-electric power generation within the Edwards Aquifer area for production of electricity for distribution through electric utilities to private and public customers is located in Bexar County. In 1990, reported water use for steam-electric power generation was 24,263 acft. The 1996 consensus water planning projected demands, with advanced water conservation, are 36,000 acft in 2000, 46,000 acft in 2020, and 56,000 acft in 2050 (Table 2-13 and Figure 2-14). The projected demands level off after 2030 since at this time there are no plans for the addition of electric power generating capacity within the area. This could change however, as growth in population occurs. It should be noted, however, that the Edwards Aquifer area is also served electricity from hydroelectric plants located on the Guadalupe River and from steam-electric power plants that are located outside the area. Water demands for plants located outside the area are included in water demand projections of the areas where the power plants are located.

Table 2-13
Steam-Electric Power Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

County	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Atascosa (part)	0	0	0	0	0	0	0
Bexar (all)	24,263	36,000	36,000	40,000	45,000	50,000	56,000
Medina (all)	0	0	0	0	0	0	0
Uvalde (all)	0	0	0	0	0	0	0
Comal (part)	0	0	0	0	0	0	0
Hays (part)	0	0	0	0	0	0	0
Guadalupe (part)	0	0	0	0	0	0	0
Caldwell (part)	0	0	0	0	0	0	0
Total	24,263	36,000	36,000	40,000	45,000	50,000	56,000

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.

(This page intentionally left blank)



HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

STEAM-ELECTRIC WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-14

(This page intentionally left blank)

2.2.2.4 Irrigation Water Demand Projections for Counties of the Edwards Aquifer Area

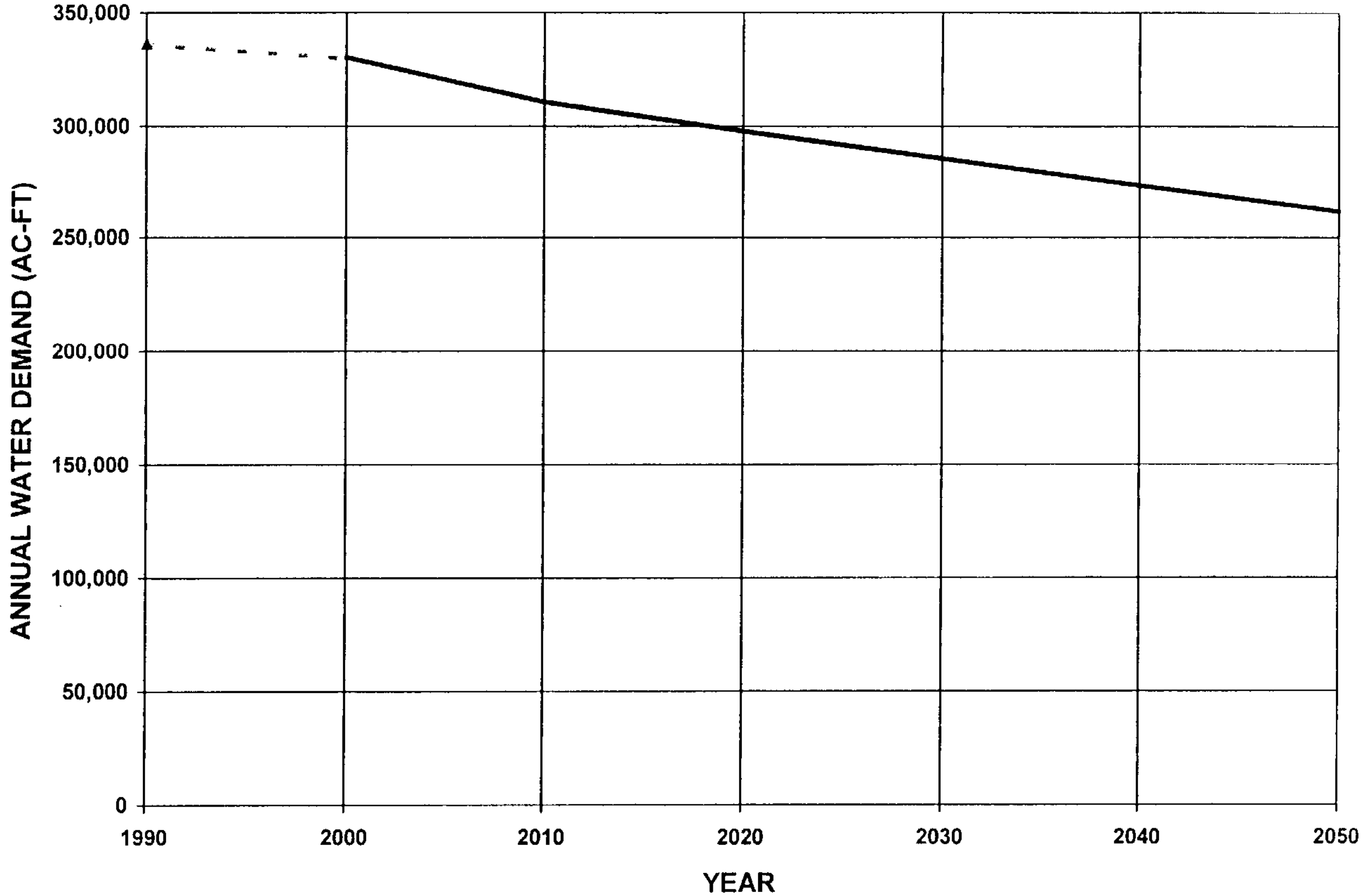
Irrigation within the Edwards Aquifer area is located in Atascosa, Bexar, Medina, and Uvalde counties. The sources of irrigation water are the Edwards Aquifer and the Medina and Nueces Rivers.

Estimated irrigation water use in the area in 1990 was 336,525 acft, with 1996 consensus water planning projections showing a reduction to 343,135 acft in 2000, 309,390 acft in 2020, and 272,373 acft in 2050 (Table 2-14 and Figure 2-15). The projections are declining due to improved irrigation efficiency and reduced acreages due to poor economic conditions expected for agricultural irrigation over the long run.

Table 2-14
Irrigation Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

County	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Atascosa (part)	1,464	1,442	1,341	1,287	1,235	1,186	1,140
Bexar (all)	37,012	40,003	36,879	35,320	33,827	32,397	31,026
Medina (all)	157,380	166,623	154,910	148,259	141,895	135,803	129,974
Uvalde (all)	140,669	135,067	129,689	124,524	119,566	114,804	110,233
Comal (part)	0	0	0	0	0	0	0
Hays (part)	0	0	0	0	0	0	0
Guadalupe (part)	0	0	0	0	0	0	0
Caldwell (part)	0	0	0	0	0	0	0
Total	336,525	343,135	322,819	309,390	296,523	284,190	272,373

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation;(Series 3 irrigation; aggressive adoption of irrigation technology, and a reduction in Federal Farm Programs by one-half).
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.



▲ 1990 USE

— WATER DEMAND PROJECTIONS

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

IRRIGATION WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-15

(This page intentionally left blank)

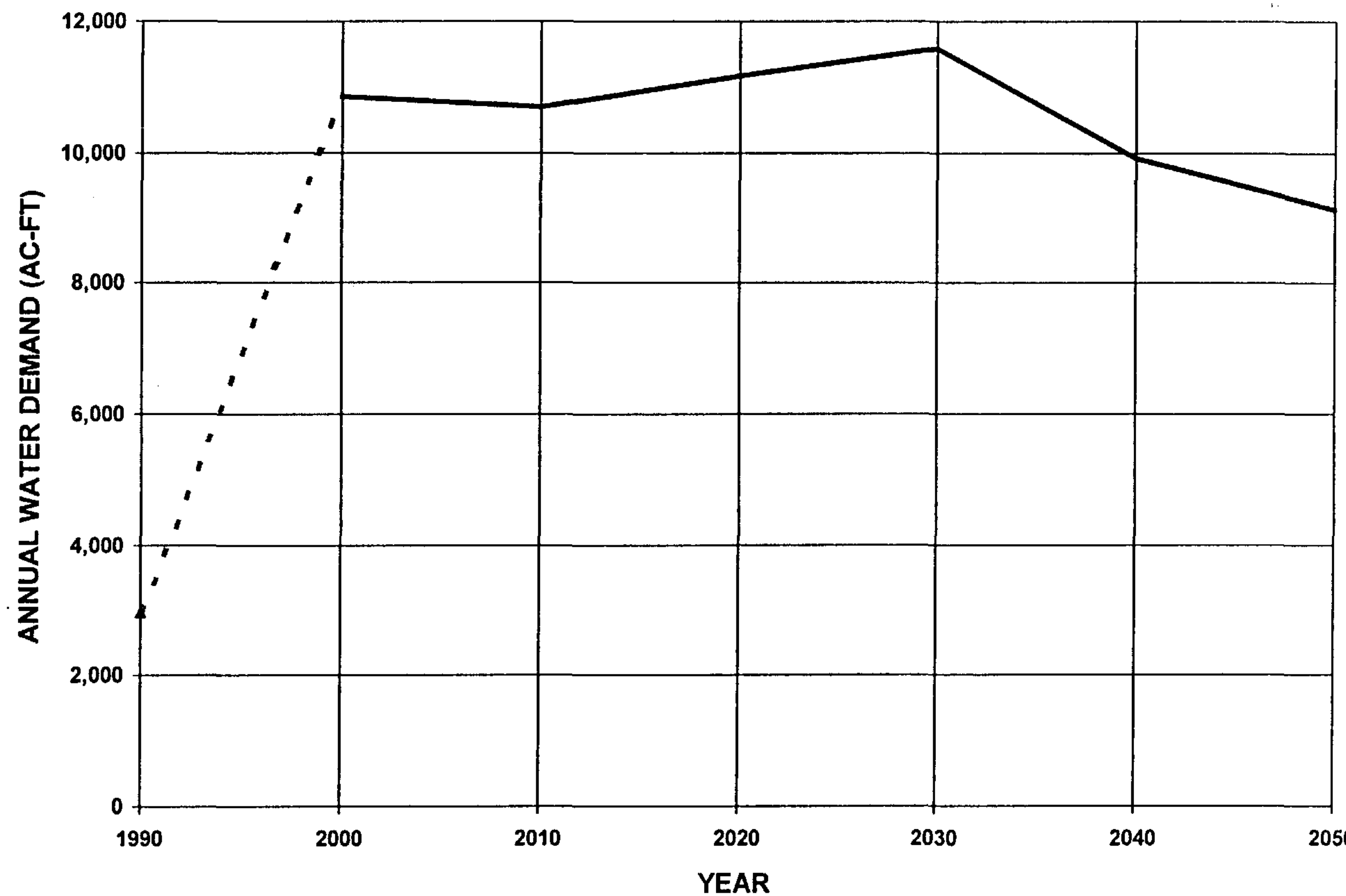
2.2.2.5 Mining Water Demand Projections for Counties of the Edwards Aquifer Area

The mining activities of the Edwards Aquifer area are primarily for quarrying of stone, clay, sand, and gravel materials. Reported water use within the area in 1990 was 2,969 acft, with projections of demand for these purposes being 10,855 acft in 2000, 11,165 acft in 2020, and 9,118 acft in 2050 (Table 2-15 and Figure 2-16). The largest concentrations of mining activities are projected for Bexar and Comal counties. Since the mining water demand is for stone and building materials, use in 1990 was lower than normal due to poor economic conditions in the construction industries. As the economy picks up, these industries will return to a higher level of employment and production and will use more water. The projections for 2000 and beyond reflect this.

Table 2-15
Mining Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

County	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Atascosa (part)	0	0	0	0	0	0	0
Bexar (all)	1,591	4,963	4,936	5,201	5,406	5,645	5,962
Medina (all)	120	143	128	128	129	132	136
Uvalde (all)	399	444	428	499	576	666	777
Comal (part)	851	5,013	4,918	5,065	5,216	3,231	2,002
Hays (part)	0	96	90	72	56	37	28
Guadalupe (part)	8	196	198	200	202	207	213
Caldwell (part)	0	0	0	0	0	0	0
Total	2,969	10,855	10,698	11,165	11,585	9,918	9,118

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

MINING WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-16

(This page intentionally left blank)

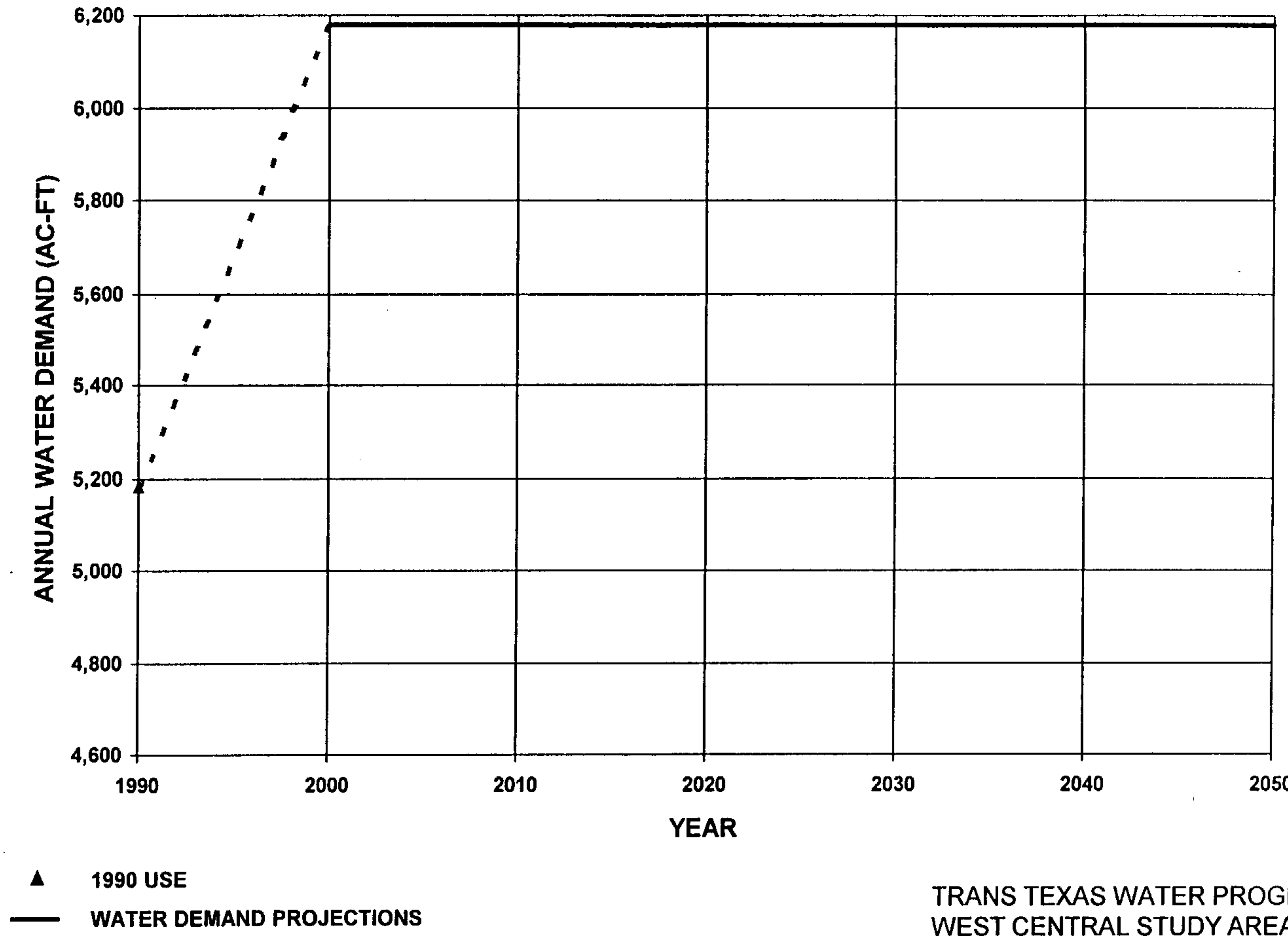
2.2.2.6 Livestock Water Demand Projections for Counties of the Edwards Aquifer Area

Livestock production, including beef, goats, horses for pleasure, dairy and poultry is done throughout the Edwards Aquifer area. Estimated water use for livestock purposes within the area in 1990 was 5,181 acft, and is projected to increase to its maximum level of 6,178 acre feet annually in 2000 and for planning purposes is held constant at that level to 2050 (Table 2-16 and Figure 2-17).

Table 2-16
Livestock Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

County	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Atascosa (part)	2	2	2	2	2	2	2
Bexar (all)	1,376	1,487	1,487	1,487	1,487	1,487	1,487
Medina (all)	1,560	1,914	1,914	1,914	1,914	1,914	1,914
Uvalde (all)	994	1,494	1,494	1,494	1,494	1,494	1,494
Comal (part)	158	178	178	178	178	178	178
Hays (part)	169	121	121	121	121	121	121
Guadalupe (part)	516	566	566	566	566	566	566
Caldwell (part)	406	416	416	416	416	416	416
Total	5,181	6,178	6,178	6,178	6,178	6,178	6,178

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.



HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

LIVESTOCK WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-17

(This page intentionally left blank)

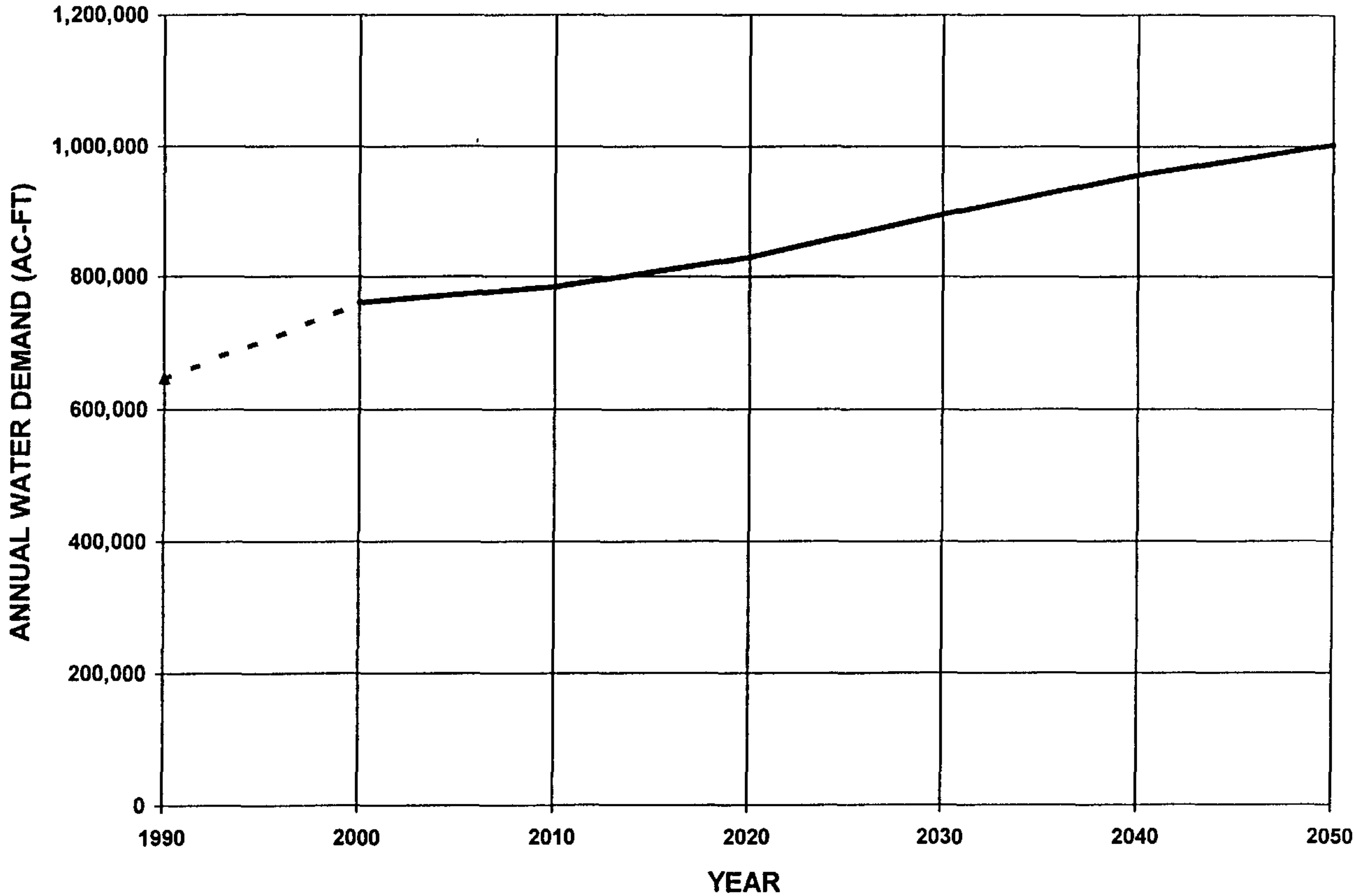
2.2.2.7 Total Water Demand Projections for Counties of the Edwards Aquifer Area

The sum of water used for all purposes within the Edwards Aquifer area in 1990 was 647,769 acft. TWDB's 1996 consensus water planning projected total water demands for the area, with advanced water conservation, in 2000 is 773,352 acft, in 2020 is 838,191 acft, and in 2050 is 1,009,512 acft (Table 2-17 and Figure 2-18).

Table 2-17
Total Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

County	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Atascosa (part)	1,802	2,003	1,943	1,924	1,938	1,942	1,953
Bexar (all)	303,586	404,291	436,383	483,931	548,644	609,441	656,013
Medina (all)	164,600	176,094	164,583	158,107	152,131	146,307	140,833
Uvalde (all)	147,897	144,315	139,328	134,509	130,355	126,341	122,592
Comal (part)	11,218	20,233	22,678	26,114	31,099	32,898	35,847
Hays (part)	7,882	10,674	12,013	13,411	15,884	18,882	22,136
Guadalupe (part)	6,509	10,831	12,929	14,925	18,371	21,159	24,730
Caldwell (part)	4,275	4,911	5,101	5,271	5,555	5,473	5,409
Total	647,769	773,352	794,959	838,191	903,976	962,443	1,009,512

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.



▲ 1990 USE

— WATER DEMAND PROJECTIONS

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

TOTAL WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-18

(This page intentionally left blank)

2.2.3 Water Demand Projections for River Basins and Adjacent Areas

In Section 2.1.3, Table 2-3, the population projections for the 32-county study area were summarized and tabulated for each of the Nueces, San Antonio, Guadalupe, and Lower Colorado Basins. Since parts of some study area counties are located in areas adjacent to river basin boundaries, the adjacent areas were grouped with the appropriate study area river basin in order to include an appropriate portion of the water needs of these adjacent areas. In the following sections, the water demand projections of the 32 counties of the study area are grouped and presented for the respective study area river basins and their associated or adjacent areas (see Figure 2-1 for basin boundaries). In this way, the projected demands upon the individual basins can be compared to the respective basins' water supplies for purposes of calculating shortages and/or surpluses for the basins.

2.2.3.1 Municipal Water Demand Projections for River Basins and Adjacent Areas

In 1990, municipal water use of the 32-county study area was 474,326 acft, of which 20,844 acft (4 percent) was used in the Nueces River Basin, 240,233 acft (51 percent) was used within the San Antonio Basin, 52,958 acft (11 percent) was used within the Guadalupe Basin, 137,421 acft (29 percent) was used within the Lower Colorado River Authority's service area within the Colorado Basin, and 22,870 acft (5 percent) was used in all other coastal and inland areas of the study area that are adjacent to the main river basin boundaries (Table 2-18, column one). Projected municipal water demands at year 2050 for the 32-county study area are 1,116,317 acft (Table 2-18) with 566,752 acft (50.7 percent) for the San Antonio Basin (Figure 2-19). Projected year 2050 municipal water demands for the area within the boundaries of the Lower Colorado Basin are 352,036 acft (31 percent). Within the Guadalupe and Nueces River Basins, projected year 2050 demands total 132,368 acft (12 percent) and 34,728 acft (3 percent) respectively. Projected year 2050 water use in all other coastal and inland areas of the study area total 30,489 acft (3 percent).

Table 2-18							
Municipal Water Demand Projections for River Basins--32-County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
		Projections					
River Basin	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
NUECES							
Study Area In-Basin[1]	20,844	27,000	28,119	29,019	31,340	33,214	34,728
7-County Area[2]	4,194	5,395	5,681	5,956	6,547	7,086	7,800
SAN ANTONIO							
Total In-Basin	240,233	325,199	359,369	403,907	466,116	523,715	566,696
Adj. Area[3]	59	58	55	53	52	53	56
Study Area Subtotal	240,292	325,257	359,424	403,960	466,168	523,768	566,752
GUADALUPE							
Total In-Basin	52,958	72,755	80,452	90,010	105,514	118,610	132,368
Adj. Area[4]	8,139	9,141	9,133	9,218	9,747	10,320	11,054
Study Area Subtotal	61,097	81,896	89,585	99,228	115,261	128,930	143,422
LOWER COLORADO							
Total In-Basin	137,421	203,174	224,376	256,904	297,763	322,532	352,036
Adj. Coastal Area[5]	10,904	11,773	11,692	11,855	12,703	13,681	14,803
Area Subtotal	148,325	214,947	236,068	268,759	310,466	336,213	366,839
Adj. Inland Area[6]	3,768	906	1,591	2,413	3,391	4,095	4,576
Study Area Subtotal	152,093	215,853	237,659	271,172	313,857	340,308	371,415
Study Area Subtotal[7]	470,558	649,100	713,196	800,966	923,235	1,022,125	1,111,741
Study Area Total	474,326	650,006	714,787	803,379	926,626	1,026,220	1,116,317

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall,and advanced water conservation.

[1]Counties of Nueces Basin included in study area (Uvalde, Medina, Zavala, Frio, Atascosa, and parts of Bexar, Wilson, and Karnes Counties).

[2] Parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties of the Nueces Basin, but not included in the West Central Trans-Texas study area.

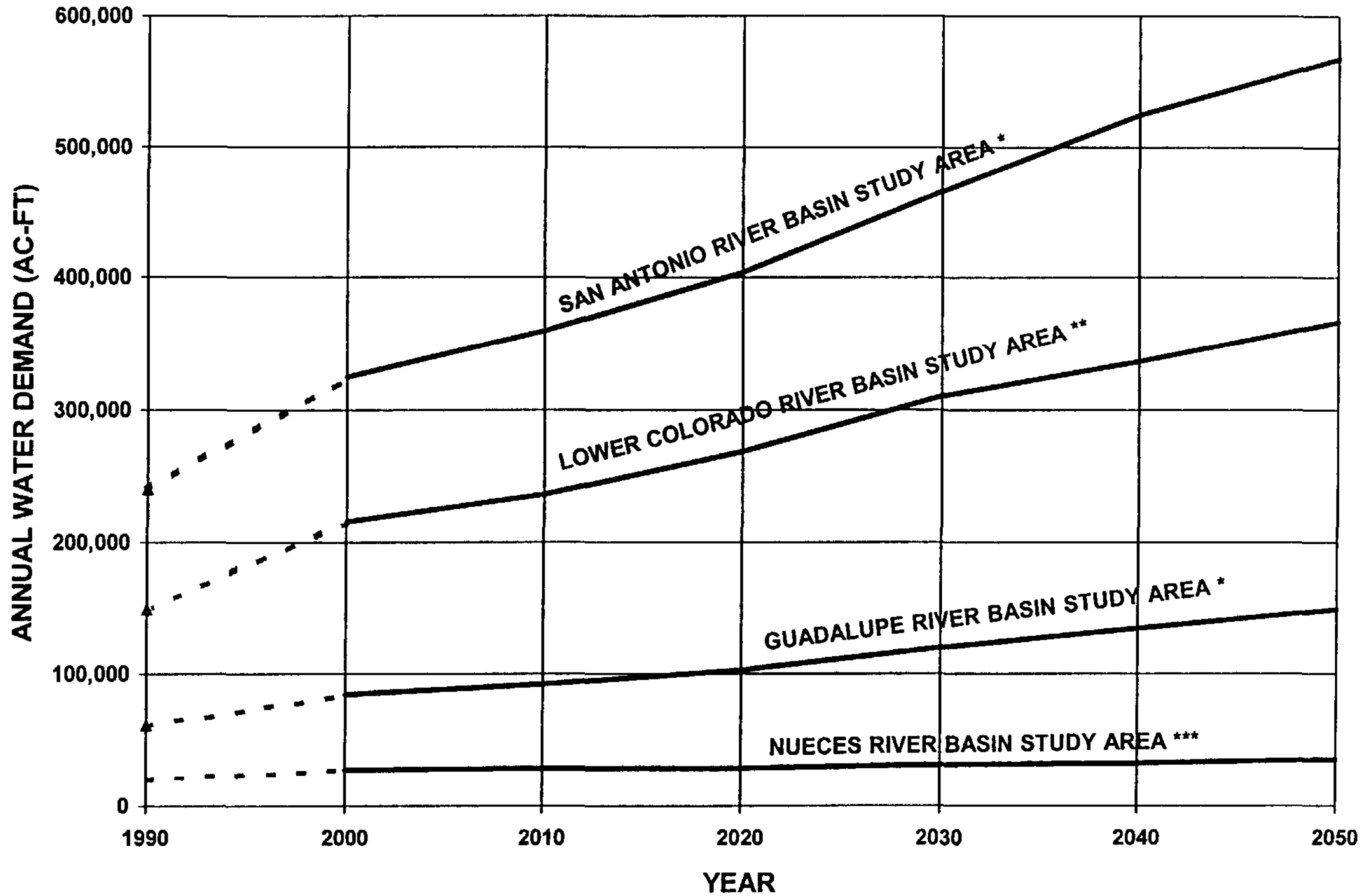
[3] Part of Goliad County located in adjacent San Antonio -Nueces Coastal Basin.

[4] Part of Victoria County located in adjacent Lavaca-Guadalupe Coastal Basin, plus all of Refugio and Calhoun Counties.

[5] Parts of Colorado, Matagorda, and Wharton Counties located in adjacent coastal basins, and obtain a part of their water supply from the Colorado River.

[6] Parts of Burnet, Bastrop, and Lee Counties located in the adjacent Brazos Basin.

[7] Does not include parts of Burnet, Bastrop, and Lee counties located in the adjacent Brazos Basin.



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

* In basin plus adjacent areas that obtain water from the basin.

** In basin plus adjacent coastal areas that obtain water from the Colorado Basin. Does not include parts of study area counties located in the Brazos Basin.

*** Includes only study area counties of the Nueces Basin.

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

MUNICIPAL WATER DEMAND PROJECTIONS RIVER BASIN STUDY AREAS

FIGURE 2-19

(This page intentionally left blank)

2.2.3.2 Industrial Water Demand Projections for River Basins and Adjacent Areas

In 1990, industrial water use was 82,981 acft in the 32-county study area, of which 56,310 acft (68 percent) was located within the boundaries of the Nueces, San Antonio, Guadalupe and Lower Colorado Basins (Table 2-19, column one). The 1996 consensus water planning projections, with advanced conservation, of industrial water demand for the period 2000 through 2050, are shown in Table 2-19 and Figure 2-20 for basins and areas adjacent to each basin for the 32-county study area, with the total for year 2050 at 227,912 acft/yr.

Table 2-19							
Industrial Water Demand Projections for River Basins--32-County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
		Projections					
River Basin	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
NUECES							
Study Area In-Basin[1]	2,149	2,320	2,482	2,611	2,719	2,942	3,164
7-County Area[2]	3	11	11	12	13	14	15
SAN ANTONIO							
Total In-Basin	14,323	17,105	20,008	22,698	25,283	28,630	32,092
Adj. Area[3]	0	0	0	0	0	0	0
Study Area Subtotal	14,323	17,105	20,008	22,698	25,283	28,630	32,092
GUADALUPE							
Total In-Basin	26,263	31,086	35,853	38,923	42,970	46,871	51,855
Adj. Area[4]	24,539	63,026	77,588	85,949	95,240	105,236	115,958
Study Area Subtotal	50,802	94,112	113,441	124,872	138,210	152,107	167,813
LOWER COLORADO							
Total In-Basin	13,575	15,043	16,519	17,523	17,591	20,082	21,884
Adj. Coastal Area[5]	2,082	2,263	2,431	2,501	2,552	2,723	2,889
Area Subtotal	15,657	17,306	18,950	20,024	20,143	22,805	24,773
Adj. Inland Area[6]	50	52	55	59	63	67	70
Study Area Subtotal	15,707	17,358	19,005	20,083	20,206	22,872	24,843
Study Area Subtotal	82,931	130,843	154,881	170,205	186,355	206,484	227,842
Study Area Total[7]	82,981	130,895	154,936	170,264	186,418	206,551	227,912

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall,and advanced water conservation.

[1] Counties of Nueces Basin included in study area (Uvalde, Medina, Zavala, Frio, Atascosa, and parts of Bexar, Wilson, and Karnes).

[2] Parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties of the Nueces Basin, but not included in the West Central Trans-Texas study area.

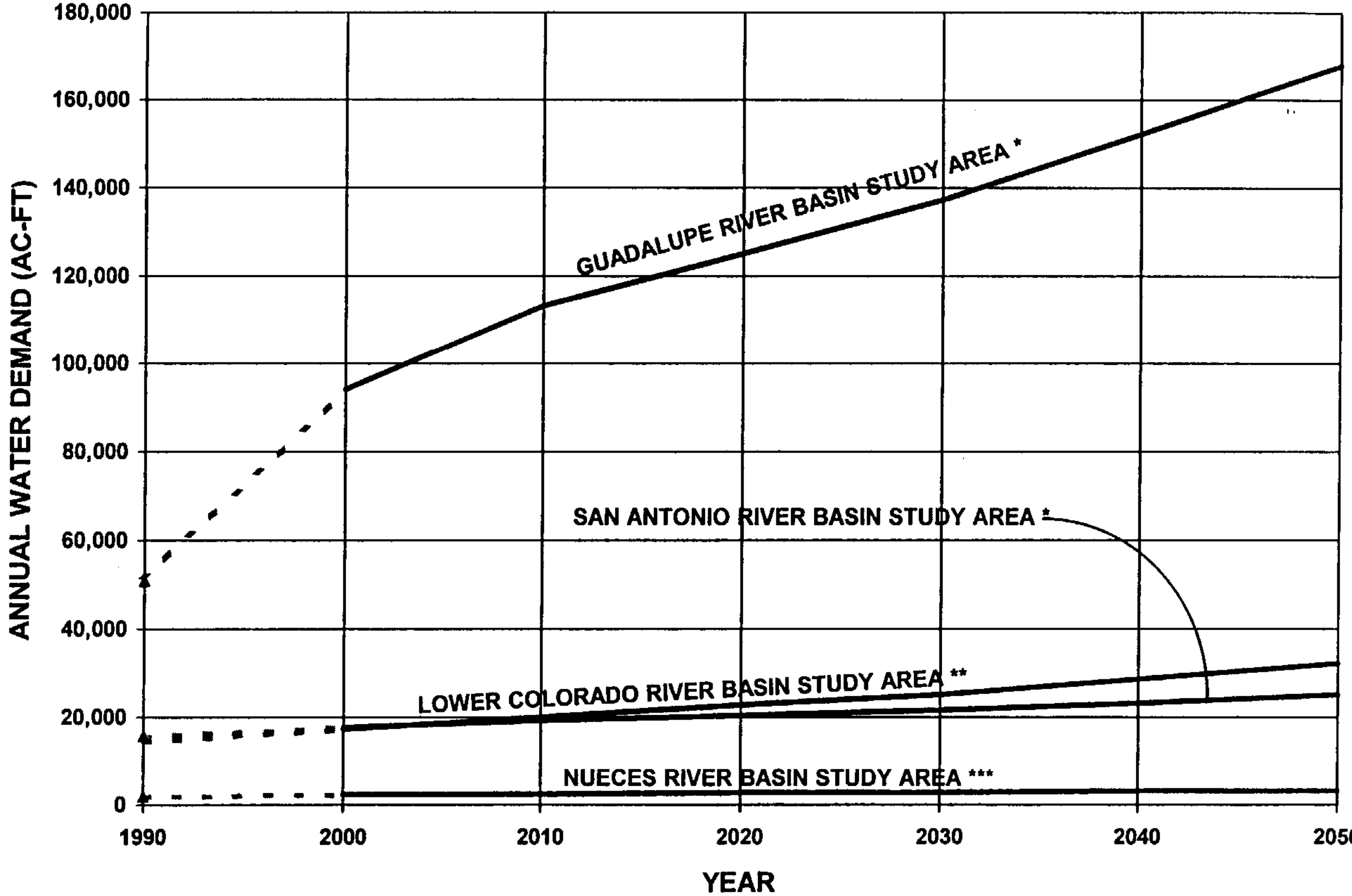
[3] Part of Goliad County located in adjacent San Antonio -Nueces Coastal Basin.

[4] Part of Victoria County located in adjacent Lavaca-Guadalupe Coastal Basin, plus all of Refugio and Calhoun Counties.

[5] Parts of Colorado, Matagorda, and Wharton Counties located in adjacent coastal basins, and obtain a part of their water supply from the Colorado River.

[6] Parts of Burnet, Bastrop, and Lee Counties located in the adjacent Brazos Basin.

[7] Does not include parts of Burnet, Bastrop, and Lee counties located in the adjacent Brazos Basin.



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

* In basin plus adjacent areas that obtain water from the basin.

** In basin plus adjacent coastal areas that obtain water from the Colorado Basin. Does not include parts of study area counties located in the Brazos Basin.

*** Includes only study area counties of the Nueces Basin.

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

INDUSTRIAL WATER DEMAND PROJECTIONS RIVER BASIN STUDY AREAS

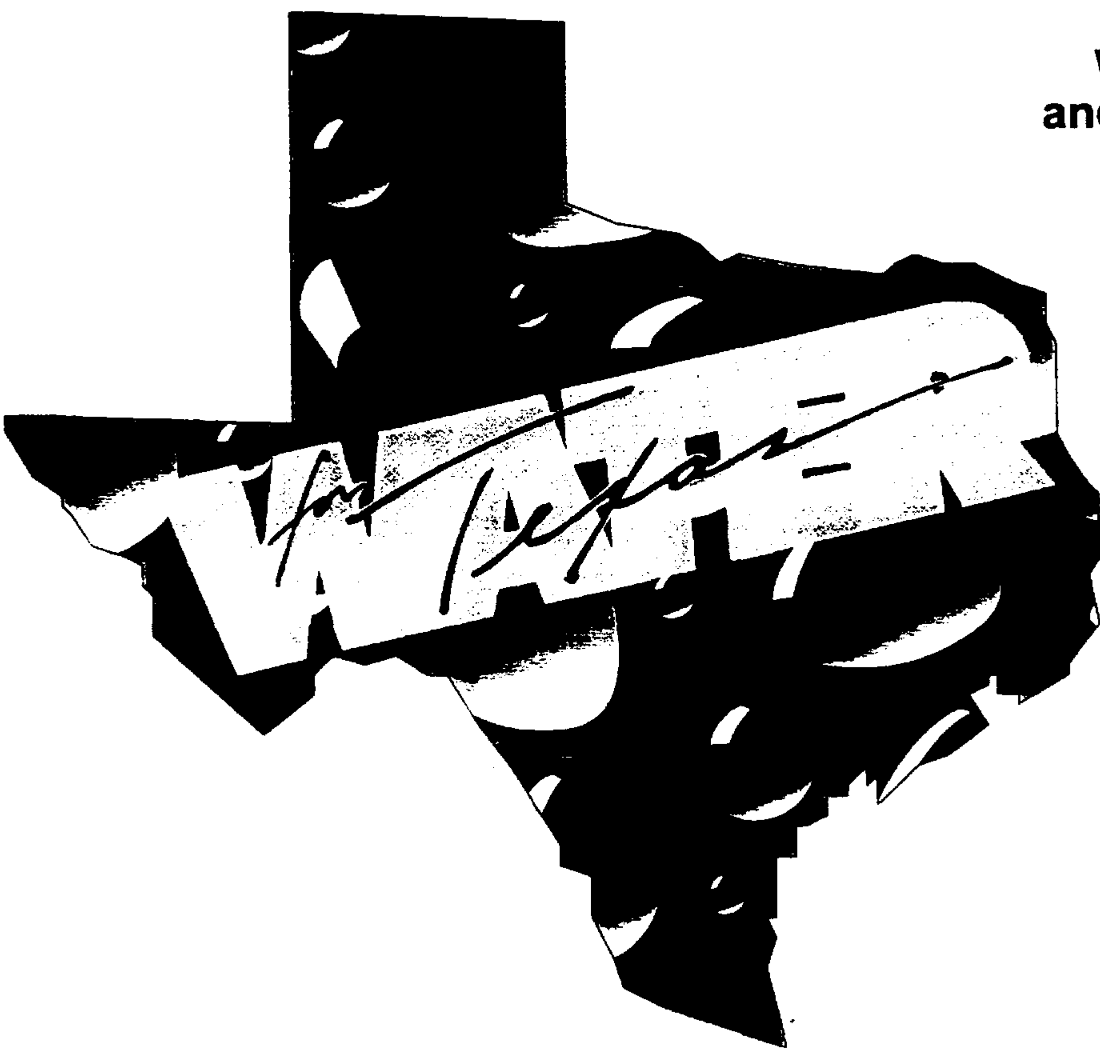
FIGURE 2-20

TRANS-TEXAS WATER PROGRAM

West Central Study Area

Phase II

Population, Water Demand, and Water Supply Projections



San Antonio River Authority

San Antonio Water System

Edwards Aquifer Authority

Guadalupe-Blanco River Authority

Lower Colorado River Authority

Bexar Metropolitan Water District

Nueces River Authority

Canyon Lake Water Supply Corporation

Bexar-Medina-Atascosa Counties WCID No. 1

Texas Natural Resource Conservation Commission

Texas Parks and Wildlife Department

Texas Water Development Board

March 1998

HDR

HDR Engineering, Inc.

TRANS-TEXAS WATER PROGRAM

WEST CENTRAL STUDY AREA

PHASE 2

POPULATION, WATER DEMAND, AND WATER SUPPLY PROJECTIONS

San Antonio River Authority
San Antonio Water System
Edwards Aquifer Authority
Guadalupe-Blanco River Authority
Lower Colorado River Authority
Bexar Metropolitan Water District
Nueces River Authority
Canyon Lake Water Supply Corporation
Bexar-Medina-Atascosa Counties WCID No. 1
Texas Natural Resource Conservation Commission
Texas Parks and Wildlife Department
Texas Water Development Board

Herbert W. Grubb
3/26/98

STATE OF TEXAS
DAVID D. DUNN
82630
REGISTERED PROFESSIONAL ENGINEER

3/26/98
Appendix C

HDR
HDR Engineering, Inc.

March 1998

STATE OF TEXAS
KELLY D. PAYNE
82053
REGISTERED PROFESSIONAL ENGINEER

3/26/98

TRANS-TEXAS WATER PROGRAM
WEST CENTRAL STUDY AREA

PHASE 2
POPULATION, WATER DEMAND, AND
WATER SUPPLY PROJECTIONS

TABLE OF CONTENTS

TABLE OF CONTENTS (CONCLUDED)

LIST OF TABLES

Table | Page

LIST OF TABLES (CONCLUDED)

LIST OF FIGURES

LIST OF FIGURES (CONCLUDED)

1.0 INTRODUCTION

In response to the water supply needs of the 32-county West Central Trans-Texas study area (Figure 1-1), the West Central Trans Texas regional water planning program was begun in September of 1993.[1] In Phase 1 studies, the Texas Water Development Board's (TWDB) 1992 high case, with conservation population and water demand projections were used, and 110 individual, standalone water conservation and water supply options were identified and evaluated as to quantity of water produced, unit cost of water, and potential environmental effects. The results of the Phase 1 studies are available for use in selecting water management and water supply options to be included in water supply plans to meet the water needs of the area in future years. The purpose of this report is to provide the most recent population, water demand, and water supply projections for use in water supply planning for the study area.

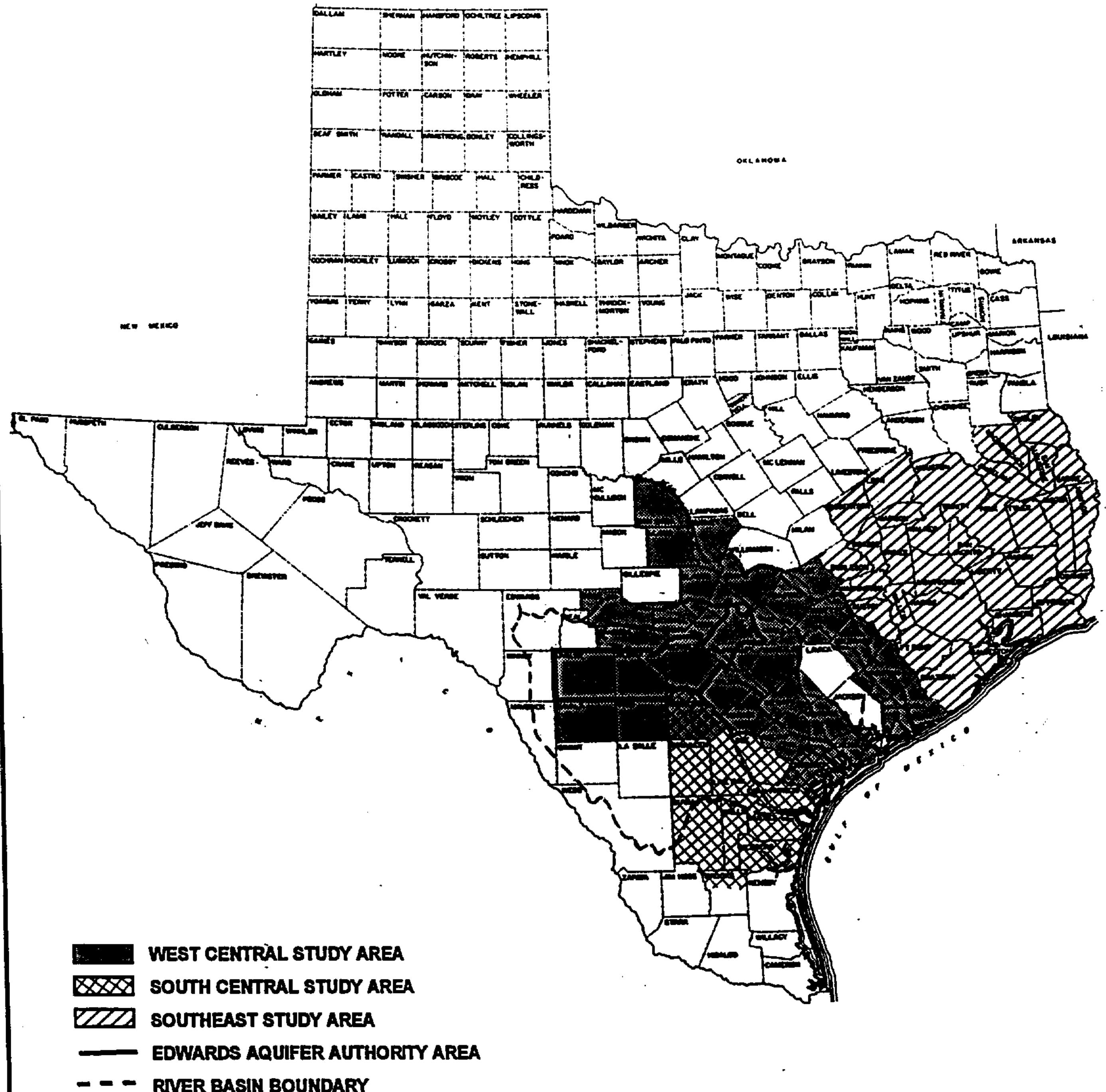
1.1 The Study Area

The West Central Trans-Texas study area includes the following 32 counties:

1. Atascosa	9. Colorado	17. Hays	25. Refugio
2. Bandera	10. Comal	18. Karnes	26. San Saba
3. Bastrop	11. DeWitt	19. Kendall	27. Travis
4. Bexar	12. Fayette	20. Kerr	28. Uvalde
5. Blanco	13. Frio	21. Lee	29. Victoria
6. Burnet	14. Goliad	22. Llano	30. Wharton
7. Caldwell	15. Gonzales	23. Matagorda	31. Wilson
8. Calhoun	16. Guadalupe	24. Medina	32. Zavala

Projections are also provided for all or parts of seven counties of the Nueces Basin (Dimmitt, Edwards, Kinney, LaSalle, Maverick, Red, and Webb) in order to have complete information about the Nueces Basin, even though these counties are not included in the West Central Trans-Texas Study Area. The 32-county study area, along with the South Central and Southeast study areas is shown in Figure 1-1. Population of the 32-county area was 2.5 million in 1990 and is projected to be 6.4 million in 2050.

[1] "Water for Texas--Trans-Texas Water Program Description," Texas Water Development Board, Austin, Texas, June 1992.



TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

STUDY AREA

HDR Engineering, Inc.

FIGURE 1-1

The Edwards Aquifer area is the area specified in Senate Bill (SB) 1477 and includes all of Bexar, Medina, and Uvalde counties, and parts of Atascosa, Comal, Caldwell, Hays, and Guadalupe counties (Figure 1-1).[2] This area depends upon the Edwards Aquifer for municipal, industrial, and irrigation water. The population of the Edwards Aquifer area (Figure 1-1) was 1.36 million in 1990 and is projected to be 3.60 million in 2050.

In addition to supplying the people and economy of San Antonio and neighboring areas, the Edwards Aquifer is home to several endangered or threatened species and is the source of water for Comal and San Marcos Springs. The aquifer cannot meet the growing needs for water and, at the same time, supply adequate spring flows for endangered species, as well as downstream needs of the environment and water rights holders.

Areas outside of the Edwards Aquifer area within the Nueces, San Antonio, Guadalupe, and intervening Coastal Basins, and in the Lower Colorado and adjacent Coastal Basins to the east are also growing and in need of water planning. These areas depend upon the Carrizo and other aquifers, and upon surface water for their supplies.

1.2 Objectives

The objectives of this West Central Trans-Texas Study are as follows:

1. Present the TWDB 1996 consensus water planning population and water demand projections for the 32-county West Central study area, plus seven additional Nueces Basin counties. The projections will be tabulated by county and city within county for the following subareas of the West Central Study Area: (1) The Edwards Aquifer Authority Area, and (2) the Nueces, San Antonio, Guadalupe and Lower Colorado River Basin areas, respectively. For study areas of Bexar, Comal, and Guadalupe Counties, and the Mid-Cities area, projections of "West Central Study Area Phase 2 Report Letter of Intent Analysis," San Antonio River Authority, et al, San Antonio, Texas, October, 1996, will be used. Projections will be shown in ten-year intervals starting in 1990 and ending in 2050. Population will be in numbers of people, and water demand projections will be in acre-feet per year for water use categories: (1) municipal, (2) industrial, (3) steam electric power general, (4) irrigation, (5) mining, (6) livestock, and (7) total water demand.

[2] Senate Bill 1477, Texas Legislature, 1993 Regular Session.

2. Using water supply information contained in the West Central Trans-Texas Phase 1 studies, water supply information of the 32-county West Central Trans-Texas study area will be tabulated for: (1) study area counties listed in objective 1, with counties and parts of counties and cities grouped by river basin subareas for the Nueces, San Antonio, Guadalupe, and Lower Colorado River Basin areas, the Brazos-Colorado, Colorado-Lavaca, Lavaca-Guadalupe, and San Antonio-Nueces Coastal Basin areas, study area counties and parts of counties of the adjacent Brazos and Lavaca Basins; and (2) cities of Bexar, Medina, Uvalde, and parts of Comal, Hays, Guadalupe, and Caldwell Counties located within the Edwards Aquifer Authority regional demand center. Projections will be shown in 10-year intervals starting in 1990 and ending in 2050.

3. Using results of objectives 1 and 2, water demand and water supply projections will be presented in tabular and graphic form, by decade from 1990 through 2050 for the counties, cities, river basins, and Edwards Aquifer Authority areas listed in objectives 1 and 2 above. The summaries will show surpluses and shortages for the water demand and water supply areas and centers.

The projections listed in the objectives will be based upon the following conditions, assumptions, and data:

A. The TWDB 1996 consensus water planning projections to be used are as follows:
   1. Most likely population;
   2. Most likely municipal water demand for below normal precipitation and advanced conservation;
   3. Base oil prices, with conservation for manufacturing;
   4. Series 3 irrigation (aggressive adoption of irrigation technology and a reduction in Federal Farm Programs by one-half);
   5. Steam-Electric power high series;
   6. Mining — TWDB only series;
   7. Livestock — TWDB only series.

B. Assume 450,000 acft/yr pumpage from the Edwards Aquifer for years 1997 through 2007, and 400,000 acft/yr beginning in year 2008.

C. Texas Water Development Board (TWDB) groundwater information for counties of the study area.

D. The quantity of water supply from the Edwards Aquifer will be based on provisions of SB 1477, with pumpage set at 450,000 acft/yr for the period 1997 through 2007, and 400,000 acft/yr beginning in 2008, and the assumption that each entity which obtained water from the Edwards Aquifer in 1990 will have its 1990 pro rata share of Edwards pumpage in future years.

E. The quantity of surface water supply from reservoirs of the study area will be the firm yield of each respective reservoir, as determined by previous studies, and in accordance with water rights permits issued by the Texas Natural Resource Conservation Commission (TNRCC).

F. The quantity of dependable surface water supplies from run-of-river water rights permits will be calculated for study area counties of the Nueces and Guadalupe-San Antonio River Basins using the existing Nueces and Guadalupe-San Antonio River Basin models developed by HDR Engineering, Inc.[3] These computations will be based upon Edwards Aquifer pumpage of 400,000 acft/yr. Dependable supplies of surface water from run-of-river permits for counties of the Lower Colorado River Basin will be tabulated from computer model results that were prepared by the Lower Colorado River Authority for use in the North Central Trans-Texas (NCTT) study.[4]

[3] HDR Engineering, Inc. et al, "Regional Water Supply Planning Study-Phase I, Nueces River Basin," Nueces River Authority et al, Uvalde, Texas, May, 1991, and HDR Engineering, Inc. et al, " Guadalupe-San Antonio River Basin Recharge Enhancement Study," Edwards Underground Water District, San Antonio, Texas, September, 1993.
[4] "Colorado River Base Case Availability," Unpublished tables, Lower Colorado River Authority, Austin, Texas, June 1997.

(This page intentionally left blank)

2.0 POPULATION AND WATER DEMAND PROJECTIONS

The purposes of this section are to present the Texas Water Development Board's (TWDB) 1996 consensus population and water demand projections for the 32-county West Central study area, as stated in Section 1.2. Projections are shown in 10-year intervals beginning with 1990 and ending in 2050. Population is shown in numbers of people; water demand is shown in acft per year (one acre-foot is 325,851 gallons) for each of the following list of water use categories: (1) municipal, (2) industrial, (3) steam-electric power generation, (4) irrigation, (5) mining, (6) livestock, and (7) total water demand.

2.1 Population Projections

TWDB 1996 consensus projections are shown in tabular and graphic form for: (1) the 32-county study area, including cities of each county, (2) the Edwards Aquifer Area (including cities of Bexar, Medina, Uvalde, and parts of Comal, Hays, Guadalupe and Caldwell counties) and (3) the Nueces, San Antonio, Guadalupe, and Lower Colorado River Basin areas.

2.1.1 Population Projections for the 32-County Study Area

The population of the 32-county study area was reported at 2.53 million in 1990 (Table 2-1) and is projected to be 3.15 million in 2000, 4.50 million in 2020, and 6.44 million in 2050 (Table 2-1 and Figure 2-1). The compound annual growth rate of this projection is 1.57 percent. The TWDB projections of the State of Texas population is from 16,986,510 in 1990 to 36,587,631 in 2050, having a compound annual growth rate of 1.287 percent. At 1.57 percent, the 32-county study area growth rate is about 22 percent higher than that projected for the State. For the 1990-2050 projection period, the 32 county study area population increases from 14.89 percent of the State total in 1990 to 17.6 percent of the State total in 2050.

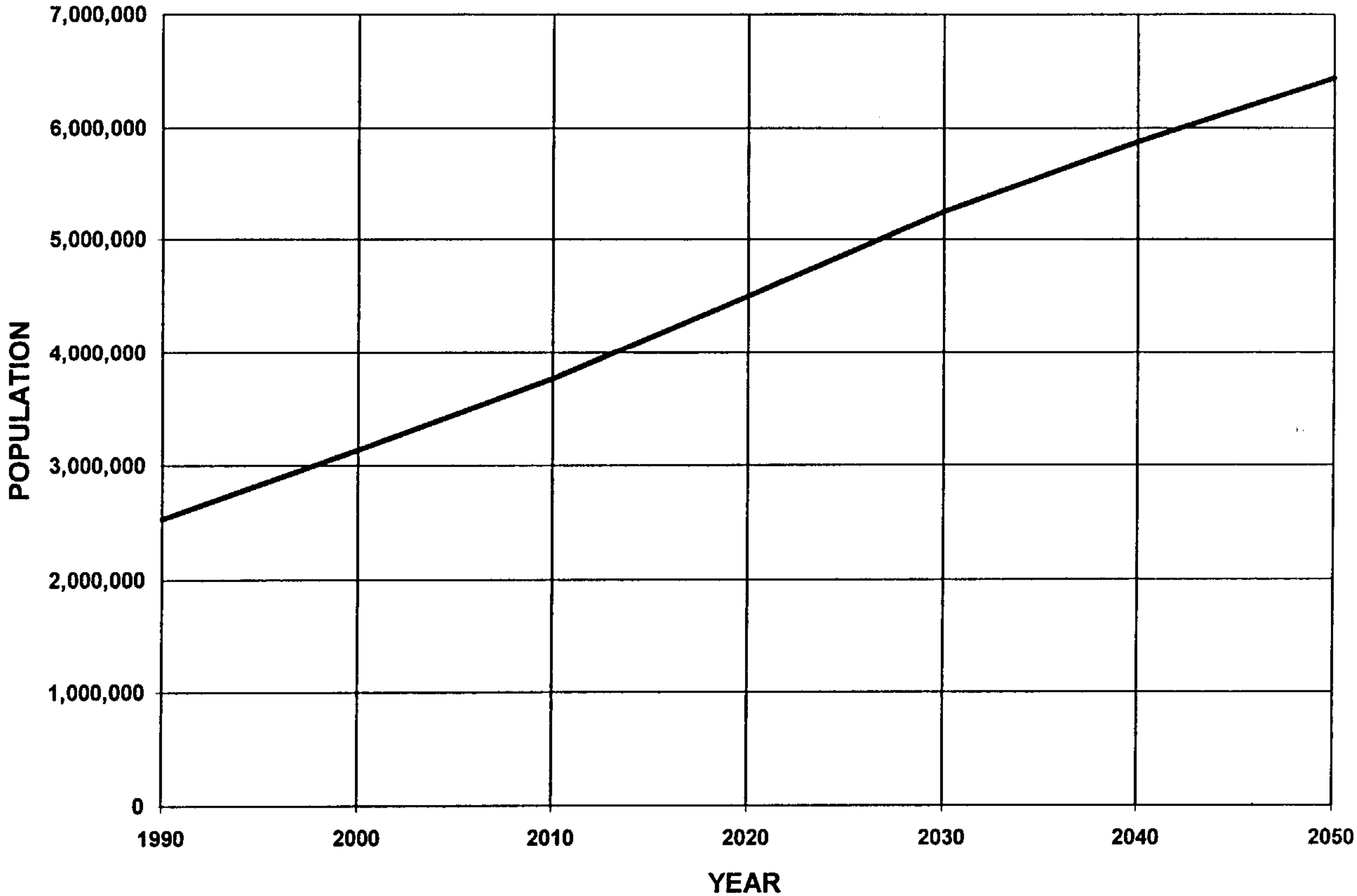
The population of those parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties that are located in the Nueces River Basin was 19,880 in 1990 and is projected at 39,779 in 2050 (Table 2-1).

Table 2-1							
Population Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
		Projections					
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
Atascosa	30,533	35,893	41,807	47,587	52,911	57,037	59,560
Bandera	10,562	14,947	17,801	21,754	24,413	27,397	30,745
Bastrop	38,263	47,917	59,430	71,679	83,583	90,915	98,331
Bexar	1,185,394	1,474,512	1,776,965	2,130,820	2,491,291	2,817,680	3,081,381
Blanco	5,972	7,468	8,998	10,667	11,910	12,549	12,418
Burnet	22,677	28,055	34,010	40,536	45,936	47,834	49,810
Caldwell	26,392	32,158	37,872	43,279	47,086	47,220	47,355
Calhoun	19,053	21,893	23,809	25,968	28,180	30,504	33,255
Colorado	18,383	20,028	21,054	22,221	23,204	24,014	24,630
Comal	51,832	79,378	106,558	144,869	187,464	226,133	267,843
DeWitt	18,840	20,217	21,180	22,340	23,550	24,773	26,030
Fayette	20,095	22,611	25,213	28,714	32,190	35,847	40,437
Frio	13,472	15,421	17,356	18,993	19,918	20,733	21,343
Goliad	5,980	6,408	6,784	7,089	7,161	7,368	7,892
Gonzales	17,205	17,817	18,647	19,305	19,405	19,843	20,292
Guadalupe	64,873	86,668	111,437	140,370	176,873	203,201	235,139
Hays	65,614	88,614	117,201	145,619	180,349	219,637	250,091
Karnes	12,455	14,578	14,835	16,322	17,460	18,457	19,353
Kendall	14,589	17,129	19,752	22,435	25,007	27,906	31,140
Kerr	36,304	44,162	51,085	59,209	66,982	71,611	73,461
Lee	12,854	14,133	15,586	16,984	18,144	19,408	20,812
Llano	11,631	12,887	13,372	14,538	14,800	15,361	16,745
Matagorda	36,928	41,018	45,805	51,008	56,834	63,211	70,902
Medina	27,312	33,349	38,069	42,299	44,945	46,969	49,556
Refugio	7,976	8,421	8,844	9,110	9,081	9,020	8,896
San Saba	5,401	5,497	5,470	5,419	5,247	5,144	4,989
Travis	576,407	744,080	892,047	1,096,329	1,288,441	1,413,420	1,550,521
Uvalde	23,340	26,466	29,756	32,788	35,595	38,087	40,565
Victoria	74,361	81,909	89,539	96,977	104,205	111,710	120,836
Wharton	39,955	42,673	46,218	49,845	53,608	57,491	61,759
Wilson	22,650	26,578	30,757	34,597	36,953	39,332	42,972
Zavala	12,162	13,619	14,584	15,117	15,789	16,770	18,203
Total	2,529,465	3,146,504	3,761,841	4,504,787	5,248,515	5,866,582	6,437,262
Dimmitt*	10,385	12,023	13,874	15,738	17,844	20,049	22,478
Edwards*	704	820	914	978	1040	1082	1123
Kinney*	489	552	611	651	582	502	433
LaSalle*	5254	6092	6748	7285	7562	7854	8034
Maverick*	341	422	489	542	583	642	726
Real*	2297	2413	2475	2532	2584	2637	2690
Webb*	410	1337	1832	2399	3135	3311	4295
Total*	19,880	23,659	26,943	30,125	33,330	36,077	39,779

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case.

*Not in West Central Trans-Texas study area; includes only part of county located in Nueces Basin.

Note: Texas population in 1990 was 16,986,510. TWDB projections of Texas population in year 2000 is 20,220,182, and in 2050 is 36,587,631 (1.287% compound annual growth rate).



TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

HDR Engineering, Inc.

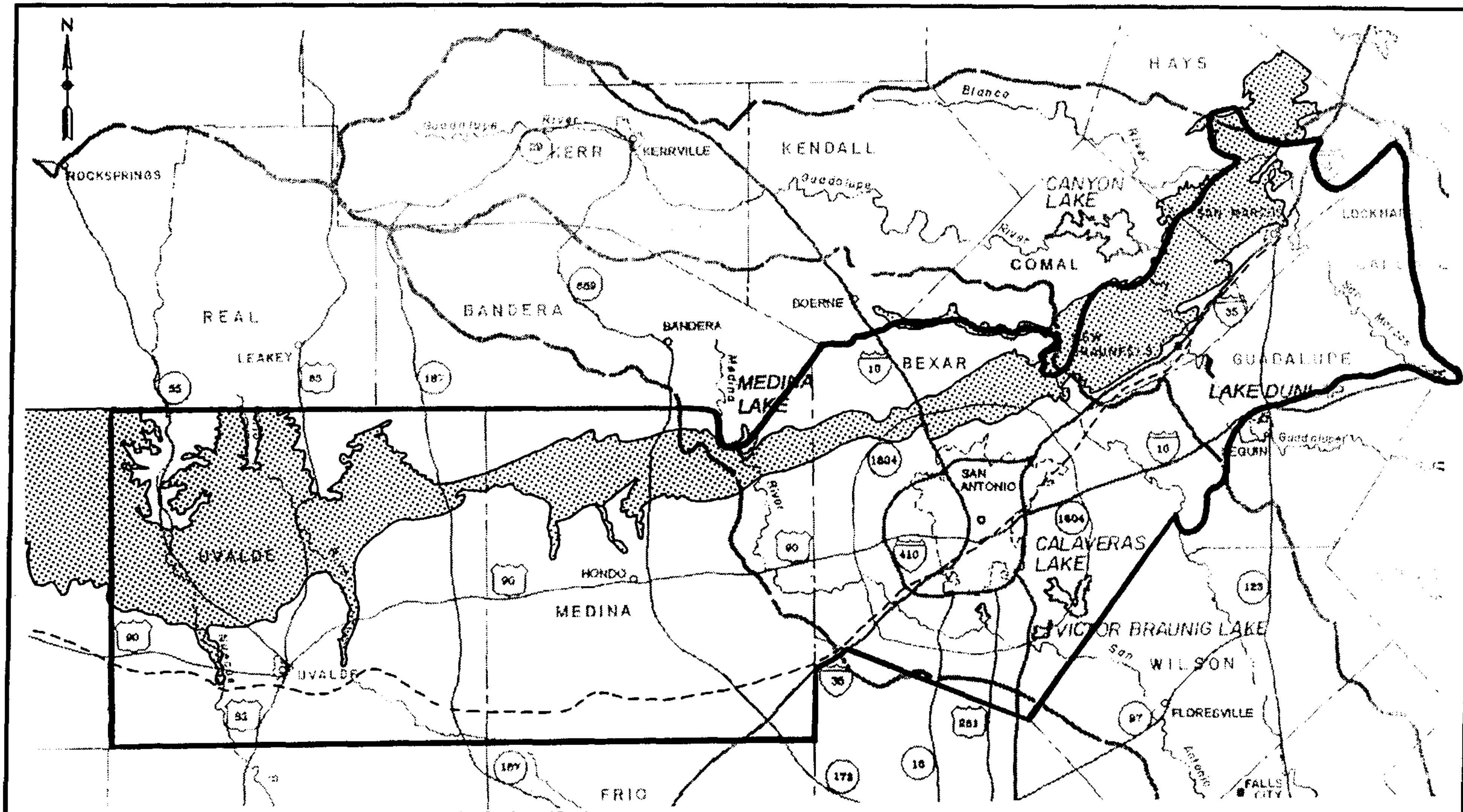
**POPULATION PROJECTIONS
32 COUNTY WEST CENTRAL
STUDY AREA**

FIGURE 2-1

(This page intentionally left blank)

2.1.2 Population Projections for the Edwards Aquifer Area Counties and Cities

The Edwards Aquifer area referenced here is the area specified in Senate Bill 1477, Texas Legislature, 73rd Session (1993), and includes all of the areas of Bexar, Medina, and Uvalde Counties, and parts of Atascosa, Comal, Caldwell, Hays, and Guadalupe Counties (Figure 2-2). Population projections for the portions of the counties and cities located within the Edwards Aquifer area are shown in Table 2-2 and Figure 2-3. The population of the Edwards Aquifer area was 1,360,937 in 1990 and is projected to be 3,602,473 in 2050. The compound annual growth rate of this area for the 1990-2050 projection period is 1.63 percent, which is about 3.8 percent higher than the 1.57 percent rate for the 32-county study area (Table 2-2).



Source: The Texas Water Development Board

Legend

- Edwards Aquifer Authority Boundary
- Basin Divide
- Edwards Aquifer Recharge Zone
- "Bad Water" Line

0 10 20 Miles

Scale

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

EDWARDS AQUIFER AUTHORITY AREA

FIGURE 2-2

Table 2-2
Population Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

Basin/County/City/Rural	Total in 1990	Projections 2000	2010	2020	2030	2040	2050
ATASCOSA COUNTY (part)							
Nueces Basin							
Lytle	1,567	2,312	2,718	3,113	3,477	3,762	4,070
BEXAR COUNTY (all)							
San Antonio Basin							
San Antonio	935,933	1,137,369	1,360,669	1,621,857	1,886,190	2,125,314	2,394,753
Balcones Heights	3,022	3,437	3,791	4,182	4,455	4,734	5,030
Terrell Hills	4,592	5,120	5,417	5,810	5,970	5,969	5,968
Olmos Park	2,161	2,438	2,669	2,920	3,086	3,253	3,429
Helotes	1,535	2,045	2,600	3,251	3,937	4,295	4,686
Leon Valley	9,581	12,455	12,704	12,577	12,748	12,919	13,694
Alamo Heights	6,502	7,039	7,391	7,759	7,868	7,959	8,051
Converse	8,887	13,658	20,424	27,634	35,537	42,763	51,458
Fair Oaks Ranch	1,640	2,318	3,070	3,952	4,899	5,762	6,777
Kirby	8,326	10,039	11,992	14,276	16,584	18,672	21,023
Live Oak Water Public Utility	10,023	12,439	15,199	18,430	21,756	24,774	28,211
Schertz (Part)	414	607	807	951	1,021	1,176	1,417
Schertz (Outside City) Estimated	3,165	4,111	5,026	6,383	7,767	8,926	10,330
Shavano Park	1,708	2,097	2,425	2,687	2,784	2,917	3,056
St. Hedwig	1,443	1,843	2,425	3,107	3,837	4,503	5,285
Universal City	13,057	15,992	19,452	23,502	27,658	31,426	35,707
Continued Next Page							

Table 2-2 continued

Basin/County/City/Rural	Total in 1990	Projections 2000	2010	2020	2030	2040	2050
Windcrest (WC&ID No. 10)	5,331	5,818	6,160	6,520	6,665	6,796	6,930
Castle Hills(BMWD)	4,198	4,967	5,328	5,667	5,778	5,742	5,706
Somerset(BMWD)	1,144	1,251	1,314	1,361	1,321	1,280	1,240
Hill Country/HollywPark(BMWD)	3,879	4,956	5,887	6,988	8,003	8,947	10,009
BMWD(Subdvisions) Estimated	108,988	125,751	167,041	207,920	245,492	284,585	307,993
Remainder of County	47,114	94,672	109,906	136,408	169,774	195,454	141,708
Total	1,182,643	1,470,422	1,771,697	2,124,142	2,483,130	2,808,166	3,072,461
MEDINA COUNTY (all)							
Nueces Basin							
Devine	3,928	4,524	4,921	5,310	5,515	5,686	5,862
Hondo	6,018	7,032	7,880	8,782	9,268	9,574	9,890
Lytle	340	382	402	425	435	448	461
Natalia	1,216	1,703	1,909	2,126	2,244	2,318	2,394
Rural	10,379	12,861	14,972	16,662	17,839	18,817	20,231
Subtotal	21,881	26,502	30,084	33,305	35,301	36,843	38,838
San Antonio Basin							
Castroville	2,159	2,632	2,950	3,289	3,469	3,583	3,701
Lacoste	1,021	1,426	1,789	2,092	2,307	2,463	2,630
Rural	2,251	2,789	3,246	3,613	3,868	4,080	4,387
Subtotal	5,431	6,847	7,985	8,994	9,644	10,126	10,718
Total	27,312	33,349	38,069	42,299	44,945	46,969	49,556

Continued Next Page

Table 2-2 continued

Basin/County/City/Rural		Total in 1990	Projections 2000	2010	2020	2030	2040	2050
UVALDE COUNTY (all)								
Nueces Basin								
Sabinal		1,584	1,880	2,184	2,460	2,737	2,976	3,236
Uvalde		14,729	17,296	20,398	23,185	25,997	28,558	31,371
Rural		7,027	7,290	7,174	7,143	6,861	6,553	5,958
	Total	23,340	26,466	29,756	32,788	35,595	38,087	40,565
COMAL COUNTY (part)								
Guadalupe Basin								
Garden Ridge		1,450	2,301	3,157	4,352	5,686	6,903	8,380
New Braunfels		27,091	38,126	49,873	65,003	82,894	95,424	109,848
Rural	(0.08 of Co. rural)	1,698	2,272	3,119	4,399	5,760	7,206	8,702
Subtotal		30,239	42,699	56,149	73,754	94,340	109,533	126,930
San Antonio Basin								
Schertz (Part)		129	210	325	484	627	891	1,187
Rural	(0.026 0f Co rural)	613	738	1,014	1,430	1,872	2,342	2,828
Subtotal		742	948	1,339	1,914	2,499	3,233	4,015
	Total	30,981	43,647	57,488	75,667	96,839	112,766	130,945
HAYS COUNTY (part)								
Guadalupe Basin								
Kyle		2,225	2,427	2,574	2,803	3,167	3,702	4,327
San Marcos		28,743	33,751	40,281	47,370	56,741	68,141	81,831
Rural	(0.26 0f Co rural)	5,127	8,180	11,667	15,012	18,979	23,312	25,713
	Total	36,095	44,358	54,522	65,185	78,887	95,155	111,871

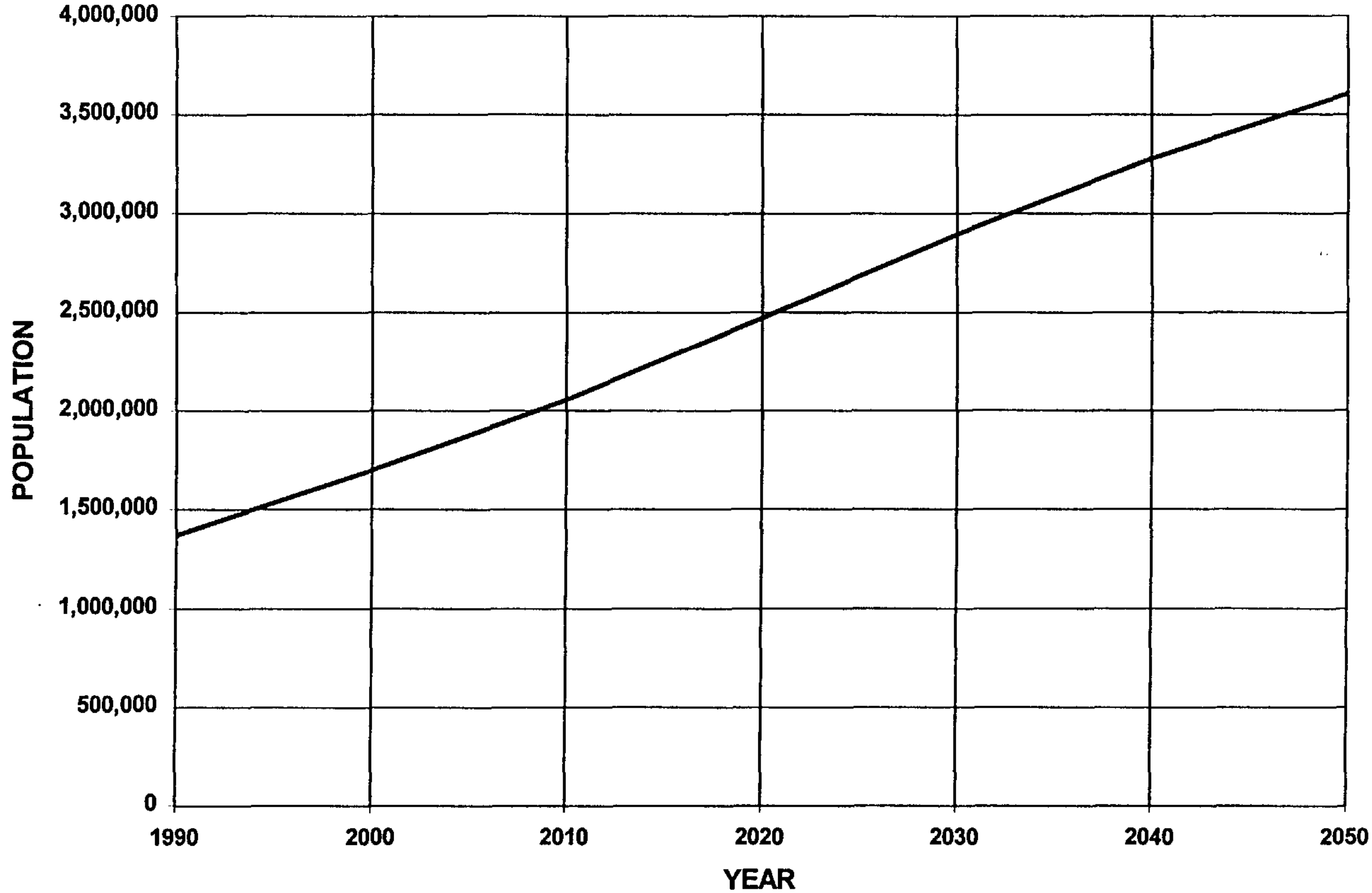
Continued Next Page

Table 2-2 continued

Basin/County/City/Rural		Total in 1990	Projections 2000	2010	2020	2030	2040	2050
GUADALUPE COUNTY (part)								
Guadalupe Basin								
New Braunfels (part)		243	278	334	414	592	657	729
Rural	(0.66 of Co rural)	21,373	24,838	33,890	42,618	53,857	59,839	67,185
Subtotal		21,616	25,116	34,224	43,032	54,449	60,496	67,914
San Antonio Basin								
Cibolo		1,757	3,840	4,490	5,830	6,710	7,780	8,420
Schertz	(Part)	10,012	12,894	18,720	24,890	32,574	42,421	55,231
Rural		5,832	11,659	14,562	17,623	22,270	24,744	27,782
Subtotal		17,601	28,393	37,772	48,343	61,554	74,945	91,433
	Total	39,217	53,509	71,996	91,375	116,003	135,441	159,347
CALDWELL COUNTY (part)								
Guadalupe Basin								
Lockhart		9,205	11,108	13,218	15,229	16,649	16,751	16,854
Luling		4,661	5,026	5,130	5,146	5,131	4,829	4,545
Rural	(0.50 of Co rural)	5,916	7,568	9,221	10,818	11,952	12,110	12,259
	Total	19,782	23,702	27,569	31,193	33,732	33,690	33,658
Edwards Aquifer Area Total*		1,360,937	1,697,764	2,053,815	2,465,762	2,892,609	3,274,036	3,602,473

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case.
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.

◇◇◇◇



TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

POPULATION PROJECTIONS
EDWARDS AQUIFER AREA

HDR Engineering, Inc.

FIGURE 2-3

(This page intentionally left blank)

2.1.3 Population Projections for River Basins and Adjacent Areas

The 32-county West Central Study Area contains all or parts of the Nueces, San Antonio, Guadalupe, and Lower Colorado River Basins, however, parts of some study area counties are located in areas adjacent to one or more of these river basins. In addition, some study area counties are located in two or more study area river basins. For purposes of making projections of water demands for each individual river basin, it is necessary to sum the population and water demand projections of the counties and parts of counties located within each river basin as well as adjacent areas that depend upon each basin, respectively. In this section, the river basin and adjacent area population projections are presented. Water demand projections for these areas are presented in Section 2.2.3.

The population projections for the counties of the West Central Study Area that are located within the Nueces, San Antonio, Guadalupe, and Lower Colorado Basins, respectively, were summed and are shown in Table 2-3 and Figure 2-4. The population projections of the counties of the Nueces Basin that are included in the 32-county study area (Uvalde, Medina, Zavala, Frio, Atascosa, and parts of Bexar, Wilson and Karnes counties) are shown on row 1 of Table 2-3 (i.e., 105,607 in 1990, and 190,834 projected in 2050). The population of the 7-county area (parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties) of the Nueces Basin that are included here for information purposes, was 19,880 in 1990, and is projected at 39,779 (Table 2-3).

In the case of the San Antonio Basin, the basin totals are shown as follows: 1,270,884 in 1990, with 3,331,113 projected for 2050. The population of areas adjacent to the San Antonio Basin (the part of Goliad County that is located in the adjacent San Antonio-Nueces Coastal Basin) that is included in the 32-county study is shown to total 450 in 1990, with a projection to 2050 of 587 (Table 2-3 and Figure 2-4).

In 1990, the population of the Guadalupe Basin was 302,409 and is projected at 824,550 in 2050 (Table 2-3). For the Guadalupe Basin, the part of Victoria County located in the adjacent Lavaca-Guadalupe Coastal Basin plus Refugio and Calhoun counties were tabulated and included

Table 2-3							
Population Projections for River Basins--32-County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
		Projections					
River Basin	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
NUECES							
Study Area In-Basin[1]	105,607	123,877	141,003	156,991	170,405	181,967	190,834
7-County Adj. Area[2]	19,880	23,659	26,943	30,125	33,330	36,077	39,779
SAN ANTONIO							
Total In-Basin	1,270,884	1,585,794	1,910,695	2,291,649	2,678,667	3,032,625	3,331,113
Adj. Area[3]	450	476	505	527	532	547	587
Study Area Subtotal	1,271,334	1,586,270	1,911,200	2,292,176	2,679,199	3,033,172	3,331,700
GUADALUPE							
Total In-Basin	302,409	376,518	456,574	549,599	653,361	739,799	824,550
Adj. Area[4]	48,076	53,562	57,980	62,510	66,814	71,207	76,605
Study Area Subtotal	350,485	430,080	514,554	612,109	720,175	811,006	901,155
LOWER COLORADO							
Total In-Basin	706,715	901,517	1,079,653	1,316,511	1,539,747	1,689,580	1,849,297
Adj. Coastal Area[5]	73,250	79,802	87,426	95,563	104,333	113,681	124,451
Area Subtotal	779,965	981,319	1,167,079	1,412,074	1,644,080	1,803,261	1,973,748
Adj. Inland Area[6]	22,074	24,958	28,005	31,437	34,656	37,176	39,825
Study Area Subtotal	802,039	1,006,277	1,195,084	1,443,511	1,678,736	1,840,437	2,013,573
Study Area Subtotal[7]	2,507,391	3,121,546	3,733,836	4,473,350	5,213,859	5,829,406	6,397,437
Study Area Total	2,529,465	3,146,504	3,761,841	4,504,787	5,248,515	5,866,582	6,437,262

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case.

[1] Counties of Nueces Basin included in study area (Uvalde, Medina, Zavala, Frio, Atascosa and parts of Bexar, Wilson, and Karnes Counties).

[2] Parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties of the Nueces Basin, but not included in the West Central Trans-Texas study area.

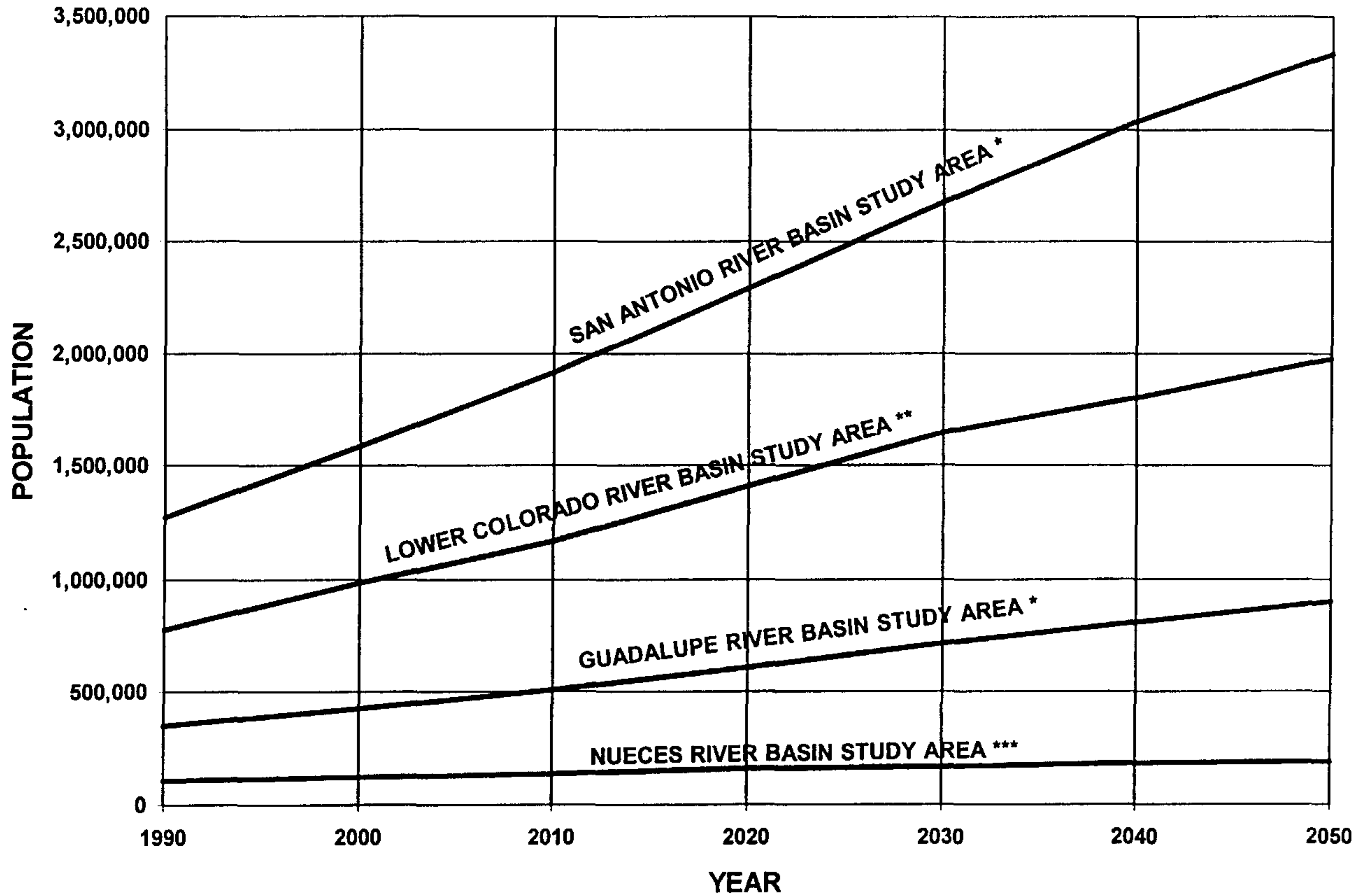
[3] Part of Goliad County located in adjacent San Antonio -Nueces Coastal Basin.

[4] Part of Victoria County located in adjacent Lavaca-Guadalupe Coastal Basin, plus all of Refugio and Calhoun Counties.

[5] Parts of Colorado, Matagorda, and Wharton Counties located in adjacent coastal basins, and obtain a part of their water supply from the Colorado River.

[6] Parts of Burnet, Bastrop, and Lee Counties located in the adjacent Brazos Basin.

[7] Does not include parts of Burnet, Bastrop, and Lee counties located in the adjacent Brazos Basin.



* In basin plus adjacent areas that obtain water from the basin.

** In basin plus adjacent coastal areas that obtain water from the Colorado Basin. Does not include parts of study area counties located in the Brazos Basin.

*** Includes only study area counties of the Nueces Basin.

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

POPULATION PROJECTIONS RIVER BASIN STUDY AREAS

FIGURE 2-4

as a separate element, since Calhoun County obtains water from the Guadalupe Basin, and Victoria and Refugio counties may need water from the Guadalupe Basin in the future. The population for the areas adjacent to the Guadalupe were 48,076 in 1990 and are projected to be 76,605 in 2050 (Table 2-3 and Figure 2-4).

The population of the Lower Colorado Basin was 706,715 in 1990 and is projected to increase to 1,849,297 in 2050 (Table 2-3). The population for areas adjacent to the Lower Colorado Basin are also shown in Table 2-3. Those parts of counties located in coastal basins adjacent to the Lower Colorado Basin (i.e., Colorado, Wharton, and Matagorda) had a 1990 population of 73,250. Projected 2050 population of these counties is 124,451 (Table 2-3 and Figure 2-4).

The 32-county study area total population in 1990 was 2,529,465 and is projected at 4,504,787 in 2020, and 6,437,262 in 2050 (Table 2-3).

2.2 Water Demand Projections

Texas Water Development Board's 1996 Consensus Water Plan water demand projections, "most likely case" with advanced conservation, are tabulated for the counties and are shown in tabular and graphic form for: (1) the 32-county study area, (2) the Edwards Aquifer area (Bexar, Medina, Uvalde, Comal, Hays, and parts of Guadalupe, and Caldwell Counties), and (3) the Nueces, San Antonio, Guadalupe, and Lower Colorado River Basin areas included within the study area. Projections are shown for each of the major water-using categories, as follows: (1) municipal, (2) manufacturing, (3) steam-electric power generation, (4) irrigation, (5) mining, (6) livestock, and (7) total of (1) through (6). Each type of water use is explained below, together with a brief description of projection methods, procedures, and data.

Municipal Water Use

Municipal water use includes freshwater for drinking, food preparation, dishwashing, bathing, toilet flushing, laundry, lawn watering, private and public swimming pools, hot tubs, restaurants, car washes, commercial laundries, office, service, hotel, motel, and retail building bathrooms and air conditioning, fire protection, fountains, public parks, sports centers, aquariums, zoos, and street washing. Municipal water must meet safe drinking standards as specified by Federal and State laws and regulations.

The municipal water demand projection for an area (city, county, other) for any future date is computed by the following formula:

$$MWD = \frac{gpcd(P)(365)}{325{,}851}$$

Where MWD = Number of acft of municipal water needed for 1 year;
gpcd = Number of gallons of water used per person per day during the year;
P = Projected population of the area in the projection year;
365 = Number of days in 1 year; and
325,851 = Number of gallons of water in 1 acre-foot.

For purposes of making projections of future municipal water demands, TWDB has conducted an annual survey of cities, and public and private water districts and authorities since the mid-1960's. In the annual survey, each respondent reports the quantities of water that have been obtained from each respective water source and supplied to municipal-type customers. From the water use reports of the cities, TWDB has computed an annual per capita water use, in gallons per person per day, for each city, for average and below normal precipitation, and for average and advanced water conservation. In this report, the advanced water conservation projection was used.

Industrial Water Use

Industrial water use includes freshwater used by industries for processing raw materials, including cooling of manufacturing processes, on-site electric power generation for use in the manufacturing plants, cleaning and waste removal, grounds maintenance, sanitation, pollution control, internal transportation, and in some cases, such as food and beverage manufacture, is included as part of the finished product.

As is done for cities, TWDB conducts an annual water use survey of business establishments of the major water using industries of Texas (petroleum refining, petrochemicals, inorganic chemicals, cement and concrete, steel, nonferrous smelters, construction machinery, pulp, paper and paperboard, food and beverages, and electronics). From the survey data, the quantity of freshwater used by each industry sector of a county is computed for the projections starting point (1990). Projections are made of quantities of water needed at future decadal points by applying estimated growth rates of each respective industry. Industrial water conservation effects are included by using projected recirculation and technology improvements coefficients for the projection period, which reduces the projected quantities obtained when growth rates are applied to the starting point water use data mentioned above.

Steam-Electric Power Water Use

Steam-electric power generation plants use freshwater for condenser cooling, boiler feed make-up, sanitation, grounds maintenance, and pollution control. Consumptive use typically ranges from one-third to one-half gallon of water for each kilowatt-hour of electricity produced, however, from 20 to 60 gallons of water must be circulated through the power plant condensers for each kilowatt-hour of electricity produced. The electric power industry uses both once-through and recirculation methods of operation. In the TWDB projections, each power plant is treated separately, and the projections are in terms of consumptive water use as opposed to total flows.

Annual water use surveys of electric power utilities provide TWDB with quantities of water used annually at each steam-electric power plant. These data, together with projections of additional generating units, and additional electric power plants form the basis for computing projections of quantities of water needed for electric power generation. It is important to note that TWDB projections of steam-electric power generation water needs are tied to projections of population growth; i.e., it is assumed that electric power generation capacity will be added as needed in order to meet the needs of the population projected for each area of the state. (Note: In some cases, electric power may be obtained from neighboring areas, with the required water supplies being provided at the power generation site).

Irrigation Water Use

The application of freshwater to land to grow crops is irrigation water use. The TWDB projection based upon aggressive adoption of irrigation technology, and a reduction in Federal Farm Programs by one-half were used in this report.

For water planning purposes, TWDB, in cooperation with the Texas State Soil and Water Conservation Board and the U.S. Natural Resource Conservation Service's County Work Units, conducts a field survey of irrigation water use every five years. The 1989 survey is the basis for making estimates of the quantities of irrigation water used in each county in which irrigation was done in 1990. The irrigation survey involves locating irrigation acreages on individual county maps, site visits to representative irrigation tracts, and checking soil conservation farm management plans and irrigation research results in order to determine the quantities of irrigation water used to produce each crop. Through this process, the number of irrigated acreages of each crop within each county is estimated. The acreages, together with estimated quantities of irrigation water used per acre allows the computation of quantities of irrigation water used in the projections starting point year (1990). For the projection period 1990-2050, irrigation water demands are projected by making projections of irrigated acreages at each decadal point in time and the quantity of water needed for each acre, assuming that efficient irrigation technology and methods appropriate at each decade point will be used by irrigation farmers.

Mining Water Use

Freshwater used in the recovery of petroleum, sand, gravel, clay and stone is mining water use. In the case of petroleum production, water is injected into petroleum bearing formations to drive crude oil and natural gas to the wells for pumping to the surface. In the case of sand, gravel, clay, and stone production, water is used to wash and separate materials into usable sizes and simply to remove soil and unusable materials.

TWDB's annual water use surveys include mining establishments. In addition, records of the Texas Railroad Commission are used to determine the quantities of freshwater used in "water flooding operations" for petroleum production. From these survey data and reports, computations are made of the quantities of freshwater used for mining purposes for the projections starting point year (1990). The growth rate (in the case of petroleum production, the direction is downward over the long run in most cases) of each mining activity of each county is projected and applied to the 1990 computed water use in order to obtain projections of quantities of water that will be needed at each decade point of the projection period (2000 - 2050).

Livestock Water Use

Drinking water and water for washing and sanitation of livestock housing and production facilities are needed for farm and ranch animals and poultry.

Livestock and poultry water requirements are estimated from nutritional needs, in gallons per day, for each type of livestock, times the number of each type. Projections are made of the numbers at each decadal point of the projection period for each county. Carrying capacity and the acreages of rangeland are used in making projections for beef cattle, sheep, and goats. Growth rates of dairy and poultry numbers are developed for making projections for these groups. Projections are made for each county by summing the projections for each livestock type.

Total Water Demand

Total water use projected for each subarea (city, county, Edwards Aquifer area, and river basin area) of the study area is the sum of the projected water demands for municipal, industrial, steam-electric power, irrigation, mining, and livestock purposes.

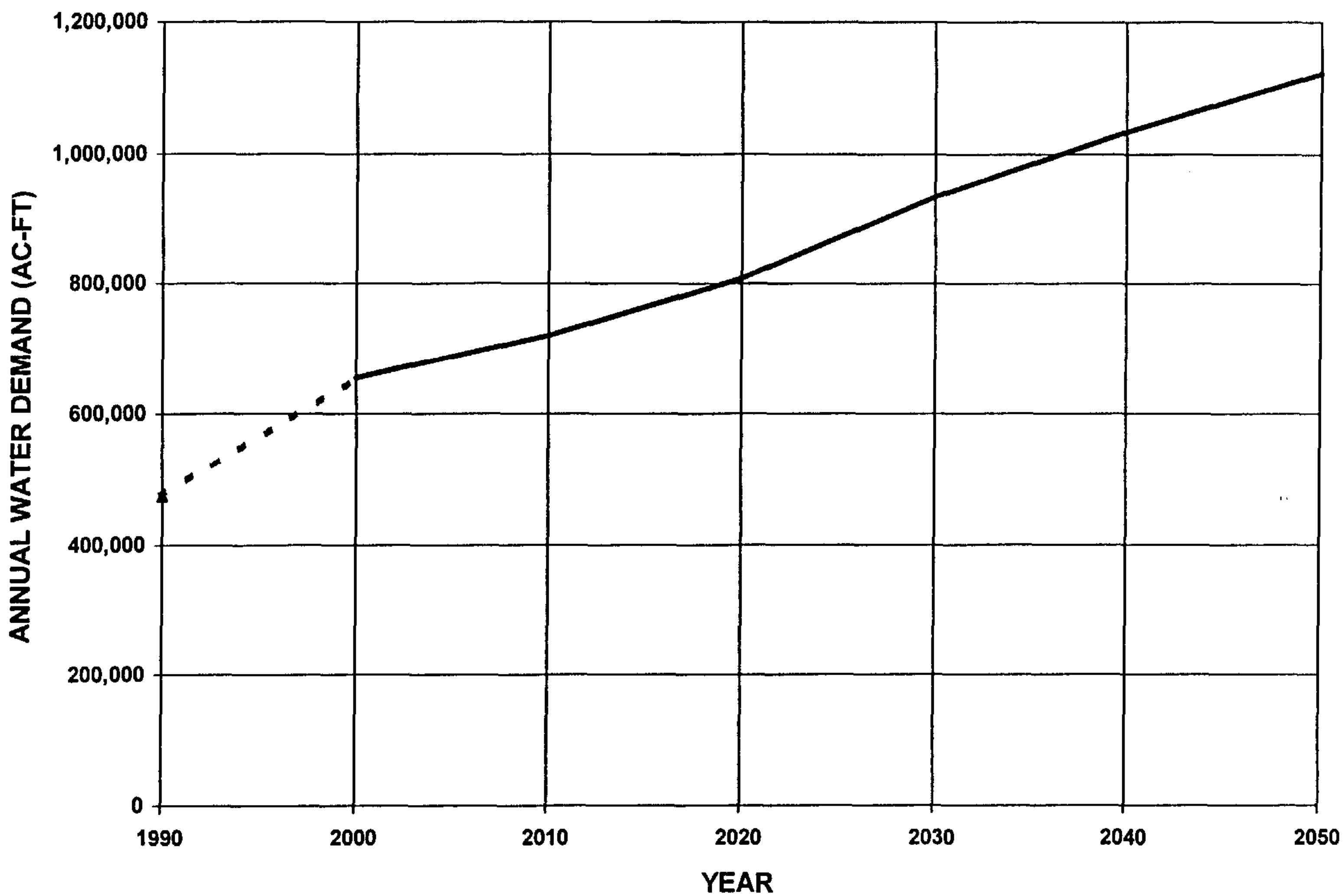
2.2.1 Water Demand Projections for the 32-County Study Area

The TWDB 1996 Consensus water planning projections of water demand with advanced water conservation are shown in tabular and graphic form for the 33-county study area for: (1) municipal, (2) industrial, (3) steam-electric power generation, (4) irrigation, (5) mining, (6) livestock, and (7) total water use.

2.2.1.1 Municipal Water Demand Projections for the 33-County Study Area

For the 32-County study area, municipal water use in 1990 was 474,326 acft and ranged from 916 acft in Goliad County to 225,626 acft in Bexar County (Table 2-4 and Figure 2-5). The municipal water demand projection, with advanced water conservation is 650,006 acft in 2000, 803,379 acft in 2020 and 1,116,317 acre feet in 2050 (Table 2-4). Projections for the individual counties are a function of the number of people projected for the counties and the per capita water use rates of the respective counties. The individual county projections are displayed in Table 2-4 and for year 2050 range from a low of 917 acft for Goliad County to a high of 531,750 acft for Bexar County. It should be noted that for 1990 the quantities are of actual use, while the projections for 2000 and beyond are for dry year conditions, with advanced water conservation. Since 1990 was not a dry year, the per capita use is lower than that which was used in the projections, thus the point for 1990 is not located on the projections curve of Figure 2-5.

Table 2-4							
Municipal Water Demand Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
	Use in	Projections					
County	1990	2000	2010	2020	2030	2040	2050
	acft	acft	acft	acft	acft	acft	acft
Atascosa	5,670	7,245	7,641	8,004	8,807	9,378	9,835
Bandera	1,445	1,830	1,911	2,108	2,332	2,576	2,848
Bastrop	6,247	8,196	9,215	10,340	11,870	12,799	13,747
Bexar	225,626	306,064	338,626	381,015	439,753	493,694	531,750
Blanco	904	1,147	1,221	1,305	1,416	1,463	1,444
Burnet	3,526	4,303	4,691	5,118	5,714	5,892	6,079
Caldwell	4,931	5,802	6,106	6,388	6,787	6,709	6,648
Calhoun	3,911	4,396	4,440	4,537	4,877	5,253	5,724
Colorado	2,927	3,072	2,958	2,911	3,015	3,099	3,172
Comal	10,415	18,587	22,780	28,687	36,569	43,590	51,227
DeWitt	3,556	3,614	3,470	3,400	3,535	3,688	3,841
Fayette	3,395	3,632	3,682	3,870	4,271	4,703	5,242
Frio	3,045	3,510	3,615	3,670	3,813	3,933	4,024
Goliad	916	928	891	858	856	868	917
Gonzales	3,832	3,879	3,729	3,613	3,589	3,628	3,684
Guadalupe	9,627	15,357	17,802	20,696	25,780	29,447	34,088
Hays	11,709	16,652	19,661	22,428	27,207	32,695	37,279
Karnes	2,187	2,586	2,401	2,436	2,564	2,682	2,776
Kendall	2,130	2,571	2,697	2,836	3,136	3,476	3,855
Kerr	5,926	8,327	9,076	9,841	10,870	11,376	11,616
Lee	2,991	3,121	3,170	3,230	3,416	3,626	3,864
Llano	2,488	2,797	2,630	2,600	2,591	2,669	2,850
Matagorda	5,225	5,852	5,927	6,105	6,661	7,317	8,091
Medina	5,254	7,112	7,312	7,467	7,832	8,074	8,398
Refugio	1,227	1,328	1,275	1,220	1,198	1,177	1,150
San Saba	1,272	1,599	1,457	1,336	1,281	1,241	1,201
Travis	114,809	172,439	191,815	222,192	259,493	281,465	308,421
Uvalde	5,278	6,710	7,074	7,317	8,019	8,618	9,271
Victoria	11,545	13,013	13,146	13,382	14,178	15,056	16,116
Wharton	6,218	6,544	6,417	6,440	6,800	7,209	7,669
Wilson	3,745	5,019	5,257	5,455	5,744	6,066	6,570
Zavala	2,349	2,774	2,694	2,574	2,652	2,753	2,920
Total	474,326	650,006	714,787	803,379	926,626	1,026,220	1,116,317
Dimmitt*	2,202	2,930	3,162	3,387	3,833	4,307	4,833
Edwards*	106	108	108	107	111	113	116
Kinney*	60	124	127	125	110	95	81
LaSalle*	1,233	1,372	1,391	1,392	1,422	1,459	1,486
Maverick*	42	61	64	65	69	74	84
Real*	500	559	525	509	521	534	551
Webb*	51	241	304	371	481	504	649
Total*	4,194	5,395	5,681	5,956	6,547	7,086	7,800
Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.							
* Not in West Central Trans-Texas study area.							
**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).							



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

MUNICIPAL WATER DEMAND PROJECTIONS 32 COUNTY WEST CENTRAL STUDY AREA

FIGURE 2-5

(This page intentionally left blank)

2.2.1.2 Industrial Water Demand Projections for the 32-County Study Area

Industrial water use in the study area in 1990 was reported at 82,981 acft and is projected to increase to 227,912 acft in 2050 (Table 2-5 and Figure 2-6). Industrial water use is concentrated in the coastal counties of Calhoun, Victoria, and Matagorda, and along the I-35 corridor (Bexar, Comal, Guadalupe, and Travis Counties). Seven of the study area counties do not have any projected industrial water use (Table 2-5). In 1990, the heavy water using industries of Calhoun,Victoria, and Matagorda counties were operating at much less than full capacity due to sluggish economic conditions. Thus, reported water use was below normal. As economic conditions improved, water use increased to that needed to return idle capacity to production. This is reflected in the projections and explains a part of the large increase in the industrial water demand projections between 1990 and 2000.

2.2.1.3 Steam-Electric Power Water Demand Projections for the 32-County Study Area

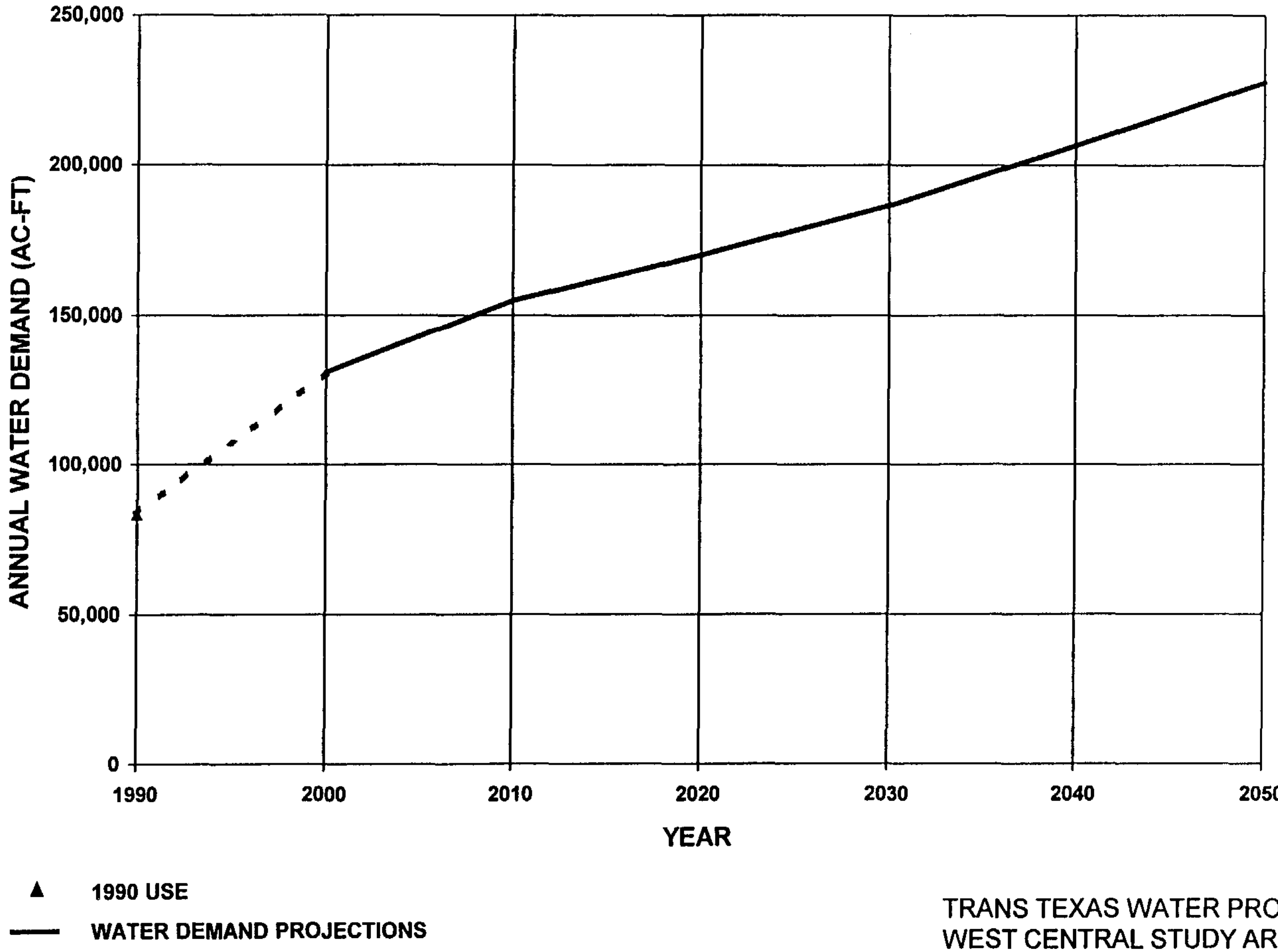
Steam-electric power generation is located in 11 of the 32-study area counties, with the larger plants located in Bexar, Matagorda, Goliad, and Fayette Counties. Consumptive use by power plants in 1990 was 101,169 acft (Table 2-6 and Figure 2-7). Projected consumptive use of water for steam-electric power generation in 2050 is 208,500 acft (Table 2-6). It is important to note that total volume of water required for circulation in steam-electric power plants is perhaps 50 times that which is consumed by evaporation. It is further useful to note that treated municipal wastewater can and is being used in Bexar County for electric power generation.

Table 2-5							
Industrial Water Demand Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
	Use in	Projections					
County	1990	2000	2010	2020	2030	2040	2050
	acft	acft	acft	acft	acft	acft	acft
Atascosa	0	0	0	0	0	0	0
Bandera	0	11	13	15	16	19	22
Bastrop	27	33	40	48	57	67	78
Bexar	14,049	16,805	19,682	22,359	24,935	28,264	31,697
Blanco	0	0	0	0	0	0	0
Burnet	1,116	1,246	1,377	1,514	1,655	1,800	1,947
Caldwell	0	0	0	0	0	0	0
Calhoun	24,539	63,026	77,588	85,949	95,240	105,236	115,958
Colorado	1,078	1,150	1,224	1,297	1,369	1,438	1,508
Comal	3,248	3,450	3,487	3,548	3,799	4,071	4,351
DeWitt	91	108	126	146	170	195	223
Fayette	32	37	44	50	55	63	71
Frio	0	0	0	0	0	0	0
Goliad	0	0	0	0	0	0	0
Gonzales	865	929	992	1,043	1,083	1,160	1,231
Guadalupe	1,661	1,883	2,102	2,248	2,385	2,590	2,797
Hays	293	381	445	507	564	620	677
Karnes	270	296	320	331	340	356	383
Kendall	2	2	3	4	4	5	6
Kerr	28	30	33	36	38	41	44
Lee	5	6	7	8	9	11	12
Llano	0	0	0	0	0	0	0
Matagorda	6,807	7,366	7,876	8,059	8,179	8,696	9,193
Medina	286	302	319	339	361	384	411
Refugio	0	0	0	0	0	0	0
San Saba	0	0	0	0	0	0	0
Travis	6,243	7,209	8,104	8,743	9,494	10,385	11,600
Uvalde	557	600	643	675	700	759	817
Victoria	20,032	24,115	28,446	31,157	33,670	37,900	42,201
Wharton	396	442	486	521	554	596	637
Wilson	50	61	72	85	99	115	134
Zavala	1,306	1,407	1,507	1,582	1,642	1,780	1,914
Total	82,981	130,895	154,936	170,264	186,418	206,551	227,912
Dimmitt*	3	11	11	12	13	14	15
Edwards*	0	0	0	0	0	0	0
Kinney*	0	0	0	0	0	0	0
LaSalle*	0	0	0	0	0	0	0
Maverick*	0	0	0	0	0	0	0
Real*	0	0	0	0	0	0	0
Webb*	0	0	0	0	0	0	0
Total	3	11	11	12	13	14	15

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).



TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

HDR Engineering, Inc.

INDUSTRIAL WATER DEMAND PROJECTIONS
32 COUNTY WEST CENTRAL STUDY AREA
FIGURE 2-6

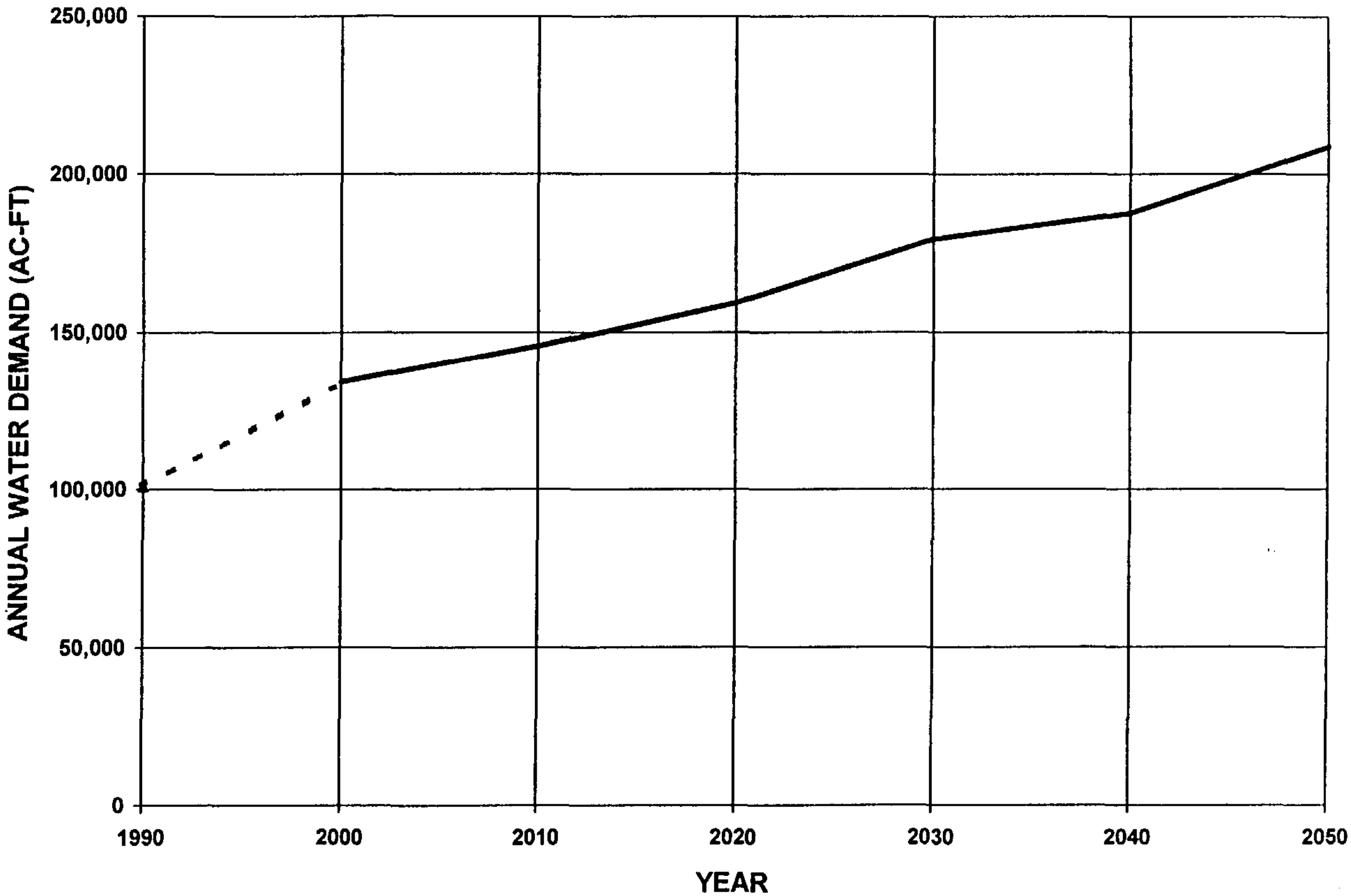
Table 2-6							
Steam-Electric Power Water Demand Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
	Use in	**Projections**					
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
Atascosa	6,036	12,000	12,000	12,000	12,000	15,000	22,000
Bandera	0	0	0	0	0	0	0
Bastrop	2,967	4,500	8,000	8,000	8,000	8,000	8,000
Bexar	24,263	36,000	36,000	40,000	45,000	50,000	56,000
Blanco	0	0	0	0	0	0	0
Burnet	0	0	0	0	0	0	0
Caldwell	0	0	0	0	0	0	0
Calhoun	62	100	100	100	100	100	100
Colorado	0	0	0	0	0	0	0
Comal	0	0	0	0	0	0	0
DeWitt	0	0	0	0	0	0	0
Fayette	11,701	15,000	20,000	25,000	40,000	40,000	45,000
Frio	38	400	400	400	400	400	400
Goliad	12,165	15,000	15,000	20,000	20,000	20,000	20,000
Gonzales	0	0	0	0	0	0	0
Guadalupe	0	0	0	0	0	0	0
Hays	0	0	0	0	0	0	0
Karnes	0	0	0	0	0	0	0
Kendall	0	0	0	0	0	0	0
Kerr	0	0	0	0	0	0	0
Lee	0	0	0	0	0	0	0
Llano	937	1,000	2,000	2,000	2,000	2,000	2,000
Matagorda	35,915	35,000	35,000	35,000	35,000	35,000	35,000
Medina	0	0	0	0	0	0	0
Refugio	0	0	0	0	0	0	0
San Saba	0	0	0	0	0	0	0
Travis	6,198	7,000	7,000	7,000	7,000	7,000	10,000
Uvalde	0	0	0	0	0	0	0
Victoria	887	8,000	10,000	10,000	10,000	10,000	10,000
Wharton	0	0	0	0	0	0	0
Wilson	0	0	0	0	0	0	0
Zavala	0	0	0	0	0	0	0
Total	101,169	134,000	145,500	159,500	179,500	187,500	208,500
Dimmitt*	0	0	0	0	0	0	0
Edwards*	0	0	0	0	0	0	0
Kinney*	0	0	0	0	0	0	0
LaSalle*	0	0	0	0	0	0	0
Maverick*	0	0	0	0	0	0	0
Real*	0	0	0	0	0	0	0
Webb*	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).

◇◇◇◇



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

STEAM-ELECTRIC POWER WATER DEMAND PROJECTIONS 32 COUNTY WEST CENTRAL STUDY AREA

FIGURE 2-7

(This page intentionally left blank)

2.2.1.4 Irrigation Water Demand Projections for the 32-County Study Area

Irrigation is done in practically all of the counties of the study area, with large acreages, and consequently large quantities of water used in the coastal counties (Wharton, Matagorda, Colorado, and Calhoun), the Winter Garden area (Zavala, Frio, and Uvalde Counties), the western Edwards Aquifer area (Bexar, Medina, and Uvalde Counties), and in Atascosa and Wilson Counties (Table 2-7). The sources of irrigation water for the coastal counties are diversions from the Colorado, Guadalupe, and San Antonio rivers and groundwater from the Gulf Coast Aquifer. The sources for the Winter Garden area are the Edwards and Carrizo Aquifers, with small quantities from the Nueces River. The sources for Bexar and Medina counties are the Edwards Aquifer and Medina and Diversion Lakes (the Medina River). Uvalde County irrigation is supplied from the Edwards Aquifer. Atascosa and Wilson County irrigation is supplied largely from the Carrizo Aquifer, with some water obtained from streams which flow through the counties. Irrigation water for other counties of the study area is obtained from both ground and surface water sources.

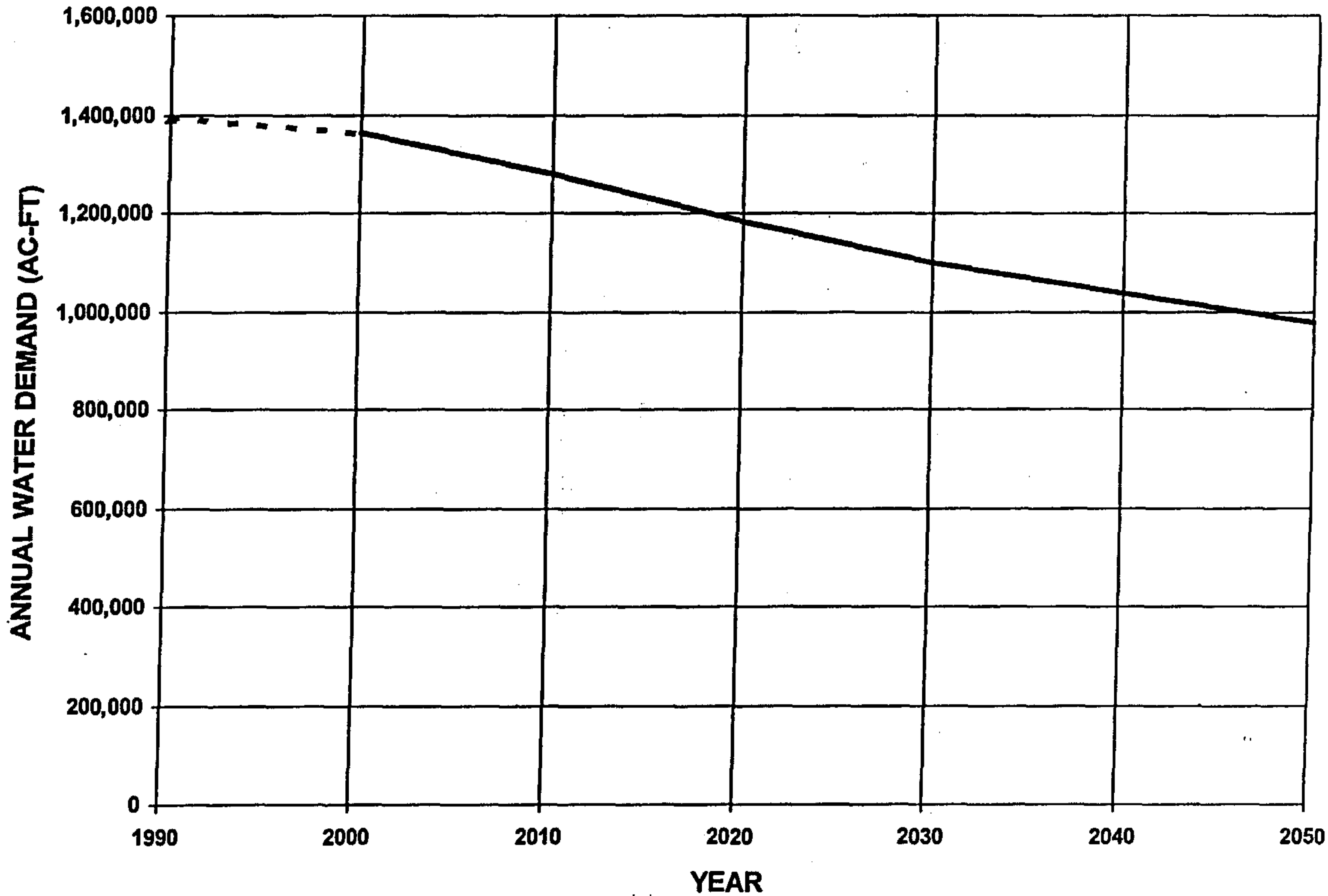
In 1990, irrigation water use in the study area from all sources was estimated at 1,393,123 acft (Table 2-7 and Figure 2-8). Irrigation water demand is projected to decline to 1.38 million acft in 2000, 1.19 million acft in 2020, and 987,648 in 2050. The projected decline is anticipated to occur due to improved application efficiency, canal lining and pipeline installation to reduce losses between the river bank diversion points and the fields, and reduced federal farm programs for some irrigated crops.

Table 2-7							
Irrigation Water Demand Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
	Use in	**Projections**					
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
Atascosa	47,208	45,415	43,691	42,032	40,436	38,900	37,423
Bandera	290	277	265	254	243	232	222
Bastrop	645	559	484	419	363	314	272
Bexar	37,012	40,003	36,879	35,320	33,827	32,397	31,026
Blanco	483	457	432	409	387	366	346
Burnet	300	292	285	277	270	263	257
Caldwell	1,375	1,215	1,073	948	837	739	653
Calhoun	35,421	26,822	22,747	19,950	17,673	16,132	15,028
Colorado	216,480	204,222	189,784	168,881	150,767	140,108	130,205
Comal	479	459	440	421	404	387	370
DeWitt	285	256	229	206	185	166	148
Fayette	400	372	345	321	298	277	258
Frio	83,233	79,688	76,294	73,045	69,933	66,955	64,103
Goliad	685	560	458	374	306	250	205
Gonzales	3,540	3,019	2,574	2,195	1,871	1,596	1,361
Guadalupe	2,646	2,501	2,364	2,234	2,111	1,996	1,886
Hays	320	316	312	308	305	301	297
Karnes	2,034	1,818	1,624	1,451	1,297	1,159	1,035
Kendall	380	364	348	333	319	305	292
Kerr	850	822	796	770	745	721	697
Lee	283	273	264	255	246	238	230
Llano	1,122	1,092	1,064	1,036	1,008	982	956
Matagorda	195,542	180,708	168,521	149,698	136,030	126,853	118,298
Medina	157,380	166,623	154,910	148,259	141,895	135,803	129,974
Refugio	0	0	0	0	0	0	0
San Saba	5,734	5,502	5,279	5,065	4,859	4,663	4,474
Travis	800	731	667	609	557	508	464
Uvalde	140,669	135,067	129,689	124,524	119,566	114,804	110,233
Victoria	13,699	10,783	8,488	6,681	5,259	4,140	3,259
Wharton	319,209	331,308	309,071	282,082	257,978	240,662	224,510
Wilson	13,697	12,071	10,638	9,376	8,263	7,282	6,419
Zavala	110,922	122,307	119,831	116,220	111,543	107,055	102,747
Total	1,393,123	1,375,901	1,289,845	1,193,953	1,109,781	1,046,553	987,648
Dimmitt*	11,185	10,551	10,199	9,932	9,828	9,432	9,026
Edwards*	0	0	0	0	0	0	0
Kinney*	201	192	184	176	168	161	154
LaSalle*	7,292	7,063	6,841	6,626	6,418	6,217	6,021
Maverick*	5,269	5,060	4,861	4,669	4,485	4,308	4,138
Real*	872	834	798	763	729	698	667
Webb*	0	0	0	0	0	0	0
Total	24,819	23,700	22,883	22,166	21,628	20,816	20,006

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall, aggressive adoption of irrigation technology, and reduction in federal farm programs by one-half.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

IRRIGATION WATER DEMAND PROJECTIONS 32 COUNTY WEST CENTRAL STUDY AREA

FIGURE 2-8

(This page intentionally left blank)

2.2.1.5 Mining Water Demand Projections for the 32-County Study Area

Mining is done in all of the counties, with the largest quantities of water use in Colorado, Wharton, Victoria, Travis, Bexar and Williamson Counties (Table 2-8). Estimated mining water use in 1990 was 45,928 acft, with projected use for the period 2010 to 2030 dropping to a range of 35,736 to 41,629 acft per year (Table 2-8 and Figure 2-9). The decline is due to a projected decline in water flooding for petroleum recovery. The 1996 consensus projections, with conservation, at year 2050 is 41,629 acft. The growth in mining after 2030 is due to growth in sand, gravel, and limestone quarrying in the San Antonio and Austin areas.

2.2.1.6 Livestock Water Demand Projections for the 32-County Study Area

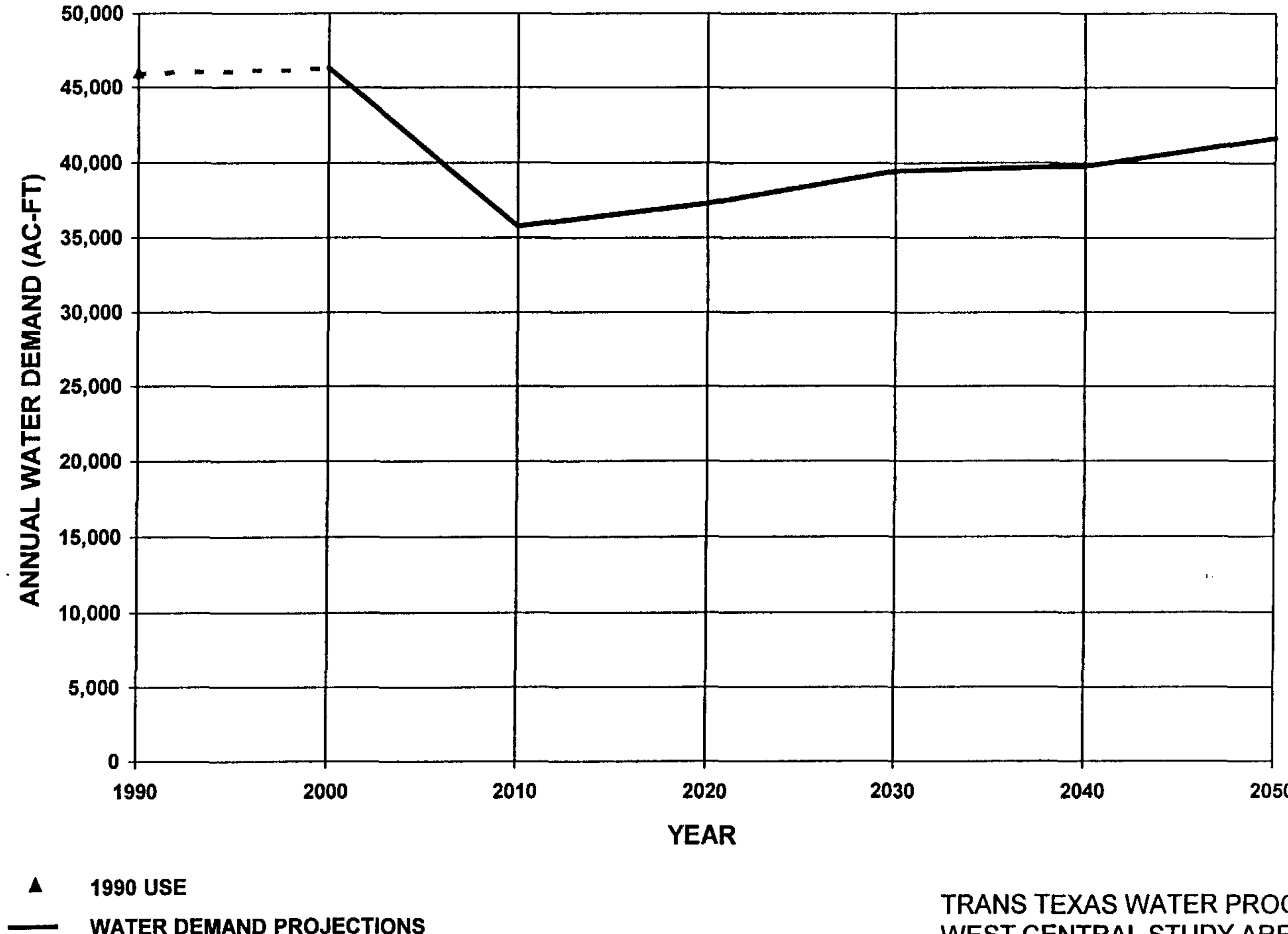
Livestock production is done throughout the study area, with the predominant activity being grazing of beef and goats. Poultry production is concentrated in Gonzales County. Estimated livestock water use in 1990 was 36,367 acft with projections of 40,177 for 2000 through 2050 (Table 2-9 and Figure 2-10). The TWDB projection method for livestock water requirements estimates the maximum grazing capacity for rangeland in each county and computes the quantity of water needed by livestock for this grazing capacity. Thus, in areas where range livestock production predominates, the projection reaches its upper limit and is held constant thereafter.

Table 2-8							
Mining Water Demand Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
	Use in	**Projections**					
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
Atascosa	945	1,740	1,680	1,751	1,842	1,948	2,068
Bandera	20	25	25	26	27	27	27
Bastrop	16	56	46	38	33	34	43
Bexar	1,591	4,963	4,936	5,201	5,406	5,645	5,962
Blanco	0	13	9	5	1	0	0
Burnet	936	1,013	987	1,006	1,028	1,058	1,091
Caldwell	27	21	16	10	4	0	0
Calhoun	1	20	15	9	5	2	2
Colorado	31,967	20,486	11,378	12,334	13,473	14,926	16,677
Comal	946	5,570	5,464	5,628	5,796	3,590	2,224
DeWitt	129	161	106	70	50	44	44
Fayette	7	29	22	21	10	6	3
Frio	313	150	63	32	16	7	3
Goliad	0	17	12	6	3	0	0
Gonzales	21	41	37	33	29	29	30
Guadalupe	8	196	198	200	202	207	213
Hays	0	96	90	72	56	37	28
Karnes	187	155	65	27	18	10	4
Kendall	0	13	9	5	1	0	0
Kerr	73	176	122	110	103	102	105
Lee	0	30	21	13	5	1	0
Llano	65	143	112	99	95	92	95
Matagorda	250	299	256	245	242	242	249
Medina	120	143	128	128	129	132	136
Refugio	77	44	26	19	11	4	4
San Saba	86	172	133	124	123	122	126
Travis	2,288	4,880	4,746	5,246	5,791	6,407	7,116
Uvalde	399	444	428	499	576	666	777
Victoria	2,409	2,578	2,028	1,732	1,714	1,720	1,862
Wharton	2,650	2,374	2,431	2,502	2,568	2,641	2,720
Wilson	281	193	105	62	39	30	20
Zavala	116	97	42	25	8	2	0
Total	45,928	46,338	35,736	37,278	39,404	39,731	41,629
Dimmitt*	506	1,003	817	906	916	926	950
Edwards*	0	0	0	0	0	0	0
Kinney*	0	0	0	0	0	0	0
LaSalle*	0	0	0	0	0	0	0
Maverick*	184	80	40	20	10	5	3
Real*	0	0	0	0	0	0	0
Webb*	0	0	0	0	0	0	0
Total*	690	1,083	857	926	926	931	953

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall, and advanced water conservation.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).



TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

HDR

HDR Engineering, Inc.

MINING WATER DEMAND PROJECTIONS 32 COUNTY WEST CENTRAL STUDY AREA

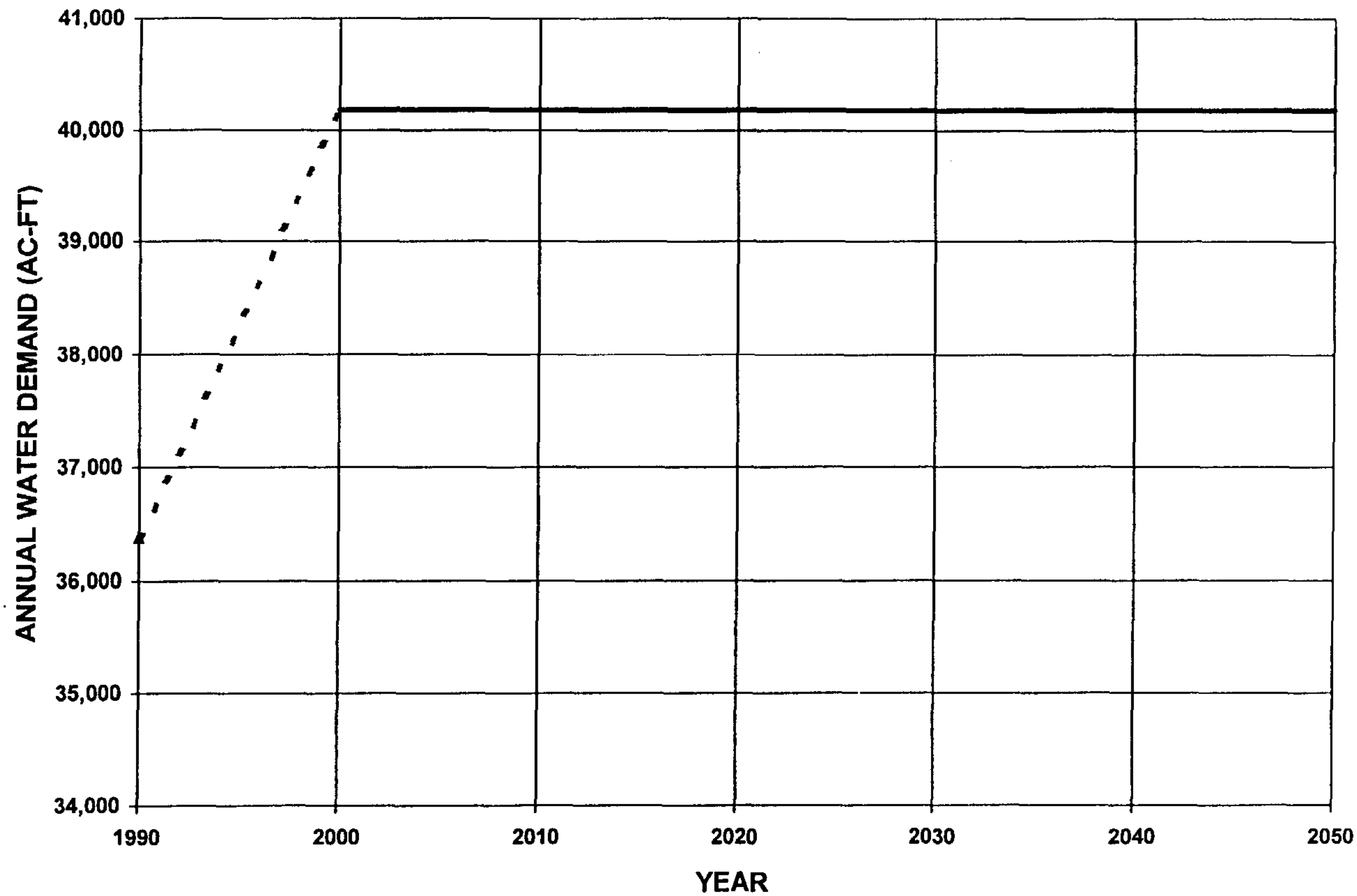
FIGURE 2-9

Table 2-9							
Livestock Water Demand Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
	Use in	**Projections**					
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
Atascosa	1,613	1,808	1,808	1,808	1,808	1,808	1,808
Bandera	325	333	333	333	333	333	333
Bastrop	1,431	1,525	1,525	1,525	1,525	1,525	1,525
Bexar	1,376	1,487	1,487	1,487	1,487	1,487	1,487
Blanco	553	670	670	670	670	670	670
Burnet	820	794	794	794	794	794	794
Caldwell	816	835	835	835	835	835	835
Calhoun	291	304	304	304	304	304	304
Colorado	1,395	1,447	1,447	1,447	1,447	1,447	1,447
Comal	316	356	356	356	356	356	356
DeWitt	1,840	1,896	1,896	1,896	1,896	1,896	1,896
Fayette	2,036	2,619	2,619	2,619	2,619	2,619	2,619
Frio	1,097	1,192	1,192	1,192	1,192	1,192	1,192
Goliad	884	1,208	1,208	1,208	1,208	1,208	1,208
Gonzales	4,108	5,064	5,064	5,064	5,064	5,064	5,064
Guadalupe	1,031	1,132	1,132	1,132	1,132	1,132	1,132
Hays	676	484	484	484	484	484	484
Karnes	1,371	1,339	1,339	1,339	1,339	1,339	1,339
Kendall	389	512	512	512	512	512	512
Kerr	382	526	526	526	526	526	526
Lee	1,398	1,711	1,711	1,711	1,711	1,711	1,711
Llano	908	689	689	689	689	689	689
Matagorda	1,120	1,023	1,023	1,023	1,023	1,023	1,023
Medina	1,560	1,914	1,914	1,914	1,914	1,914	1,914
Refugio	563	407	407	407	407	407	407
San Saba	1,121	1,200	1,200	1,200	1,200	1,200	1,200
Travis	942	906	906	906	906	906	906
Uvalde	994	1,494	1,494	1,494	1,494	1,494	1,494
Victoria	1,271	1,398	1,398	1,398	1,398	1,398	1,398
Wharton	1,213	1,118	1,118	1,118	1,118	1,118	1,118
Wilson	1,813	1,905	1,905	1,905	1,905	1,905	1,905
Zavala	714	881	881	881	881	881	881
Total	36,367	40,177	40,177	40,177	40,177	40,177	40,177
Dimmitt*	795	621	621	621	621	621	621
Edwards*	228	254	254	254	254	254	254
Kinney*	261	283	283	283	283	283	283
LaSalle*	988	1,077	1,077	1,077	1,077	1,077	1,077
Maverick*	526	527	527	527	527	527	527
Real*	196	146	146	146	146	146	146
Webb*	880	477	477	477	477	477	477
Total*	3,874	3,385	3,385	3,385	3,385	3,385	3,385

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall, and advanced water conservation.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

LIVESTOCK WATER DEMAND PROJECTIONS
32 COUNTY WEST CENTRAL STUDY AREA

FIGURE 2-10

(This page intentionally left blank)

2.2.1.7 Total Water Demand Projections for the 32-County Study Area

In previous sections, projections of future water demands have been tabulated for each of the major water using functions of the 32-county area; i.e., municipal, industrial, steam-electric power generation, irrigation, mining, and livestock water. In this section, the totals of all uses projected for each county are shown along with the sum for the 32-counties (Table 2-10).

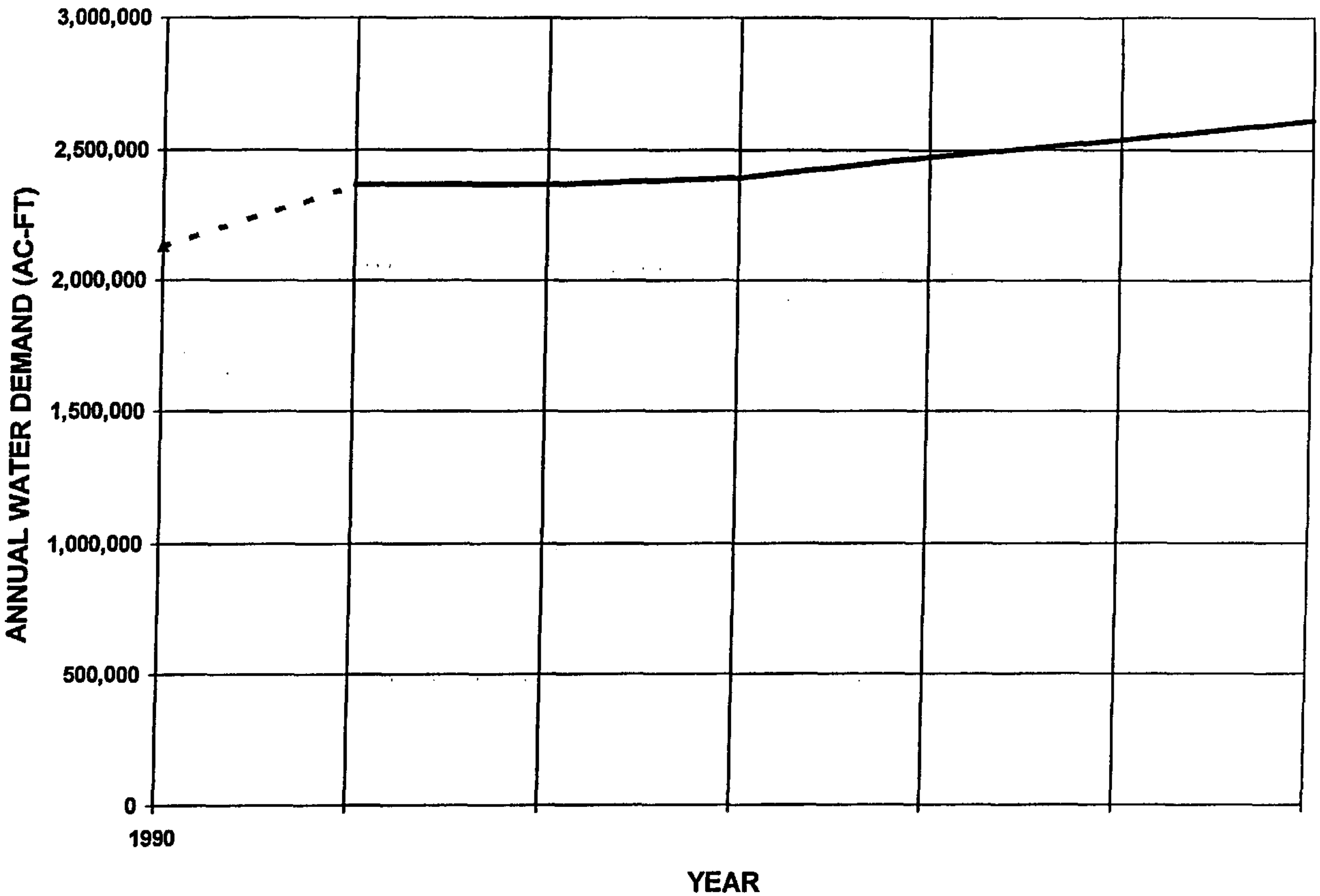
Water use in 1990 was 2,133,894 acft for the 32-county area, with 15.5 percent in Wharton County, 14 percent in Bexar County, 12 percent in each of Matagorda and Colorado counties, 7.5 percent in Medina County, 6.7 percent in Uvalde County, 6.0 percent in Travis County, and 5.2 percent in Zavala County (Table 2-10). The TWDB 1996 consensus water planning projection of water demand for below normal precipitation with advanced conservation for the 32-county area is approximately 2.37 million acft in 2000, 2.39 million acft in 2020, and 2.61 million acft in 2050 (Table 2-10 and Figure 2-11).

Table 2-10							
Total Water Demand Projections--32 County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
	Use in	**Projections**					
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
Atascosa	61,472	68,208	66,820	65,595	64,893	67,034	73,134
Bandera	2,080	2,476	2,547	2,736	2,951	3,187	3,452
Bastrop	11,333	14,869	19,310	20,370	21,848	22,739	23,665
Bexar	303,917	405,322	437,610	485,382	550,408	611,487	657,922
Blanco	1,940	2,287	2,332	2,389	2,474	2,499	2,460
Burnet	6,698	7,648	8,134	8,709	9,461	9,807	10,168
Caldwell	7,149	7,873	8,030	8,181	8,463	8,283	8,136
Calhoun	64,225	94,668	105,194	110,849	118,199	127,027	137,116
Colorado	253,847	230,377	206,791	186,870	170,071	161,018	153,009
Comal	15,404	28,422	32,527	38,640	46,924	51,994	58,528
DeWitt	5,901	6,035	5,827	5,718	5,836	5,989	6,152
Fayette	17,571	21,689	26,712	31,881	47,253	47,668	53,193
Frio	87,726	84,940	81,564	78,339	75,354	72,487	69,722
Goliad	14,650	17,713	17,569	22,446	22,373	22,326	22,330
Gonzales	12,366	12,932	12,396	11,948	11,636	11,477	11,370
Guadalupe	14,973	21,069	23,598	26,510	31,610	35,372	40,116
Hays	12,998	17,929	20,992	23,799	28,616	34,137	38,765
Karnes	6,049	6,194	5,749	5,584	5,558	5,546	5,537
Kendall	2,901	3,462	3,569	3,690	3,972	4,298	4,665
Kerr	7,259	9,881	10,553	11,283	12,282	12,766	12,988
Lee	4,677	5,141	5,173	5,217	5,387	5,587	5,817
Llano	5,520	5,721	6,495	6,424	6,383	6,432	6,590
Matagorda	244,859	230,248	218,603	200,130	187,135	179,131	171,854
Medina	164,600	176,094	164,583	158,107	152,131	146,307	140,833
Refugio	1,867	1,779	1,708	1,646	1,616	1,588	1,561
San Saba	8,213	8,473	8,069	7,725	7,463	7,226	7,001
Travis	131,280	193,165	213,238	244,696	283,241	306,671	338,507
Uvalde	147,897	144,315	139,328	134,509	130,355	126,341	122,592
Victoria	49,843	59,887	63,506	64,350	66,219	70,214	74,836
Wharton	329,686	341,786	319,523	292,663	269,018	252,226	236,654
Wilson	19,586	19,249	17,977	16,883	16,050	15,398	15,048
Zavala	115,407	127,466	124,955	121,282	116,726	112,471	108,462
Total	2,133,894	2,377,318	2,380,981	2,404,551	2,481,906	2,546,732	2,622,184
Dimmitt*	14,691	15,116	14,810	14,858	15,211	15,300	15,445
Edwards*	334	362	362	361	365	367	370
Kinney*	522	599	594	584	561	539	518
LaSalle*	9,513	9,512	9,309	9,095	8,917	8,753	8,584
Maverick*	6,021	5,728	5,492	5,281	5,091	4,914	4,752
Real*	1,568	1,539	1,469	1,418	1,396	1,378	1,364
Webb*	931	718	781	848	958	981	1,126
Total*	33,580	33,574	32,817	32,445	32,499	32,232	32,159

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall, and advanced water conservation.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

TOTAL WATER DEMAND PROJECTIONS 32 COUNTY WEST CENTRAL STUDY AREA

FIGURE 2-11

(This page intentionally left blank)

2.2.2 Water Demand Projections for the Edwards Aquifer Area

The TWDB 1996 consensus water planning municipal water demand projections are shown in tabular form for cities and counties of the Edwards Aquifer area, as defined in Senate Bill 1477, 1993 Texas Legislature (Figure 2-1). The projections are also shown in tabular and graphic form for counties of the Edwards Aquifer area for industrial, steam-electric power, irrigation, mining, livestock, and total water demand. Only the municipal water demand projections are available at the city level.

2.2.2.1 Municipal Water Demand Projections for Cities and Counties of the Edwards Aquifer Area

In 1990, reported municipal water use in cities and rural areas of the Edwards Aquifer area was 259,568 acft (Table 2-11 and Figure 2-12). Projected municipal water demand for the area, under dry weather conditions, with advanced water conservation, is 354,705 acft in 2000, 442,906 acft in 2020, and 626,492 acft in 2050 (Table 2-11 and Figure 2-12). The projections for individual cities can be seen in Table 2-11.

Table 2-11
Municipal Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

Basin/County/Water Utility	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
ATASCOSA COUNTY (part)							
Nueces Basin							
Lytle	336	559	600	635	701	754	811
BEXAR COUNTY (all)							
San Antonio Basin							
San Antonio	166,616	220,405	242,339	272,507	312,695	349,957	391,640
Balcones Heights	538	731	739	759	798	843	885
Terrell Hills	817	1,090	1,056	1,054	1,070	1,063	1,050
Olmos Park	385	519	520	530	553	579	603
Helotes	310	360	387	415	494	534	577
Leon Valley	1,715	2,288	2,135	1,958	1,956	1,954	2,040
Alamo Heights	2,210	2,799	2,732	2,686	2,706	2,728	2,742
Converse	1,213	2,127	2,837	3,529	4,498	5,365	6,456
Fair Oaks Ranch	617	774	894	1,005	1,240	1,452	1,700
Kirby	1,080	1,586	1,693	1,839	2,099	2,343	2,614
Live Oak Water Public Utility	1,221	1,101	1,141	1,389	1,554	1,738	2,200
Schertz (Part)	60	116	140	152	162	186	222
Schertz (Outside City) Estimated	607	819	1,031	1,243	1,455	1,667	1,880
Shavano Park	840	1,088	1,163	1,192	1,232	1,284	1,342
St. Hedwig	187	200	215	230	275	318	367
Universal City	2,323	3,386	3,748	4,186	4,864	5,491	6,200

Continued Next Page

Table 2-11 continued

Basin/County/Water Utility	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Windcrest (WC&ID No. 10)	1,329	1,675	1,663	1,665	1,687	1,713	1,731
Castle Hills(BMWD)	1,311	1,714	1,743	1,765	1,786	1,769	1,751
Somerset(BMWD)	215	220	225	230	235	237	240
Hill Country/HollywPark(BMWD)	2,174	2,395	5,633	2,901	3,307	3,664	4,079
BMWD(Subdvisions) Estimated	20,741	27,999	34,024	39,841	46,235	52,910	56,821
Remainder of County	18,786	31,641	31,341	38,488	47,088	53,853	42,701
Total	225,295	305,033	337,399	379,564	437,989	491,648	529,841
MEDINA COUNTY (all)							
Nueces Basin							
Devine	630	953	943	940	964	987	1,005
Hondo	1,456	2,032	2,092	2,164	2,263	2,327	2,393
Lytle	73	92	89	87	88	90	92
Natalia	294	397	408	422	440	452	464
Rural	1,535	1,961	2,038	2,075	2,197	2,272	2,416
Subtotal	3,988	5,435	5,570	5,688	5,952	6,128	6,370
San Antonio Basin							
Castroville	779	958	985	1,013	1,061	1,092	1,123
Lacoste	229	278	299	300	326	345	365
Rural	258	441	458	466	493	509	540
Subtotal	1,266	1,677	1,742	1,779	1,880	1,946	2,028
Total	5,254	7,112	7,312	7,467	7,832	8,074	8,398

Continued Next Page

Table 2-11 continued

Basin/County/Water Utility		Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
UVALDE COUNTY (all)								
Nueces Basin								
Sabinal		381	510	546	573	632	683	739
Uvalde		3,915	5,173	5,621	5,921	6,610	7,198	7,871
Rural		982	1,027	907	823	777	737	661
	Total	5,278	6,710	7,074	7,317	8,019	8,618	9,271
COMAL COUNTY (part)								
Guadalupe Basin								
Garden Ridge		361	564	672	799	1,038	1,253	1,511
New Braunfels		6,199	10,335	12,570	15,436	19,499	22,447	25,717
Rural	(0.08 of Co. rural)	210	447	554	723	932	1,155	1,393
Subtotal		6,770	11,346	13,796	16,958	21,469	24,855	28,621
San Antonio Basin								
Schertz (Part)		19	40	56	78	100	141	186
Rural	(0.026 0f Co rural)	172	207	243	286	337	422	509
Subtotal		191	247	299	364	437	563	695
	Total	6,961	11,592	14,095	17,322	21,906	25,418	29,316
HAYS COUNTY (part)								
Guadalupe Basin								
Kyle		326	353	337	339	376	435	504
San Marcos		6,321	8,431	9,385	10,453	12,394	14,808	17,691
Rural	(0.26 0f Co rural)	773	1,292	1,635	1,919	2,373	2,861	3,115
	Total	7,420	10,076	11,357	12,711	15,143	18,104	21,310

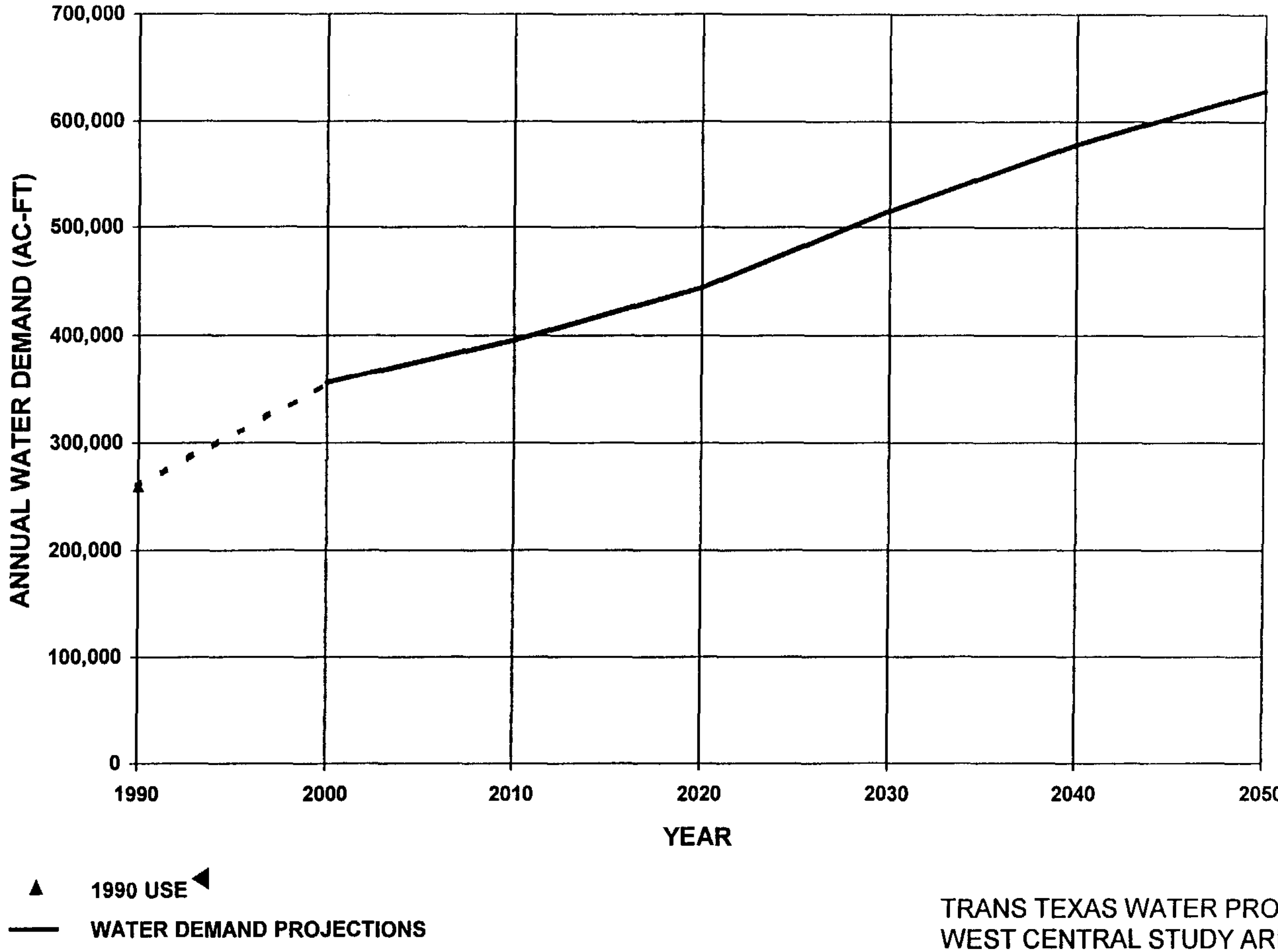
Continued Next Page

Table 2-11 continued

Basin/County/Water Utility	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
GUADALUPE COUNTY (part)							
Guadalupe Basin							
New Braunfels (part)	55	75	84	98	139	155	171
Rural (0.66 of Co rural)	2,649	4,257	5,238	6,110	7,601	8,379	9,407
Subtotal	2,704	4,332	5,322	6,208	7,740	8,534	9,578
San Antonio Basin							
Cibolo	178	308	307	313	346	392	424
Schertz (Part)	1,454	2,680	3,217	3,851	5,016	6,490	8,411
Rural	819	1,807	2,268	2,663	3,308	3,675	4,140
Subtotal	2,451	4,795	5,792	6,827	8,670	10,557	12,975
Total	5,155	9,127	11,114	13,035	16,410	19,091	22,553
CALDWELL COUNTY (part)							
Guadalupe Basin							
Lockhart	1,816	2,003	2,162	2,303	2,499	2,496	2,492
Luling	1,207	1,306	1,235	1,164	1,149	1,066	1,003
Rural (0.50 of Co rural)	846	1,186	1,288	1,388	1,491	1,495	1,498
Total	3,869	4,495	4,685	4,855	5,139	5,057	4,993
Edwards Aquifer Area Total*	259,568	354,705	393,637	442,906	513,139	576,764	626,492

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.

2-50



TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

HDR Engineering, Inc.

MUNICIPAL WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-12

2.2.2.2 Industrial Water Demand Projections for Counties of the Edwards Aquifer Area

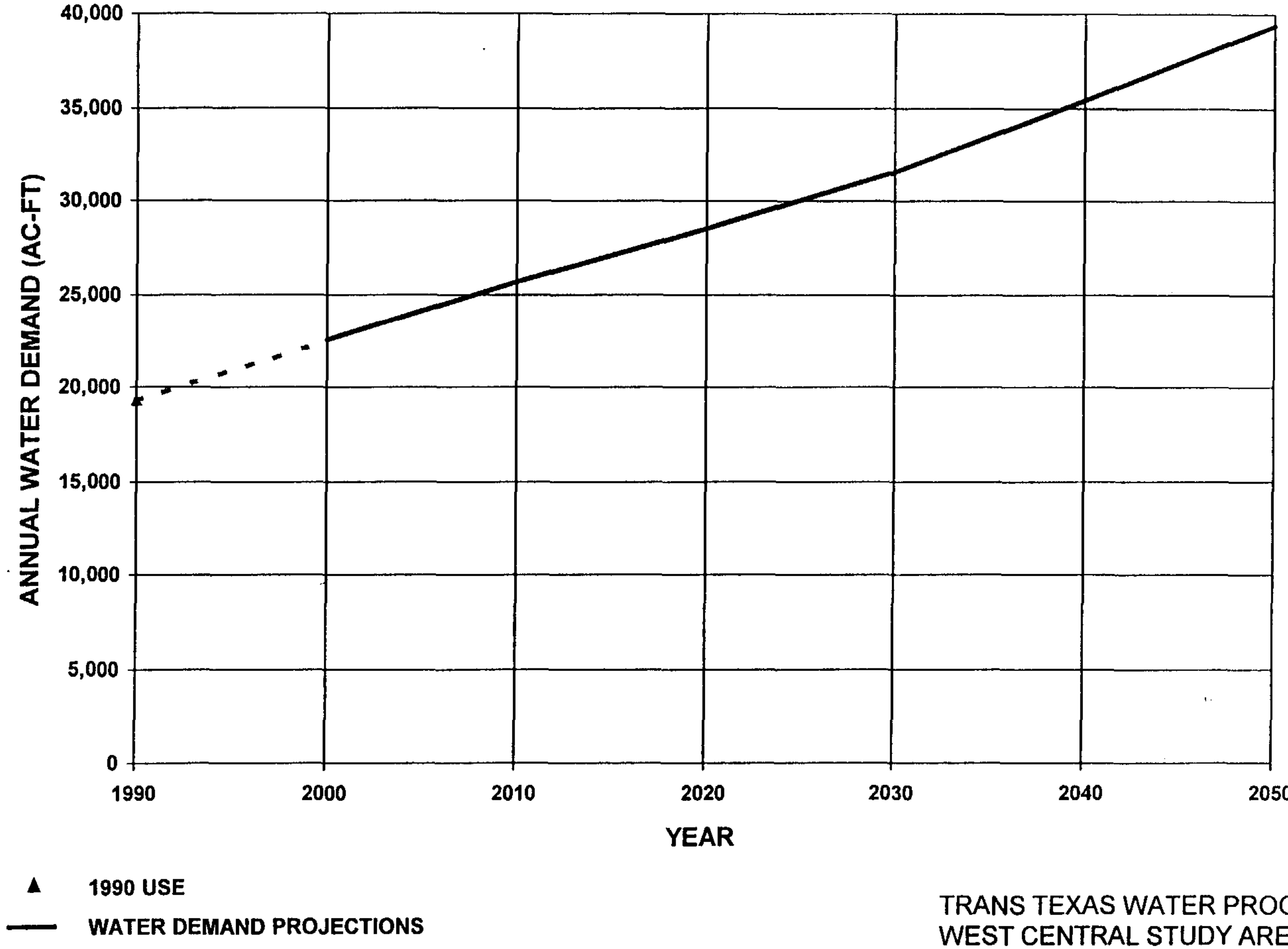
Industrial water use in the Edwards Aquifer area in 1990 was reported at 19,264 acft and is projected to increase to 22,480 acft in 2000, 28,552 acft in 2020, and 39,352 acft in 2050 (Table 2-12 and Figure 2-14). Industrial water use is located primarily in Bexar, Comal, Hays, and Guadalupe counties. However, there is some industrial water use in all the other Edwards Aquifer area counties, except Caldwell. It should be noted that a part of the industrial water use is for electric power generation for use within manufacturing plants (primarily cement plants) located within the area.

Table 2-12
Industrial Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

County	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Atascosa (part)	0	0	0	0	0	0	0
Bexar (all)	14,049	16,805	19,682	22,359	24,935	28,264	31,697
Medina (all)	286	302	319	339	361	384	411
Uvalde (all)	557	600	643	675	700	759	817
Comal (part)	3,248	3,450	3,487	3,548	3,799	4,071	4,351
Hays (part)	293	381	445	507	564	620	677
Guadalupe (part)	831	942	1,051	1,124	1,193	1,295	1,399
Caldwell (part)	0	0	0	0	0	0	0
Total	19,264	22,480	25,627	28,552	31,552	35,393	39,352

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.

*As specified in Senate Bill 1477, Texas Legislature, 73rd Session, 1993, as amended.



TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

HDR Engineering, Inc.

INDUSTRIAL WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-13

2.2.2.3 Steam-Electric Power Water Demand Projections for Counties of the Edwards Aquifer Area

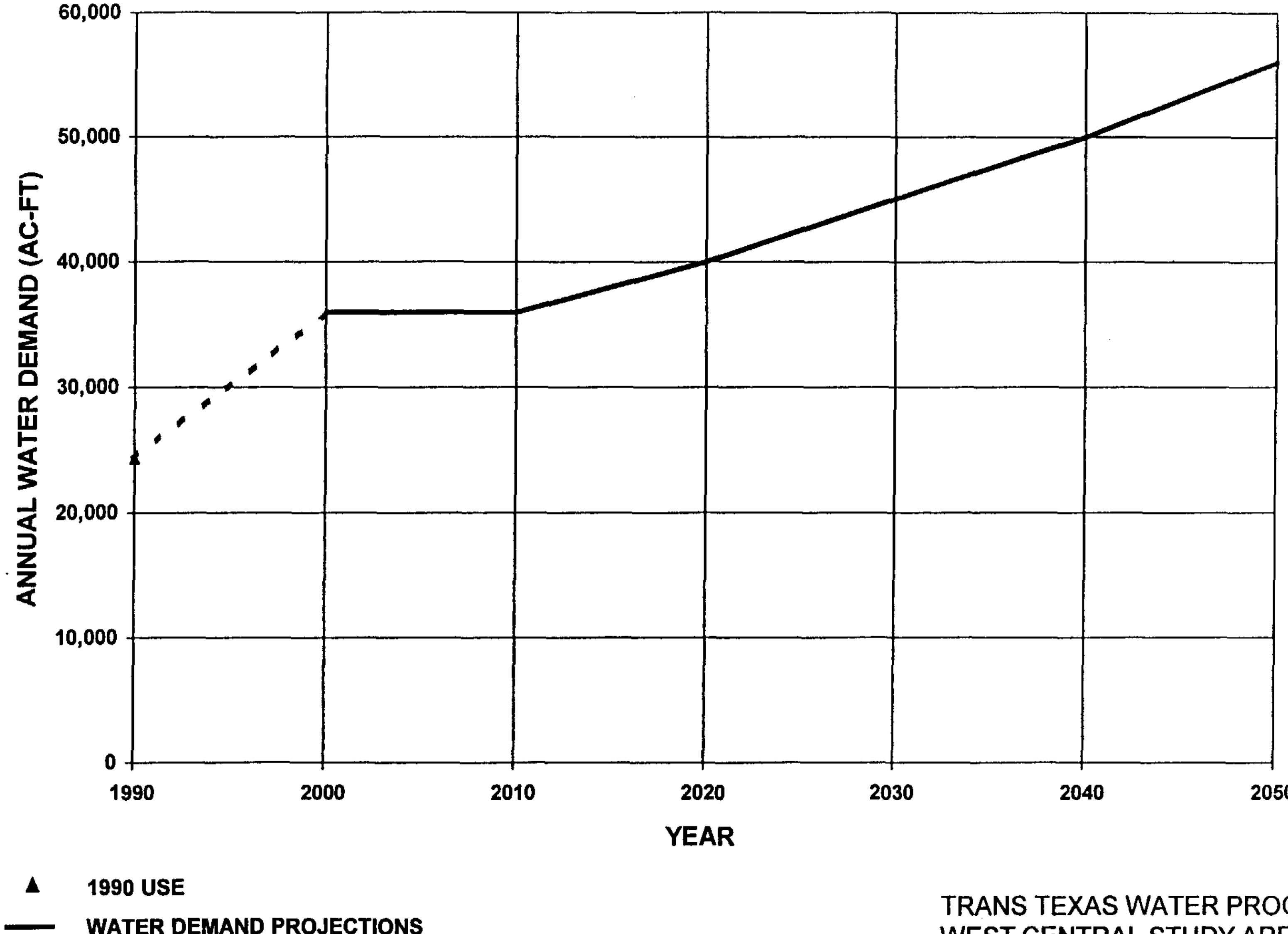
The only steam-electric power generation within the Edwards Aquifer area for production of electricity for distribution through electric utilities to private and public customers is located in Bexar County. In 1990, reported water use for steam-electric power generation was 24,263 acft. The 1996 consensus water planning projected demands, with advanced water conservation, are 36,000 acft in 2000, 46,000 acft in 2020, and 56,000 acft in 2050 (Table 2-13 and Figure 2-14). The projected demands level off after 2030 since at this time there are no plans for the addition of electric power generating capacity within the area. This could change however, as growth in population occurs. It should be noted, however, that the Edwards Aquifer area is also served electricity from hydroelectric plants located on the Guadalupe River and from steam-electric power plants that are located outside the area. Water demands for plants located outside the area are included in water demand projections of the areas where the power plants are located.

Table 2-13
Steam-Electric Power Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

County	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Atascosa (part)	0	0	0	0	0	0	0
Bexar (all)	24,263	36,000	36,000	40,000	45,000	50,000	56,000
Medina (all)	0	0	0	0	0	0	0
Uvalde (all)	0	0	0	0	0	0	0
Comal (part)	0	0	0	0	0	0	0
Hays (part)	0	0	0	0	0	0	0
Guadalupe (part)	0	0	0	0	0	0	0
Caldwell (part)	0	0	0	0	0	0	0
Total	24,263	36,000	36,000	40,000	45,000	50,000	56,000

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.

(This page intentionally left blank)



HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

STEAM-ELECTRIC WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-14

(This page intentionally left blank)

2.2.2.4 Irrigation Water Demand Projections for Counties of the Edwards Aquifer Area

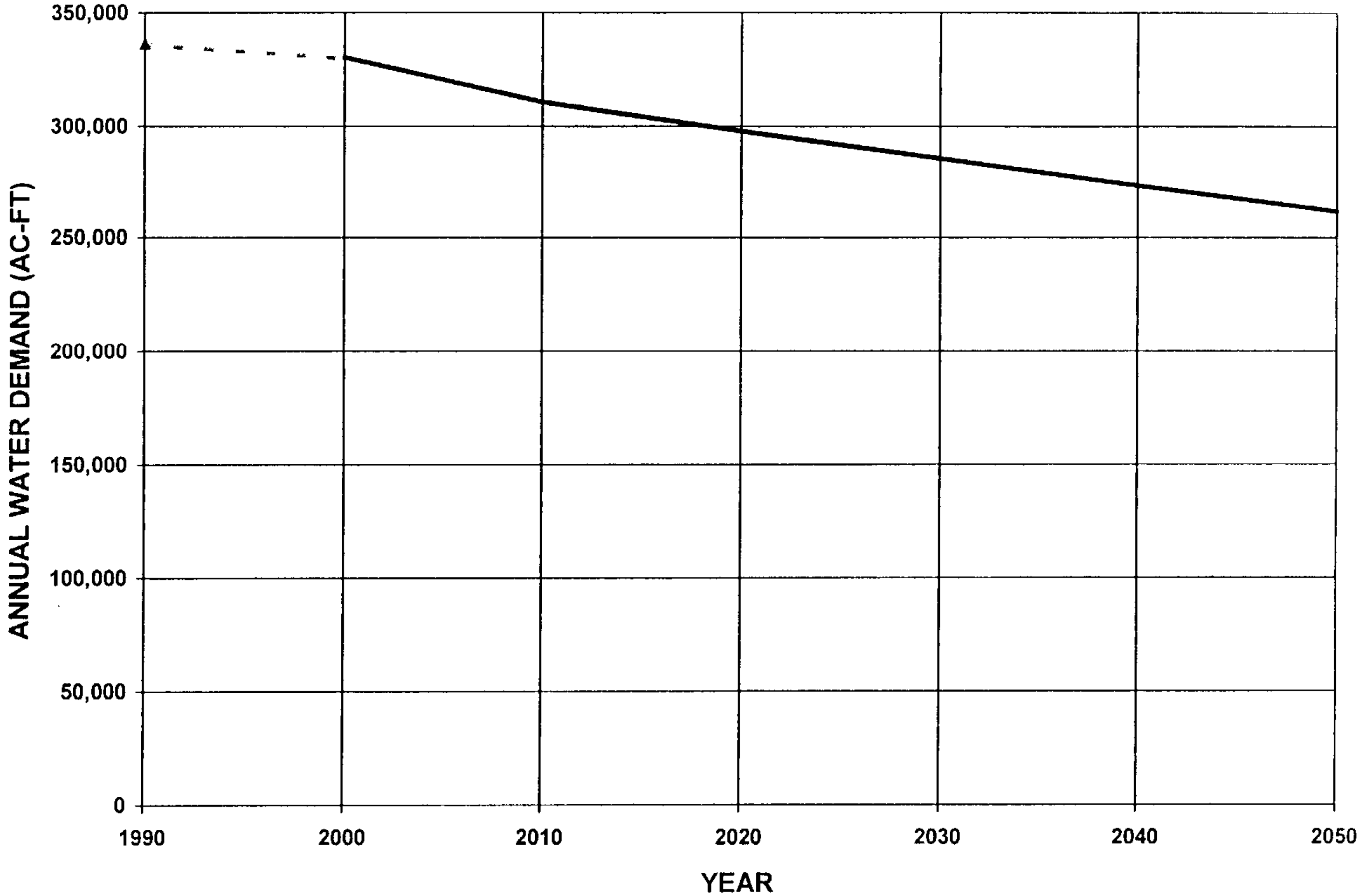
Irrigation within the Edwards Aquifer area is located in Atascosa, Bexar, Medina, and Uvalde counties. The sources of irrigation water are the Edwards Aquifer and the Medina and Nueces Rivers.

Estimated irrigation water use in the area in 1990 was 336,525 acft, with 1996 consensus water planning projections showing a reduction to 343,135 acft in 2000, 309,390 acft in 2020, and 272,373 acft in 2050 (Table 2-14 and Figure 2-15). The projections are declining due to improved irrigation efficiency and reduced acreages due to poor economic conditions expected for agricultural irrigation over the long run.

Table 2-14
Irrigation Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

County	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Atascosa (part)	1,464	1,442	1,341	1,287	1,235	1,186	1,140
Bexar (all)	37,012	40,003	36,879	35,320	33,827	32,397	31,026
Medina (all)	157,380	166,623	154,910	148,259	141,895	135,803	129,974
Uvalde (all)	140,669	135,067	129,689	124,524	119,566	114,804	110,233
Comal (part)	0	0	0	0	0	0	0
Hays (part)	0	0	0	0	0	0	0
Guadalupe (part)	0	0	0	0	0	0	0
Caldwell (part)	0	0	0	0	0	0	0
Total	336,525	343,135	322,819	309,390	296,523	284,190	272,373

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation;(Series 3 irrigation; aggressive adoption of irrigation technology, and a reduction in Federal Farm Programs by one-half).
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.



▲ 1990 USE

— WATER DEMAND PROJECTIONS

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

IRRIGATION WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-15

(This page intentionally left blank)

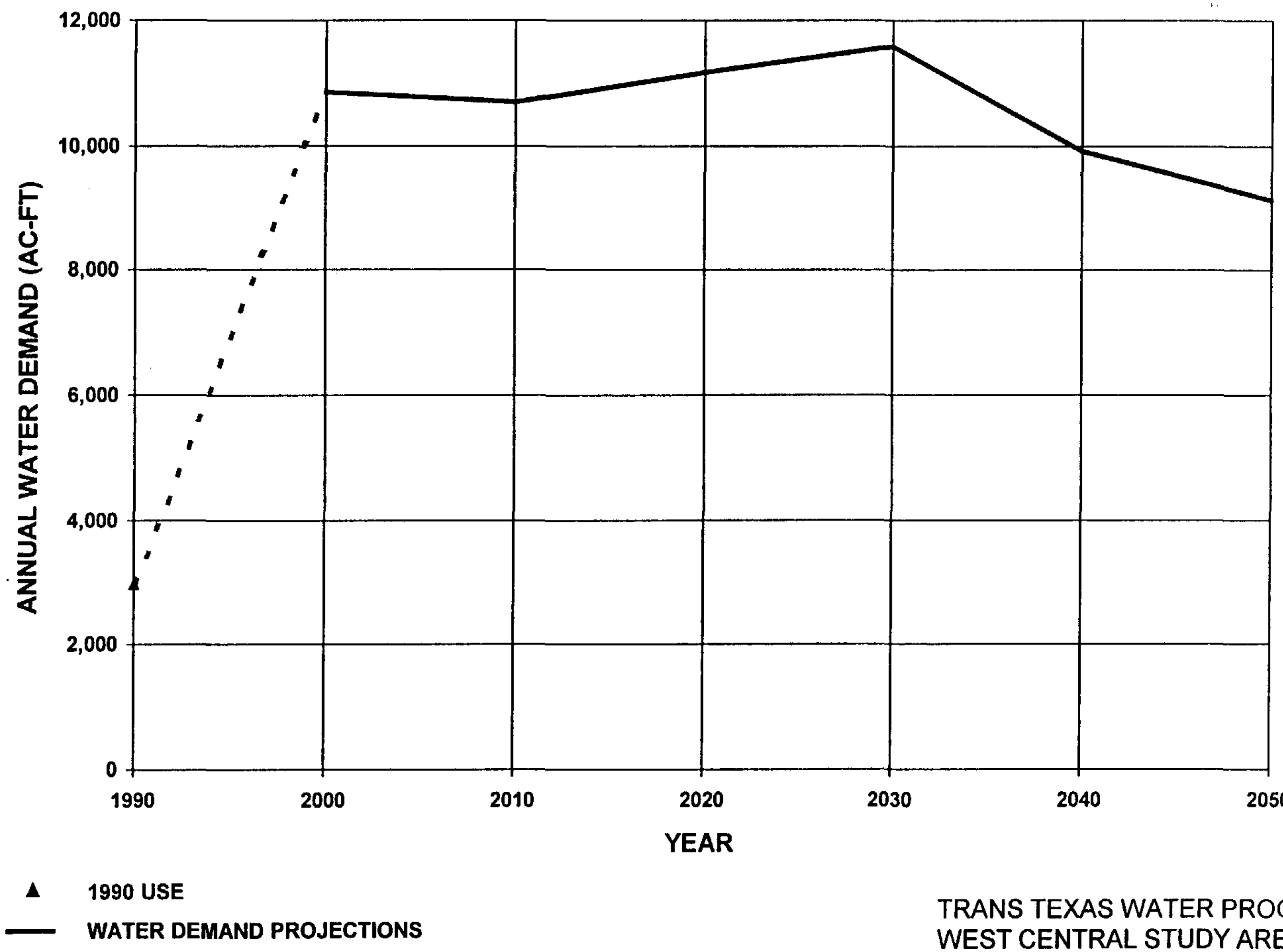
2.2.2.5 Mining Water Demand Projections for Counties of the Edwards Aquifer Area

The mining activities of the Edwards Aquifer area are primarily for quarrying of stone, clay, sand, and gravel materials. Reported water use within the area in 1990 was 2,969 acft, with projections of demand for these purposes being 10,855 acft in 2000, 11,165 acft in 2020, and 9,118 acft in 2050 (Table 2-15 and Figure 2-16). The largest concentrations of mining activities are projected for Bexar and Comal counties. Since the mining water demand is for stone and building materials, use in 1990 was lower than normal due to poor economic conditions in the construction industries. As the economy picks up, these industries will return to a higher level of employment and production and will use more water. The projections for 2000 and beyond reflect this.

Table 2-15
Mining Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

County	Total Use in 1990 acft	Projections					
		2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Atascosa (part)	0	0	0	0	0	0	0
Bexar (all)	1,591	4,963	4,936	5,201	5,406	5,645	5,962
Medina (all)	120	143	128	128	129	132	136
Uvalde (all)	399	444	428	499	576	666	777
Comal (part)	851	5,013	4,918	5,065	5,216	3,231	2,002
Hays (part)	0	96	90	72	56	37	28
Guadalupe (part)	8	196	198	200	202	207	213
Caldwell (part)	0	0	0	0	0	0	0
Total	2,969	10,855	10,698	11,165	11,585	9,918	9,118

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.



TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

HDR Engineering, Inc.

MINING WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-16

(This page intentionally left blank)

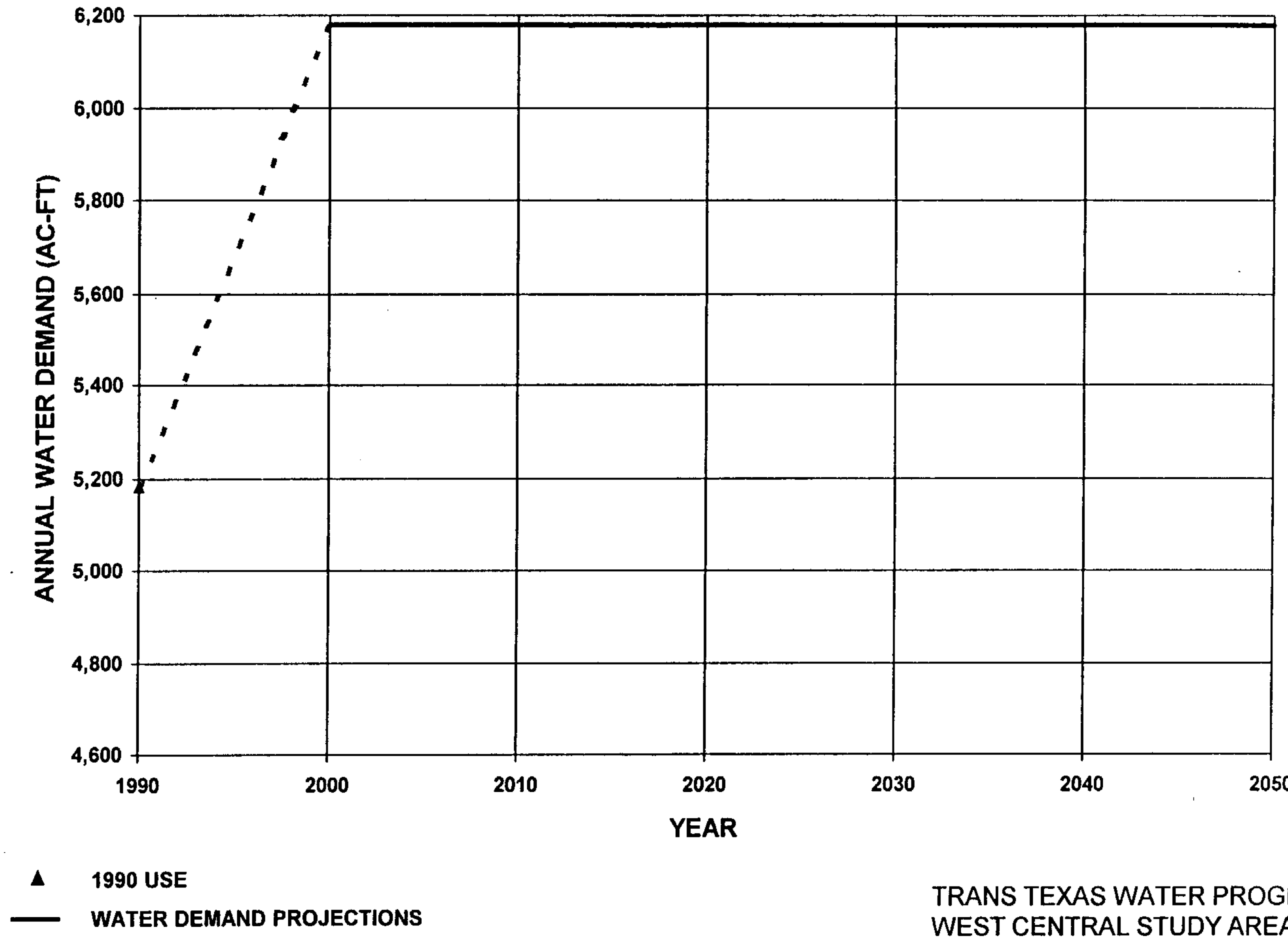
2.2.2.6 Livestock Water Demand Projections for Counties of the Edwards Aquifer Area

Livestock production, including beef, goats, horses for pleasure, dairy and poultry is done throughout the Edwards Aquifer area. Estimated water use for livestock purposes within the area in 1990 was 5,181 acft, and is projected to increase to its maximum level of 6,178 acre feet annually in 2000 and for planning purposes is held constant at that level to 2050 (Table 2-16 and Figure 2-17).

Table 2-16
Livestock Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

County	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Atascosa (part)	2	2	2	2	2	2	2
Bexar (all)	1,376	1,487	1,487	1,487	1,487	1,487	1,487
Medina (all)	1,560	1,914	1,914	1,914	1,914	1,914	1,914
Uvalde (all)	994	1,494	1,494	1,494	1,494	1,494	1,494
Comal (part)	158	178	178	178	178	178	178
Hays (part)	169	121	121	121	121	121	121
Guadalupe (part)	516	566	566	566	566	566	566
Caldwell (part)	406	416	416	416	416	416	416
Total	5,181	6,178	6,178	6,178	6,178	6,178	6,178

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.



TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

HDR Engineering, Inc.

LIVESTOCK WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-17

(This page intentionally left blank)

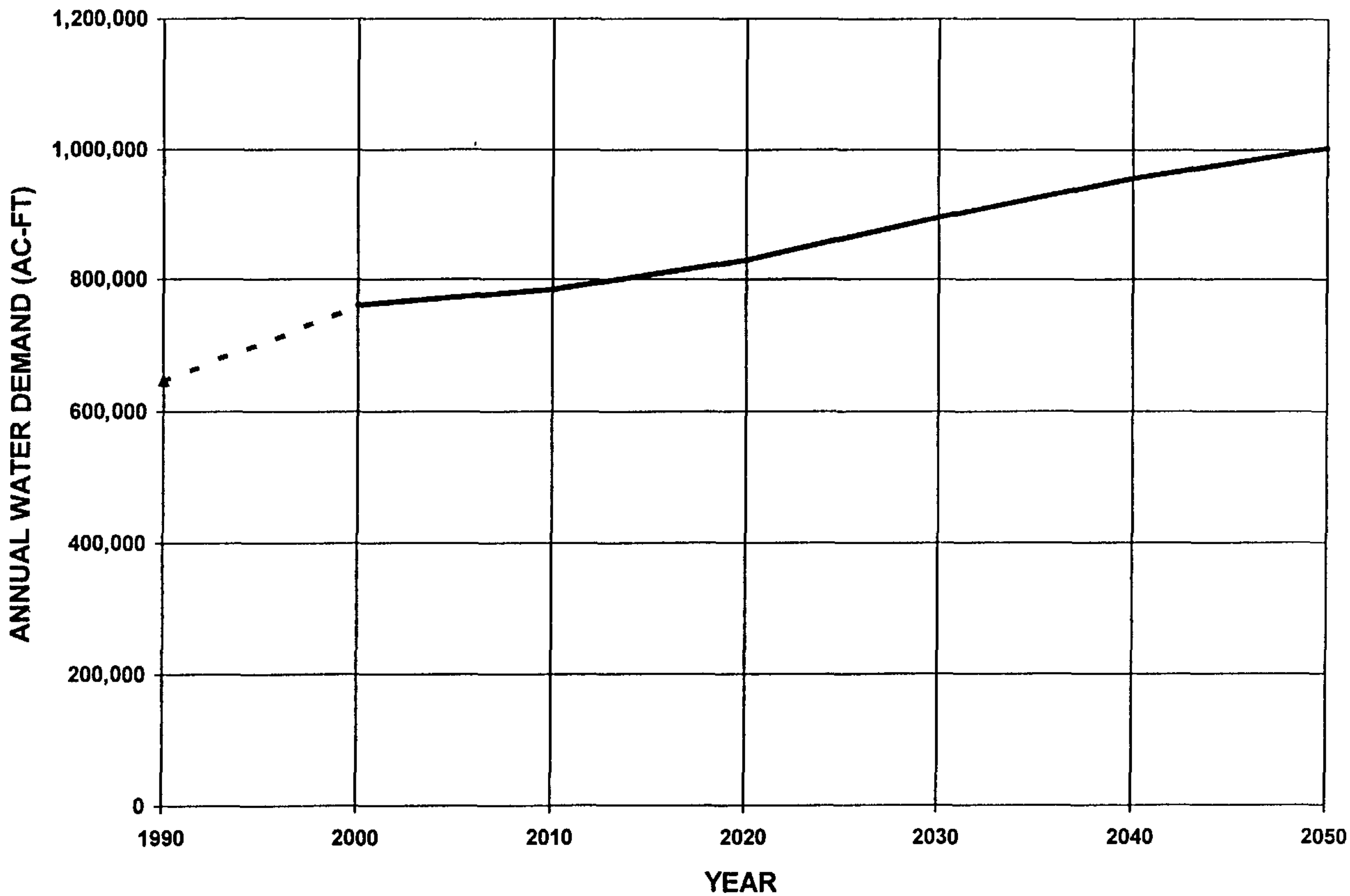
2.2.2.7 Total Water Demand Projections for Counties of the Edwards Aquifer Area

The sum of water used for all purposes within the Edwards Aquifer area in 1990 was 647,769 acft. TWDB's 1996 consensus water planning projected total water demands for the area, with advanced water conservation, in 2000 is 773,352 acft, in 2020 is 838,191 acft, and in 2050 is 1,009,512 acft (Table 2-17 and Figure 2-18).

Table 2-17
Total Water Demand Projections
Edwards Aquifer Area*
West Central Trans-Texas Study Area
Trans-Texas Water Program

County	Total Use in 1990 acft	Projections 2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft
Atascosa (part)	1,802	2,003	1,943	1,924	1,938	1,942	1,953
Bexar (all)	303,586	404,291	436,383	483,931	548,644	609,441	656,013
Medina (all)	164,600	176,094	164,583	158,107	152,131	146,307	140,833
Uvalde (all)	147,897	144,315	139,328	134,509	130,355	126,341	122,592
Comal (part)	11,218	20,233	22,678	26,114	31,099	32,898	35,847
Hays (part)	7,882	10,674	12,013	13,411	15,884	18,882	22,136
Guadalupe (part)	6,509	10,831	12,929	14,925	18,371	21,159	24,730
Caldwell (part)	4,275	4,911	5,101	5,271	5,555	5,473	5,409
Total	647,769	773,352	794,959	838,191	903,976	962,443	1,009,512

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.
*As specified in Senate Bill 1477, Texas Legislature, 73rd Session,1993, as amended.



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

TOTAL WATER DEMAND PROJECTIONS COUNTIES OFTHE EDWARDS AQUIFER AREA

FIGURE 2-18

(This page intentionally left blank)

2.2.3 Water Demand Projections for River Basins and Adjacent Areas

In Section 2.1.3, Table 2-3, the population projections for the 32-county study area were summarized and tabulated for each of the Nueces, San Antonio, Guadalupe, and Lower Colorado Basins. Since parts of some study area counties are located in areas adjacent to river basin boundaries, the adjacent areas were grouped with the appropriate study area river basin in order to include an appropriate portion of the water needs of these adjacent areas. In the following sections, the water demand projections of the 32 counties of the study area are grouped and presented for the respective study area river basins and their associated or adjacent areas (see Figure 2-1 for basin boundaries). In this way, the projected demands upon the individual basins can be compared to the respective basins' water supplies for purposes of calculating shortages and/or surpluses for the basins.

2.2.3.1 Municipal Water Demand Projections for River Basins and Adjacent Areas

In 1990, municipal water use of the 32-county study area was 474,326 acft, of which 20,844 acft (4 percent) was used in the Nueces River Basin, 240,233 acft (51 percent) was used within the San Antonio Basin, 52,958 acft (11 percent) was used within the Guadalupe Basin, 137,421 acft (29 percent) was used within the Lower Colorado River Authority's service area within the Colorado Basin, and 22,870 acft (5 percent) was used in all other coastal and inland areas of the study area that are adjacent to the main river basin boundaries (Table 2-18, column one). Projected municipal water demands at year 2050 for the 32-county study area are 1,116,317 acft (Table 2-18) with 566,752 acft (50.7 percent) for the San Antonio Basin (Figure 2-19). Projected year 2050 municipal water demands for the area within the boundaries of the Lower Colorado Basin are 352,036 acft (31 percent). Within the Guadalupe and Nueces River Basins, projected year 2050 demands total 132,368 acft (12 percent) and 34,728 acft (3 percent) respectively. Projected year 2050 water use in all other coastal and inland areas of the study area total 30,489 acft (3 percent).

Table 2-18							
Municipal Water Demand Projections for River Basins--32-County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
		Projections					
River Basin	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
NUECES							
Study Area In-Basin[1]	20,844	27,000	28,119	29,019	31,340	33,214	34,728
7-County Area[2]	4,194	5,395	5,681	5,956	6,547	7,086	7,800
SAN ANTONIO							
Total In-Basin	240,233	325,199	359,369	403,907	466,116	523,715	566,696
Adj. Area[3]	59	58	55	53	52	53	56
Study Area Subtotal	240,292	325,257	359,424	403,960	466,168	523,768	566,752
GUADALUPE							
Total In-Basin	52,958	72,755	80,452	90,010	105,514	118,610	132,368
Adj. Area[4]	8,139	9,141	9,133	9,218	9,747	10,320	11,054
Study Area Subtotal	61,097	81,896	89,585	99,228	115,261	128,930	143,422
LOWER COLORADO							
Total In-Basin	137,421	203,174	224,376	256,904	297,763	322,532	352,036
Adj. Coastal Area[5]	10,904	11,773	11,692	11,855	12,703	13,681	14,803
Area Subtotal	148,325	214,947	236,068	268,759	310,466	336,213	366,839
Adj. Inland Area[6]	3,768	906	1,591	2,413	3,391	4,095	4,576
Study Area Subtotal	152,093	215,853	237,659	271,172	313,857	340,308	371,415
Study Area Subtotal[7]	470,558	649,100	713,196	800,966	923,235	1,022,125	1,111,741
Study Area Total	474,326	650,006	714,787	803,379	926,626	1,026,220	1,116,317

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall,and advanced water conservation.

[1]Counties of Nueces Basin included in study area (Uvalde, Medina, Zavala, Frio, Atascosa, and parts of Bexar, Wilson, and Karnes Counties).

[2] Parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties of the Nueces Basin, but not included in the West Central Trans-Texas study area.

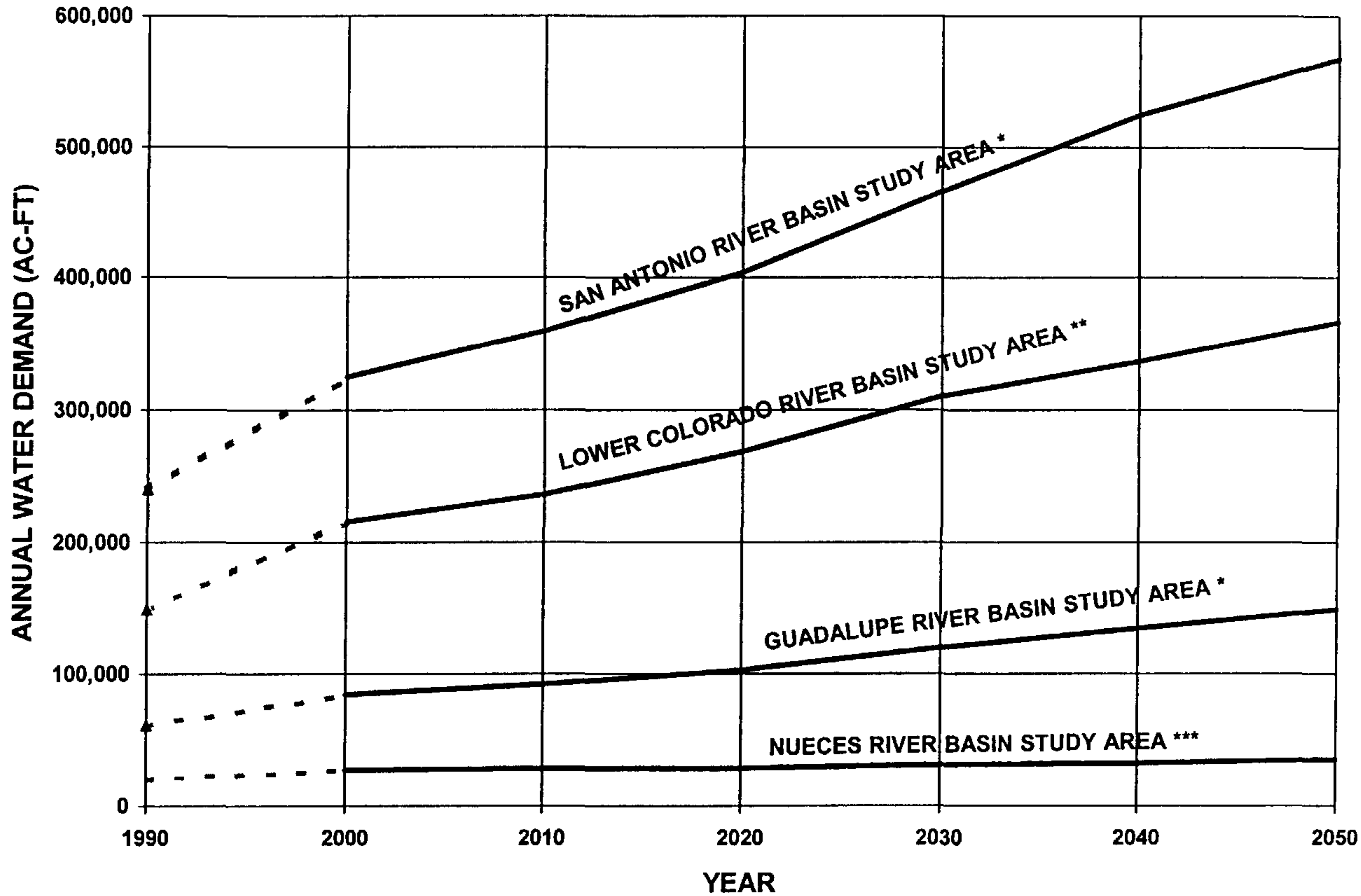
[3] Part of Goliad County located in adjacent San Antonio -Nueces Coastal Basin.

[4] Part of Victoria County located in adjacent Lavaca-Guadalupe Coastal Basin, plus all of Refugio and Calhoun Counties.

[5] Parts of Colorado, Matagorda, and Wharton Counties located in adjacent coastal basins, and obtain a part of their water supply from the Colorado River.

[6] Parts of Burnet, Bastrop, and Lee Counties located in the adjacent Brazos Basin.

[7] Does not include parts of Burnet, Bastrop, and Lee counties located in the adjacent Brazos Basin.



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

* In basin plus adjacent areas that obtain water from the basin.

** In basin plus adjacent coastal areas that obtain water from the Colorado Basin. Does not include parts of study area counties located in the Brazos Basin.

*** Includes only study area counties of the Nueces Basin.

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

MUNICIPAL WATER DEMAND PROJECTIONS RIVER BASIN STUDY AREAS

FIGURE 2-19

(This page intentionally left blank)

2.2.3.2 Industrial Water Demand Projections for River Basins and Adjacent Areas

In 1990, industrial water use was 82,981 acft in the 32-county study area, of which 56,310 acft (68 percent) was located within the boundaries of the Nueces, San Antonio, Guadalupe and Lower Colorado Basins (Table 2-19, column one). The 1996 consensus water planning projections, with advanced conservation, of industrial water demand for the period 2000 through 2050, are shown in Table 2-19 and Figure 2-20 for basins and areas adjacent to each basin for the 32-county study area, with the total for year 2050 at 227,912 acft/yr.

Table 2-19							
Industrial Water Demand Projections for River Basins--32-County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
		Projections					
River Basin	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
NUECES							
Study Area In-Basin[1]	2,149	2,320	2,482	2,611	2,719	2,942	3,164
7-County Area[2]	3	11	11	12	13	14	15
SAN ANTONIO							
Total In-Basin	14,323	17,105	20,008	22,698	25,283	28,630	32,092
Adj. Area[3]	0	0	0	0	0	0	0
Study Area Subtotal	14,323	17,105	20,008	22,698	25,283	28,630	32,092
GUADALUPE							
Total In-Basin	26,263	31,086	35,853	38,923	42,970	46,871	51,855
Adj. Area[4]	24,539	63,026	77,588	85,949	95,240	105,236	115,958
Study Area Subtotal	50,802	94,112	113,441	124,872	138,210	152,107	167,813
LOWER COLORADO							
Total In-Basin	13,575	15,043	16,519	17,523	17,591	20,082	21,884
Adj. Coastal Area[5]	2,082	2,263	2,431	2,501	2,552	2,723	2,889
Area Subtotal	15,657	17,306	18,950	20,024	20,143	22,805	24,773
Adj. Inland Area[6]	50	52	55	59	63	67	70
Study Area Subtotal	15,707	17,358	19,005	20,083	20,206	22,872	24,843
Study Area Subtotal	82,931	130,843	154,881	170,205	186,355	206,484	227,842
Study Area Total[7]	82,981	130,895	154,936	170,264	186,418	206,551	227,912

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall,and advanced water conservation.

[1] Counties of Nueces Basin included in study area (Uvalde, Medina, Zavala, Frio, Atascosa, and parts of Bexar, Wilson, and Karnes).

[2] Parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties of the Nueces Basin, but not included in the West Central Trans-Texas study area.

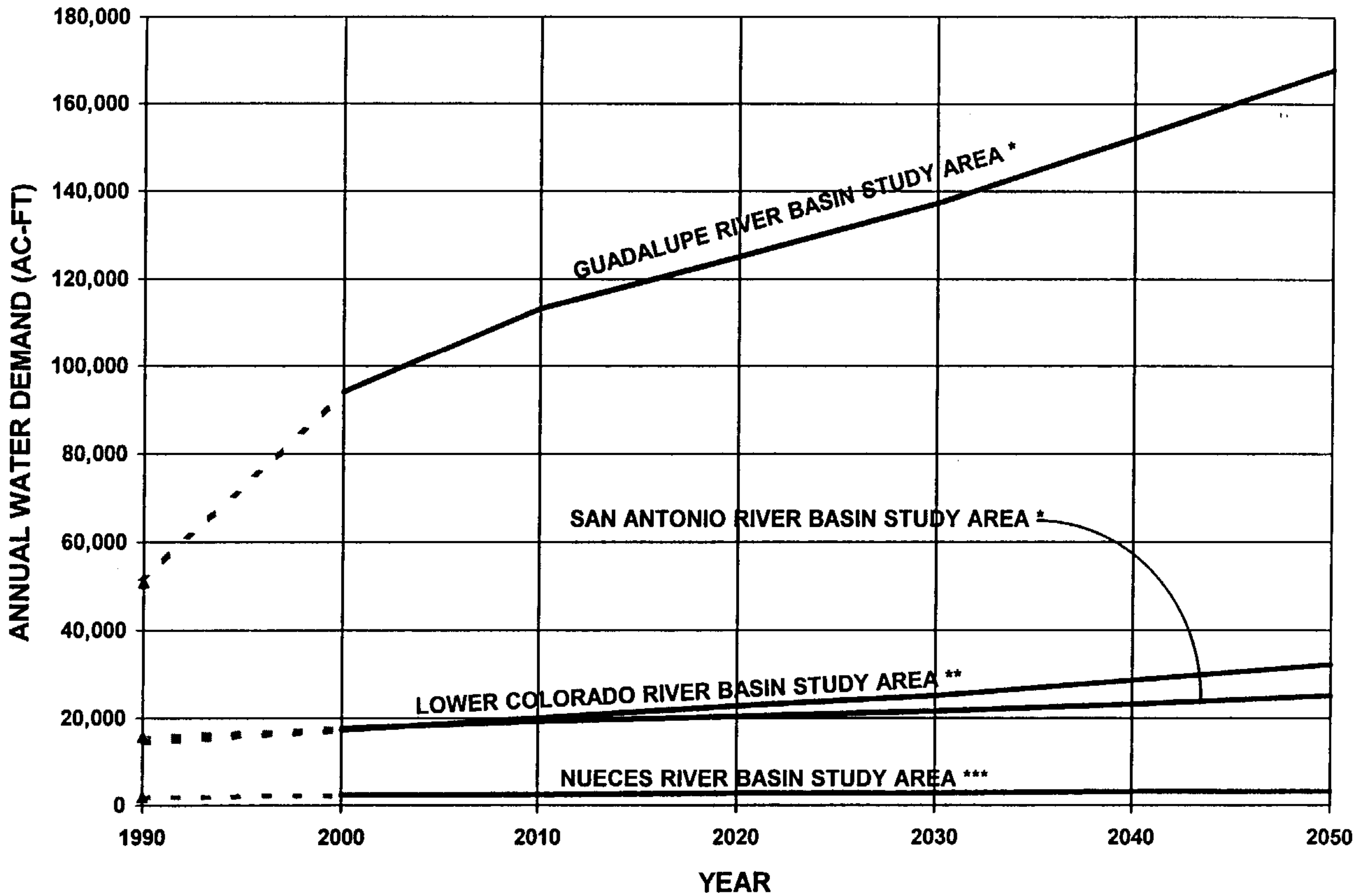
[3] Part of Goliad County located in adjacent San Antonio -Nueces Coastal Basin.

[4] Part of Victoria County located in adjacent Lavaca-Guadalupe Coastal Basin, plus all of Refugio and Calhoun Counties.

[5] Parts of Colorado, Matagorda, and Wharton Counties located in adjacent coastal basins, and obtain a part of their water supply from the Colorado River.

[6] Parts of Burnet, Bastrop, and Lee Counties located in the adjacent Brazos Basin.

[7] Does not include parts of Burnet, Bastrop, and Lee counties located in the adjacent Brazos Basin.



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

* In basin plus adjacent areas that obtain water from the basin.

** In basin plus adjacent coastal areas that obtain water from the Colorado Basin. Does not include parts of study area counties located in the Brazos Basin.

*** Includes only study area counties of the Nueces Basin.

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

INDUSTRIAL WATER DEMAND PROJECTIONS RIVER BASIN STUDY AREAS

FIGURE 2-20

(This page intentionally left blank)

2.2.3.3 Steam-Electric Power Water Demand Projections for River Basins and Adjacent Areas

In 1990, 101,169 acft of water was used (consumed through evaporation) by steam-electric power plants located in the 32-county study area (Table 2-20). The distribution of use among river basins, together with projections of quantities needed for electric power generation in the 2000 - 2050 projection period are shown in Table 2-20 and Figure 2-21. The 1996 consensus water plan projected demand for steam-electric power generation is 208,500 acft/yr in 2050, with 22,400 acft/yr in the Nueces Basin, 56,000 acft/yr in the San Antonio Basin, 30,000 acft/yr in the Guadalupe Basin, and 100,000 acft/yr in the Lower Colorado Basin (Table 2-20 and Figure 2-21).

Table 2-20							
Steam-Electric Water Demand Projections for River Basins--32-County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
		Projections					
River Basin	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
NUECES							
Study Area In-Basin[1]	6,074	12,400	12,400	12,400	12,400	15,400	22,400
7-County Area[2]	0	0	0	0	0	0	0
SAN ANTONIO							
Total In-Basin	24,263	36,000	36,000	40,000	45,000	50,000	56,000
Adj. Area[3]	0	0	0	0	0	0	0
Study Area Subtotal	24,263	36,000	36,000	40,000	45,000	50,000	56,000
GUADALUPE							
Total In-Basin	13,052	23,000	25,000	30,000	30,000	30,000	30,000
Adj. Area[4]	62	100	100	100	100	100	100
Study Area Subtotal	13,114	23,100	25,100	30,100	30,100	30,100	30,100
LOWER COLORADO							
Total In-Basin	57,718	62,500	72,000	77,000	92,000	92,000	100,000
Adj. Coastal Area[5]	0	0	0	0	0	0	0
Area Subtotal	57,718	62,500	72,000	77,000	92,000	92,000	100,000
Adj. Inland Area[6]	0	0	0	0	0	0	0
Study Area Subtotal	57,718	62,500	72,000	77,000	92,000	92,000	100,000
Study Area Subtotal[7]	101,169	134,000	145,500	159,500	179,500	187,500	208,500
Study Area Total	101,169	134,000	145,500	159,500	179,500	187,500	208,500

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall,and advanced water conservation.

[1] Counties of Nueces Basin included in study area (Uvalde, Medina, Zavala, Frio, Atascosa, and parts of Bexar, Wilson, and Karnes).

[2] Parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties of the Nueces Basin, but not included in the West Central Trans-Texas study area.

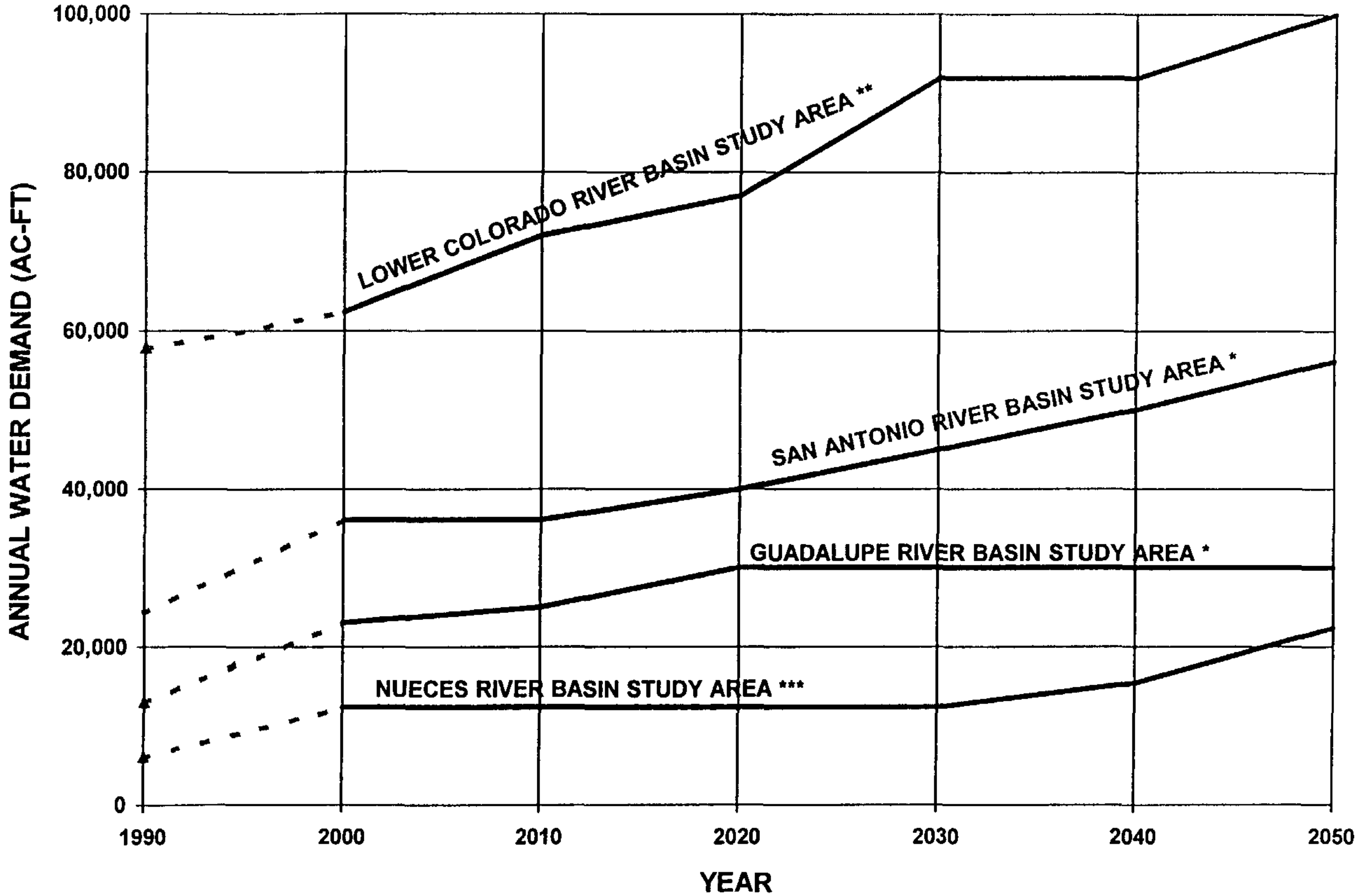
[3] Part of Goliad County located in adjacent San Antonio -Nueces Coastal Basin.

[4] Part of Victoria County located in adjacent Lavaca-Guadalupe Coastal Basin, plus all of Refugio and Calhoun Counties.

[5] Parts of Colorado, Matagorda, and Wharton Counties located in adjacent coastal basins, and obtain a part of their water supply from the Colorado River.

[6] Parts of Burnet, Bastrop, and Lee Counties located in the adjacent Brazos Basin.

[7] Does not include parts of Burnet, Bastrop, and Lee counties located in the adjacent Brazos Basin.



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

* In basin plus adjacent areas that obtain water from the basin.

** In basin plus adjacent coastal areas that obtain water from the Colorado Basin. Does not include parts of study area counties located in the Brazos Basin.

*** Includes only study area counties of the Nueces Basin.

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

STEAM-ELECTRIC WATER DEMAND PROJECTIONS RIVER BASIN STUDY AREAS

FIGURE 2-21

(This page intentionally left blank)

2.2.3.4. Irrigation Water Demand Projections River Basins and Adjacent Areas

Irrigation water use in 1990 was estimated at 1,393,123 acft for the 32-county study area (Table 2-21). Of this total, 521,395 acft (37 percent) were used in the Nueces Basin study area counties (Uvalde, Medina, Atascosa, Zavala, Frio, and parts of Karnes, Wilson, and Bexar counties), 72,393 acft (5 percent) were used in the San Antonio Basin, 58,400 acft (4 percent) were used in the Guadalupe Basin and adjacent areas, and 740,935 acft (53 percent) were used in the Lower Colorado and adjacent areas (Table 2-21). The TWDB 1996 consensus water plan projections, with advanced water conservation, of irrigation water demand in 2050 is 976,912 acft or 30 percent less than was used in 1990. The 2050 projections show 427,381 acft (44 percent) of irrigation water demand in the study area counties of the Nueces Basin, 56,260 acft (5.7 percent) in the San Antonio Basin and adjacent areas, 12,781 acft (1.3 percent) in the Guadalupe Basin and adjacent areas and 480,491 acft (49 percent) in the Lower Colorado Basin and adjacent areas (Table 2-21 and Figure 2-22). The downward trend in irrigation water demand projections is due to the projection of improved irrigation efficiency and declining irrigation acreages that are expected to result from reduced Federal Agricultural programs, and poor economic conditions for irrigation agriculture.

Table 2-21 Irrigation Water Demand Projections for River Basins--32-County West Central Trans-Texas Study Area Trans-Texas Water Program							
		Projections					
River Basin	1990	2000	2010	2020	2030	2040	2050
	acft	acft	acft	acft	acft	acft	acft
NUECES							
Study Area In-Basin[1]	521,395	528,390	504,948	485,204	465,090	445,828	427,381
7-County Area[2]	24,819	24,388	23,437	22,522	21,642	20,802	19,991
SAN ANTONIO							
Total In-Basin	72,393	75,745	69,629	65,936	62,494	59,274	56,260
Adj. Area[3]	0	0	0	0	0	0	0
Study Area Subtotal	72,393	75,745	69,629	65,936	62,494	59,274	56,260
GUADALUPE							
Total In-Basin	11,275	10,274	9,131	8,155	7,316	6,596	5,969
Adj. Area[4]	47,125	36,034	29,998	25,657	22,166	19,669	17,812
Study Area Subtotal	58,400	46,308	39,129	33,812	29,482	26,265	23,781
LOWER COLORADO							
Total In-Basin	118,522	110,417	103,067	95,101	88,015	82,181	76,749
Adj. Coastal Area[5]	622,133	612,572	570,766	511,780	462,720	431,154	401,745
Area Subtotal	740,655	725,192	675,887	608,759	552,487	514,968	480,018
Adj. Inland Area[6]	280	265	253	241	228	218	209
Study Area Subtotal	740,935	725,457	676,140	609,000	552,715	515,186	480,226
Study Area Subtotal[7]	1,392,843	1,375,636	1,289,592	1,193,712	1,109,553	1,046,335	987,439
Study Area Total	1,393,123	1,375,901	1,289,845	1,193,953	1,109,781	1,046,553	987,648

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall,and advanced water conservation.

[1] Counties of Nueces Basin included in study area (Uvalde, Medina, Zavala, Frio, Atascosa, and parts of Bexar, Wilson, and Karnes).

[2] Parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties of the Nueces Basin, but not included in the West Central Trans-Texas study area.

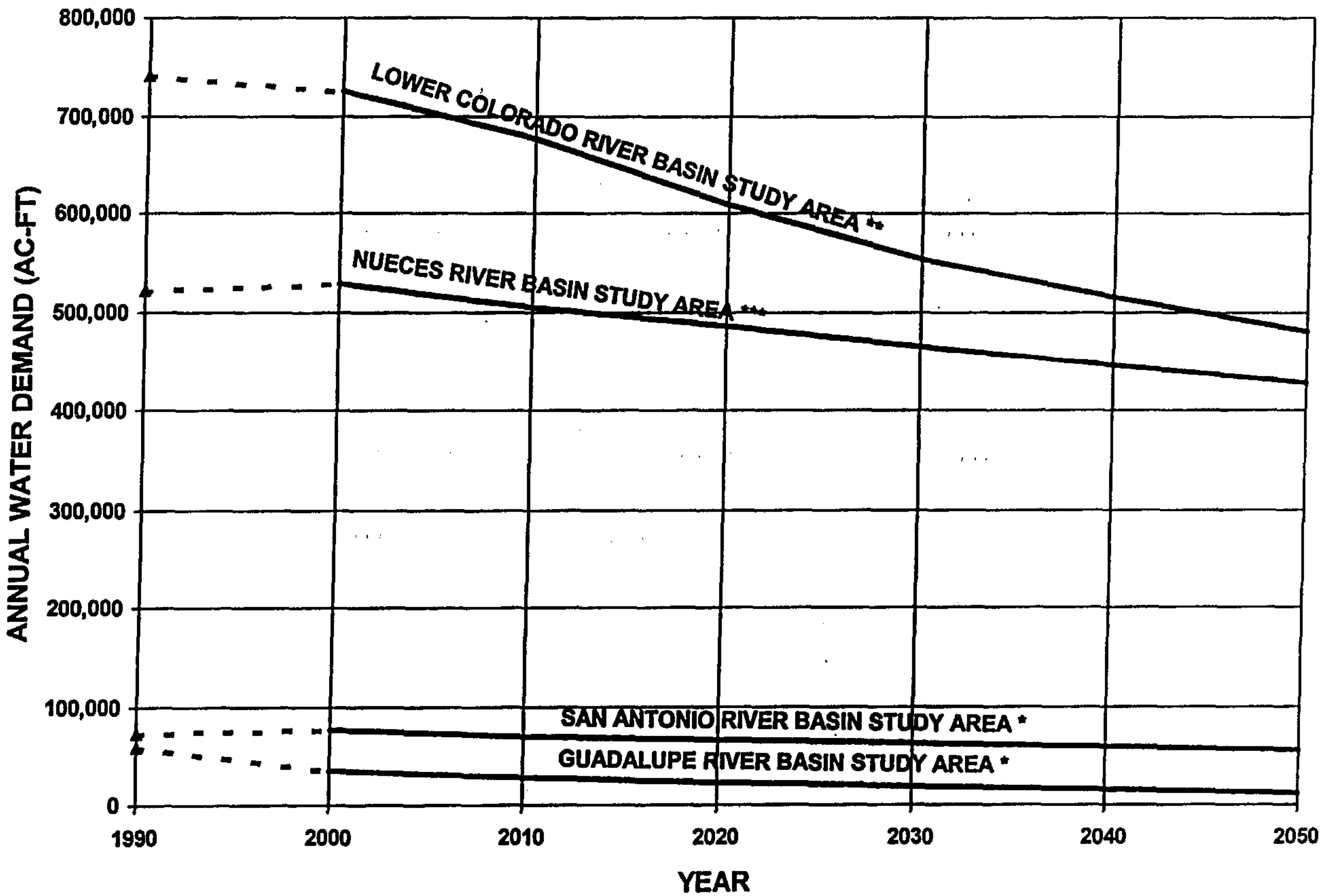
[3] Part of Goliad County located in adjacent San Antonio -Nueces Coastal Basin.

[4] Part of Victoria County located in adjacent Lavaca-Guadalupe Coastal Basin, plus all of Refugio and Calhoun Counties.

[5] Parts of Colorado, Matagorda, and Wharton Counties located in adjacent coastal basins, and obtain a part of their water supply from the Colorado River.

[6] Parts of Burnet, Bastrop, and Lee Counties located in the adjacent Brazos Basin.

[7] Does not include parts of Burnet, Bastrop, and Lee counties located in the adjacent Brazos Basin.



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

* In basin plus adjacent areas that obtain water from the basin.

** In basin plus adjacent coastal areas that obtain water from the Colorado Basin. Does not include parts of study area counties located in the Brazos Basin.

*** Includes only study area counties of the Nueces Basin.

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

IRRIGATION WATER DEMAND PROJECTIONS RIVER BASIN STUDY AREAS

FIGURE 2-22

(This page intentionally left blank)

2.2.3.5 Mining Water Demand Projections for River Basins and Adjacent Areas

In 1990, water use in the 32-county study area for mining purposes was 45,928 acft. TWDB 1996 consensus projections for 2050 mining water demand are 41,629 acft (Table 2-22). Over 84 percent of mining water use in the study area in 1990 was in the Lower Colorado Basin and adjacent areas. The 2050 projection of mining water demands shows 57 percent for the Lower Colorado Basin and adjacent areas, with the projections for the other basin areas increasing from the level of use in 1990 (Table 2-22 and Figure 2-23).

Table 2-22							
Mining Water Demand Projections for River Basins--32-County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
		Projections					
River Basin	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
NUECES							
Study Area In-Basin[1]	1,706	2,506	2,354	2,490	2,650	2,845	3,087
7-County Area[2]	690	1,083	857	926	926	931	953
SAN ANTONIO							
Total In-Basin	1,993	5,213	5,017	5,915	7,001	8,334	10,451
Adj. Area[3]	0	5	3	1	1	0	0
Study Area Subtotal	1,993	5,218	5,020	5,916	7,002	8,334	10,451
GUADALUPE							
Total In-Basin	3,486	8,085	7,268	6,987	6,997	4,659	3,306
Adj. Area[4]	89	704	767	856	947	1,051	1,180
Study Area Subtotal	3,575	8,789	8,035	7,843	7,944	5,710	4,486
LOWER COLORADO							
Total In-Basin	34,573	25,306	16,107	16,830	17,644	18,530	19,082
Adj. Coastal Area[5]	4,079	4,489	4,199	4,186	4,159	4,311	4,523
Area Subtotal	38,652	29,795	20,306	21,016	21,803	22,841	23,605
Adj. Inland Area[6]	2	30	21	13	5	1	0
Study Area Subtotal	38,654	29,825	20,327	21,029	21,808	22,842	23,605
Study Area Subtotal[7]	45,926	46,308	35,715	37,265	39,399	39,730	41,629
Study Area Total	45,928	46,338	35,736	37,278	39,404	39,731	41,629

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall,and advanced water conservation.

[1] Counties of Nueces Basin included in study area (Uvalde, Medina, Zavala, Frio, Atascosa, and parts of Bexar, Wilson, and Karnes).

[2] Parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties of the Nueces Basin, but not included in the West Central Trans-Texas study area.

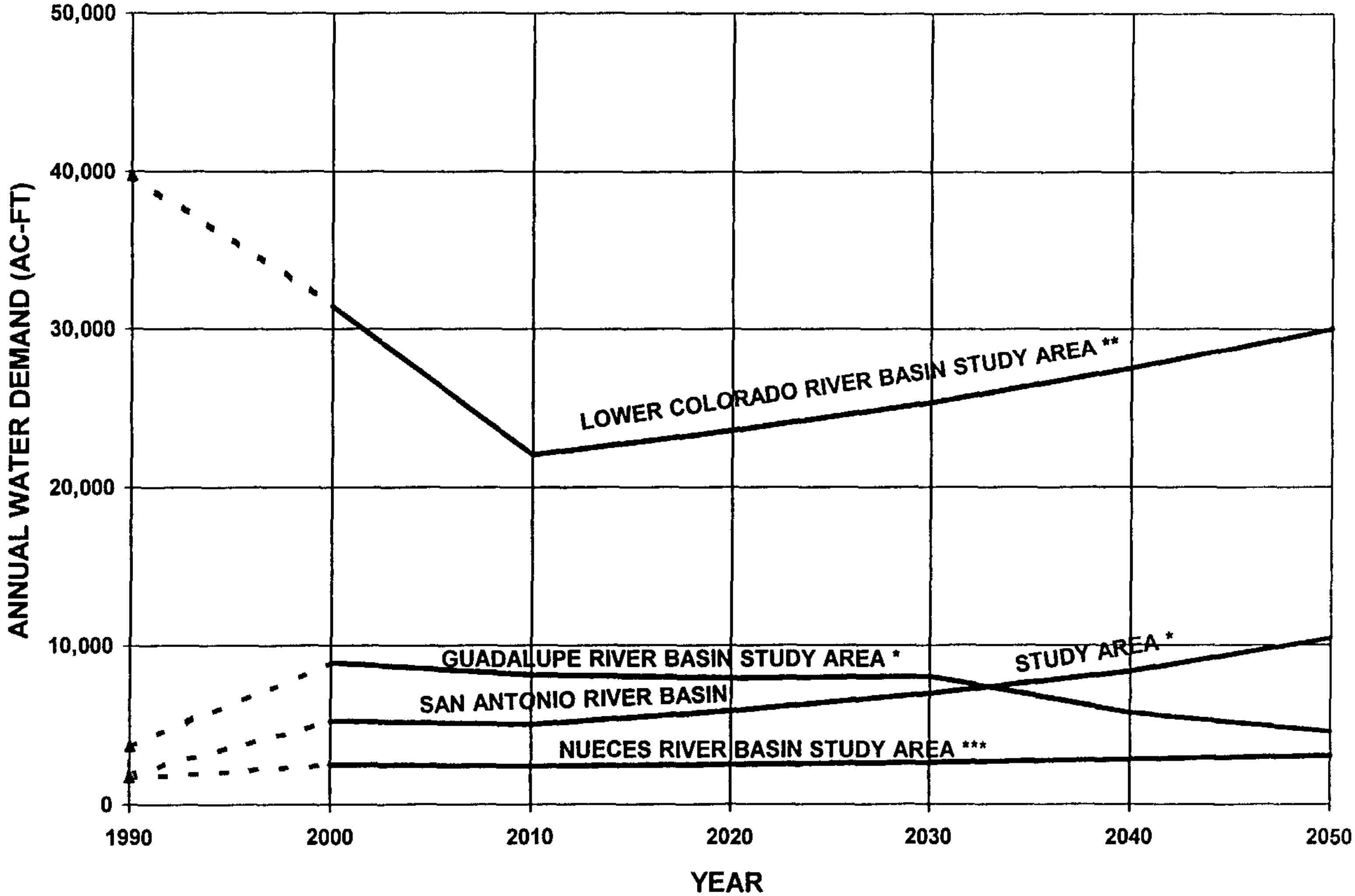
[3] Part of Goliad County located in adjacent San Antonio -Nueces Coastal Basin.

[4] Part of Victoria County located in adjacent Lavaca-Guadalupe Coastal Basin, plus all of Refugio and Calhoun Counties.

[5] Parts of Colorado, Matagorda, and Wharton Counties located in adjacent coastal basins, and obtain a part of their water supply from the Colorado River.

[6] Parts of Burnet, Bastrop, and Lee Counties located in the adjacent Brazos Basin.

[7] Does not include parts of Burnet, Bastrop, and Lee counties located in the adjacent Brazos Basin.



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

* In basin plus adjacent areas that obtain water from the basin.

** In basin plus adjacent coastal areas that obtain water from the Colorado Basin. Does not include parts of study area counties located in the Brazos Basin.

*** Includes only study area counties of the Nueces Basin.

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

MINING WATER DEMAND PROJECTIONS RIVER BASIN STUDY AREAS

FIGURE 2-23

(This page intentionally left blank)

2.2.3.6 Livestock Water Demand Projections for River Basins and Adjacent Areas

Livestock water use in the 32-county study area in 1990 was estimated at 36,367 acft. TWDB consensus projections for the period 2000 through 2050 are 40,177 acft/yr, with 18 percent in the Nueces study area counties, 16 percent in the San Antonio Basin and adjacent areas, 30 percent in the Guadalupe Basin and adjacent areas, and 35 percent in the Lower Colorado and adjacent areas (Table 2-23 and Figure 2-24).

2.2.3.7 Total Water Demand Projections for River Basins and Adjacent Areas

Total water use in the 32-county study area in 1990 was 2,133,894 acft, of which 558,248 acft (26 percent) were in the Nueces Basin study area counties, 359,144 acft (17 percent) were in the San Antonio Basin and adjacent areas, 197,928 acft (9 percent) were in the Guadalupe Basin and adjacent areas, and 1,018,574 acft (48 percent) were in the Lower Colorado Basin and adjacent areas (Table 2-24). TWDB 1996 consensus water plan, with advanced water conservation, projected total water demands in 2050 are 2,622,183 acft for the 32-county study area, with 498,105 acft (19 percent) in Nueces Basin study area counties, 727,985 acft (28 percent) in the San Antonio Basin and adjacent areas, 381,866 acft (14 percent) in the Guadalupe Basin and adjacent areas, and 1,014,228 acft (39 percent) in the Lower Colorado Basin and adjacent areas (Table 2-24 and Figure 2-25). Projections for other decadal points within the 2000 - 2050 planning period are shown for the respective study area river basins and adjacent areas in Table 2-24 and are graphed in Figure 2-25.

Table 2-23							
Livestock Water Demand Projections for River Basins--32-County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
		Projections					
River Basin	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
NUECES							
Study Area In-Basin[1]	6,080	7,345	7,345	7,345	7,345	7,345	7,345
7-County Area[2]	3,874	3,385	3,385	3,385	3,385	3,385	3,385
SAN ANTONIO							
Total In-Basin	5,536	5,960	5,960	5,960	5,960	5,960	5,960
Adj. Area[3]	344	470	470	470	470	470	470
Study Area Subtotal	5,880	6,430	6,430	6,430	6,430	6,430	6,430
GUADALUPE							
Total In-Basin	9,485	10,893	10,893	10,893	10,893	10,893	10,893
Adj. Area[4]	1,455	1,371	1,371	1,371	1,371	1,371	1,371
Study Area Subtotal	10,940	12,264	12,264	12,264	12,264	12,264	12,264
LOWER COLORADO							
Total In-Basin	8,491	8,906	8,906	8,906	8,906	8,906	8,906
Adj. Coastal Area[5]	2,429	2,294	2,294	2,294	2,294	2,294	2,294
Area Subtotal	10,920	11,200	11,200	11,200	11,200	11,200	11,200
Adj. Inland Area[6]	2,547	2,938	2,938	2,938	2,938	2,938	2,938
Study Area Subtotal	13,467	14,138	14,138	14,138	14,138	14,138	14,138
Study Area Subtotal[7]	33,820	37,239	37,239	37,239	37,239	37,239	37,239
Study Area Total	36,367	40,177	40,177	40,177	40,177	40,177	40,177

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall,and advanced water conservation.

[1] Counties of Nueces Basin included in study area (Uvalde, Medina, Zavala, Frio, Atascosa, and parts of Bexar, Wilson, and Karnes).

[2] Parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties of the Nueces Basin, but not included in the West Central Trans-Texas study area.

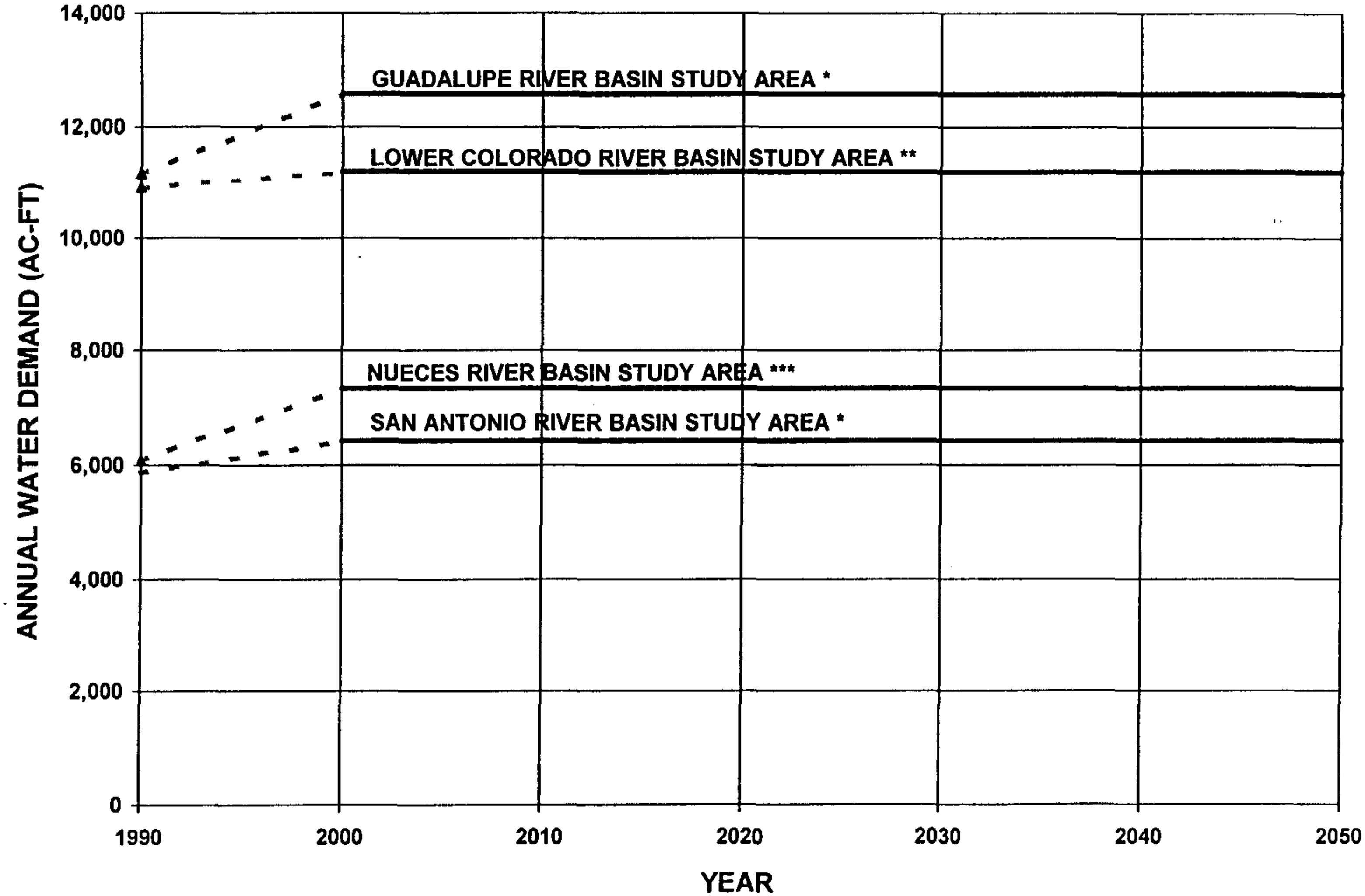
[3] Part of Goliad County located in adjacent San Antonio -Nueces Coastal Basin.

[4] Part of Victoria County located in adjacent Lavaca-Guadalupe Coastal Basin, plus all of Refugio and Calhoun Counties.

[5] Parts of Colorado, Matagorda, and Wharton Counties located in adjacent coastal basins, and obtain a part of their water supply from the Colorado River.

[6] Parts of Burnet, Bastrop, and Lee Counties located in the adjacent Brazos Basin.

[7] Does not include parts of Burnet, Bastrop, and Lee counties located in the adjacent Brazos Basin.



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

* In basin plus adjacent areas that obtain water from the basin.

** In basin plus adjacent coastal areas that obtain water from the Colorado Basin. Does not include parts of study area counties located in the Brazos Basin.

*** Includes only study area counties of the Nueces Basin.

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

LIVESTOCK WATER DEMAND PROJECTIONS RIVER BASIN STUDY AREAS

FIGURE 2-24

Table 2-24							
Total Water Demand Projections for River Basins--32-County West Central Trans-Texas Study Area							
Trans-Texas Water Program							
		Projections					
River Basin	**1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
	acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
NUECES							
Study Area In-Basin1	558,248	579,961	557,648	539,069	521,544	507,574	498,105
7-County Adj. Area[2]	33,580	34,262	33,371	32,801	32,513	32,218	32,144
SAN ANTONIO							
Total In-Basin	358,741	465,222	495,983	544,416	611,854	675,913	727,459
Adj. Area[3]	403	533	528	524	523	523	526
Study Area Subtotal	359,144	465,755	496,511	544,940	612,377	676,436	727,985
GUADALUPE							
Total In-Basin	116,519	156,093	168,597	184,968	203,690	217,629	234,391
Adj. Area[4]	81,409	110,376	118,957	123,151	129,571	137,747	147,475
Study Area Subtotal	197,928	266,469	287,554	308,119	333,261	355,376	381,866
LOWER COLORADO							
Total In-Basin	370,300	425,346	440,975	472,264	521,919	544,231	578,657
Adj. Coastal Area[5]	641,627	633,391	591,382	532,616	484,428	454,163	426,254
Area Subtotal	1,011,927	1,060,940	1,034,411	1,006,758	1,008,099	1,000,027	1,006,435
Adj. Inland Area [6]	6,647	4,191	4,858	5,664	6,625	7,319	7,793
Study Area Subtotal	1,018,574	1,065,131	1,039,269	1,012,422	1,014,724	1,007,346	1,014,228
Study Area Subtotal [7]	2,127,247	2,373,126	2,376,123	2,398,887	2,475,281	2,539,413	2,614,390
Study Area Total	2,133,894	2,377,317	2,380,981	2,404,551	2,481,906	2,546,732	2,622,183

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall,and advanced water conservation.

[1] Counties of Nueces Basin included in study area (Uvalde, Medina, Zavala, Frio, Atascosa, and parts of Bexar, Wilson, and Karnes).

[2] Parts of Dimmitt, Edwards, Kinney, LaSalle, Maverick, Real, and Webb Counties of the Nueces Basin, but not included in the West Central Trans-Texas study area.

[3] Part of Goliad County located in adjacent San Antonio -Nueces Coastal Basin.

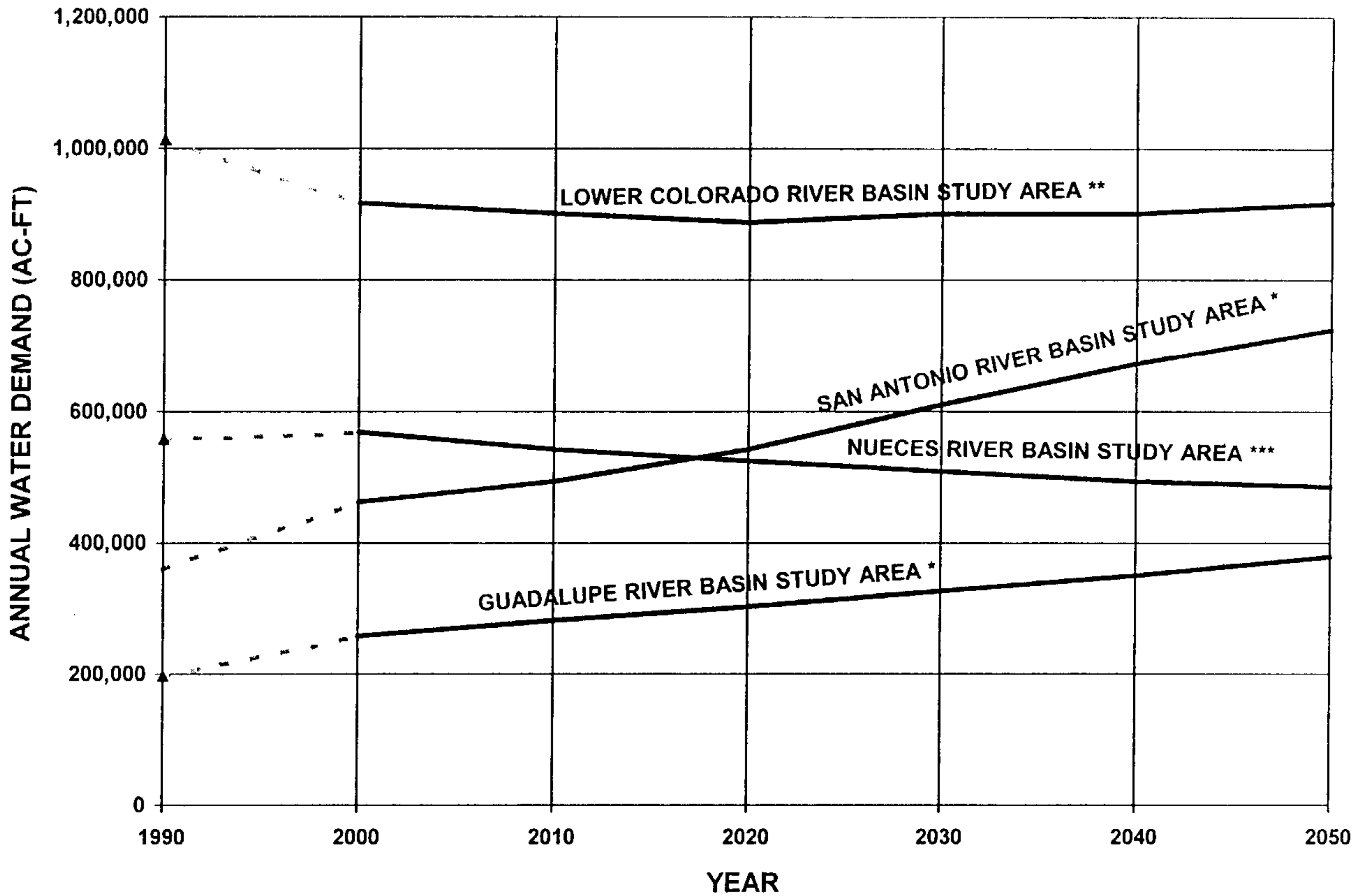
[4] Part of Victoria County located in adjacent Lavaca-Guadalupe Coastal Basin, plus all of Refugio and Calhoun Counties.

[5] Parts of Colorado, Matagorda, and Wharton Counties located in adjacent coastal basins, and obtain a part of their water supply from the Colorado River.

[6] Parts of Burnet, Bastrop, and Lee Counties located in the adjacent Brazos Basin.

[7] Does not include parts of Burnet, Bastrop, and Lee counties located in the adjacent Brazos Basin.

◇◇◇



▲ 1990 USE

—— WATER DEMAND PROJECTIONS

* In basin plus adjacent areas that obtain water from the basin.

** In basin plus adjacent coastal areas that obtain water from the Colorado Basin. Does not include parts of study area counties located in the Brazos Basin.

*** Includes only study area counties of the Nueces Basin.

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

TOTAL WATER DEMAND PROJECTIONS
RIVER BASIN STUDY AREAS

FIGURE 2-25

(This page intentionally left blank)

3.0 WATER SUPPLY PROJECTIONS

In previous sections, 1990 population and water use and population and water demand projections to the year 2050 have been presented for each of the study area counties. In addition, the population and water demand projections have been summarized and tabulated for the study area river basins (Nueces, San Antonio, Guadalupe, and Lower Colorado) and their respective adjacent areas. In 1990, total water use in the 32-county study area was 2,133,894 acft, of which 51.29 percent was from groundwater sources and 48.71 percent was surface water (Table 3-1). Projected total water demands for the 32-county area in year 2050 are 2,611,184. In subsections 3.1 and 3.2, the ground and surface water resources of the West Central Trans-Texas study area are identified and described briefly. In Section 4, the water demand and water supply projections are presented and compared for each county and part of county of each river and coastal basin.

3.1 Groundwater Supply Projections

The Texas Water Development Board projects that the 32-county West Central Trans-Texas study area has an average annual supply of groundwater from the Carrizo-Wilcox, Edwards-Trinity, Trinity and minor aquifers of approximately 735,605 acft (Table 3-1). In addition, in accordance with provisions of Senate Bill 1477, the Edwards Aquifer area counties of the study area (all of Uvalde, Medina and Bexar Counties, and parts of Atascosa, Comal, Hays, Caldwell, and Guadalupe Counties) have a supply of 450,000 acft/yr from the Edwards Aquifer between the present and December 31, 2007.[1] Beginning in 2008, supplies from the Edwards Aquifer are specified at 400,000 acft/yr with the further condition, as specified in S.B. 1477, that by year 2012, the Edwards Aquifer Authority shall have a plan in place which limits pumpage from the Aquifer to a level that will assure that Comal and San Marcos springs will not go dry. For purposes of this analysis, it is assumed that the annual supply available from the Edwards Aquifer to the Edwards Aquifer Authority (EAA) counties, beginning in year 2008, is 400,000 acft/yr, and that this quantity is prorated among the EAA counties in the same proportions as each county's pumpage was of total pumpage in 1990 (i.e., 27.72 percent to Uvalde, 16.02 percent to Medina, 51.58 percent to Bexar,

[1] Senate Bill 1477, Texas Legislature, Regular Session, 1993.

Table 3-1 1990 Water Use and Projected Annual Groundwater Supplies 32 County West Central Trans-Texas Study Area---Trans-Texas Water Program							
	1990 Water Use (Acre-Feet)				Projected Annual Groundwater Supply(acre-Feet)		
County	Ground	Surface	Total		Aquifers[1]	Edwards[2]	Total
Atascosa	60,019	1,453	61,472		47,134	1,385	48,519
Bandera	1,848	232	2,080		7,285	0	7,285
Bastrop	7,178	4,155	11,333		41,548	0	41,548
Bexar	269,505	34,412	303,917		19,125	206,342	225,467
Blanco	1,514	426	1,940		7,737	0	7,737
Burnet	1,946	4,752	6,698		16,280	0	16,280
Caldwell	4,371	2,778	7,149		10,383	326	10,709
Calhoun	4,544	59,681	64,225		2,940	0	2,940
Colorado	49,133	204,714	253,847		31,659	0	31,659
Comal	13,243	2,161	15,404		1,800	8,633	10,433
DeWitt	4,170	1,731	5,901		15,866	0	15,866
Fayette	3,716	13,855	17,571		37,829	0	37,829
Frio	85,073	2,653	87,726		30,914	0	30,914
Goliad	1,344	13,306	14,650		12,809	0	12,809
Gonzales	4,660	7,706	12,366		46,560	0	46,560
Guadalupe	6,566	8,407	14,973		12,583	2,286	14,869
Hays	11,994	1,004	12,998		1,810	6,065	7,875
Karnes	4,610	1,439	6,049		18,780	0	18,780
Kendall	2,322	579	2,901		4,840	0	4,840
Kerr	3,281	3,978	7,259		9,810	0	9,810
Lee	3,719	958	4,677		24,943	0	24,943
Llano	2,122	3,398	5,520		11,882	0	11,882
Matagorda	28,252	216,607	244,859		26,000	0	26,000
Medina	83,509	81,091	164,600		7,826	64,079	71,905
Refugio	1,360	507	1,867		7,768	0	7,768
San Saba	1,919	6,294	8,213		30,224	0	30,224
Travis	9,491	121,789	131,280		8,855	0	8,855
Uvalde	144,522	3,375	147,897		8,213	110,884	119,097
Victoria	29,222	20,621	49,843		41,130	0	41,130
Wharton	153,809	175,877	329,686		100,000	0	100,000
Wilson	15,898	3,688	19,586		60,597	0	60,597
Zavala	80,138	35,269	115,407		30,475	0	30,475
Total	1,094,998	1,038,896	2,133,894		735,605	400,000	1,135,605
Dimmitt*	9,433	5,258	14,691		27,250	0	27,250
Edwards*	184	77	261		13,868	0	13,868
Kinney*[3]	452	70	522		7,708	3,403	11,111
LaSalle*	7,529	1,984	9,513		36,635	0	36,635
Maverick*	5,495	526	6,021		1,242	0	1,242
Real*	747	821	1,568		1,970	0	1,970
Webb*	51	880	931		18,868	0	18,868
Total*	23,891	9,616	33,507		107,541	3,403	110,944

Source: Texas Water Development Board, 1992.

* Not in West Central Trans-Texas study area.

[1] Includes Carrizo- Wilcox, Trinity, Edwards-Trinity, Queen City , and Sparta Aquifers.

[2] Edwards Balcones Fault Zone Aquifer; As provided in SB 1477 for the period beginning January 1, 2008; Through December 31, 2007, SB 1477 sets the quantity at 450,000 acft/yr.

[3] Not included in Edwards Aquifer Authority Area, as established by S.B.1477.

0.34 percent to Atascosa, 2.16 percent to Comal, 1.52 percent to Hays, 0.08 percent to Caldwell, and 0.58 percent to Guadalupe) as shown on Table 3-1. Refer to Section 4 for a comparison of projected water supplies with projected water demands of each county of the study area.

It should be noted that in 1990, groundwater use in seven of the non-Edwards Aquifer area counties was greater than the projected average long-term annual supply (Table 3-1), meaning that in these counties (Calhoun, Colorado, Frio, Matagorda, Travis, Wharton, and Zavala) groundwater overdrafting or mining was occurring. However, in 16 of the non-Edwards Aquifer area counties (Bastrop, Blanco, Burnet, DeWitt, Fayette, Goliad, Gonzales, Karnes, Kendall, Kerr, Lee, Llano, Refugio, San Saba, Victoria, and Wilson) 1990 groundwater use was less than projected annual supply, which means that groundwater resources can perhaps meet some projected growth in water demands in some of these counties (Table 3-1), depending upon location of demands.

3.2 Surface Water Supply Projections[2]

The existing surface water supplies of the West Central Trans-Texas Study Area include: (1) reservoirs that have a firm yield; (2) storage reservoirs for steam-electric power cooling; (3) storage reservoirs for water supply management and recreation; and (4) run-of-river water rights. Information about each of these surface water supply types is presented below.

Lakes and Reservoirs

Medina Lake is located on the Medina River at the boundaries of Medina and Bandera counties, with Diversion Lake on the Medina River downstream of Medina Lake. These lakes are owned by the Bexar-Medina-Atascosa Counties Water Control and Improvement District No. 1 and historically have been used primarily to supply irrigation water to irrigation farms located in Bexar and Medina counties (Table 3-2). In addition to supplying irrigation water, percolation through the lake and riverbeds recharges the Edwards Aquifer. Although the firm yield of Medina Lake is only about 8,770 acft/yr, the computed average annual water supply that was obtained from Medina Lake and Diversion Lake was 57,970 acft during the 1934–1989 period (Table 3-2). Braunig and

[2] West Central Study Area Phase I, Interim Report, Volume 1, San Antonio River Authority, San Antonio, Texas, May 1994.

Table 3-2
Reservoirs and Surface Water Supplies -- West Central Study Area
Trans-Texas Water Program*

Reservoir	Owner	Firm Yield (acft/yr)	Average Supply[2] (acft/yr)	Permit (acft/yr)	Purposes
San Antonio Basin					
Medina Lake	Bexar-Medina-Atascosa District	8,770[1]	57,970	66,750	Irrigation, municipal, domestic, livestock
Diversion Lake	Bexar-Medina-Atascosa District	---	---	---	Irrigation, municipal, domestic, livestock
Victor Braunig Lake	City Public Service Board of San Antonio	---	---	12,000[4]	Steam-electric power generation
Calaveras Lake	City Public Service Board of San Antonio	---	---	37,000[5]	Steam-electric power generation
Guadalupe Basin					
Canyon Lake	Guadalupe-Blanco River Authority/USCOE	82,627[3]	---	50,000[3]	Municipal, industrial, steam-electric & hydropower, irrigation, flood protection
Coleto Creek	Central Power and Light Company	---	---	12,500	Steam-electric power generation
Colorado Basin					
Highland Lakes**	Lower Colorado River Authority	445,266**	---	1,500,000	Municipal, industrial, steam-electric & hydropower, irrigation & hydroelectric power,
Lake Austin	City of Austin	---	---	---	Steam-electric power, water supply storage, rec.
Town Lake	City of Austin	---	---	---	Steam-electric power, water supply storage, rec.
Decker Lake	City of Austin	---	---	36,456	Steam-electric power
Lake Bastrop	Lower Colorado River Authority	---	---	---	Steam-electric power
Cedar Creek	Lower Colorado River Authority	---	---	---	Steam-electric power
Eagle Lake	Lower Colorado River Authority	---	---	---	Irrigation storage
South Texas Project	Houston Light & Power	---	---	---	Steam-electric power
TOTAL		536,663**			

*See Table 3-3 for reference to run-of-river permits.
**Includes Lakes Travis, Marble Falls, LBJ, Inks and Buchanan.
[1]Firm yield based on uniform monthly diversion directly from Medina Lake.
[2]Average supply based on the 1934-89 historical period.
[3]Based on subordination of GBRA hydropower rights.
[4]Includes the rights to divert up to 12,000 acft/yr from the San Antonio River to Braunig Lake and to consume up to 12,000 acft/yr at Braunig Lake.
[5]Includes the rights to divert up to 60,000 acft/yr of reclaimed wastewater from the San Antonio River to Calaveras Lake and to consume up to 37,000 acft/yr at Calaveras Lake.

Calaveras Lakes are located in Bexar County to the southeast of San Antonio and are used for electric power plant cooling water (Table 3-2). Runoff from the watersheds above the lakes, diversion from the San Antonio River, and diversions of San Antonio reclaimed wastewater are used to maintain the necessary lake levels and meet the cooling water demands (24,263 acft in 1990).

Canyon Lake in the Guadalupe Basin is located in Comal County on the mainstem of the Guadalupe River. The purposes of the lake include water supply for municipal, industrial, steam-electric power generation, irrigation, hydroelectric power generation, flood protection, and recreation (Table 3-2). Yield of Canyon Lake is 82,627 acft/yr, of which 50,000 acft/yr is permitted to the Guadalupe-Blanco River Authority (GBRA) by the TNRCC and made available by GBRA to water users within the basin.[3]

Lakes Dunlap, McQueeny, Placid, Nolte, H-4, and Wood, on the Guadalupe River, form hydroelectric power generation pools and are the sites of hydroelectric power plants on the Guadalupe River in the reach from New Braunfels to about eight miles west of Gonzales. The lakes and the water rights are owned by GBRA, and since hydroelectric power generation is a nonconsumptive use of water, these rights and permits (1,300 cfs at Lake Dunlap) to Guadalupe River flows for these purposes are included in the tabulation of water rights of the Guadalupe Basin. (Seguin's hydropower right of 365 cfs is not included for the same reason).

Coleto Creek Reservoir, owned by Central Power and Light Company is located at the borders of Victoria and Goliad counties in the lower Guadalupe Basin and is a cooling reservoir for steam-electric power generation. The source of water is drainage from the Coleto Creek watershed, with diversions from the Guadalupe River, backed by storage in Canyon Lake, when needed. The reservoir supplies water for steam-electric power generation at a power plant located in Goliad County (12,165 acft in 1990).

The Highland Lakes (Travis, Marble Falls, LBJ, Inks, and Buchanan) located on the main steam of the Colorado River upstream of Austin are owned by the Lower Colorado River Authority (LCRA) (Table 3-2). The purposes of the Highland Lakes are water supply for municipal,

[3] The Guadalupe-Blanco River Authority plans to apply to TNRCC for a change in its Canyon Lake permit to allow more of the yield to be used for municipal and industrial purposes.

industrial, steam-electric power generation, hydroelectric power generation, irrigation, flood protection, and recreation. The firm yield of the Highland Lakes, as reported by the TWDB[4] in the 1990 Texas water plan is 445,266 acft/yr. The water supply of the Highland Lakes is made available by LCRA through contracts with various downstream water users for municipal, industrial, steam-electric power generation, and irrigation purposes within the Colorado River Basin and adjacent coastal basins. In addition, LCRA uses water released from the lakes for hydroelectric power generation.

Downstream of the Highland Lakes at Austin on the main stem of the Colorado River are Lake Austin and Town Lake, both owned by the City of Austin. The three City of Austin municipal water intakes are located on these lakes and Town Lake supplies steam-electric cooling water to Austin (Table 3-2). In addition to these main stem reservoirs, there are four steam-electric power-cooling lakes (Decker, Bastrop, Cedar Creek, and the South Texas Project) and one irrigation storage reservoir (Eagle Lake in Colorado County) on tributaries to the Colorado River. These lakes are authorized to capture and store local runoff, with provisions for diversions from the Colorado River when needed. In the case of steam-electric power water demands, the Colorado River tributary cooling lakes are the sites of steam-electric power water use as projected for Bastrop, Fayette, Matagorda, and Travis counties.

In the West Central Study Area, the estimated firm water supply from storage reservoirs is 536,663 acft per year (Table 3-2). Of this total, 8,770 acft are in the San Antonio Basin, 82,627 acft are in the Guadalupe Basin, and 445,266 acft are in the Colorado Basin (Table 3-2).

Run-of-River Water Rights

In addition to surface water from reservoirs, rights have been issued by the TNRCC and predecessor agencies to individuals, cities, industries, and water districts and authorities for diversion from flowing streams of the West Central Study Area. Each right bears a priority date, location for diversion, dates for diversion, rates of diversion, annual quantity of diversion, river flow conditions below which diversions are not to be made, and perhaps other conditions. The

[4] Water for Texas — Today and Tomorrow, 1990, Texas Water Development Board, Austin, Texas, December, 1990.

principle of prior appropriation or "first-in-time-first-in-right" is applied, which means that the senior or oldest rights (earliest date of permit) have first call on flows, with the second, third, and more recent rights having second, third, and later standings for diversions. This procedure gives senior rights holders priority when stream flows are low, as in periods of drought, and renders junior rights less reliable during droughts (i.e., the most junior rights holders may not be able to divert any water during critical droughts).

It is important to note that many run-of-river rights are for irrigation purposes, where chances are taken at planting time upon whether or not water will be available for crop production during the growing season, while most of the municipal, industrial, and steam-electric power demands are for more reliable supplies than are available from river flows and, thus, reservoirs having firm yields have been permitted by TNRCC and constructed by water suppliers, or, as in the case of Austin and the South Texas Project, run-of-river rights are firmed up through contracts and agreements with LCRA for stored water from the firm yield of the Highland Lakes. Similar agreements have been made in the Guadalupe Basin for stored water from Canyon Lake to firm up downstream run-of-river rights.

Run-of-river permits have been summarized for the streams of the West Central Study Area (Table 3-3). For the Nueces study area upstream of the Edwards recharge zone, the total is 12,915 acft/yr (Table 3-3). These quantities are available in that area to meet a part of the local area irrigation water demands as projected in Section 2.0. For the Nueces study area downstream of the Edwards recharge zone in Zavala, Frio, and Atascosa counties total run-of-river water rights are 35,302 acft, all of which are for irrigation purposes in those counties, as projected in Section 2.0.

In the San Antonio Basin on the Medina River, upstream of Medina Lake, there are 1,083 acft of run-of-river rights, with 10,503 acft of such rights downstream of Medina Lake (Table 3-3). On the San Antonio River from San Antonio to Goliad, 35,222 acft of run-of-river rights have been awarded (Table 3-3). Most, if not all, of these rights are for irrigation and livestock water, and can be viewed as supply available to meet those needs in areas along the Medina and San Antonio Rivers. (Note: the Medina Lake rights are shown in Table 3-2.)

Total run-of-river rights in the Guadalupe Basin upstream of Canyon Lake are 13,229 acft, and downstream of Canyon to Victoria are 44,599 acft. These are for irrigation, municipal, and industrial purposes. In addition, GBRA and Seguin have hydroelectric power generation rights—600 cfs at Dunlap for GBRA and 365 cfs at Seguin for Seguin. Since this is a non-consumptive use, these flows can be used for other purposes once they have passed the most downstream hydroelectric plant, which in this case, is GBRA's plant at Lake Wood near Gonzales.

In the Guadalupe and San Antonio Basin downstream of Victoria and Goliad, respectively, total run-of-river rights are 214,499 acft/yr considering only consumptive rights for municipal, irrigation and industrial process water (Table 3-3).

In the Colorado Basin, run-of-river water rights holders include the City of Austin (334,009 acft), Gulf Coast Irrigation Division (262,500 acft), Garwood Irrigation Company (168,000 acft), Lakeside Irrigation Division (131,250 acft), Pierce Ranch Irrigation (110,000 acft), and the South Texas Nuclear Project (102,000 acft). Austin's right is for municipal and steam-electric power generation, the South Texas Project right is for steam-electric power generation, and the others are for irrigation. Within the study area upstream of the Highland Lakes there are 36,491 acft of run- of-river rights, and in the stretch from Austin to Colorado County there are 34,146 acft of such rights. The estimated dependable supply from Colorado River flows in the river stretch from Colorado County to the Gulf of Mexico is about 350,921 acft/yr during the critical drought of record[5].

In the West Central Study Area, the sum of the major consumptive run-of-river permitted water rights is 1,545,748 acft/yr (Table 3-3). The supply from run-of-river rights (1,545,748 acft/yr) plus the firm yield of reservoirs (504,036 acft/yr) is the existing surface water supply for the study area. Refer to Section 4 for a comparison of projected water demands with available water supplies.

[5] "Water Supply and Demand Assessment of Wharton County," Lower Colorado River Authority, Austin, Texas, October, 1991.

Table 3-3 Summary of Run-of-River Water Rights West Central Study Area Trans-Texas Water Program	
River Basin and Segment	**Sum of Permits (acft)**
Nueces Basin Study Area	
Upstream Edwards Recharge Zone	12,915
Downstream Edwards Recharge Zone	35,302
Subtotal	48,217
San Antonio Basin Study Area	
Medina Upstream Medina Lake	1,083
Medina Downstream Medina Lake	10,503
Downstream San Antonio to Goliad	35,222
Subtotal	46,808
Guadalupe Basin Study Area	
Upstream of Canyon Lake	13,229
Downstream Canyon Lake to Victoria	44,599[1]
Downstream Goliad and Victoria (consumptive)	214,499[1]
Subtotal	272,327
Colorado Basin Study Area	
Upstream of Highland Lakes (Study Area)	36,491
City of Austin	334,009[2]
Travis County to Colorado County	34,146
Gulf Coast Irrigation[3]	262,500[4]
Garwood Irrigation[3]	168,000[4]
Lakeside Irrigation[3]	131,250[4]
Pierce Ranch Irrigation[3]	110,000[4]
South Texas Project (HL&P/LCRA)[3]	102,000[5]
Subtotal	1,178,396
TOTAL FOR STUDY AREA	1,545,748

Source: Data from Water Rights Records of Texas Natural Resource Conservation Commission.
[1]Totals shown include only consumptive right for irrigation, industrial, and steam-electric cooling water. Does not include hydroelectric right of 1,300 cfs at Lake Dunlap, which is a non-consumptive right.
[2]Through agreement with LCRA for stored water 290,156 acft is firm supply during drought of record.
[3]Source: "LCRA Drought Management Plan," Lower Colorado River Authority, Austin, TexasJuly, 1990.
[4]LCRA staff estimates that during the critical period of record (1946-1957), the dependable supply from all of these permits is about 350,921 acft annually. "Water Supply and Demand Assessment of Wharton County," Lower Colorado River Authority, Austin, TexasOctober, 1991.
[5]Through agreement with LCRA for stored water, the 102,000 is firm supply during drought of record.

(This page intentionally left blank)

4.0 COMPARISON OF PROJECTED WATER DEMANDS WITH PROJECTED WATER SUPPLIES

In Section 2.0, projected water demands are shown for whole counties and are not identified as to river or coastal basin of location. In this section, counties of the study area, or parts of counties in cases where a study area county lies in two or more river or coastal basins, are grouped by river and coastal basin, and projected water demands, as shown in Section 2.0, and projected water supplies, as shown in Section 3.0, are tabulated and compared for each county or part of county. (See Table 4-00 for river and coastal basin locations of study area counties.) Projections of municipal water demand are shown for each city of each county or part of county, while industrial, steam-electric power, irrigation, mining, and livestock water demands are shown as county or part of county totals. The water demands and water supplies for counties and parts of counties are then added to obtain a river and coastal basin summary. These tabulations show the locations, by county, where water supplies are adequate to meet projected water demands, as well as the locations where additional quantities of water will be needed, the approximate dates at which additional supplies will be needed, and the projected quantities of water that will be needed.

The water supply information tabulated for each county or part of county is developed from water supply data shown in Section 3.0. In the case of groundwater, the annual supplies for counties (Table 3-1) were prorated to the river or coastal basin in which that county or part of county is located (i.e., if 50 percent of the county is in the San Antonio Basin, it is assumed that 50 percent of the county's groundwater supply is also located in the San Antonio Basin). In the case of supplies from the Edwards Aquifer, the provisions of SB 1477 were applied (i.e., 450,000 acft/yr until December 31, 2007, and 400,000 acft/yr beginning in 2008), with these quantities prorated among the Edwards Aquifer Authority counties in the same proportion as the county's water use from the Edwards Aquifer in 1990 (See Section 3.1).

Local surface and groundwater is the estimated quantity of water from windmills, stock watering tanks, and stream flows consumed by livestock and is equated to the projected livestock water demands of each county or part of county being analyzed. For example, in practice, livestock water is produced or obtained on or very near the sites where it is used, and although

Table 4-00 West Central Trans-Texas List of Counties of Study Area Location by River Basin and Edwards Aquifer West Central Trans-Texas Study Area Trans-Texas Water Program*											
		River and Coastal Basin									
County	Edwards Aquifer	Nueces Basin	San Antonio Basin	Guadalupe Basin	Lower Colorado Basin	Brazos Basin	Brazos/ Colorado CB	Colorado/ Lavaca CB	Lavaca Basin	Lavaca/ Guadalupe CB	San Antonio/ Nueces CB
Atascosa	X	X	X								
Bandera		X	X	X							
Bastrop				X	X	X					
Bexar	X	X	X								
Blanco				X	X						
Burnet					X	X					
Caldwell	X			X	X						
Calhoun				X				X		X	
Colorado					X		X		X		
Comal	X		X	X							
DeWitt			X	X					X	X	
Fayette				X	X				X		
Frio		X									
Goliad			X	X							X
Gonzales				X					X		
Guadalupe	X		X	X							
Hays	X			X	X						
Karnes		X	X	X							X
Kendall			X	X	X						
Kerr		X	X	X	X						
Lee					X	X					
Llano					X						
Matagorda					X		X	X			
Medina	X	X	X								
Refugio			X								X
San Saba					X						
Travis				X	X	X					
Uvalde	X	X									
Victoria			X	X					X	X	
Wharton					X		X	X	X		
Wilson		X	X	X							
Zavala		All									
Dimmitt		Part									
Edwards		Part									
Kinney		Part									
LaSalle		All									
Maverick		Part									
Real		Part									
Webb		Part									

* An X in the column indicates that all or part of the county is located in the River or Coastal Basin named in the column heading.

livestock water demands are shown in the water demand projections, this water does not get included in the hydrology data from which water supply information is obtained. Thus, the method used here includes projections of livestock water demands in the counties and parts of counties of each river and coastal basin, but assumes that projected livestock water demands are, or will be met from local supplies.

Surface water supplies have two components as follows: (1) firm yields of reservoirs, and (2) run-of-river (ROR) water rights. Firm yields of reservoirs are known and quantities of firm yield are tabulated in the counties or parts of counties having rights or contracts to use the firm yield. For example, the firm yield of Canyon Lake located in Comal County is 82,627 acft/yr. Entities located in Comal County have contracts with the Guadalupe-Blanco river Authority (GBRA) for 16,007 acft/yr of Canyon Lake water. Thus, the Comal County water supply includes this 16,007 acft/yr, with the remainder of the Canyon Lake yield shown in the county of location of each customer, in the amount of the contract or agreement. In cases where the total firm yield has not been committed, the uncommitted quantities are included in the summary table in the basin of location, but are not included in an individual county's supply.

With respect to run-of-river water rights, the Texas Natural Resource Conservation Commission (TNRCC) water rights records were obtained and the quantities of permitted diversions were tabulated as to county of location where the water is used. Computer models were then used to obtain estimates of the water supplies available from these permitted diversions for three weather conditions as follows:

(1) Average quantity available for the period for which streamflow records are available, usually the 1930s through early 1990s;

(2) Average quantity available for the drought of record of 1947 through 1956; and

(3) Quantity available for the driest year of the 1947-56 drought (See Appendices B and C).[1]

[1] HDR Engineering, Inc. et. al, "Regional Water Supply Planning Study—Phase I, Nueces River Basin," Nueces River Authority, et.al, Uvalde, Texas, May, 1991; HDR Engineering, Inc. et. al, "Guadalupe-San Antonio River Basin Recharge Enhancement Study," Edwards Underground Water District, San Antonio, Texas, September, 1993; and "Colorado River Base Case Availability," Unpublished, Lower Colorado River Authority, Austin, Texas, June, 1997,

Total water supplies available for each of the three conditions are shown for each county or part of county, along with the companion computation of surplus or shortage for the county or part of county. The projections and comparisons are presented below for the Nueces and San Antonio River Basins, the Guadalupe Basin and adjacent Lavaca-Guadalupe Coastal Basin, the Lower Colorado River Basin and adjacent Brazos-Colorado and Colorado-Lavaca Coastal Basins, the study area counties of the Brazos and Lavaca River Basins, and the study area counties of the San Antonio-Nueces Coastal Basin.

4.1 Nueces River Basin Study Area Projected Water Demand and Water Supply Comparisons

In the Nueces Basin, the west central study area includes all of Frio, Uvalde, and Zavala counties, and parts of Atascosa, Bandera, Bexar, Karnes, Kerr, Medina, and Wilson counties. The population of the Nueces Basin West Central Trans-Texas study area was 105,607 in 1990, and is projected at 190,834 in 2050 (Appendix A: Table 1). The water demand and water supply projections are shown for each county and part of county of the study area. The Zavala County water demand and water supply projections table for the Nueces Basin is shown below for purposes of illustrating how to read and understand the projections and comparisons.

The 1990 reported water use and the projected municipal water demands are shown for each city of Zavala County (Crystal City and rural areas) (Table 4-01). Total municipal water use in Zavala County in the Nueces Basin in 1990 was 2,349 acft/yr, with projected municipal water demands of 2,774 acft/yr in 2000, 2,574 acft/yr in 2020, and 2,920 acft/yr in 2050 (Table 4-01). Industrial water demand is projected to increase from 1,306 acft/yr in 1990 to 1,914 acft/yr in 2050, steam-electric power generation water demand is projected at zero and irrigation water demand is projected to decrease due to water conservation efforts from 110,922 acft/yr in 1990 to 102,747 acft/yr in 2050 (Table 4-01). Mining water use was 116 acft/yr in 1990 and is projected to decrease to zero in 2050. Livestock water use in 1990 was 714 acft/yr and is projected at 881 acft/yr from year 2000 through year 2050 (Table 4-01). Total water use in Zavala County in the Nueces Basin in 1990 was 115,407 acft/yr and is projected to decrease to 108,462 acft/yr in 2050 (Table 4-01). Water supplies available to users in

Table 4-01								
Comparison of Water Demand and Water Supply Projections								
Zavala County of the Nueces River Basin								
West Central Trans-Texas Study Area								
Trans-Texas Water Program*								
		Total Use	Projections					
Basin/County/City		in 1990	2000	2010	2020	2030	2040	2050
		acft	acft	acft	acft	acft	acft	acft
Zavala (all)								
Crystal City		1,692	2,034	1,948	1,850	1,908	1,902	1,908
Rural		657	740	746	724	744	851	1,012
Total Municipal Demand		2,349	2,774	2,694	2,574	2,652	2,753	2,920
Industrial Demand		1,306	1,407	1,507	1,582	1,642	1,780	1,914
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		110,922	122,307	119,831	116,220	111,543	107,055	102,747
Mining Demand		116	97	42	25	8	2	0
Livestock Demand		714	881	881	881	881	881	881
Total Demand		115,407	127,466	124,955	121,282	116,726	112,471	108,462
Supply								
Groundwater		80,701	30,475	30,475	30,475	30,475	30,475	30,475
Local Surface&Ground		714	881	881	881	881	881	881
Surface Water/Streams	ROR rights 1	33,992	33,992	33,992	33,992	33,992	33,992	33,992
Surface Water/Streams	Ave.available(70%) 2	23,794	23,794	23,794	23,794	23,794	23,794	23,794
Surface Water/Streams	Ave.avail-dry(51%) 3	17,336	17,336	17,336	17,336	17,336	17,336	17,336
Surface Water/Streams	Min.Yr.Ava. (5%) 4	1,700	1,700	1,700	1,700	1,700	1,700	1,700
Total Supply	ROR rights 5	115,407	65,348	65,348	65,348	65,348	65,348	65,348
Total Supply	Ave.available(70%) 6	105,209	55,150	55,150	55,150	55,150	55,150	55,150
Total Supply	Ave.avail-dry(51%) 7	98,751	48,692	48,692	48,692	48,692	48,692	48,692
Total Supply	Min.Yr.Ava. (5%) 8	83,115	33,056	33,056	33,056	33,056	33,056	33,056
Surplus/Shortage	ROR rights 9	0	-62,118	-59,607	-55,934	-51,378	-47,123	-43,114
Surplus/Shortage	Ave.available(70%)10	-10,198	-72,316	-69,805	-66,132	-61,576	-57,320	-53,312
Surplus/Shortage	Ave.avail-dry(51%)11	-16,656	-78,774	-76,263	-72,590	-68,034	-63,779	-59,770
Surplus/Shortage	Min.Yr.Ava. (5%)12	-32,292	-94,411	-91,900	-88,226	-83,671	-79,415	-75,407

* From Table 4-1 of this report.
1 ROR is total run-of-river rights in Zavala county.
2 Average quantity of water available annually (70%) from 33,992 acft/yr of run-of-river rights listed above.
3 Average quantity of water available annually (51%) during 1947-56 drought from 33,992 acft/yr of run-of-river rights listed above.
4 Quantity of water available during worst year of drought (5%) (Min.Yr.Ava.) from 33,992 acft/yr of run-of-river rights listed above.
5 Total supply from groundwater and full ROR rights (80,701+714+33,992=115,407).
6 Total supply from groundwater and average quantity available from ROR (80,701+714+23,794=105,209).
7 Total supply from groundwater and average available (1947-56 drought) from ROR (80,701+714+17,336=98,115).
8 Total supply from groundwater and minimum year available (1947-56 drought) from ROR (80,701+714+1,7=83,115).
9 Shortage in year 2000 for full ROR available (65,348-127,466=--62,118).
10 Shortage in year 2000 for average available from ROR (55,150-127,466=--72,316).
11 Shortage in year 2000 for average available from ROR during 1947-56 drought (48,692-127,466=--78,774).
12 Shortage in year 2000 for quantity avaliable from ROR during worst year of drought (33,056-127,466=--94,411).

Zavala County in the Nueces Basin include the Carrizo Aquifer, local surface and groundwater and run-of-river (ROR) water rights from streams in the county.

Water supply from the Carrizo Aquifer in Zavala County in the Nueces Basin was 80,701 acft/yr in 1990, but is projected to be only 30,475 acft/yr through 2050 (Table 4-01). Local surface and groundwater for livestock supply was 714 acft/yr in 1990 and is projected at 881 acft/yr through 2050.

Run-of-river water rights from streams of Zavala County in the Nueces Basin are 33,992 acft/yr, which in an average year would supply 23,794 acft/yr (70 percent). During the 1947 through 1956 10-year drought, the 33,992 acft/yr of ROR rights in Zavala County in the Nueces Basin would have supplied 17,336 acft/yr (Ave.avail-dry; 51 percent), but the supply available during the driest year (Min.Yr.Ava; 5 percent) would have been only 1,700 acft/yr (Table 4-01; Surface Water/Streams, ROR).

The total water supply available in Zavala County in the Nueces Basin is the sum of groundwater from the Carrizo Aquifer, local surface and groundwater, and surface water from streams, or ROR water. These sums are shown for each of the four ROR conditions (i.e., the supply for the condition of 33,992 acft/yr of ROR rights in 1990 is the summation 80,701 + 714 + 33,992 or 115,407) in Table 4-01.

The total supply for average availability of water from ROR rights in 1990 is the summation 80,701 + 714 + 23,794 = 105,209 (Table 4-01). The total supply for the average availability in 1990 for the 1947 through 1956 10-year drought condition is 80,701 + 714 + 17,336 or 98,751 acft/yr (Table 4-01), and the total supply available in 1990 for the worst year of the 10-year drought was 83,115 acft/yr (80,701 + 714 + 1,700) (Table 4-01). The same kinds of calculations are made for the projection years 2000 through 2050, as are stated above for 1990 (Table 4-01).

Given the four surface water supply potentials listed above for the water demand projections that decrease from 115,707 acft/yr in 1990 to 108,462 acft/yr in 2050, a surplus/shortage calculation is made for each potential water supply condition by subtracting projected water demands from projected water supplies for each projection date (Table 4-01). For example, if the full 33,992 acft/yr of water from existing ROR water rights is available, which in wet years would be possible, the projected shortage in year 2000 is 62,118 acft/yr and would decrease to 43,114 acft/yr in 2050 (Surplus/Shortage ROR rights row of Table 4-01). Under the average surface water availability case, the shortage in year 2000 is 72,316 acft/yr and decreases to 53,312 acft/yr in 2050. In the case of the surface water supply available during the worst year of the drought, the shortage in Zavala County in the Nueces Basin is projected at 94,411 acft/yr in 2000, and 75,407 acft/yr in 2050 (Table 4-01, Surplus/Shortage Min.Yr.Ava.5% row). The projected decline in water supply shortages in Zavala County in future years is due to the projected decline in irrigation water demand, which is expected to occur as Federal Government Farm Support programs are reduced, and as irrigation water conservation practices are implemented. In many counties of the study area, the projected shortages increase in future years due to increasing population and industrial water demands, as will be shown in the following sections of this report.

In the Nueces Basin, there are projected water shortages for Atascosa, Bexar, Frio, Medina, Uvalde, and Zavala Counties for the entire projection period (i.e., beginning now and continuing through 2050), however, due to the projected decline in irrigation water use, the projected shortages are lower in future years (Table 4-1). However, for those parts of Bandera, Karnes, and Wilson Counties that are located in the study area in the Nueces Basin, there are projected surpluses throughout the projection period, due largely to adequate groundwater supplies to meet the relatively low projected demands of these counties. The projections for each study area county are included in Table 4-1 and will not be verbalized here.

The Nueces Basin study area water use in 1990 was 558,248 acft/yr and is projected to decrease to 498,105 acft/yr in 2050 due to reductions in Federal Farm Support programs and increased water conservation in irrigation. Projected total water supply available to meet the projected demands includes supply from the Edwards Aquifer of 163,243 acft/yr beginning in year 2008 (See Section 3.1 for explanation of Edwards Aquifer supplies), 137,449 acft/yr from the Carrizo and other Aquifers, 7,345 acft/yr from local surface and groundwater sources for livestock use, and between 8,588 acft/yr of surface water in severe drought years and

80,017 acft/yr of surface water during high rainfall years from ROW water rights, depending upon weather conditions that affect stream flow (see Nueces Basin WCTT Study area Summary of Table 4-1). Given the demand and supply projections, the Nueces Basin study area is projected to have shortages ranging between 171,503 acft/yr and 242,932 acft/yr in year 2000, and shortages ranging between 110,051 acft/yr and 181,479 acft/yr in year 2050 (See Table 4-1 Nueces Basin WCTT Study Area Summary and Figure 4-1).2 Further, it is important to note that in this analysis, water demands have not been allocated to any particular source of supply, and that it may not be feasible to meet some demands from a particular source of supply located within the basin.

[2] In addition to study area counties, projections are shown in Table 4-1 for all or parts of other counties of the Nueces Basin following the Nueces Basin WCTT Study Area Summary.

Table 4-1								
Comparison of Water Demand and Water Supply Projections								
Nueces River Basin Area								
West Central Trans-Texas Study Area								
Trans-Texas Water Program								
		Total Use	**Projections**					
Basin/County/City		**in 1990**	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
		acft	**acft**	**acft**	**acft**	**acft**	**acft**	**acft**
Atascosa (part)								
Charlotte		247	409	436	464	510	547	568
Jourdanton		670	815	863	899	988	1,047	1,124
Lytle		410	559	600	635	701	754	811
Pleasanton		1,556	2,226	2,372	2,493	2,753	2,931	3,155
Poteet		1,055	1,285	1,325	1,369	1,479	1,549	1,629
Rural		1,633	1,850	1,939	2,033	2,253	2,418	2,416
Total Municipal Demand		5,571	7,144	7,535	7,893	8,684	9,246	9,703
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		6,036	12,000	12,000	12,000	12,000	15,000	22,000
Irrigation Demand		45,792	44,052	42,380	40,771	39,222	37,733	36,300
Mining Demand		664	1,558	1,583	1,693	1,804	1,918	2,048
Livestock Demand		1,556	1,742	1,742	1,742	1,742	1,742	1,742
Total Demand		59,619	66,496	65,240	64,099	63,452	65,639	71,793
Supply								
Groundwater/Edwards		1,800	1,558	1,385	1,385	1,385	1,385	1,385
Groundwater/Carrizo		56,103	45,720	45,720	45,720	45,720	45,720	45,720
Local Surface&Ground		1,556	1,742	1,742	1,742	1,742	1,742	1,742
Surface Water/Streams	ROR rights	190	190	190	190	190	190	190
Surface Water/Streams	Ave.available(99%)	188	188	188	188	188	188	188
Surface Water/Streams	Ave.avail-dry(97%)	184	184	184	184	184	184	184
Surface Water/Streams	Min.Yr.Ava. (84%)	160	160	160	160	160	160	160
Total Supply	ROR rights	59,649	49,210	49,037	49,037	49,037	49,037	49,037
Total Supply	Ave.available(99%)	59,647	49,208	49,035	49,035	49,035	49,035	49,035
Total Supply	Ave.avail-dry(97%)	59,643	49,204	49,031	49,031	49,031	49,031	49,031
Total Supply	Min.Yr.Ava. (84%)	59,619	49,180	49,007	49,007	49,007	49,007	49,007
Surplus/Shortage	ROR rights	30	-17,286	-16,203	-15,062	-14,415	-16,602	-22,756
Surplus/Shortage	Ave.available(99%)	28	-17,288	-16,205	-15,064	-14,417	-16,604	-22,758
Surplus/Shortage	Ave.avail-dry(97%)	24	-17,292	-16,209	-15,068	-14,421	-16,608	-22,762
Surplus/Shortage	Min.Yr.Ava. (84%)	0	-17,316	-16,233	-15,092	-14,445	-16,632	-22,786
Bandera (part)								
Rural		94	118	124	137	152	168	186
Total Municipal Demand		94	118	124	137	152	168	186
Industrial Demand		0	11	13	15	16	19	22
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		113	108	103	99	94	90	86
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		95	97	97	97	97	97	97

Total Demand		302	334	337	348	359	374	391
Supply								
Groundwater		1,020	1,020	1,020	1,020	1,020	1,020	1,020
Local Surface&Ground		95	97	97	97	97	97	97
Surface Water/Streams	ROR rights	879	879	879	879	879	879	879
Surface Water/Streams	Ave.available(92%)	809	809	809	809	809	809	809
Surface Water/Streams	Ave.avail-dry(79%)	703	703	703	703	703	703	703
Surface Water/Streams	Min.Yr.Ava. (52%)	457	457	457	457	457	457	457
Total Supply	ROR rights	1,994	1,996	1,996	1,996	1,996	1,996	1,996
Total Supply	Ave.available(92%)	1,924	1,926	1,926	1,926	1,926	1,926	1,926
Total Supply	Ave.avail-dry(79%)	1,818	1,820	1,820	1,820	1,820	1,820	1,820
Total Supply	Min.Yr.Ava. (52%)	1,572	1,574	1,574	1,574	1,574	1,574	1,574
Surplus/Shortage	ROR rights	1,692	1,662	1,659	1,648	1,637	1,622	1,605
Surplus/Shortage	Ave.available(92%)	1,622	1,592	1,589	1,578	1,567	1,552	1,535
Surplus/Shortage	Ave.avail-dry(79%)	1,516	1,486	1,483	1,472	1,461	1,446	1,429
Surplus/Shortage	Min.Yr.Ava. (52%)	1,270	1,240	1,237	1,226	1,215	1,200	1,183
Bexar (part)								
Lytle		1	1	1	1	1	1	1
Rural		330	1,030	1,226	1,450	1,763	2,045	1,908
Total Municipal Demand		331	1,031	1,227	1,451	1,764	2,046	1,909
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		3,374	3,461	3,220	3,084	2,954	2,829	2,709
Mining Demand		147	182	178	183	189	194	199
Livestock Demand		23	26	26	26	26	26	26
Total Demand		3,875	4,700	4,651	4,744	4,933	5,095	4,843
Supply								
Groundwater/Edwards		1,770	1,532	1,362	1,362	1,362	1,362	1,362
Groundwater/Carrizo		2,082	191	191	191	191	191	191
Local Surface&Ground		23	26	26	26	26	26	26
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		3,875	1,749	1,579	1,579	1,579	1,579	1,579
Surplus/Shortage		0	-2,951	-3,072	-3,165	-3,354	-3,516	-3,264
Frio (all)								
Dilley		771	824	855	873	906	939	962
Pearsall		1,602	1,955	2,020	2,057	2,146	2,210	2,263
Rural		672	731	740	740	761	784	799
Total Municipal Demand		3,045	3,510	3,615	3,670	3,813	3,933	4,024
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		38	400	400	400	400	400	400
Irrigation Demand		83,233	79,688	76,294	73,045	69,933	66,955	64,103
Mining Demand		313	150	63	32	16	7	3
Livestock Demand		1,097	1,192	1,192	1,192	1,192	1,192	1,192
Total Demand		87,726	84,940	81,564	78,339	75,354	72,487	69,722
Supply								

Groundwater		85,509	30,914	30,914	30,914	30,914	30,914	30,914
Local Surface&Ground		1,097	1,192	1,192	1,192	1,192	1,192	1,192
Surface Water/Streams	ROR rights	1,120	1,120	1,120	1,120	1,120	1,120	1,120
Surface Water/Streams	Ave.available(89%)	997	997	997	997	997	997	997
Surface Water/Streams	Ave.avail-dry(75%)	840	840	840	840	840	840	840
Surface Water/Streams	Min.Yr.Ava. (48%)	538	538	538	538	538	538	538
Total Supply	ROR rights	87,726	33,226	33,226	33,226	33,226	33,226	33,226
Total Supply	Ave.available(89%)	87,603	33,103	33,103	33,103	33,103	33,103	33,103
Total Supply	Ave.avail-dry(75%)	87,446	32,946	32,946	32,946	32,946	32,946	32,946
Total Supply	Min.Yr.Ava. (48%)	87,144	32,644	32,644	32,644	32,644	32,644	32,644
Surplus/Shortage	ROR rights	0	-51,714	-48,338	-45,113	-42,128	-39,261	-36,496
Surplus/Shortage	Ave.available(89%)	-123	-51,837	-48,461	-45,236	-42,251	-39,384	-36,619
Surplus/Shortage	Ave.avail-dry(75%)	-280	-51,994	-48,618	-45,393	-42,408	-39,541	-36,776
Surplus/Shortage	Min.Yr.Ava. (48%)	-582	-52,296	-48,920	-45,695	-42,710	-39,843	-37,078
Karnes (part)								
Rural		39	74	68	68	71	75	76
Total Municipal Demand		39	74	68	68	71	75	76
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		118	117	117	117	117	117	117
Total Demand		157	191	185	185	188	192	193
Supply								
Groundwater		376	376	376	376	376	376	376
Local Surface&Ground		118	117	117	117	117	117	117
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		494	493	493	493	493	493	493
Surplus/Shortage		337	302	308	308	305	301	300
Kerr (part)								
Rural		28	31	31	33	35	38	40
Total Municipal Demand		28	31	31	33	35	38	40
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		1	4	4	4	4	4	4
Total Demand		29	35	35	37	39	42	44
Supply								
Groundwater		29	29	29	29	29	29	29
Local Surface&Ground		1	4	4	4	4	4	4
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		30	33	33	33	33	33	33
Surplus/Shortage		1	-2	-2	-4	-6	-9	-11

Medina (part)								
Devine		630	953	943	940	964	987	1,005
Hondo		1,456	2,032	2,092	2,164	2,263	2,327	2,393
Lytle		73	92	89	87	88	90	92
Natalia		294	397	408	422	440	452	464
Rural		1,535	1,961	2,038	2,075	2,197	2,272	2,416
Total Municipal Demand		3,988	5,435	5,570	5,688	5,952	6,128	6,370
Industrial Demand		286	302	319	339	361	384	411
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		133,196	140,098	130,249	124,658	119,306	114,185	109,283
Mining Demand		67	75	60	58	57	58	60
Livestock Demand		1,336	1,638	1,638	1,638	1,638	1,638	1,638
Total Demand		138,873	147,548	137,836	132,381	127,314	122,393	117,762
Supply								
Groundwater/Edwards		64,466	55,810	49,609	49,609	49,609	49,609	49,609
Groundwater/Other		6,574	6,574	6,574	6,574	6,574	6,574	6,574
Local Surface&Ground		1,336	1,638	1,638	1,638	1,638	1,638	1,638
Surface Water/Streams	ROR rights	2,409	2,409	2,409	2,409	2,409	2,409	2,409
Surface Water/Streams	Ave.available(92%)	2,216	2,216	2,216	2,216	2,216	2,216	2,216
Surface Water/Streams	Ave.avail-dry(81%)	1,951	1,951	1,951	1,951	1,951	1,951	1,951
Surface Water/Streams	Min.Yr.Ava. (53%)	1,277	1,277	1,277	1,277	1,277	1,277	1,277
Surface Water/MedinaL	MedinaLake Permit 1	66,497	31,800	31,800	31,800	31,800	31,800	31,800
Surface Water/MedinaL	Ave.available(86%)	57,187	27,348	27,348	27,348	27,348	27,348	27,348
Surface Water/MedinaL	Ave.avail-dry(40%)	26,599	12,720	12,720	12,720	12,720	12,720	12,720
Surface Water/MedinaL	Min.Yr.Ava. (1%)	665	318	318	318	318	318	318
Total Supply	MedinaLake Permit 1	141,282	98,231	92,030	92,030	92,030	92,030	92,030
Total Supply	Ave.available(86%)	131,780	93,586	87,385	87,385	87,385	87,385	87,385
Total Supply	Ave.avail-dry(40%)	100,926	78,693	72,492	72,492	72,492	72,492	72,492
Total Supply	Min.Yr.Ava. (1%)	74,318	65,617	59,416	59,416	59,416	59,416	59,416
Surplus/Shortage	MedinaLake Permit 1	2,409	-49,317	-45,806	-40,351	-35,284	-30,363	-25,732
Surplus/Shortage	Ave.available(86%)	-7,093	-53,962	-50,451	-44,996	-39,929	-35,008	-30,377
Surplus/Shortage	Ave.avail-dry(40%)	-37,947	-68,855	-65,344	-59,889	-54,822	-49,901	-45,270
Surplus/Shortage	Min.Yr.Ava. (1%)	-64,555	-81,931	-78,421	-72,965	-67,899	-62,977	-58,346
Uvalde (all)								
Sabinal		381	510	546	573	632	683	739
Uvalde		3,915	5,173	5,621	5,921	6,610	7,198	7,871
Rural		982	1,027	907	823	777	737	661
Total Municipal Demand		5,278	6,710	7,074	7,317	8,019	8,618	9,271
Industrial Demand		557	600	643	675	700	759	817
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		140,669	135,067	129,689	124,524	119,566	114,804	110,233
Mining Demand		399	444	428	499	576	666	777
Livestock Demand		994	1,494	1,494	1,494	1,494	1,494	1,494
Total Demand		147,897	144,315	139,328	134,509	130,355	126,341	122,592
Supply								
Groundwater/Edwards		144,096	124,747	110,887	110,887	110,887	110,887	110,887
Groundwater/Other		8,213	8,213	8,213	8,213	8,213	8,213	8,213
Local Surface&Ground		994	1,494	1,494	1,494	1,494	1,494	1,494

Surface Water/Streams	ROR rights	9,627	9,627	9,627	9,627	9,627	9,627	9,627
Surface Water/Streams	Ave.available(94%)	9,049	9,049	9,049	9,049	9,049	9,049	9,049
Surface Water/Streams	Ave.avail-dry(79%)	7,605	7,605	7,605	7,605	7,605	7,605	7,605
Surface Water/Streams	Min.Yr.Ava. (43%)	4,140	4,140	4,140	4,140	4,140	4,140	4,140
Total Supply	ROR rights	162,930	144,081	130,221	130,221	130,221	130,221	130,221
Total Supply	Ave.available(94%)	162,352	143,503	129,643	129,643	129,643	129,643	129,643
Total Supply	Ave.avail-dry(79%)	160,908	142,059	128,199	128,199	128,199	128,199	128,199
Total Supply	Min.Yr.Ava. (43%)	157,443	138,594	124,734	124,734	124,734	124,734	124,734
Surplus/Shortage	ROR rights	15,033	-234	-9,107	-4,288	-134	3,880	7,629
Surplus/Shortage	Ave.available(94%)	14,455	-812	-9,685	-4,866	-712	3,302	7,051
Surplus/Shortage	Ave.avail-dry(79%)	13,011	-2,256	-11,129	-6,310	-2,156	1,858	5,607
Surplus/Shortage	Min.Yr.Ava. (43%)	9,546	-5,721	-14,594	-9,775	-5,621	-1,607	2,142
Wilson (part)								
Rural		121	173	181	188	198	209	229
Total Municipal Demand		121	173	181	188	198	209	229
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		4,096	3,609	3,181	2,803	2,471	2,177	1,919
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		146	154	154	154	154	154	154
Total Demand		4,363	3,936	3,516	3,145	2,823	2,540	2,302
Supply								
Groundwater		13,937	13,937	13,937	13,937	13,937	13,937	13,937
Local Surface&Ground		146	154	154	154	154	154	154
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		14,083	14,091	14,091	14,091	14,091	14,091	14,091
Surplus/Shortage		9,720	10,155	10,575	10,946	11,268	11,551	11,789
Zavala (all)								
Crystal City		1,692	2,034	1,948	1,850	1,908	1,902	1,908
Rural		657	740	746	724	744	851	1,012
Total Municipal Demand		2,349	2,774	2,694	2,574	2,652	2,753	2,920
Industrial Demand		1,306	1,407	1,507	1,582	1,642	1,780	1,914
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		110,922	122,307	119,831	116,220	111,543	107,055	102,747
Mining Demand		116	97	42	25	8	2	0
Livestock Demand		714	881	881	881	881	881	881
Total Demand		115,407	127,466	124,955	121,282	116,726	112,471	108,462
Supply								
Groundwater		80,701	30,475	30,475	30,475	30,475	30,475	30,475
Local Surface&Ground		714	881	881	881	881	881	881
Surface Water/Streams	ROR rights	33,992	33,992	33,992	33,992	33,992	33,992	33,992
Surface Water/Streams	Ave.available(70%)	23,794	23,794	23,794	23,794	23,794	23,794	23,794
Surface Water/Streams	Ave.avail-dry(51%)	17,336	17,336	17,336	17,336	17,336	17,336	17,336
Surface Water/Streams	Min.Yr.Ava. (5%)	1,700	1,700	1,700	1,700	1,700	1,700	1,700
Total Supply	ROR rights	115,407	65,348	65,348	65,348	65,348	65,348	65,348
Total Supply	Ave.available(70%)	105,209	55,150	55,150	55,150	55,150	55,150	55,150

Total Supply	Ave.avail-dry(51%)	98,751	48,692	48,692	48,692	48,692	48,692	48,692
Total Supply	Min.Yr.Ava. (5%)	83,115	33,056	33,056	33,056	33,056	33,056	33,056
Surplus/Shortage	ROR rights	0	-62,118	-59,607	-55,934	-51,378	-47,123	-43,114
Surplus/Shortage	Ave.available(70%)	-10,198	-72,316	-69,805	-66,132	-61,576	-57,320	-53,312
Surplus/Shortage	Ave.avail-dry(51%)	-16,656	-78,774	-76,263	-72,590	-68,034	-63,779	-59,770
Surplus/Shortage	Min.Yr.Ava. (5%)	-32,292	-94,411	-91,900	-88,226	-83,671	-79,415	-75,407
Nueces Basin WCTT Study Area Summary								
Municipal Demand		20,844	27,000	28,119	29,019	31,340	33,214	34,728
Industrial Demand		2,149	2,320	2,482	2,611	2,719	2,942	3,164
Steam-Electric Power Demand		6,074	12,400	12,400	12,400	12,400	15,400	22,400
Irrigation Demand		521,395	528,390	504,948	485,204	465,090	445,828	427,381
Mining Demand		1,706	2,506	2,354	2,490	2,650	2,845	3,087
Livestock Demand		6,080	7,345	7,345	7,345	7,345	7,345	7,345
Total Demand		558,248	579,961	557,648	539,069	521,544	507,574	498,105
Supply								
Groundwater/Edwards		212,132	183,647	163,243	163,243	163,243	163,243	163,243
Groundwater/Other		254,544	137,449	137,449	137,449	137,449	137,449	137,449
Local Surface&Ground		6,080	7,345	7,345	7,345	7,345	7,345	7,345
Surface Water 1	ROR rights+MedinaL	114,714	80,017	80,017	80,017	80,017	80,017	80,017
Surface Water	Ave.available	94,241	64,402	64,402	64,402	64,402	64,402	64,402
Surface Water	Ave.avail-dry	55,219	41,340	41,340	41,340	41,340	41,340	41,340
Surface Water	Min.Yr.Ava.	8,935	8,588	8,588	8,588	8,588	8,588	8,588
Total Supply	ROR rights+MedinaL	587,470	408,458	388,054	388,054	388,054	388,054	388,054
Total Supply	Ave.available	566,997	392,843	372,439	372,439	372,439	372,439	372,439
Total Supply	Ave.avail-dry	527,975	369,781	349,377	349,377	349,377	349,377	349,377
Total Supply	Min.Yr.Ava.	481,691	337,029	316,625	316,625	316,625	316,625	316,625
Surplus/Shortage	ROR rights+MedinaL	29,222	-171,503	-169,594	-151,015	-133,490	-119,520	-110,051
Surplus/Shortage	Ave.available	8,749	-187,119	-185,209	-166,631	-149,105	-135,135	-125,666
Surplus/Shortage	Ave.avail-dry	-30,273	-210,180	-208,270	-189,692	-172,167	-158,197	-148,727
Surplus/Shortage	Min.Yr.Ava.	-76,557	-242,932	-241,022	-222,444	-204,919	-190,949	-181,479
NUECES BASIN NON-STUDY AREA								
Dimmitt (part)*								
Asherton		215	211	205	206	224	243	267
Carrizo Springs		1,592	2,316	2,583	2,827	3,232	3,657	4,137
Rural		395	403	374	354	377	407	429
Total Municipal Demand		2,202	2,930	3,162	3,387	3,833	4,307	4,833
Industrial Demand		3	11	11	12	13	14	15
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		11,185	11,239	10,753	10,288	9,842	9,418	9,011
Mining Demand		506	1,003	817	906	916	926	950
Livestock Demand		795	621	621	621	621	621	621
Total Demand		14,691	15,804	15,364	15,214	15,225	15,286	15,430

Supply								
Groundwater		24,525	24,525	24,525	24,525	24,525	24,525	24,525
Local Surface&Ground		795	621	621	621	621	621	621
Surface Water/Streams	ROR rights	3,522	3,522	3,522	3,522	3,522	3,522	3,522
Surface Water/Streams	Ave.available(63%)2	2,219	2,219	2,219	2,219	2,219	2,219	2,219
Surface Water/Streams	Ave.avail-dry(46%)2	1,620	1,620	1,620	1,620	1,620	1,620	1,620
Surface Water/Streams	Min.Yr.Ava. (4%)2	141	141	141	141	141	141	141
Total Supply	ROR rights	28,842	28,668	28,668	28,668	28,668	28,668	28,668
Total Supply	Ave.available(63%)2	27,539	27,365	27,365	27,365	27,365	27,365	27,365
Total Supply	Ave.avail-dry(46%)2	26,940	26,766	26,766	26,766	26,766	26,766	26,766
Total Supply	Min.Yr.Ava. (4%)2	25,461	25,287	25,287	25,287	25,287	25,287	25,287
Surplus/Shortage	ROR rights	14,151	12,864	13,304	13,454	13,443	13,382	13,238
Surplus/Shortage	Ave.available(63%)2	12,848	11,561	12,001	12,151	12,139	12,078	11,935
Surplus/Shortage	Ave.avail-dry(46%)2	12,249	10,962	11,402	11,552	11,541	11,480	11,336
Surplus/Shortage	Min.Yr.Ava. (4%)2	10,770	9,483	9,923	10,073	10,061	10,000	9,857
Edwards (part)*								
Rocksprings		29	28	29	29	30	31	32
Rural		77	80	79	78	81	82	84
Total Municipal Demand		106	108	108	107	111	113	116
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		228	254	254	254	254	254	254
Total Demand		334	362	362	361	365	367	370
Supply								
Groundwater		6,934	6,934	6,934	6,934	6,934	6,934	6,934
Local Surface&Ground		228	254	254	254	254	254	254
Surface Water/Streams	ROR rights	1,717	1,717	1,717	1,717	1,717	1,717	1,717
Surface Water/Streams	Ave.available(94%) 3	1,614	1,614	1,614	1,614	1,614	1,614	1,614
Surface Water/Streams	Ave.avail-dry(79%)	1,356	1,356	1,356	1,356	1,356	1,356	1,356
Surface Water/Streams	Min.Yr.Ava. (43%)	738	738	738	738	738	738	738
Total Supply	ROR rights	8,879	8,905	8,905	8,905	8,905	8,905	8,905
Total Supply	Ave.available(94%)	8,776	8,802	8,802	8,802	8,802	8,802	8,802
Total Supply	Ave.avail-dry(79%)	8,518	8,544	8,544	8,544	8,544	8,544	8,544
Total Supply	Min.Yr.Ava. (43%)	7,900	7,926	7,926	7,926	7,926	7,926	7,926
Surplus/Shortage	ROR rights	8,545	8,543	8,543	8,544	8,540	8,538	8,535
Surplus/Shortage	Ave.available(94%)	8,442	8,440	8,440	8,441	8,437	8,435	8,432
Surplus/Shortage	Ave.avail-dry(79%)	8,184	8,182	8,182	8,183	8,179	8,177	8,174
Surplus/Shortage	Min.Yr.Ava. (43%)	7,566	7,564	7,564	7,565	7,561	7,559	7,556
Kinney (part)*								
Rural		60	124	127	125	110	95	81
Total Municipal Demand		60	124	127	125	110	95	81
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		201	192	184	176	168	161	154

Mining Demand		0	0	0	0	0	0	0
Livestock Demand		261	283	283	283	283	283	283
Total Demand		522	599	594	584	561	539	518
Supply								
Groundwater/Ed&Other		3,403	3,403	3,403	3,403	3,403	3,403	3,403
Local Surface&Ground		261	283	283	283	283	283	283
Surface Water/Streams	ROR rights	10	10	10	10	10	10	10
Surface Water/Streams	Ave.available(94%)3	9	9	9	9	9	9	9
Surface Water/Streams	Ave.avail-dry(79%)	8	8	8	8	8	8	8
Surface Water/Streams	Min.Yr.Ava. (43%)	4	4	4	4	4	4	4
Total Supply	ROR rights	3,674	3,696	3,696	3,696	3,696	3,696	3,696
Total Supply	Ave.available(94%)	3,673	3,695	3,695	3,695	3,695	3,695	3,695
Total Supply	Ave.avail-dry(79%)	3,672	3,694	3,694	3,694	3,694	3,694	3,694
Total Supply	Min.Yr.Ava. (43%)	3,668	3,690	3,690	3,690	3,690	3,690	3,690
Surplus/Shortage	ROR rights	3,152	3,097	3,102	3,112	3,135	3,157	3,178
Surplus/Shortage	Ave.available(94%)	3,151	3,096	3,101	3,111	3,134	3,156	3,177
Surplus/Shortage	Ave.avail-dry(79%)	3,150	3,095	3,100	3,110	3,133	3,155	3,176
Surplus/Shortage	Min.Yr.Ava. (43%)	3,146	3,091	3,096	3,106	3,129	3,151	3,172
LaSalle (all)*								
Cotulla		795	908	934	942	970	1,005	1,040
Rural		438	464	457	450	452	454	446
Total Municipal Demand		1,233	1,372	1,391	1,392	1,422	1,459	1,486
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		7,292	7,063	6,841	6,626	6,418	6,217	6,021
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		988	1,077	1,077	1,077	1,077	1,077	1,077
Total Demand		9,513	9,512	9,309	9,095	8,917	8,753	8,584
Supply								
Groundwater		36,635	36,635	36,635	36,635	36,635	36,635	36,635
Local Surface&Ground		988	1,077	1,077	1,077	1,077	1,077	1,077
Surface Water/Streams	ROR rights	7,482	7,482	7,482	7,482	7,482	7,482	7,482
Surface Water/Streams	Ave.available(63%)[1]	4,714	4,714	4,714	4,714	4,714	4,714	4,714
Surface Water/Streams	Ave.avail-dry(46%)[1]	3,442	3,442	3,442	3,442	3,442	3,442	3,442
Surface Water/Streams	Min.Yr.Ava. (4%)[1]	299	299	299	299	299	299	299
Total Supply	ROR rights	45,105	45,194	45,194	45,194	45,194	45,194	45,194
Total Supply	Ave.available(63%)[1]	42,337	42,426	42,426	42,426	42,426	42,426	42,426
Total Supply	Ave.avail-dry(46%)[1]	41,065	41,154	41,154	41,154	41,154	41,154	41,154
Total Supply	Min.Yr.Ava. (4%)[1]	37,922	38,011	38,011	38,011	38,011	38,011	38,011
Surplus/Shortage	ROR rights	35,592	35,682	35,885	36,099	36,277	36,441	36,610
Surplus/Shortage	Ave.available(63%)[1]	32,824	32,914	33,117	33,331	33,509	33,673	33,842
Surplus/Shortage	Ave.avail-dry(46%)[1]	31,552	31,642	31,845	32,059	32,237	32,401	32,570
Surplus/Shortage	Min.Yr.Ava. (4%)[1]	28,409	28,499	28,702	28,916	29,094	29,258	29,427
Maverick (part)*								
Rural		42	61	64	65	69	74	84
Total Municipal Demand		42	61	64	65	69	74	84

Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		5,269	5,060	4,861	4,669	4,485	4,308	4,138
Mining Demand		184	80	40	20	10	5	3
Livestock Demand		526	527	527	527	527	527	527
Total Demand		6,021	5,728	5,492	5,281	5,091	4,914	4,752
Supply								
Groundwater		5,495	497	497	497	497	497	497
Local Surface&Ground		526	527	527	527	527	527	527
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		6,021	1,024	1,024	1,024	1,024	1,024	1,024
Surplus/Shortage		0	-4,704	-4,468	-4,257	-4,067	-3,890	-3,728
Real (part)*								
Leakey		134	153	147	161	180	200	223
Rural		366	406	378	348	341	334	328
Total Municipal Demand		500	559	525	509	521	534	551
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		872	834	798	763	729	698	667
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		196	146	146	146	146	146	146
Total Demand		1,568	1,539	1,469	1,418	1,396	1,378	1,364
Supply								
Groundwater		1,872	1,872	1,872	1,872	1,872	1,872	1,872
Local Surface&Ground		196	146	146	146	146	146	146
Surface Water/Streams	ROR rights	7,185	7,185	7,185	7,185	7,185	7,185	7,185
Surface Water/Streams	Ave.available(94%)3	6,754	6,754	6,754	6,754	6,754	6,754	6,754
Surface Water/Streams	Ave.avail-dry(79%)	5,676	5,676	5,676	5,676	5,676	5,676	5,676
Surface Water/Streams	Min.Yr.Ava. (43%)	3,090	3,090	3,090	3,090	3,090	3,090	3,090
Total Supply	ROR rights	9,253	9,203	9,203	9,203	9,203	9,203	9,203
Total Supply	Ave.available(94%)	8,822	8,772	8,772	8,772	8,772	8,772	8,772
Total Supply	Ave.avail-dry(79%)	7,744	7,694	7,694	7,694	7,694	7,694	7,694
Total Supply	Min.Yr.Ava. (43%)	5,158	5,108	5,108	5,108	5,108	5,108	5,108
Surplus/Shortage	ROR rights	7,685	7,664	7,734	7,785	7,807	7,825	7,839
Surplus/Shortage	Ave.available(94%)	7,254	7,233	7,303	7,354	7,376	7,394	7,408
Surplus/Shortage	Ave.avail-dry(79%)	6,176	6,155	6,225	6,276	6,298	6,316	6,330
Surplus/Shortage	Min.Yr.Ava. (43%)	3,590	3,569	3,639	3,690	3,712	3,730	3,744
Webb (part)*								
Rural		51	241	304	371	481	504	649
Total Municipal Demand		51	241	304	371	481	504	649
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		880	477	477	477	477	477	477
Total Demand		931	718	781	848	958	981	1,126

Supply								
Groundwater		9,434	9,434	9,434	9,434	9,434	9,434	9,434
Local Surface&Ground		880	477	477	477	477	477	477
Surface Water/Streams	ROR rights	200	200	200	200	200	200	200
Surface Water/Streams	Ave.available(63%)2	126	126	126	126	126	126	126
Surface Water/Streams	Ave.avail-dry(46%)	92	92	92	92	92	92	92
Surface Water/Streams	Min.Yr.Ava. (4%)	8	8	8	8	8	8	8
Total Supply	ROR rights	10,514	10,111	10,111	10,111	10,111	10,111	10,111
Total Supply	Ave.available(63%)	10,440	10,037	10,037	10,037	10,037	10,037	10,037
Total Supply	Ave.avail-dry(46%)	10,406	10,003	10,003	10,003	10,003	10,003	10,003
Total Supply	Min.Yr.Ava. (4%)	10,322	9,919	9,919	9,919	9,919	9,919	9,919
Surplus/Shortage	ROR rights	9,583	9,393	9,330	9,263	9,153	9,130	8,985
Surplus/Shortage	Ave.available(63%)	9,509	9,319	9,256	9,189	9,079	9,056	8,911
Surplus/Shortage	Ave.avail-dry(46%)	9,475	9,285	9,222	9,155	9,045	9,022	8,877
Surplus/Shortage	Min.Yr.Ava. (4%)	9,391	9,201	9,138	9,071	8,961	8,938	8,793

Nueces Basin Non-Study Area Summary								
Municipal Demand		4,194	5,395	5,681	5,956	6,547	7,086	7,800
Industrial Demand		3	11	11	12	13	14	15
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		24,819	24,388	23,437	22,522	21,642	20,802	19,991
Mining Demand		690	1,083	857	926	926	931	953
Livestock Demand		3,874	3,385	3,385	3,385	3,385	3,385	3,385
Non-Study Area Total Demand		33,580	34,262	33,371	32,801	32,513	32,218	32,144
Supply								
Groundwater/Edwards		0	0	0	0	0	0	0
Groundwater/Other		88,298	83,300	83,300	83,300	83,300	83,300	83,300
Local Surface&Ground		3,874	3,385	3,385	3,385	3,385	3,385	3,385
Surface Water/Streams	ROR rights	20,116	20,116	20,116	20,116	20,116	20,116	20,116
Surface Water/Streams	Ave.available	19,100	19,122	19,122	19,122	19,122	19,122	19,122
Surface Water/Streams	Ave.avail-dry	12,194	12,194	12,194	12,194	12,194	12,194	12,194
Surface Water/Streams	Min.Yr.Ava.	4,280	4,280	4,280	4,280	4,280	4,280	4,280
Total Supply	ROR rights	112,288	106,801	106,801	106,801	106,801	106,801	106,801
Total Supply	Ave.available	111,272	105,807	105,807	105,807	105,807	105,807	105,807
Total Supply	Ave.avail-dry	104,366	98,879	98,879	98,879	98,879	98,879	98,879
Total Supply	Min.Yr.Ava.	96,452	90,965	90,965	90,965	90,965	90,965	90,965
Surplus/Shortage	ROR rights	78,708	72,539	73,430	74,000	74,288	74,583	74,657
Surplus/Shortage	Ave.available	77,692	71,545	72,436	73,006	73,293	73,588	73,663
Surplus/Shortage	Ave.avail-dry	70,786	64,617	65,508	66,078	66,366	66,661	66,735
Surplus/Shortage	Min.Yr.Ava.	62,872	56,703	57,594	58,164	58,452	58,747	58,821

Nueces Basin Study Area Plus								
Non-Study Area Summary**								
Municipal Demand		25,038	32,395	33,800	34,975	37,887	40,300	42,528
Industrial Demand		2,152	2,331	2,493	2,623	2,732	2,956	3,179
Steam-Electric Power Demand		6,074	12,400	12,400	12,400	12,400	15,400	22,400
Irrigation Demand		546,214	552,779	528,385	507,726	486,732	466,630	447,371
Mining Demand		2,396	3,589	3,211	3,416	3,576	3,776	4,040
Livestock Demand		9,954	10,730	10,730	10,730	10,730	10,730	10,730
Basin Subtotal**		591,828	614,224	591,019	571,870	554,057	539,792	530,248
Supply								
Groundwater/Edwards		212,132	183,647	163,243	163,243	163,243	163,243	163,243
Groundwater/Other		342,842	220,749	220,749	220,749	220,749	220,749	220,749
Local Surface&Ground		9,954	10,730	10,730	10,730	10,730	10,730	10,730
Surface Water/Streams	ROR rights	134,830	100,133	100,133	100,133	100,133	100,133	100,133
Surface Water/Streams	Ave.available	113,341	83,523	83,523	83,523	83,523	83,523	83,523
Surface Water/Streams	Ave.avail-dry	67,413	53,534	53,534	53,534	53,534	53,534	53,534
Surface Water/Streams	Min.Yr.Ava.	13,216	12,869	12,869	12,869	12,869	12,869	12,869
Total Supply	ROR rights	699,758	515,259	494,855	494,855	494,855	494,855	494,855
Total Supply	Ave.available	678,269	498,649	478,245	478,245	478,245	478,245	478,245
Total Supply	Ave.avail-dry	632,341	468,660	448,256	448,256	448,256	448,256	448,256
Total Supply	Min.Yr.Ava.	578,144	427,995	407,591	407,591	407,591	407,591	407,591
Surplus/Shortage	ROR rights	107,930	-98,965	-96,164	-77,015	-59,202	-44,937	-35,393
Surplus/Shortage	Ave.available	86,441	-115,574	-112,773	-93,625	-75,812	-61,547	-52,003
Surplus/Shortage	Ave.avail-dry	40,513	-145,563	-142,762	-123,614	-105,801	-91,536	-81,992
Surplus/Shortage	Min.Yr.Ava.	-13,684	-186,229	-183,428	-164,280	-146,467	-132,202	-122,658

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.

* Not in West Central Trans-Texas study area.

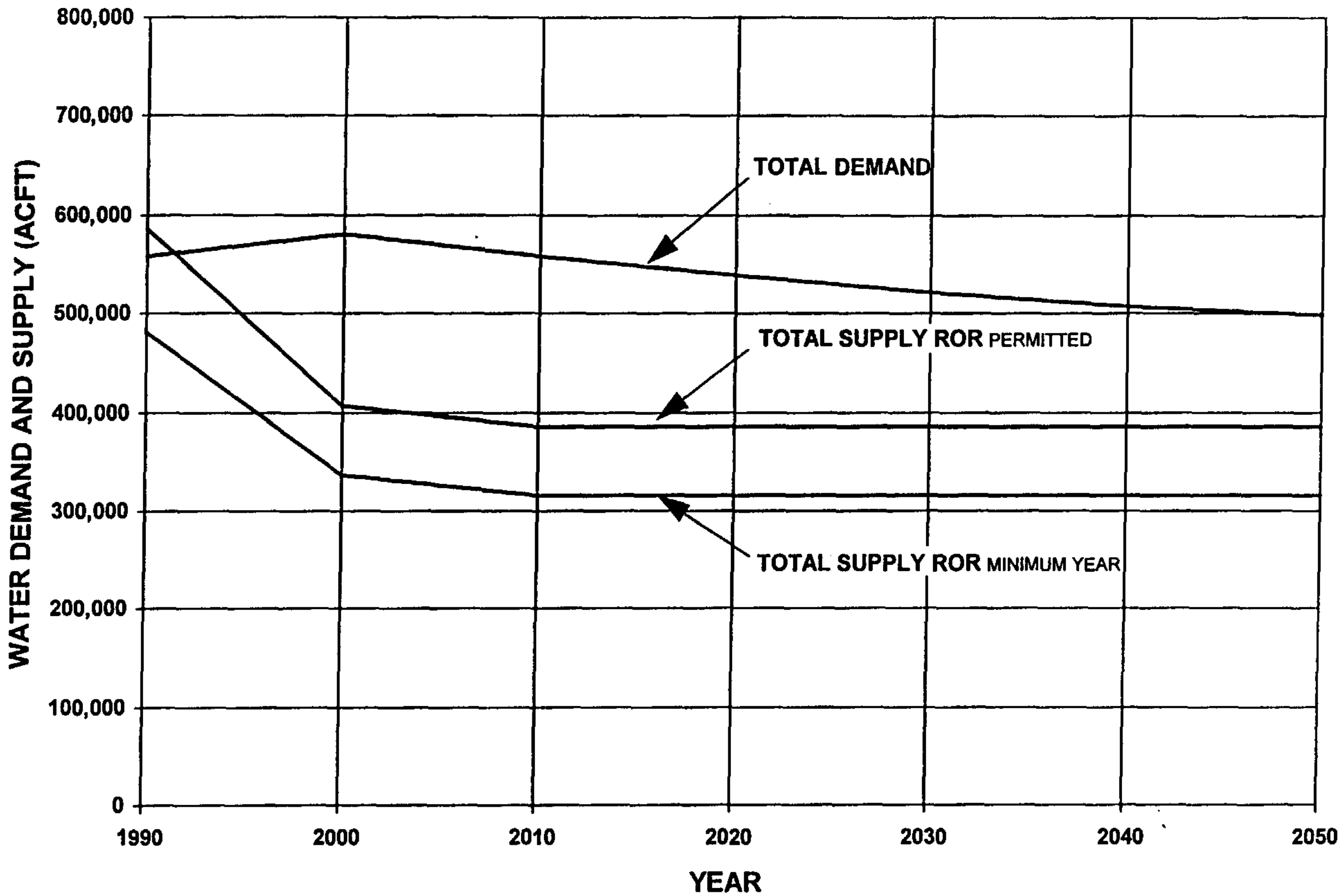
**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).

1 Medina Lake Permit is for 65,830 acre-feet per year, and is allocated among Medina County in the Nueces Basin in the amount of 31,800 acft/yr, Medina County in the San Antonio Basin in the amount of 29,030 acft/yr, and Bandera County of the San Antonio Basin in the amount of 5,000 acft/yr. The allocations are based upon proportions of the acreages irrigated using Medina Lake water an agreement between The Bexar-Medina-Atascosa Irrigation District and interests in Bandera County.

2 Availibility estimated at 10% below that for Zavala County.

3 Availibility estimated at same level as for Uvalde County.

◇◇◇



- Total Supply ROR is the sum of groundwater, firm yields of reservoirs, if any, and run-of-river permits at maximum permitted quantities.
- Total Supply ROR Minimum Year is the sum of groundwater, firm yields of reservoirs, if any, and quantities from run-of-river permits during driest year of record.

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

NUECES BASIN PROJECTIONS
WATER DEMAND/WATER SUPPLY

FIGURE 4-1

4.2 San Antonio River Basin Study Area Projected Water Demand and Water Supply Comparisons

The San Antonio River Basin study area includes parts of 14 counties, as follows: Atascosa, Bandera, Bexar, Comal, DeWitt, Goliad, Guadalupe, Karnes, Kendall, Kerr, Medina, Refugio, Victoria, and Wilson Counties. Water demand and water supply projections are shown for each part of each county of the basin (Table 4-2).

In 1990, the population of the San Antonio River Basin was 1,270,884 and is projected at 3,331,113 in 2050 (Appendix A: Table 2). Water use in the San Antonio River Basin in 1990, was 358,741 acft/yr of which 84 percent was in Bexar County, 7 percent was in Medina County, 1.5 percent was in Karnes County, and the remaining 7.5 percent was in the parts of the remaining 12 counties having parts of their areas located within the basin (Table 4-2). Projected water demands in the San Antonio River Basin are 544,416 acft/yr in 2020, and 727,459 acft/yr in 2050, with approximately 88 percent of projected demands in Bexar County (Table 4-2).

Total water supply available to meet projected water demands in the year 2000 ranges between 468,566 acft/yr during severe droughts and 513,585 acft/yr during average weather conditions (Table 4-2) (Refer to Table 4-01 for an illustration of how to read Table 4-2). Of the total supply projected to be available in the year 2000, 48 percent is from the Edwards Aquifer, 19 percent is from the Carrizo, Trinity, and other aquifers, 15 percent is reclaimed wastewater, and between 8 percent and 16 percent is from ROR surface water rights (See San Antonio Basin Summary at the end of Table 4-2). However, due to limits upon pumpage from the Edwards Aquifer, as specified in SB 1477, the annual supply is projected to decline in the year 2010 to a range of 440,868 acft/yr for severe drought to 485,887 acft/yr for average weather conditions (Table 4-2 and Figure 4-2).

Of the 14 parts of counties located in the San Antonio River Basin, 9 (Bander, DeWitt, Goliad, Karnes, Kendall, Kerr, Refugio, Victoria, and Wilson) have projected supplies that are greater than projected demands, taking into account both ground and surface water supply estimates (Table 4-2). However, it should be recognized that due to location of supply in relation to demand, there may be local shortages within these counties. For the remaining 5 counties that are partially located in the San Antonio River Basin (Atascosa, Bexar, Comal, Guadalupe, and Medina), projected demands exceed projected water supplies on or before the year 2000, with the exception of the Atascosa County area of the San Antonio Basin, which shows a projected shortage in the year 2020 (Table 4-2). In the case of Bexar County, in which more than 85 percent of San Antonio Basin water use is projected, the projected demand/supply comparison shows a shortage in the year 2000 ranging from 42,116 acft/yr for average weather conditions to 54,989 acft/yr during a severe drought. The projected shortage increases with time and ranges between 320,195 acft/yr and 333,068 acft/yr in 2050 (Table 4-2).

The San Antonio River Basin summary shows a projected water shortage in the year 2010 of 2,682 acft/yr for full run-of-river rights, and 55,115 acft/yr during severe droughts when surface water availability is at its lowest (Table 4-2). The projected San Antonio River Basin shortage in 2020 ranges between 51,115 acft/yr and 103,549 acft/yr, and for 2050 ranges between 234,158 acft/yr and 286,591 acft/yr (Table 4-2 and Figure 4-2). Demands have not been allocated to any particular source of supply, and it should be noted that a part of the supply available within the basin may not be readily available to those parts of the basin where shortages are projected; (i.e. some counties have projected shortages while others have projected surpluses), both of which are included in the San Antonio River Basin summary (Table 4-2 and Figure 4-2).

Table 4-2									
Comparison of Water Demand and Water Supply Projections									
San Antonio River Basin Area									
West Central Trans Texas Study Area									
Trans-Texas Water Program									
		Total Use	Projections						
Basin/County/City		in 1990	2000	2010	2020	2030	2040	2050	
		acft	acft	acft	acft	acft	acft	acft	
Atascosa (part)									
Rural		99	101	106	111	123	132	132	
Total Municipal Demand		99	101	106	111	123	132	132	
Industrial Demand		0	0	0	0	0	0	0	
Steam-Electric Power Demand		0	0	0	0	0	0	0	
Irrigation Demand		1,416	1,363	1,311	1,261	1,214	1,167	1,123	
Mining Demand		0	0	0	710	1,622	2,734	4,551	
Livestock Demand		57	66	66	66	66	66	66	
Total Demand		1,572	1,530	1,483	2,148	3,025	4,099	5,872	
Supply									
Groundwater		1,515	1,414	1,414	1,414	1,414	1,414	1,414	
Local Surface&Ground		57	66	66	66	66	66	66	
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0	
Total Supply		1,572	1,480	1,480	1,480	1,480	1,480	1,480	
Surplus/Shortage		0	-50	-3	-668	-1,545	-2,619	-4,392	
Bandera (part)									
Bandera		171	254	261	288	326	364	407	
Rural		1,164	1,437	1,504	1,659	1,827	2,015	2,222	
Total Municipal Demand		1,335	1,691	1,765	1,947	2,153	2,379	2,629	
Industrial Demand		0	0	0	0	0	0	0	
Steam-Electric Power Demand		0	0	0	0	0	0	0	
Irrigation Demand		177	169	162	155	149	142	136	
Mining Demand		20	25	25	26	27	27	27	
Livestock Demand		225	230	230	230	230	230	230	
Total Demand		1,757	2,115	2,182	2,358	2,559	2,778	3,022	
Supply									
Groundwater		6,119	6,119	6,119	6,119	6,119	6,119	6,119	
Local Surface&Ground		225	230	230	230	230	230	230	
Surface Water/Streams	ROR rights	1,088	1,088	1,088	1,088	1,088	1,088	1,088	
Surface Water/Streams	Ave.available(98%)	1,066	1,066	1,066	1,066	1,066	1,066	1,066	
Surface Water/Streams	Ave.avail-dry(93%)	1,012	1,012	1,012	1,012	1,012	1,012	1,012	
Surface Water/Streams	Min.Yr.Ava. (86%)	936	936	936	936	936	936	936	
Surface Water/Streams	Medina Lake 1	5,000	5,000	5,000	5,000	5,000	5,000	5,000	
Surface Water/Streams	Ave.available(86%)	4,300	4,300	4,300	4,300	4,300	4,300	4,300	
Surface Water/Streams	Ave.avail-dry(40%)	2,000	2,000	2,000	2,000	2,000	2,000	2,000	
Surface Water/Streams	Min.Yr.Ava. (1%)	50	50	50	50	50	50	50	
Total Supply	ROR rights	12,432	12,437	12,437	12,437	12,437	12,437	12,437	
Total Supply	Ave.available(98%)	11,710	11,715	11,715	11,715	11,715	11,715	11,715	
Total Supply	Ave.avail-dry(93%)	9,356	9,361	9,361	9,361	9,361	9,361	9,361	
Total Supply	Min.Yr.Ava. (86%)	7,330	7,335	7,335	7,335	7,335	7,335	7,335	
Surplus/Shortage	ROR rights	10,675	10,322	10,255	10,079	9,878	9,659	9,415	

Surplus/Shortage	Ave.available(98%)	9,953	9,600	9,533	9,357	9,156	8,937	8,693
Surplus/Shortage	Ave.avail-dry(93%)	7,599	7,246	7,179	7,003	6,802	6,583	6,339
Surplus/Shortage	Min.Yr.Ava. (86%)	5,573	5,220	5,153	4,977	4,776	4,557	4,313
Bexar (part)								
San Antonio		166,616	220,405	242,339	272,507	312,695	349,957	391,640
Balcones Heights		538	731	739	759	798	843	885
Terrell Hills		817	1,090	1,056	1,054	1,070	1,063	1,050
Olmos Park		385	519	520	530	553	579	603
Helotes		310	360	387	415	494	534	577
Leon Valley		1,715	2,288	2,135	1,958	1,956	1,954	2,040
Alamo Heights		2,210	2,799	2,732	2,686	2,706	2,728	2,742
Converse		1,213	2,127	2,837	3,529	4,498	5,365	6,456
Fair Oaks Ranch		617	774	894	1,005	1,240	1,452	1,700
Kirby		1,080	1,586	1,693	1,839	2,099	2,343	2,614
Live Oak Water Public Utility		1,221	1,101	1,141	1,389	1,554	1,738	2,200
Schertz (Part)		60	116	140	152	162	186	222
Schertz (Outside City) Estimated		607	819	1,031	1,243	1,455	1,667	1,880
Shavano Park		840	1,088	1,163	1,192	1,232	1,284	1,342
St. Hedwig		187	200	215	230	275	318	367
Universal City		2,323	3,386	3,748	4,186	4,864	5,491	6,200
Windcrest (WC&ID No. 10)		1,329	1,675	1,663	1,665	1,687	1,713	1,731
Castle Hills(BMWD)		1,311	1,714	1,743	1,765	1,786	1,769	1,751
Somerset(BMWD)		215	220	225	230	235	237	240
Hill Country/HollywPark(BMWD)		2,174	2,395	5,633	2,901	3,307	3,664	4,079
BMWD(Subdvisions) Estimated		20,741	27,999	34,024	39,841	46,235	52,910	56,821
Remainder of County		18,786	31,641	31,341	38,488	47,088	53,853	42,701
Total Municipal Demand		225,295	305,033	337,399	379,564	437,989	491,648	529,841
Industrial Demand		14,049	16,805	19,682	22,359	24,935	28,264	31,697
Steam-Electric Power Demand		24,263	36,000	36,000	40,000	45,000	50,000	56,000
Irrigation Demand		33,638	36,542	33,659	32,235	30,873	29,568	28,317
Mining Demand		1,444	4,781	4,758	5,018	5,217	5,451	5,763
Livestock Demand		1,353	1,461	1,461	1,461	1,461	1,461	1,461
Total Demand		300,042	400,622	432,959	480,637	545,475	606,392	653,079
Supply								
Groundwater/Edwards		266,374	230,606	204,984	204,984	204,984	204,984	204,984
Groundwater/Other		18,934	18,934	18,934	18,934	18,934	18,934	18,934
Local Surface&Ground		1,353	1,461	1,461	1,461	1,461	1,461	1,461
Surface/Cooling Water		49,000	49,000	49,000	49,000	49,000	49,000	49,000
Surface Water/Streams	ROR rights	30,650	30,650	30,650	30,650	30,650	30,650	30,650
Surface Water/Streams	Ave.available(93%)	28,505	28,505	28,505	28,505	28,505	28,505	28,505
Surface Water/Streams	Ave.avail-dry(78%)	23,907	23,907	23,907	23,907	23,907	23,907	23,907
Surface Water/Streams	Min.Yr.Ava. (51%)	15,632	15,632	15,632	15,632	15,632	15,632	15,632
Surface Water/Recycle		0	30,000	30,000	30,000	30,000	30,000	30,000
Total Supply	ROR rights	366,311	360,651	335,029	335,029	335,029	335,029	335,029
Total Supply	Ave.available(93%)	364,166	358,506	332,884	332,884	332,884	332,884	332,884
Total Supply	Ave.avail-dry(78%)	359,568	353,908	328,286	328,286	328,286	328,286	328,286
Total Supply	Min.Yr.Ava. (51%)	351,293	345,633	320,011	320,011	320,011	320,011	320,011
Surplus/Shortage	ROR rights	66,269	-39,971	-97,930	-145,608	-210,446	-271,363	-318,050
Surplus/Shortage	Ave.available(93%)	64,124	-42,116	-100,076	-147,754	-212,591	-273,508	-320,195
Surplus/Shortage	Ave.avail-dry(78%)	59,526	-46,714	-104,673	-152,351	-217,189	-278,106	-324,793
Surplus/Shortage	Min.Yr.Ava. (51%)	51,251	-54,989	-112,949	-160,627	-225,464	-286,381	-333,068

Comal (part)								
Fair Oaks Ranch		19	29	37	46	61	74	90
Schertz (Part)		19	40	56	78	100	141	186
Rural		1,718	2,036	2,520	3,285	4,226	5,235	6,310
Total Municipal Demand		1,756	2,105	2,613	3,409	4,387	5,450	6,586
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		409	66	63	61	58	56	53
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		45	50	50	50	50	50	50
Total Demand		2,210	2,221	2,726	3,520	4,495	5,556	6,689
Supply								
Groundwater/Edwards		337	292	259	259	259	259	259
Groundwater/Other		1,828	270	270	270	270	270	270
Local Surface&Ground		45	50	50	50	50	50	50
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		2,210	612	579	579	579	579	579
Surplus/Shortage		0	-1,609	-2,147	-2,941	-3,916	-4,977	-6,110
DeWitt (part)								
Rural		109	109	102	98	100	103	106
Total Municipal Demand		109	109	102	98	100	103	106
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		22	20	18	16	14	13	11
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		148	153	153	153	153	153	153
Total Demand		279	282	273	267	267	269	270
Supply								
Groundwater		793	793	793	793	793	793	793
Local Surface&Ground		148	153	153	153	153	153	153
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		941	946	946	946	946	946	946
Surplus/Shortage		662	664	673	679	679	677	676
Goliad (part)								
Goliad		412	429	419	408	407	416	440
Rural		261	259	245	233	233	234	247
Total Municipal Demand		673	688	664	641	640	650	687
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		685	560	458	374	306	250	205
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		345	471	471	471	471	471	471
Total Demand		1,703	1,719	1,593	1,486	1,417	1,371	1,363
Supply								
Groundwater		1,537	1,537	1,537	1,537	1,537	1,537	1,537
Local Surface&Ground		345	471	471	471	471	471	471
Surface Water/Streams	ROR rights	4,048	4,048	4,048	4,048	4,048	4,048	4,048
Surface Water/Streams	Ave.available(98%)	3,967	3,967	3,967	3,967	3,967	3,967	3,967

Surface Water/Streams	Ave.avail-dry(94%)	3,805	3,805	3,805	3,805	3,805	3,805	3,805
Surface Water/Streams	Min.Yr.Ava. (80%)	3,238	3,238	3,238	3,238	3,238	3,238	3,238
Total Supply	ROR rights	5,930	6,056	6,056	6,056	6,056	6,056	6,056
Total Supply	Ave.available(98%)	5,849	5,975	5,975	5,975	5,975	5,975	5,975
Total Supply	Ave.avail-dry(94%)	5,687	5,813	5,813	5,813	5,813	5,813	5,813
Total Supply	Min.Yr.Ava. (80%)	5,120	5,246	5,246	5,246	5,246	5,246	5,246
Surplus/Shortage	ROR rights	4,227	4,337	4,463	4,570	4,639	4,685	4,693
Surplus/Shortage	Ave.available(98%)	4,146	4,256	4,382	4,489	4,558	4,604	4,612
Surplus/Shortage	Ave.avail-dry(94%)	3,984	4,094	4,220	4,327	4,396	4,442	4,450
Surplus/Shortage	Min.Yr.Ava. (80%)	3,417	3,527	3,653	3,760	3,829	3,875	3,883
Guadalupe (part)								
Cibolo		198	308	307	313	346	392	424
Schertz (Part)		1,437	2,680	3,217	3,851	5,016	6,490	8,411
Rural		1,021	1,807	2,268	2,663	3,308	3,675	4,140
Total Municipal Demand		2,656	4,795	5,792	6,827	8,670	10,557	12,975
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		343	324	306	289	273	258	244
Mining Demand		8	10	10	10	10	10	10
Livestock Demand		258	284	284	284	284	284	284
Total Demand		3,265	5,413	6,392	7,410	9,237	11,109	13,513
Supply								
Groundwater/Edwards		2,439	2,112	1,877	1,877	1,877	1,877	1,877
Groundwater/Other		2,768	2,768	2,768	2,768	2,768	2,768	2,768
Local Surface&Ground		258	284	284	284	284	284	284
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		5,465	5,164	4,929	4,929	4,929	4,929	4,929
Surplus/Shortage		2,200	-249	-1,463	-2,481	-4,308	-6,180	-8,584
Karnes (part)								
Karnes City		410	468	435	442	468	491	515
Kenedy		682	828	779	799	847	885	931
Runge		164	199	184	187	196	203	213
Rural		820	936	860	865	904	945	958
Total Municipal Demand		2,076	2,431	2,258	2,293	2,415	2,524	2,617
Industrial Demand		270	296	320	331	340	356	383
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		2,034	1,818	1,624	1,451	1,297	1,159	1,035
Mining Demand		187	147	59	23	15	8	4
Livestock Demand		1,088	1,060	1,060	1,060	1,060	1,060	1,060
Total Demand		5,655	5,752	5,321	5,158	5,127	5,107	5,099
Supply								
Groundwater		17,465	17,465	17,465	17,465	17,465	17,465	17,465
Local Surface&Ground		1,088	1,060	1,060	1,060	1,060	1,060	1,060
Surface Water/Streams	ROR rights	4,625	4,625	4,625	4,625	4,625	4,625	4,625
Surface Water/Streams	Ave.available(98%)	4,533	4,533	4,533	4,533	4,533	4,533	4,533
Surface Water/Streams	Ave.avail-dry(96%)	4,440	4,440	4,440	4,440	4,440	4,440	4,440
Surface Water/Streams	Min.Yr.Ava. (83%)	3,839	3,839	3,839	3,839	3,839	3,839	3,839
Total Supply	ROR rights	23,178	23,150	23,150	23,150	23,150	23,150	23,150
Total Supply	Ave.available(98%)	23,086	23,058	23,058	23,058	23,058	23,058	23,058

Total Supply	Ave.avail-dry(96%)	22,993	22,965	22,965	22,965	22,965	22,965	22,965
Total Supply	Min.Yr.Ava. (83%)	22,392	22,364	22,364	22,364	22,364	22,364	22,364
Surplus/Shortage	ROR rights	17,523	17,398	17,829	17,992	18,023	18,043	18,051
Surplus/Shortage	Ave.available(98%)	17,431	17,306	17,737	17,900	17,931	17,951	17,959
Surplus/Shortage	Ave.avail-dry(96%)	17,338	17,213	17,644	17,807	17,838	17,858	17,866
Surplus/Shortage	Min.Yr.Ava. (83%)	16,737	16,612	17,043	17,206	17,237	17,257	17,265
Kendall (part)								
Boerne		785	1,123	1,266	1,383	1,585	1,783	2,006
Fair Oaks Ranch		64	71	71	70	78	87	97
Rural		515	594	587	596	634	690	751
Total Municipal Demand		1,364	1,788	1,924	2,049	2,297	2,560	2,854
Industrial Demand		2	2	3	4	4	5	6
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		70	91	91	91	91	91	91
Total Demand		1,436	1,881	2,018	2,144	2,392	2,656	2,951
Supply								
Groundwater		2,372	2,372	2,372	2,372	2,372	2,372	2,372
Local Surface&Ground		70	91	91	91	91	91	91
Surface Water/Streams	ROR rights	915	915	915	915	915	915	915
Surface Water/Streams	Ave.available(98%)	897	897	897	897	897	897	897
Surface Water/Streams	Ave.avail-dry(94%)	860	860	860	860	860	860	860
Surface Water/Streams	Min.Yr.Ava. (87%)	796	796	796	796	796	796	796
Total Supply	ROR rights	3,357	3,378	3,378	3,378	3,378	3,378	3,378
Total Supply	Ave.available(98%)	3,339	3,360	3,360	3,360	3,360	3,360	3,360
Total Supply	Ave.avail-dry(94%)	3,302	3,323	3,323	3,323	3,323	3,323	3,323
Total Supply	Min.Yr.Ava. (87%)	3,238	3,259	3,259	3,259	3,259	3,259	3,259
Surplus/Shortage	ROR rights	1,921	1,497	1,360	1,234	986	722	427
Surplus/Shortage	Ave.available(98%)	1,903	1,479	1,342	1,216	968	704	409
Surplus/Shortage	Ave.avail-dry(94%)	1,866	1,442	1,305	1,179	931	667	372
Surplus/Shortage	Min.Yr.Ava. (87%)	1,802	1,378	1,241	1,115	867	603	308
Kerr (part)								
Rural		3	4	4	4	4	4	5
Total Municipal Demand		3	4	4	4	4	4	5
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation		0	0	0	0	0	0	0
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		26	37	37	37	37	37	37
Total Demand		29	41	41	41	41	41	42
Supply								
Groundwater		29	29	29	29	29	29	29
Local Surface&Ground		26	37	37	37	37	37	37
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		55	66	66	66	66	66	66
Surplus/Shortage		26	25	25	25	25	25	24

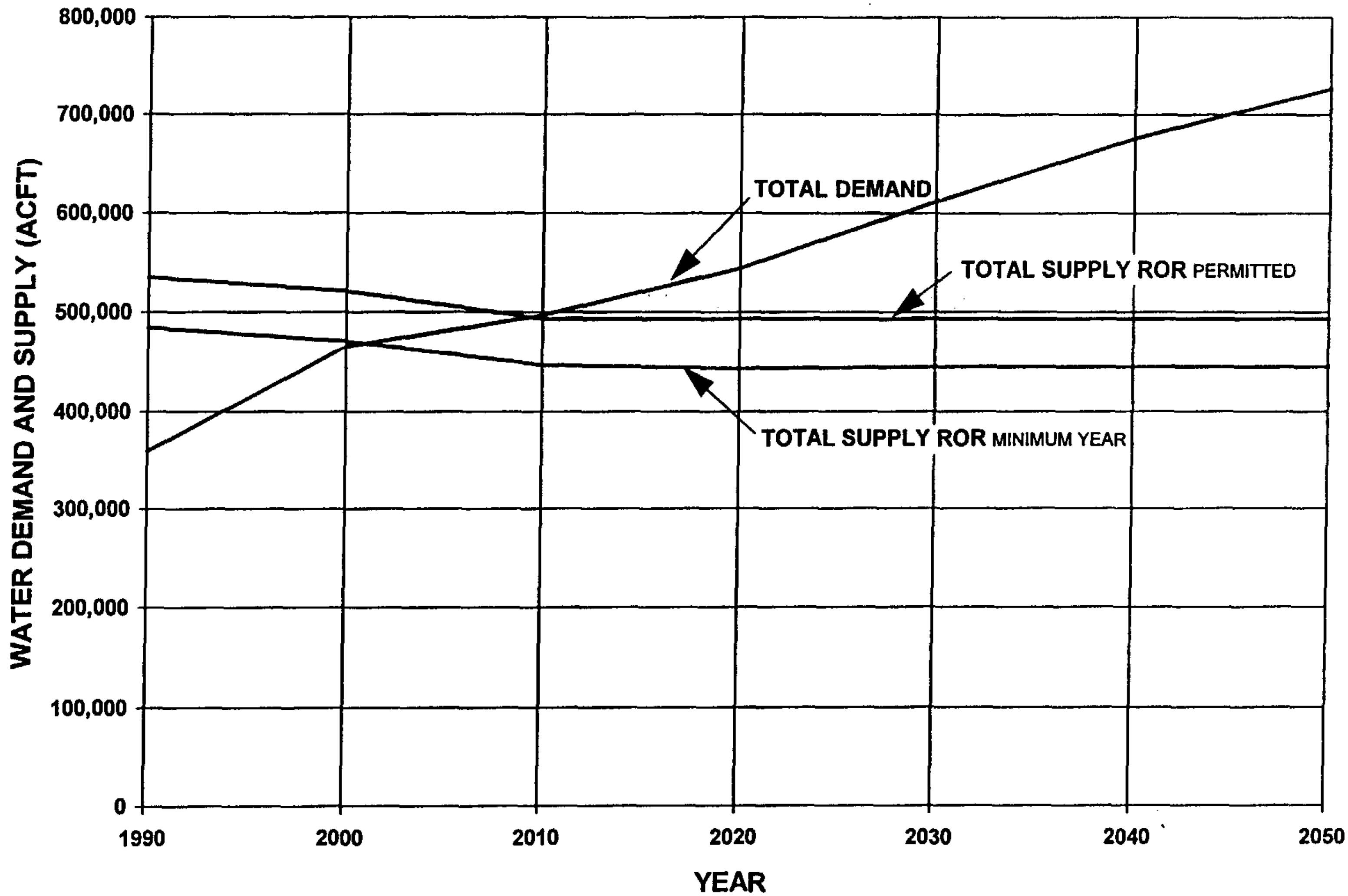
Medina (part)								
Castroville		779	958	985	1,013	1,061	1,092	1,123
Lacoste		229	278	299	300	326	345	365
Rural		258	441	458	466	493	509	540
Total Municipal Demand		1,266	1,677	1,742	1,779	1,880	1,946	2,028
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		24,184	26,525	24,660	23,601	22,588	21,618	20,691
Mining Demand		53	68	68	70	72	74	76
Livestock Demand		224	276	276	276	276	276	276
Total Demand		25,727	28,546	26,746	25,726	24,816	23,914	23,071
Supply								
Groundwater/Edwards		18,797	16,273	14,465	14,465	14,465	14,465	14,465
Groundwater/Other		5,756	1,252	1,252	1,252	1,252	1,252	1,252
Local Surface&Ground		224	276	276	276	276	276	276
Surface Water/Medina L	Medina Lake 1	29,030	29,030	29,030	29,030	29,030	29,030	29,030
Surface Water/Medina L	Ave.available(86%)	24,966	24,966	24,966	24,966	24,966	24,966	24,966
Surface Water/Medina L	Ave.avail-dry(40%)	11,612	11,612	11,612	11,612	11,612	11,612	11,612
Surface Water/Medina L	Min.Yr.Ava. (1%)	290	290	290	290	290	290	290
Surface Water/Streams	ROR rights	950	950	950	950	950	950	950
Surface Water/Streams	Ave.available(93%)	884	884	884	884	884	884	884
Surface Water/Streams	Ave.avail-dry(72%)	684	684	684	684	684	684	684
Surface Water/Streams	Min.Yr.Ava. (46%)	437	437	437	437	437	437	437
Total Supply	ROR rights	54,757	47,781	45,973	45,973	45,973	45,973	45,973
Total Supply	Ave.available(93%)	50,626	43,650	41,842	41,842	41,842	41,842	41,842
Total Supply	Ave.avail-dry(72%)	37,073	30,097	28,289	28,289	28,289	28,289	28,289
Total Supply	Min.Yr.Ava. (46%)	25,504	18,528	16,720	16,720	16,720	16,720	16,720
Surplus/Shortage	ROR rights	29,030	19,235	19,227	20,247	21,157	22,059	22,902
Surplus/Shortage	Ave.available(93%)	24,899	15,105	15,096	16,116	17,026	17,928	18,771
Surplus/Shortage	Ave.avail-dry(72%)	11,346	1,551	1,543	2,563	3,473	4,375	5,218
Surplus/Shortage	Min.Yr.Ava. (46%)	-223	-10,017	-10,026	-9,006	-8,096	-7,194	-6,351
Refugio (part)								
Rural		11	10	9	9	8	8	8
Total Municipal Demand		11	10	9	9	8	8	8
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		21	16	16	16	16	16	16
Total Demand		32	26	25	25	24	24	24
Supply								
Groundwater		155	155	155	155	155	155	155
Local Surface&Ground		21	16	16	16	16	16	16
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		176	171	171	171	171	171	171
Surplus/Shortage		144	145	146	146	147	147	147
Victoria (part)								
Rural		34	34	33	32	33	34	37
Total Municipal Demand		34	34	33	32	33	34	37

Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		70	78	78	78	78	78	78
Total Demand		104	112	111	110	111	112	115
Supply								
Groundwater		82	82	82	82	82	82	82
Local Surface&Ground		70	78	78	78	78	78	78
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		152	160	160	160	160	160	160
Surplus/Shortage		48	48	49	50	49	48	45
Wilson (part)								
Floresville		1,044	1,290	1,340	1,385	1,453	1,531	1,613
Poth		361	449	474	494	522	552	600
Stockdale		273	334	353	369	392	412	448
Rural		1,878	2,660	2,791	2,896	3,050	3,225	3,530
Total Municipal Demand		3,556	4,733	4,958	5,144	5,417	5,720	6,191
Industrial Demand		2	2	3	4	4	5	6
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		9,485	8,359	7,367	6,493	5,722	5,043	4,445
Mining Demand		281	182	97	58	38	30	20
Livestock Demand		1,606	1,687	1,687	1,687	1,687	1,687	1,687
Total Demand		14,930	14,963	14,112	13,386	12,868	12,485	12,349
Supply								
Groundwater		46,054	46,054	46,054	46,054	46,054	46,054	46,054
Local Surface&Ground		1,606	1,687	1,687	1,687	1,687	1,687	1,687
Surface Water/Streams	ROR rights	11,206	11,206	11,206	11,206	11,206	11,206	11,206
Surface Water/Streams	Ave.available(98%)	10,982	10,982	10,982	10,982	10,982	10,982	10,982
Surface Water/Streams	Ave.avail-dry(96%)	10,758	10,758	10,758	10,758	10,758	10,758	10,758
Surface Water/Streams	Min.Yr.Ava. (88%)	9,861	9,861	9,861	9,861	9,861	9,861	9,861
Total Supply	ROR rights	58,866	58,947	58,947	58,947	58,947	58,947	58,947
Total Supply	Ave.available(98%)	58,642	58,723	58,723	58,723	58,723	58,723	58,723
Total Supply	Ave.avail-dry(96%)	58,418	58,499	58,499	58,499	58,499	58,499	58,499
Total Supply	Min.Yr.Ava. (88%)	57,521	57,602	57,602	57,602	57,602	57,602	57,602
Surplus/Shortage	ROR rights	43,936	43,984	44,835	45,561	46,079	46,462	46,598
Surplus/Shortage	Ave.available(98%)	43,712	43,760	44,611	45,337	45,855	46,238	46,374
Surplus/Shortage	Ave.avail-dry(96%)	43,488	43,536	44,387	45,113	45,631	46,014	46,150
Surplus/Shortage	Min.Yr.Ava. (88%)	42,591	42,639	43,490	44,216	44,734	45,117	45,253

San Antonio Basin Summary								
Municipal Demand		240,233	325,199	359,369	403,907	466,116	523,715	566,696
Industrial Demand		14,323	17,105	20,008	22,698	25,283	28,630	32,092
Steam-Electric Power Demand		24,263	36,000	36,000	40,000	45,000	50,000	56,000
Irrigation Demand		72,393	75,745	69,629	65,936	62,494	59,274	56,260
Mining Demand		1,993	5,213	5,017	5,915	7,001	8,334	10,451
Livestock Demand		5,536	5,960	5,960	5,960	5,960	5,960	5,960
Basin Total		358,741	465,222	495,983	544,416	611,854	675,913	727,459
Supply								
Groundwater/Edwards		287,947	249,283	221,585	221,585	221,585	221,585	221,585
Groundwater/Other		105,407	99,244	99,244	99,244	99,244	99,244	99,244
Local Surface&Ground		5,536	5,960	5,960	5,960	5,960	5,960	5,960
Surface/Cooling Water		49,000	49,000	49,000	49,000	49,000	49,000	49,000
Surface Water/Medina L	Medina Lake 1	34,030	34,030	34,030	34,030	34,030	34,030	34,030
Surface Water/Medina L	Ave.available(86%)	29,266	29,266	29,266	29,266	29,266	29,266	29,266
Surface Water/Medina L	Ave.avail-dry(40%)	13,612	13,612	13,612	13,612	13,612	13,612	13,612
Surface Water/Medina L	Min.Yr.Ava. (1%)	340	340	340	340	340	340	340
Surface Water/Streams	ROR rights	53,482	53,482	53,482	53,482	53,482	53,482	53,482
Surface Water/Streams	Ave.available	50,832	50,832	50,832	50,832	50,832	50,832	50,832
Surface Water/Streams	Ave.avail-dry	45,466	45,466	45,466	45,466	45,466	45,466	45,466
Surface Water/Streams	Min.Yr.Ava.	34,739	34,739	34,739	34,739	34,739	34,739	34,739
Surface Water/Recycle		0	30,000	30,000	30,000	30,000	30,000	30,000
Total Supply	ROR rights	535,402	520,999	493,301	493,301	493,301	493,301	493,301
Total Supply	Ave.available	527,988	513,585	485,887	485,887	485,887	485,887	485,887
Total Supply	Ave.avail-dry	506,968	492,565	464,867	464,867	464,867	464,867	464,867
Total Supply	Min.Yr.Ava.	482,969	468,566	440,868	440,868	440,868	440,868	440,868
Surplus/Shortage	ROR rights	176,661	55,777	-2,682	-51,115	-118,553	-182,612	-234,158
Surplus/Shortage	Ave.available	169,247	48,363	-10,095	-58,529	-125,967	-190,026	-241,572
Surplus/Shortage	Ave.avail-dry	148,227	27,342	-31,116	-79,550	-146,987	-211,046	-262,592
Surplus/Shortage	Min.Yr.Ava.	124,228	3,344	-55,115	-103,549	-170,986	-235,045	-286,591

Source: Texas Water Development Board; 1996 Consensus Water Plan. Most Likely Case, below normal rainfall and advanced water conservation.

1 Medina Lake Permit is for 65,830 acre-feet per year, and is allocated among Medina County in the Nueces Basin in the amount of 31,800 acft/yr, Medina County in the San Antonio Basin in the amount of 29,030 acft/yr, and Bandera County of the San Antonio Basin in the amount of 5,000 acft/yr. The allocations are based upon proportions of the acreages irrigated using Medina Lake water and an agreement between The Bexar-Medina-Atascosa Irrigation District and interests in Bandera County.



- Total Supply ROR is the sum of groundwater, firm yields of reservoirs, if any, and run-of-river permits at maximum permitted quantities.
- Total Supply ROR Minimum Year is the sum of groundwater, firm yields of reservoirs, if any, and quantities from run-of-river permits during driest year of record.

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

SAN ANTONIO BASIN PROJECTIONS WATER DEMAND/WATER SUPPLY

FIGURE 4-2

(This page intentionally left blank)

4.3 Guadalupe River Basin and Adjacent Lavaca-Guadalupe Coastal Basin Study Area Projected Water Demand and Water Supply Comparisons

Water demand and water supply projections are tabulated and compared for the study area counties and parts of counties of the Guadalupe and adjacent Lavaca-Guadalupe Coastal Basins. The part of counties included are Bandera, Bastrop, Blanco, Caldwell, Comal, Fayette, Goliad, Gonzales, Gudadalupe, Hays, Karnes, Kendall, Kerr, Travis, Wilson, Calhoun, DeWitt, and Victoria. Those parts of counties of the Lavaca-Guadalupe Coastal Basin are included with the Guadalupe Basin, since parts of Calhoun and Victoria Counties obtain surface water via permits which authorize the diversion and use of water from the Guadalupe River.

The population of the combined Guadalupe River Basin area and the Lavaca-Guadalupe Coastal Basin was 340,914 in 1990 and is projected at 889,580 in 2050 (Appendix A: Table 3 and Table 5). Of the totals in 1990, 302,409 was in the Guadalupe Basin area and 38,505 was in the Lavaca-Guadalupe Coastal Basin. In 2050, 824,550 population is projected for the Guadalupe Basin area and 65,050 is projected for the Lavaca-Guadalupe Coastal Basin.

Water demand and water supply projections are tabulated for each part of each county of the Guadalupe and adjacent Lavaca-Guadalupe Coastal Basins in Table 4-3. In 1990, water use in the Guadalupe/Lavaca-Guadalupe area was 190,261 acft/yr, and water dmand for the area is projected to increase to 352,329 acft/yr (Table 4-3) (Refer to Table 4-01 for an illustration of how to read Table 4-3). In this area, municipal use was 30 percent of the total in 1990 and is projected to increase to 41 percent of total use in 2050. In 1990, industrial use was 22 percent of total water use, and is projected at 39 percent of total use in 2050. Irrigation accounted for 29 percent of water use in the area in 1990 and is projected to decline to 4 percent in 2050 due to reductions in Federal Farm Support Programs and increased water conservation in irrigation water use.

The summary of projected water supplies and demands shows adequate supplies to meet projected demands for all parts of counties of the Guadalupe/Lavaca-Guadalupe area except for Comal, Guadalupe, and Hays Counties located in the Hill Country along the rapidly-growing IH-35 San Antonio to Austin Corridor (Table 4-3). However, it is noted and emphasized that in the Hill Country area, Counties (Bandera, Blanco, Kendall, and Kerr Counties) of the Guadalupe River Basin, the margins between projected supply and demand are very thin, and, as a practical matter, groundwater supplies from the Trinity Group aquifers shown in the tables for these counties are not readily available to meet the needs of the growing cities within the area, due to the fact that well yields are quite low, which would make it necessary to drill and equip a large number of widely-spaced wells in order to obtain the water that is indicated to be available from these aquifers.

The counties located in mid-basin (Caldwell, DeWitt, and Gonzales) show water surpluses over the projection period due to fairly significant quantities of water available from the Carrizo Aquifer, while the coastal area counties (Calhoun, Victoria, and Goliad) have both groundwater from the Gulf Coast aquifer and surface water rights to the Guadalupe River, which together are projected to exceed projected water demand throughout the 1990 through 2050 projection period (Table 4-3 and Figure 4-3).

For the Guadalupe/Lavaca-Guadalupe area, projected annual water supplies beginning in the year 2010 range from a low of 460,658 acft/yr during severe droughts to 570,451 acft/yr for full run-of-river water rights (Table 4-3 and Figure 4-3). These quantities are greater than projected total demands for the entire area; however, as mentioned above, shortages are projected for the upstream Hill Country counties. In addition, it is imporant to note that supplies available have not been allocated to meet any particular demand. In fact, it may not be feasible to meet some demands of the basin from some supplies located within the basin.

Table 4-3 Comparison of Water Demand and Water Supply Projections Guadalupe River Basin and Adjacent Lavaca-Guadalupe Coastal Basin Area West Central Trans Texas Study Area Trans-Texas Water Program								
		Total Use	Projections					
Basin/County/Water Utility		in 1990	2000	2010	2020	2030	2040	2050
		acft	acft	acft	acft	acft	acft	acft
Bandera (part)								
Rural		16	21	22	24	27	29	33
Total Municipal Demand		16	21	22	24	27	29	33
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		5	6	6	6	6	6	6
Total Demand		21	27	28	30	33	35	39
Supply								
Groundwater		73	73	73	73	73	73	73
Local Surface&Ground		5	6	6	6	6	6	6
Surface Water/Streams	ROR rights	21	21	21	21	21	21	21
Surface Water/Streams	Ave.available(98%)	21	21	21	21	21	21	21
Surface Water/Streams	Ave.avail-dry(93%)	20	20	20	20	20	20	20
Surface Water/Streams	Min.Yr.Ava. (86%)	18	18	18	18	18	18	18
Total Supply	ROR rights	99	100	100	100	100	100	100
Total Supply	Ave.available(98%)	99	100	100	100	100	100	100
Total Supply	Ave.avail-dry(93%)	98	99	99	99	99	99	99
Total Supply	Min.Yr.Ava. (86%)	96	97	97	97	97	97	97
Surplus/Shortage	ROR rights	78	73	72	70	67	65	61
Surplus/Shortage	Ave.available(98%)	78	73	72	70	67	65	61
Surplus/Shortage	Ave.avail-dry(93%)	77	72	71	69	66	64	60
Surplus/Shortage	Min.Yr.Ava. (86%)	75	70	69	67	64	62	58
Bastrop (part)								
Rural		31	60	69	79	91	98	100
Total Municipal Demand		31	60	69	79	91	98	100
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	12	8	5	2	0	0
Livestock Demand		61	65	65	65	65	65	65
Total Demand		92	137	142	149	158	163	165
Supply								
Groundwater		332	332	332	332	332	332	332
Local Surface&Ground		61	65	65	65	65	65	65
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		393	397	397	397	397	397	397
Surplus/Shortage		301	260	255	248	239	234	232

Blanco (part)								
Blanco		227	283	263	242	238	226	216
Rural		200	264	294	329	366	386	374
Total Municipal Demand		427	547	557	571	604	612	590
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		105	98	93	88	83	79	74
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		130	157	157	157	157	157	157
Total Demand		662	802	807	816	844	848	821
Supply								
Groundwater		2,631	2,631	2,631	2,631	2,631	2,631	2,631
Local Surface&Ground		130	157	157	157	157	157	157
Surface Water/Streams	ROR rights	768	768	768	768	768	768	768
Surface Water/Streams	Ave.available(99%)	760	760	760	760	760	760	760
Surface Water/Streams	Ave.avail-dry(97%)	745	745	745	745	745	745	745
Surface Water/Streams	Min.Yr.Ava. (96%)	737	737	737	737	737	737	737
Total Supply	ROR rights	3,529	3,556	3,556	3,556	3,556	3,556	3,556
Total Supply	Ave.available(99%)	3,521	3,548	3,548	3,548	3,548	3,548	3,548
Total Supply	Ave.avail-dry(97%)	3,506	3,533	3,533	3,533	3,533	3,533	3,533
Total Supply	Min.Yr.Ava. (96%)	3,498	3,525	3,525	3,525	3,525	3,525	3,525
Surplus/Shortage	ROR rights	2,867	2,754	2,749	2,740	2,712	2,708	2,735
Surplus/Shortage	Ave.available(99%)	2,859	2,746	2,741	2,732	2,704	2,700	2,727
Surplus/Shortage	Ave.avail-dry(97%)	2,844	2,731	2,726	2,717	2,689	2,685	2,712
Surplus/Shortage	Min.Yr.Ava. (96%)	2,836	2,723	2,718	2,709	2,681	2,677	2,704
Caldwell (part)								
Lockhart		1,816	2,003	2,162	2,303	2,499	2,496	2,492
Luling		1,207	1,306	1,235	1,164	1,149	1,066	1,003
Rural		1,692	2,372	2,576	2,776	2,982	2,990	2,995
Total Municipal Demand		4,715	5,681	5,973	6,243	6,630	6,552	6,490
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		1,355	1,197	1,057	934	824	728	643
Mining Demand		27	8	7	5	2	0	0
Livestock Demand		681	696	696	696	696	696	696
Total Demand		6,778	7,582	7,733	7,878	8,152	7,976	7,829
Supply								
Groundwater/Edwards		423	366	326	326	326	326	326
Groundwater/Other		9,864	9,864	9,864	9,864	9,864	9,864	9,864
Surface Water/Canyon	Firm Yield 1	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Local Surface&Ground		681	696	696	696	696	696	696
Surface Water/Streams	ROR rights	11,565	11,565	11,565	11,565	11,565	11,565	11,565
Surface Water/Streams	Ave.available(98%)	11,334	11,334	11,334	11,334	11,334	11,334	11,334
Surface Water/Streams	Ave.avail-dry(97%)	11,218	11,218	11,218	11,218	11,218	11,218	11,218
Surface Water/Streams	Min.Yr.Ava. (94%)	10,871	10,871	10,871	10,871	10,871	10,871	10,871
Total Supply	ROR rights	23,533	23,491	23,451	23,451	23,451	23,451	23,451
Total Supply	Ave.available(98%)	23,302	23,260	23,220	23,220	23,220	23,220	23,220
Total Supply	Ave.avail-dry(97%)	23,186	23,144	23,104	23,104	23,104	23,104	23,104
Total Supply	Min.Yr.Ava. (94%)	22,839	22,797	22,757	22,757	22,757	22,757	22,757

Surplus/Shortage	ROR rights	16,755	15,909	15,718	15,573	15,299	15,475	15,622
Surplus/Shortage	Ave.available(98%)	16,524	15,678	15,487	15,342	15,068	15,244	15,391
Surplus/Shortage	Ave.avail-dry(97%)	16,408	15,562	15,371	15,226	14,952	15,128	15,275
Surplus/Shortage	Min.Yr.Ava. (94%)	16,061	15,215	15,024	14,879	14,605	14,781	14,928
Comal (part)								
Garden Ridge		361	564	672	799	1,038	1,253	1,511
New Braunfels		6,199	10,335	12,570	15,436	19,499	22,447	25,717
Rural		2,099	5,583	6,925	9,043	11,645	14,440	17,413
Total Municipal Demand		8,659	16,482	20,167	25,278	32,182	38,140	44,641
Industrial Demand		3,248	3,450	3,487	3,548	3,799	4,071	4,351
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		70	393	377	360	346	331	317
Mining Demand		946	5,570	5,464	5,628	5,796	3,590	2,224
Livestock Demand		271	306	306	306	306	306	306
Total Demand		13,194	26,201	29,801	35,120	42,429	46,438	51,839
Supply								
Groundwater/Edwards		10,881	9,420	8,373	8,373	8,373	8,373	8,373
Groundwater/Other		1,530	1,530	1,530	1,530	1,530	1,530	1,530
Surface Water/Canyon	Firm Yield 1	0	16,007	16,007	16,007	16,007	16,007	16,007
Local Surface&Ground		271	306	306	306	306	306	306
Surface Water/Streams	ROR rights	8,121	8,121	8,121	8,121	8,121	8,121	8,121
Surface Water/Streams	Ave.available(93%)	7,553	7,553	7,553	7,553	7,553	7,553	7,553
Surface Water/Streams	Ave.avail-dry(68%)	5,522	5,522	5,522	5,522	5,522	5,522	5,522
Surface Water/Streams	Min.Yr.Ava. (9%)	731	731	731	731	731	731	731
Total Supply	ROR rights	20,803	35,384	34,337	34,337	34,337	34,337	34,337
Total Supply	Ave.available(93%)	20,235	34,816	33,769	33,769	33,769	33,769	33,769
Total Supply	Ave.avail-dry(68%)	18,204	32,785	31,738	31,738	31,738	31,738	31,738
Total Supply	Min.Yr.Ava. (9%)	13,413	27,994	26,947	26,947	26,947	26,947	26,947
Surplus/Shortage	ROR rights	7,609	9,183	4,536	-783	-8,092	-12,101	-17,502
Surplus/Shortage	Ave.available(93%)	7,041	8,615	3,968	-1,351	-8,660	-12,669	-18,070
Surplus/Shortage	Ave.avail-dry(68%)	5,010	6,584	1,937	-3,382	-10,691	-14,700	-20,101
Surplus/Shortage	Min.Yr.Ava. (9%)	219	1,793	-2,854	-8,173	-15,482	-19,491	-24,892
Fayette (part)								
Flatonia		302	355	363	374	411	451	497
Rural		84	72	72	76	83	91	103
Total Municipal Demand		386	427	435	450	494	542	600
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	16	12	7	4	2	0
Livestock Demand		130	168	168	168	168	168	168
Total Demand		516	611	615	625	666	712	768
Supply								
Groundwater		1,135	1,135	1,135	1,135	1,135	1,135	1,135
Local Surface&Ground		130	168	168	168	168	168	168
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		1,265	1,303	1,303	1,303	1,303	1,303	1,303
Surplus/Shortage		749	692	688	678	637	591	535

Goliad (part)								
Rural		184	182	172	164	164	165	174
Total Municipal Demand		184	182	172	164	164	165	174
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		12,165	15,000	15,000	20,000	20,000	20,000	20,000
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	12	9	5	2	0	0
Livestock Demand		195	267	267	267	267	267	267
Total Demand		12,544	15,461	15,448	20,436	20,433	20,432	20,441
Supply								
Groundwater		12,349	10,888	10,888	10,888	10,888	10,888	10,888
Surface Water/Canyon	Firm Yield 1	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Local Surface&Ground		195	267	267	267	267	267	267
Surface Water/Streams	ROR rights	12,500	12,500	12,500	12,500	12,500	12,500	12,500
Surface Water/Streams	Ave.available(98%)	12,250	12,250	12,250	12,250	12,250	12,250	12,250
Surface Water/Streams	Ave.avail-dry(93%)	11,625	11,625	11,625	11,625	11,625	11,625	11,625
Surface Water/Streams	Min.Yr.Ava. (60%)	7,500	7,500	7,500	7,500	7,500	7,500	7,500
Total Supply	ROR rights	31,044	29,655	29,655	29,655	29,655	29,655	29,655
Total Supply	Ave.available(98%)	30,794	29,405	29,405	29,405	29,405	29,405	29,405
Total Supply	Ave.avail-dry(93%)	30,169	28,780	28,780	28,780	28,780	28,780	28,780
Total Supply	Min.Yr.Ava. (60%)	26,044	24,655	24,655	24,655	24,655	24,655	24,655
Surplus/Shortage	ROR rights	18,500	14,194	14,207	9,219	9,222	9,223	9,214
Surplus/Shortage	Ave.available(98%)	18,250	13,944	13,957	8,969	8,972	8,973	8,964
Surplus/Shortage	Ave.avail-dry(93%)	17,625	13,319	13,332	8,344	8,347	8,348	8,339
Surplus/Shortage	Min.Yr.Ava. (60%)	13,500	9,194	9,207	4,219	4,222	4,223	4,214
Gonzales (part)								
Gonzales		1,646	1,648	1,607	1,566	1,564	1,589	1,623
Nixon		373	384	368	353	351	358	363
Rural		1,805	1,833	1,741	1,681	1,661	1,668	1,685
Total Municipal Demand		3,824	3,865	3,716	3,600	3,576	3,615	3,671
Industrial Demand		865	929	992	1,043	1,083	1,160	1,231
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		3,540	3,019	2,574	2,195	1,871	1,596	1,361
Mining Demand		21	37	34	32	29	29	30
Livestock Demand		4,072	5,018	5,018	5,018	5,018	5,018	5,018
Total Demand		12,322	12,868	12,334	11,888	11,577	11,418	11,311
Supply								
Groundwater		46,094	46,094	46,094	46,094	46,094	46,094	46,094
Surface Water/Canyon	Firm Yield 1	0	0	391	391	391	391	391
Local Surface&Ground		4,072	5,018	5,018	5,018	5,018	5,018	5,018
Surface Water/Streams	ROR rights	6,419	6,419	6,419	6,419	6,419	6,419	6,419
Surface Water/Streams	Ave.available(98%)	6,291	6,291	6,291	6,291	6,291	6,291	6,291
Surface Water/Streams	Ave.avail-dry(93%)	5,970	5,970	5,970	5,970	5,970	5,970	5,970
Surface Water/Streams	Min.Yr.Ava. (70%)	4,493	4,493	4,493	4,493	4,493	4,493	4,493
Total Supply	ROR rights	56,585	57,531	57,922	57,922	57,922	57,922	57,922
Total Supply	Ave.available(98%)	56,457	57,403	57,794	57,794	57,794	57,794	57,794
Total Supply	Ave.avail-dry(93%)	56,136	57,082	57,473	57,473	57,473	57,473	57,473
Total Supply	Min.Yr.Ava. (70%)	54,659	55,605	55,996	55,996	55,996	55,996	55,996

Surplus/Shortage	ROR rights	44,263	44,663	45,588	46,034	46,345	46,504	46,611
Surplus/Shortage	Ave.available(98%)	44,135	44,535	45,460	45,906	46,217	46,376	46,483
Surplus/Shortage	Ave.avail-dry(93%)	43,814	44,214	45,139	45,585	45,896	46,055	46,162
Surplus/Shortage	Min.Yr.Ava. (70%)	42,337	42,737	43,662	44,108	44,419	44,578	44,685
Guadalupe (part)								
New Braunfels		55	75	84	98	139	155	171
Seguin		3,604	4,037	3,989	4,513	5,454	6,040	6,689
Rural		3,312	6,450	7,937	9,258	11,517	12,695	14,253
Total Municipal Demand		6,971	10,562	12,010	13,869	17,110	18,890	21,113
Industrial Demand		1,661	1,883	2,102	2,248	2,385	2,590	2,797
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		2,303	2,177	2,058	1,945	1,838	1,738	1,642
Mining Demand		0	186	188	190	192	197	203
Livestock Demand		773	848	848	848	848	848	848
Total Demand		11,708	15,656	17,206	19,100	22,373	24,263	26,603
Supply								
Groundwater/Edwards		531	460	409	409	409	409	409
Groundwater/Other		9,815	9,815	9,815	9,815	9,815	9,815	9,815
Surface Water/Canyon	Firm Yield 1	4,992	4,992	6,184	6,184	6,184	6,184	6,184
Local Surface&Ground		773	848	848	848	848	848	848
Surface Water/Streams	ROR rights	9,935	9,935	9,935	9,935	9,935	9,935	9,935
Surface Water/Streams	Ave.available(98%)	9,736	9,736	9,736	9,736	9,736	9,736	9,736
Surface Water/Streams	Ave.avail-dry(97%)	9,637	9,637	9,637	9,637	9,637	9,637	9,637
Surface Water/Streams	Min.Yr.Ava. (70%)	6,955	6,955	6,955	6,955	6,955	6,955	6,955
Total Supply	ROR rights	26,046	26,050	27,191	27,191	27,191	27,191	27,191
Total Supply	Ave.available(98%)	25,847	25,851	26,992	26,992	26,992	26,992	26,992
Total Supply	Ave.avail-dry(97%)	25,748	25,752	26,893	26,893	26,893	26,893	26,893
Total Supply	Min.Yr.Ava. (70%)	23,066	23,070	24,211	24,211	24,211	24,211	24,211
Surplus/Shortage	ROR rights	14,338	10,394	9,985	8,091	4,818	2,928	588
Surplus/Shortage	Ave.available(98%)	14,139	10,195	9,786	7,892	4,619	2,729	389
Surplus/Shortage	Ave.avail-dry(97%)	14,040	10,096	9,687	7,793	4,520	2,630	290
Surplus/Shortage	Min.Yr.Ava. (70%)	11,358	7,414	7,005	5,111	1,838	-53	-2,393
Hays (part)								
Kyle		326	353	337	339	376	435	504
San Marcos		6,321	8,431	9,385	10,453	12,394	14,808	17,691
Rural		3,158	4,970	6,290	7,379	9,126	11,005	11,980
Total Municipal Demand		9,805	13,754	16,012	18,171	21,896	26,248	30,175
Industrial Demand		57	93	105	118	129	142	154
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		298	294	290	286	283	280	276
Mining Demand		0	84	82	68	55	37	28
Livestock Demand		378	271	271	271	271	271	271
Total Demand		10,538	14,496	16,760	18,914	22,634	26,978	30,904
Supply								
Groundwater/Edwards		7,882	6,824	6,065	6,065	6,065	6,065	6,065
Groundwater/Other		1,466	1,466	1,466	1,466	1,466	1,466	1,466
Surface Water/Canyon	Firm Yield 1	5,000	5,500	9,000	9,000	9,000	9,000	9,000

Local Surface&Ground		378	271	271	271	271	271	271
Surface Water/Streams	ROR rights	3,724	3,724	3,724	3,724	3,724	3,724	3,724
Surface Water/Streams	Ave.available(98%)	3,650	3,650	3,650	3,650	3,650	3,650	3,650
Surface Water/Streams	Ave.avail-dry(97%)	3,612	3,612	3,612	3,612	3,612	3,612	3,612
Surface Water/Streams	Min.Yr.Ava. (94%)	3,501	3,501	3,501	3,501	3,501	3,501	3,501
Total Supply	ROR rights	18,450	17,785	20,526	20,526	20,526	20,526	20,526
Total Supply	Ave.available(98%)	18,376	17,711	20,452	20,452	20,452	20,452	20,452
Total Supply	Ave.avail-dry(97%)	18,338	17,673	20,414	20,414	20,414	20,414	20,414
Total Supply	Min.Yr.Ava. (94%)	18,227	17,562	20,303	20,303	20,303	20,303	20,303
Surplus/Shortage	ROR rights	7,912	3,289	3,766	1,612	-2,108	-6,452	-10,378
Surplus/Shortage	Ave.available(98%)	7,838	3,215	3,692	1,538	-2,182	-6,526	-10,452
Surplus/Shortage	Ave.avail-dry(97%)	7,800	3,177	3,654	1,500	-2,220	-6,564	-10,490
Surplus/Shortage	Min.Yr.Ava. (94%)	7,689	3,066	3,543	1,389	-2,331	-6,675	-10,601
Karnes (part)								
Rural		14	27	25	25	26	28	28
Total Municipal Demand		14	27	25	25	26	28	28
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	11	8	4	1	0	0
Livestock Demand		94	92	92	92	92	92	92
Total Demand		108	130	125	121	119	120	120
Supply								
Groundwater		188	188	188	188	188	188	188
Local Surface&Ground		94	92	92	92	92	92	92
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		282	280	280	280	280	280	280
Surplus/Shortage		174	150	155	159	161	160	160
Kendall (part)								
Rural		746	761	752	765	816	891	973
Total Municipal Demand		746	761	752	765	816	891	973
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		380	364	348	333	319	305	292
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		307	404	404	404	404	404	404
Total Demand		1,433	1,529	1,504	1,502	1,539	1,600	1,669
Supply								
Groundwater		2,372	2,372	2,372	2,372	2,372	2,372	2,372
Surface Water/Canyon	Firm Yield 1	0	1,000	1,000	1,000	1,000	1,000	1,000
Local Surface&Ground		307	404	404	404	404	404	404
Surface Water/Streams	ROR rights	2,656	2,656	2,656	2,656	2,656	2,656	2,656
Surface Water/Streams	Ave.available(98%)	2,603	2,603	2,603	2,603	2,603	2,603	2,603
Surface Water/Streams	Ave.avail-dry(94%)	2,497	2,497	2,497	2,497	2,497	2,497	2,497
Surface Water/Streams	Min.Yr.Ava. (86%)	2,284	2,284	2,284	2,284	2,284	2,284	2,284
Total Supply	ROR rights	5,335	6,432	6,432	6,432	6,432	6,432	6,432
Total Supply	Ave.available(98%)	5,282	6,379	6,379	6,379	6,379	6,379	6,379
Total Supply	Ave.avail-dry(94%)	5,176	6,273	6,273	6,273	6,273	6,273	6,273

Total Supply	Min.Yr.Ava. (86%)	4,963	6,060	6,060	6,060	6,060	6,060	6,060
Surplus/Shortage	ROR rights	3,902	4,903	4,928	4,930	4,893	4,832	4,763
Surplus/Shortage	Ave.available(98%)	3,849	4,850	4,875	4,877	4,840	4,779	4,710
Surplus/Shortage	Ave.avail-dry(94%)	3,743	4,744	4,769	4,771	4,734	4,673	4,604
Surplus/Shortage	Min.Yr.Ava. (86%)	3,530	4,531	4,556	4,558	4,521	4,460	4,391
Kerr (part)								
Ingram		244	285	300	297	305	295	291
Kerrville		3,492	5,317	5,863	6,228	6,933	7,285	7,425
Rural		2,081	2,605	2,793	3,189	3,495	3,650	3,745
Total Municipal Demand		5,817	8,206	8,956	9,714	10,733	11,230	11,461
Industrial Demand		28	30	33	36	38	41	44
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		850	822	796	770	745	721	697
Mining Demand		73	163	113	105	102	102	105
Livestock Demand		257	350	350	350	350	350	350
Total Demand		7,025	9,571	10,248	10,975	11,968	12,444	12,657
Supply								
Groundwater		9,457	9,457	9,457	9,457	9,457	9,457	9,457
Surface Water/Canyon	Firm Yield 1	0	1,000	1,000	1,000	1,000	1,000	1,000
Local Surface&Ground		257	350	350	350	350	350	350
Surface Water/Streams	ROR rights (Firm)	10,003	10,003	10,003	10,003	10,003	10,003	10,003
Total Supply		19,717	20,810	20,810	20,810	20,810	20,810	20,810
Surplus/Shortage		12,692	11,239	10,562	9,835	8,842	8,366	8,153
Travis (part)								
Rural		66	123	128	139	158	168	180
Total Municipal Demand		66	123	128	139	158	168	180
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	0	0	0	0	0	0
Livestock Demand		36	36	36	36	36	36	36
Total Demand		102	159	164	175	194	204	216
Supply								
Groundwater		66	36	36	36	36	36	36
Local Surface&Ground		36	36	36	36	36	36	36
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		102	72	72	72	72	72	72
Surplus/Shortage		0	-87	-92	-103	-122	-132	-144
Wilson (part)								
Rural		68	113	118	123	129	137	150
Total Municipal Demand		68	113	118	123	129	137	150
Industrial Demand		48	59	69	81	95	110	128
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		116	103	90	80	70	62	55
Mining Demand		0	11	8	4	1	0	0
Livestock Demand		61	64	64	64	64	64	64
Total Demand		293	350	349	352	359	373	397

Supply								
Groundwater		606	606	606	606	606	606	606
Local Surface&Ground		61	64	64	64	64	64	64
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		667	670	670	670	670	670	670
Surplus/Shortage		374	320	321	318	311	297	273
Calhoun County Summary (part)								
Port Lavaca	Lavaca-Guadalupe CB	1,507	1,769	1,709	1,698	1,792	1,909	2,033
Seadrift	Lavaca-Guadalupe CB	169	196	202	216	238	257	280
Rural	Lavaca-Guadalupe CB	2,015	2,004	2,101	2,188	2,382	2,588	2,869
Rural	Guadalupe Basin	3	9	9	10	11	11	13
Total Municipal Demand		3,694	3,978	4,021	4,112	4,423	4,765	5,195
Industrial Demand	Lavaca-Guadalupe CB	17,963	46,069	56,704	62,813	69,603	76,905	84,738
Industrial Demand	Guadalupe Basin	233	419	493	546	601	662	726
Total Industrial Demand		18,196	46,488	57,197	63,359	70,204	77,567	85,464
Steam-Electric Power Demand	Lavaca-Guad CB	0	0	0	0	0	0	0
Steam-Electric Power Demand	Guadalupe Basin	0	0	0	0	0	0	0
Total Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand	Lavaca-Guadalupe CB	35,421	26,822	22,747	19,950	17,673	16,132	15,028
Irrigation Demand	Guadalupe Basin	0	0	0	0	0	0	0
Total Irrigation Demand		35,421	26,822	22,747	19,950	17,673	16,132	15,028
Mining Demand	Lavaca-Guadalupe CB	1	6	5	4	3	2	2
Mining Demand	Guadalupe Basin	0	13	9	5	2	0	0
Total Mining Demand		1	19	14	9	5	2	2
Livestock Demand	Lavaca-Guadalupe CB	278	287	287	287	287	287	287
Livestock Demand	Guadalupe Basin	0	2	2	2	2	2	2
Total Livestock Demand		278	289	289	289	289	289	289
Total Demand		57,590	77,596	84,268	87,719	92,594	98,755	105,978
Supply								
Groundwater		2,940	2,940	2,940	2,940	2,940	2,940	2,940
Surface Water/Canyon	Firm Yield 1	8,534	8,534	8,534	8,534	8,534	8,534	8,534
Local Surface&Ground		278	289	289	289	289	289	289
Surface Water/Streams	ROR rightsFrom Guad	172,773	172,773	172,773	172,773	172,773	172,773	172,773
Surface Water/Streams	Ave.available(95%)	164,134	164,134	164,134	164,134	164,134	164,134	164,134
Surface Water/Streams	Ave.avali-dry(85%)	146,857	146,857	146,857	146,857	146,857	146,857	146,857
Surface Water/Streams	Min.Yr.Ave. (55%)	95,025	95,025	95,025	95,025	95,025	95,025	95,025
Total Supply	ROR rightsFrom Guad	184,525	184,536	184,536	184,536	184,536	184,536	184,536
Total Supply	Ave.available(95%)	175,886	175,897	175,897	175,897	175,897	175,897	175,897
Total Supply	Ave.avali-dry(85%)	158,609	158,620	158,620	158,620	158,620	158,620	158,620
Total Supply	Min.Yr.Ave. (55%)	106,777	106,788	106,788	106,788	106,788	106,788	106,788
Surplus/Shortage	ROR rightsFrom Guad	126,935	106,940	100,268	96,817	91,942	85,781	78,558
Surplus/Shortage	Ave.available(95%)	118,296	98,301	91,629	88,178	83,303	77,142	69,919
Surplus/Shortage	Ave.avali-dry(85%)	101,019	81,024	74,352	70,901	66,026	59,865	52,642
Surplus/Shortage	Min.Yr.Ave. (55%)	49,187	29,192	22,520	19,069	14,194	8,033	810

DeWitt County Summary (part)								
Yoakum	Lavaca Basin	425	453	443	438	463	487	516
Rural	Lavaca Basin	136	136	126	121	124	128	131
Rural	Lavaca-Guadalup CB	3	3	3	3	3	3	3
Cuero	Guadalupe Basin	1,716	1,767	1,710	1,684	1,749	1,823	1,891
Yorktown	Guadalupe Basin	405	438	427	424	451	479	510
Rural	Guadalupe Basin	762	708	659	632	645	665	684
Total Municipal Demand		3,447	3,505	3,368	3,302	3,435	3,585	3,735
Industrial Demand	Lavaca Basin	0	0	0	0	0	0	0
Industrial Demand	Lavaca-Guadalupe CB	0	0	0	0	0	0	0
Industrial Demand	Guadalupe Basin	91	108	126	146	170	195	223
Total Industrial Demand		91	108	126	146	170	195	223
Steam-Electric Power Demand	Lavaca Basin	0	0	0	0	0	0	0
Steam-Electric Power Demand	Lavaca Guad CB	0	0	0	0	0	0	0
Steam-Electric Power Demand	Guadalupe Basin	0	0	0	0	0	0	0
Total Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand	Lavaca Basin	0	0	0	0	0	0	0
Irrigation Demand	Lavaca-Guadalupe CB	0	0	0	0	0	0	0
Irrigation Demand	Guadalupe Basin	263	236	211	190	171	153	137
Total Irrigation Demand		263	236	211	190	171	153	137
Mining Demand	Lavaca Basin	108	94	52	26	18	16	16
Mining Demand	Lavaca-Guadalupe CB	0	43	30	19	6	1	0
Mining Demand	Guadalupe Basin	21	24	24	25	26	27	28
Total Mining Demand		129	161	106	70	50	44	44
Livestock Demand	Lavaca Basin	263	271	271	271	271	271	271
Livestock Demand	Lavaca-Guadalupe CB	51	53	53	53	53	53	53
Livestock Demand	Guadalupe Basin	1,378	1,419	1,419	1,419	1,419	1,419	1,419
Total Livestock Demand		1,692	1,743	1,743	1,743	1,743	1,743	1,743
Total Demand		5,622	5,753	5,554	5,451	5,569	5,720	5,882
Supply								
Groundwater		15,075	15,074	15,074	15,074	15,074	15,074	15,074
Surface Water/Canyon	Firm Yield 1	0	0	421	421	421	421	421
Local Surface&Ground		1,692	1,743	1,743	1,743	1,743	1,743	1,743
Surface Water/Streams	ROR rights Lavaca Basin	801	801	801	801	801	801	801
Surface Water/Streams	Ave.available(98%)	785	785	785	785	785	785	785
Surface Water/Streams	Ave.avail-dry(96%)	769	769	769	769	769	769	769
Surface Water/Streams	Min.Yr.Ava. (83%)	665	665	665	665	665	665	665
Total Supply	ROR rights	17,568	17,618	18,039	18,039	18,039	18,039	18,039
Total Supply	Ave.available(98%)	17,552	17,602	18,023	18,023	18,023	18,023	18,023
Total Supply	Ave.avail-dry(96%)	17,536	17,586	18,007	18,007	18,007	18,007	18,007
Total Supply	Min.Yr.Ava. (83%)	17,432	17,482	17,903	17,903	17,903	17,903	17,903
Surplus/Shortage	ROR rights	11,946	11,865	12,485	12,588	12,470	12,319	12,157
Surplus/Shortage	Ave.available(98%)	11,930	11,849	12,469	12,572	12,454	12,303	12,141
Surplus/Shortage	Ave.avail-dry(96%)	11,914	11,833	12,453	12,556	12,438	12,287	12,125
Surplus/Shortage	Min.Yr.Ava. (83%)	11,810	11,729	12,349	12,452	12,334	12,183	12,021

Victoria County Summary (part)								
Bloomington	Lavaca-Guadalupe CB	181	269	268	281	316	343	373
Victoria	Lavaca-Guadalupe CB	1,883	2,161	2,210	2,269	2,410	2,571	2,743
Rural	Lavaca-Guadalupe CB	937	987	940	911	946	976	1,064
Victoria	Guadalupe Basin	7,269	8,345	8,533	8,762	9,304	9,927	10,590
Rural	Guadalupe Basin	1,220	1,195	1,141	1,107	1,148	1,183	1,285
Total Municipal Demand		11,490	12,957	13,092	13,330	14,124	15,000	16,055
Industrial Demand	Lavaca-Guadalupe CB	0	0	0	0	0	0	0
Industrial Demand	Guadalupe Basin	20,032	24,115	28,446	31,157	33,670	37,900	42,201
Total Industrial Demand		20,032	24,115	28,446	31,157	33,670	37,900	42,201
Steam-Electric Power Demand	Lavaca-Guad CB	0	0	0	0	0	0	0
Steam-Electric Power Demand	Guadalupe Basin	887	8,000	10,000	10,000	10,000	10,000	10,000
Total Steam-Electric Power Demand		887	8,000	10,000	10,000	10,000	10,000	10,000
Irrigation Demand	Lavaca-Guadalupe CB	11,704	9,212	7,251	5,707	4,493	3,537	2,784
Irrigation Demand	Guadalupe Basin	1,995	1,571	1,237	974	766	603	475
Total Irrigation Demand		13,699	10,783	8,488	6,681	5,259	4,140	3,259
Mining Demand	Lavaca-Guadalupe CB	11	640	726	828	931	1,045	1,174
Mining Demand	Guadalupe Basin	2,398	1,938	1,302	904	783	675	688
Total Miming Demand		2,409	2,578	2,028	1,732	1,714	1,720	1,862
Livestock Demand	Lavaca-Guadalupe CB	601	660	660	660	660	660	660
Livestock Demand	Guadalupe Basin	595	653	653	653	653	653	653
Total Livestock Demand		1,196	1,313	1,313	1,313	1,313	1,313	1,313
Total Demand		49,713	59,746	63,367	64,213	66,080	70,073	74,690
Supply								
Groundwater		42,548	41,007	41,007	41,007	41,007	41,007	41,007
Surface Water/Canyon	Firm Yield 1	0	0	5,702	5,702	5,702	5,702	5,702
Local Surface&Ground		1,196	1,313	1,313	1,313	1,313	1,313	1,313
Surface Water/Streams	ROR rights Lav-Guad CB	548	548	548	548	548	548	548
Surface Water/Streams	Ave.available(95%) 1	521	521	521	521	521	521	521
Surface Water/Streams	Ave.avali-dry(85%)	466	466	466	466	466	466	466
Surface Water/Streams	Min.Yr.Ave. (55%)	301	301	301	301	301	301	301
Surface Water/Streams	ROR rights Guadalupe	65,216	65,216	65,216	65,216	65,216	65,216	65,216
Surface Water/Streams	Ave.available(98%)	63,912	63,912	63,912	63,912	63,912	63,912	63,912
Surface Water/Streams	Ave.avail-dry(93%)	60,651	60,651	60,651	60,651	60,651	60,651	60,651
Surface Water/Streams	Min.Yr.Ava. (80%)	52,173	52,173	52,173	52,173	52,173	52,173	52,173
Total Supply	ROR rights	109,508	108,084	113,786	113,786	113,786	113,786	113,786
Total Supply	Ave.available(98%)	108,176	106,752	112,454	112,454	112,454	112,454	112,454
Total Supply	Ave.avail-dry(93%)	104,861	103,437	109,139	109,139	109,139	109,139	109,139
Total Supply	Min.Yr.Ava. (80%)	96,218	94,794	100,496	100,496	100,496	100,496	100,496
Surplus/Shortage	ROR rights	59,795	48,338	50,419	49,573	47,706	43,713	39,096
Surplus/Shortage	Ave.available(98%)	58,463	47,006	49,087	48,241	46,374	42,381	37,764
Surplus/Shortage	Ave.avail-dry(93%)	55,148	43,691	45,772	44,926	43,059	39,066	34,449
Surplus/Shortage	Min.Yr.Ava. (80%)	46,505	35,048	37,129	36,283	34,416	30,423	25,806

Guadalupe Basin and Adjacent Lavaca-- Guadalupe Coastal Basin Summary								
Municipal Demand		60,360	81,251	89,593	99,959	116,618	130,695	145,364
Industrial Demand		44,226	77,155	92,557	101,736	111,573	123,776	136,593
Steam-Electric Power Demand		13,052	23,000	25,000	30,000	30,000	30,000	30,000
Irrigation Demand		58,400	46,308	39,129	33,812	29,482	26,265	23,781
Mining Demand		3,606	8,868	8,081	7,864	7,955	5,723	4,498
Livestock Demand		10,617	12,093	12,093	12,093	12,093	12,093	12,093
Basin Total 1		190,261	248,675	266,453	285,464	307,721	328,552	352,329
Supply								
Groundwater/Edwards		19,717	17,070	15,173	15,173	15,173	15,173	15,173
Groundwater/Other		158,541	155,508	155,508	155,508	155,508	155,508	155,508
Surface Water/Canyon	Firm Yield to users 2	17,592	36,099	47,305	47,305	47,305	47,305	47,305
Surface Water/Canyon	Firm Yield remaining 3	65,035	46,528	35,322	35,322	35,322	35,322	35,322
Local Surface&Ground		10,617	12,093	12,093	12,093	12,093	12,093	12,093
Surface Water/Streams	ROR rights Lavaca Basin	801	801	801	801	801	801	801
Surface Water/Streams	Ave.available(98%)	785	785	785	785	785	785	785
Surface Water/Streams	Ave.avail-dry(96%)	769	769	769	769	769	769	769
Surface Water/Streams	Min.Yr.Ava. (83%)	665	665	665	665	665	665	665
Surface Water/Streams	ROR rights Lav-Guad CB	548	548	548	548	548	548	548
Surface Water/Streams	Ave.available(95%) 4	521	521	521	521	521	521	521
Surface Water/Streams	Ave.avali-dry(85%)	466	466	466	466	466	466	466
Surface Water/Streams	Min.Yr.Ave. (55%)	301	301	301	301	301	301	301
Surface Water/Streams	ROR rights Guadalupe	303,701	303,701	303,701	303,701	303,701	303,701	303,701
Surface Water/Streams	Ave.available	292,245	292,245	292,245	292,245	292,245	292,245	292,245
Surface Water/Streams	Ave.avail-dry	268,356	268,356	268,356	268,356	268,356	268,356	268,356
Surface Water/Streams	Min.Yr.Ava.	194,291	194,291	194,291	194,291	194,291	194,291	194,291
Total Supply	ROR rights	576,552	572,348	570,451	570,451	570,451	570,451	570,451
Total Supply	Ave.available	565,053	560,849	558,952	558,952	558,952	558,952	558,952
Total Supply	Ave.avail-dry	541,093	536,889	534,992	534,992	534,992	534,992	534,992
Total Supply	Min.Yr.Ava.	466,759	462,555	460,658	460,658	460,658	460,658	460,658
Surplus/Shortage	ROR rights	386,291	323,673	303,998	284,987	262,730	241,899	218,122
Surplus/Shortage	Ave.available	374,792	312,174	292,499	273,488	251,231	230,400	206,623
Surplus/Shortage	Ave.avail-dry	350,832	288,214	268,539	249,528	227,271	206,440	182,663
Surplus/Shortage	Min.Yr.Ava.	276,498	213,880	194,205	175,194	152,937	132,106	108,329

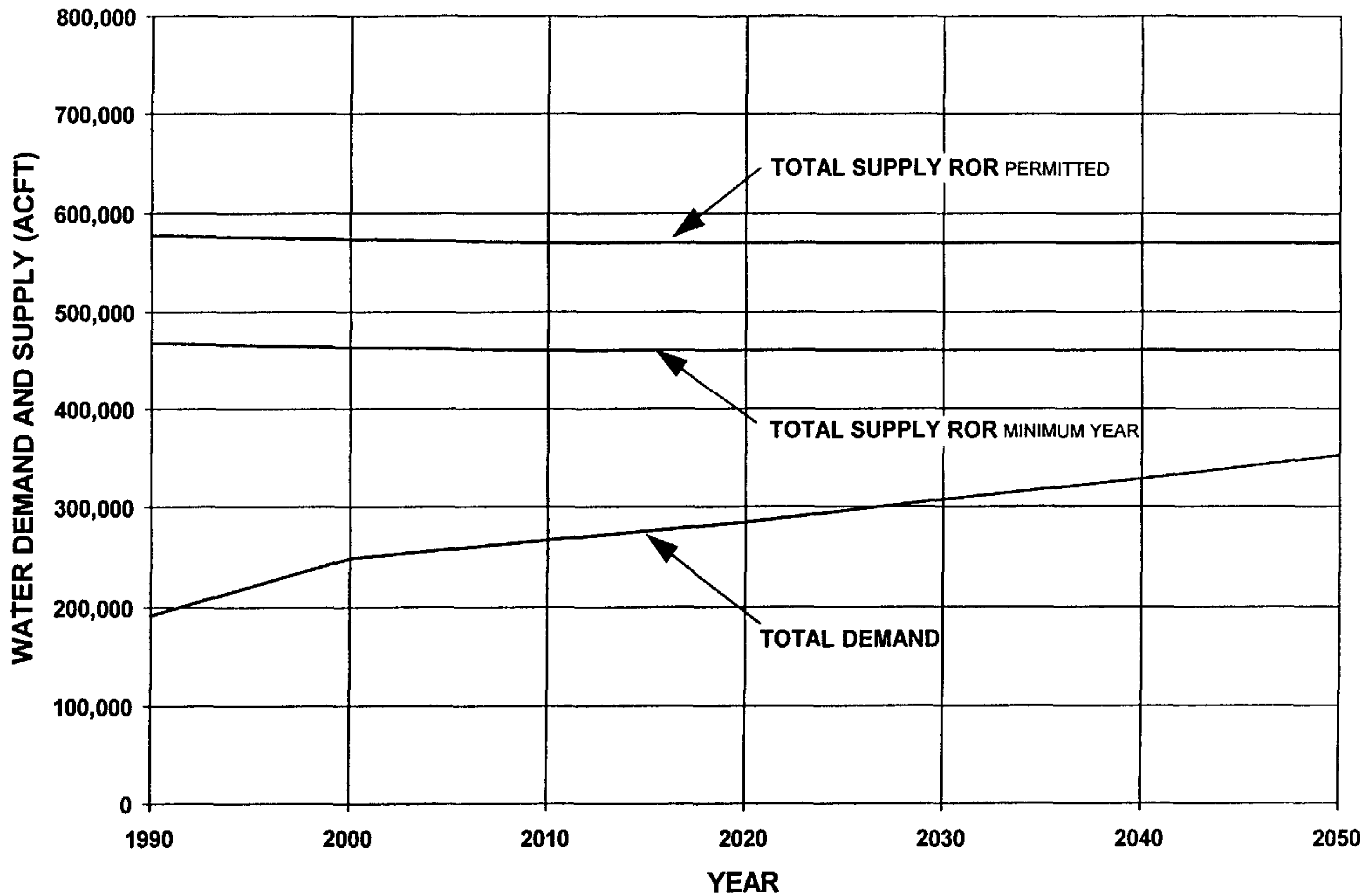
Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.

1 Totals do not include demands for that part of Calhoun County that is located in the Colorado-Lavaca Coastal Basin.

2 Canyon Lake is located in Comal County, and has an estimated Firm Yield of 82,627 acft/yr. The quantity shown on this row is the sum of existing contracts and tentative commitments to customers located in counties of the Guadalupe-Blanco River Authority's service area.

3 The uncomitted supply from the yield of Canyon Lake; this quantity is included in basin totals for all cases of weather conditions.

4 Used availibility estimates for neighboring Calhoun County of the Guadalupe Basin.



- Total Supply ROR is the sum of groundwater, firm yields of reservoirs, if any, and run-of-river permits at maximum permitted quantities.
- Total Supply ROR Minimum Year is the sum of groundwater, firm yields of reservoirs, if any, and quantities from run-of-river permits during driest year of record.

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM / WEST CENTRAL STUDY AREA

GUADALUPE AND ADJACENT COASTAL BASINS PROJECTIONS WATER DEMAND/WATER SUPPLY

FIGURE 4-3

4.4 Lower Colorado River Basin and Adjacent Coastal Basins Area Projected Water Demand and Water Supply Comparisons

In the Lower Colorado River Basin Coastal area, parts of Colorado, Wharton, and Matagorda Counties are located in the adjacent Brazos-Colorado and Colorado-Lavaca Coastal Basins, with parts of Colorado and Wharton Counties also located in the adjacent Lavaca River Basin. Since these parts of those counties obtain surface water from the Lower Colorado River, they have been grouped with the Lower Colorado River Basin for purposes of presenting the water demand and water supply comparisons. Thus, the Lower Colorado River Basin and adjacent Coastal Basins area includes all of Colorado, Matagorda, and Wharton Counties, and parts of Bastrop, Blanco, Burnet, Caldwell, Fayette, Hays, Kendall, Kerr, Lee, Llano, San Saba, and Travis Counties.

In 1990, the population of the Lower Colorado/adjacent Coastal Basins area was 779,965 and is projected at 1,973,748 in 2050 (Apendix A: Table 4 and Table 5). In 1990, 88 percent of this population was located in the Lower Colorado River Basin study area, with 6 percent in the Brazos-Colorado Coastal Basin, 4 percent in the Colorado-Lavaca Coastal Basin, and 2 percent in the Lavaca River Basin. The Lower Colorado River Basin area is projected to have 92 percent of the 2050 projected population (2,012,743), with 4 percent in the Brazos-Colorado area, 3 percent in the Colorado-Lavaca area, and 1 percent in Colorado and Wharton Counties in the Lavaca Basin.

In 1990, water use in the Lower Colorado/Adjacent Coastal Basins area was 1,043,323 acft/yr, of which 14 percent was for municipal purposes, 1.5 percent was for industrial uses, 5.5 percent was for steam-electric power generation, 71 percent was for irrigation, 3.6 percent was for mining, 1 percent was for livestock, and 3 percent was for in-stream flows (Table 4-4). Projected water demands in 2050, with advanced water conservation, are 1,038,987 acft/yr, of which 35 percent are for municipal purposes, 2.4 percent are for industrial purposes, 9.6 percent are for steam-electric power generation, 46 percent are for irrigation, 2.7 percent are for mining, 1 percent is for livestock, and 3 percent are for in-stream purposes. For the 1990 through 2050 projection period, municipal water demand is projected to increase from 148,325 acft/yr to 362,739 acft/yr, with industrial water demand increasing from 15,657 acft/yr to 25,124 acft/yr, and steam-electric power water demand increasing from 57,718 acft/yr to 100,000 acft/yr. Due to declining Federal Farm Support programs and increased water conservation in irrigated agriculture, irrigation water demands are projected to decrease from 740,655 acft/yr in 1990 to 480,018 acft/yr in 2050 (Table 4-4, Basin Summary).

The comparison of projected water demands and supplies shows that of the 15 counties and parts of counties included in the Lower Colorado/Adjacent Coastal basins study area, 11 counties or parts of counties are projected to have adequate water supplies to meet projected demands through the 1990 through 2050 projection period (Table 4-4) (Refer to Table 4-01 for an explanation of how to read Table 4-4). The counties having projected shortages are Hays County in the Hill Country, and Colorado, Wharton, and Matagorda Counties near the coast during severe droughts (Table 4-4)

The total water supply available from ground and surface sources, including the firm yield of the Highland Lakes and permits to divert run-of-river flows is shown for each county and part of county of the Lower Colorado/Adjacent Coastal Basins area (Table 4-4). The summary for all counties and parts of counties shows a total supply for the period 2000 through 2050 ranging from 1,095,256 during severe drought (based on drought of 1947 to 1956) to 1,972,093 acft/yr for full run-of-river water rights (Table 4-4). The comparison of projected water demands with projected water supplies, shows a surplus for the area in 2050 of 56,275 acft/yr for the severe drought condition and a surplus of 933,112 acft/yr for full run-of-river water rights (Table 4-4 and Figure 4-4). However, as is the case in other basins of the West Central Trans-Texas study area, there are counties within the basin where shortages are projected, and it is emphasized that in this analysis, water demands have not been allocated to any particular surface or groundwater source. In fact, some sources may not be a feasible supply to meet some demands.

Table 4-4								
Comparison of Water Demand and Water Supply Projections								
Lower Colorado River and Adjacent Coastal Basins Area								
West Central Trans-Texas Study Area								
Trans-Texas Water Program								
		Total Use	Projections					
Basin/County/Water Utility		in 1990	2000	2010	2020	2030	2040	2050
		acft	acft	acft	acft	acft	acft	acft
Bastrop (part)								
Bastrop		767	1,013	1,147	1,291	1,486	1,606	1,959
Elgin		701	834	881	946	1,066	1,137	1,367
Garfield CDP		14	20	21	22	25	27	33
Smithville		624	624	628	679	766	805	963
Rural		3,940	5,346	6,125	6,934	7,987	8,640	8,828
Total Municipal Demand		6,046	7,837	8,802	9,872	11,330	12,215	13,150
Industrial Demand		27	33	40	48	57	67	78
Steam-Electric Power Demand		2,967	4,500	8,000	8,000	8,000	8,000	8,000
Irrigation Demand		609	528	457	396	343	297	257
Mining Demand		16	28	27	27	29	34	43
Livestock Demand		1,133	1,207	1,207	1,207	1,207	1,207	1,207
Total Demand		10,798	14,133	18,533	19,550	20,966	21,820	22,735
Supply								
Groundwater		39,471	39,471	39,471	39,471	39,471	39,471	39,471
Surface Water/HLakes*		11,600	11,600	11,600	11,600	11,600	11,600	11,600
Local Surface&Ground		1,133	1,207	1,207	1,207	1,207	1,207	1,207
Surface Water/Streams	ROR rights	11,265	11,265	11,265	11,265	11,265	11,265	11,265
Surface Water/Streams	Ave.available(42%)1	4,731	4,731	4,731	4,731	4,731	4,731	4,731
Surface Water/Streams	Ave.avali-dry(35%)	3,943	3,943	3,943	3,943	3,943	3,943	3,943
Surface Water/Streams	Min.Yr.Ave. (28%)	3,154	3,154	3,154	3,154	3,154	3,154	3,154
Total Supply	ROR rights	63,469	63,543	63,543	63,543	63,543	63,543	63,543
Total Supply	Ave.available(42%)	56,935	57,009	57,009	57,009	57,009	57,009	57,009
Total Supply	Ave.avali-dry(35%)	56,147	56,221	56,221	56,221	56,221	56,221	56,221
Total Supply	Min.Yr.Ave. (28%)	55,358	55,432	55,432	55,432	55,432	55,432	55,432
Surplus/Shortage	ROR rights	52,671	49,410	45,010	43,993	42,577	41,723	40,808
Surplus/Shortage	Ave.available(42%)	46,137	42,876	38,476	37,459	36,043	35,189	34,274
Surplus/Shortage	Ave.avali-dry(35%)	45,349	42,088	37,688	36,671	35,255	34,401	33,486
Surplus/Shortage	Min.Yr.Ave. (28%)	44,560	41,299	36,899	35,882	34,466	33,612	32,697
Blanco (part)								
Johnson City		194	277	306	336	371	387	403
Rural		283	323	358	398	441	464	451
Total Municipal Demand		477	600	664	734	812	851	854
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		378	359	339	321	304	287	272
Mining Demand		0	13	9	5	1	0	0
Livestock Demand		423	513	513	513	513	513	513
Total Demand		1,278	1,485	1,525	1,573	1,630	1,651	1,639

Supply								
Groundwater		5,106	5,106	5,106	5,106	5,106	5,106	5,106
Local Surface&Ground		423	513	513	513	513	513	513
Surface Water/Streams	ROR rights	220	220	220	220	220	220	220
Surface Water/Streams	Ave.available(96%)2	211	211	211	211	211	211	211
Surface Water/Streams	Ave.avali-dry(91%)	200	200	200	200	200	200	200
Surface Water/Streams	Min.Yr.Ave. (75%)	165	165	165	165	165	165	165
Total Supply	ROR rights	5,749	5,839	5,839	5,839	5,839	5,839	5,839
Total Supply	Ave.available(96%)	5,740	5,830	5,830	5,830	5,830	5,830	5,830
Total Supply	Ave.avali-dry(91%)	5,729	5,819	5,819	5,819	5,819	5,819	5,819
Total Supply	Min.Yr.Ave. (75%)	5,694	5,784	5,784	5,784	5,784	5,784	5,784
Surplus/Shortage	ROR rights	4,471	4,354	4,314	4,266	4,209	4,188	4,200
Surplus/Shortage	Ave.available(96%)	4,462	4,345	4,305	4,257	4,200	4,179	4,191
Surplus/Shortage	Ave.avali-dry(91%)	4,451	4,334	4,294	4,246	4,189	4,168	4,180
Surplus/Shortage	Min.Yr.Ave. (75%)	4,416	4,299	4,259	4,211	4,154	4,133	4,145
Burnet (part)								
Burnet		611	723	824	878	963	985	1,007
Granit Shoals		172	201	225	237	268	280	297
Marble Falls		845	1,198	1,380	1,564	1,764	1,833	1,905
Rural		1,352	1,559	1,616	1,741	1,939	1,992	2,046
Total Municipal Demand		2,980	3,681	4,045	4,420	4,934	5,090	5,255
Industrial Demand		1,116	1,246	1,377	1,514	1,655	1,800	1,947
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		300	292	285	277	270	263	257
Mining Demand		922	981	960	984	1,009	1,039	1,071
Livestock Demand		420	408	408	408	408	408	408
Total Demand		5,738	6,608	7,075	7,603	8,276	8,600	8,938
Supply								
Groundwater		13,838	13,838	13,838	13,838	13,838	13,838	13,838
Surface Water/HLakes*		8,901	8,901	8,901	8,901	8,901	8,901	8,901
Local Surface&Ground		420	408	408	408	408	408	408
Surface Water/Streams	ROR rights	12,259	12,259	12,259	12,259	12,259	12,259	12,259
Surface Water/Streams	Ave.available(96%)2	11,769	11,769	11,769	11,769	11,769	11,769	11,769
Surface Water/Streams	Ave.avali-dry(91%)	11,156	11,156	11,156	11,156	11,156	11,156	11,156
Surface Water/Streams	Min.Yr.Ave. (75%)	9,194	9,194	9,194	9,194	9,194	9,194	9,194
Total Supply	ROR rights	35,418	35,406	35,406	35,406	35,406	35,406	35,406
Total Supply	Ave.available(96%)	34,928	34,916	34,916	34,916	34,916	34,916	34,916
Total Supply	Ave.avali-dry(91%)	34,315	34,303	34,303	34,303	34,303	34,303	34,303
Total Supply	Min.Yr.Ave. (75%)	32,353	32,341	32,341	32,341	32,341	32,341	32,341
Surplus/Shortage	ROR rights	29,680	28,798	28,331	27,803	27,130	26,806	26,468
Surplus/Shortage	Ave.available(96%)	29,190	28,308	27,841	27,313	26,640	26,316	25,978
Surplus/Shortage	Ave.avali-dry(91%)	28,577	27,695	27,228	26,700	26,027	25,703	25,365
Surplus/Shortage	Min.Yr.Ave. (75%)	26,615	25,733	25,266	24,738	24,065	23,741	23,403
Caldwell (part)								
Rural		216	121	133	145	157	157	158
Total Municipal Demand		216	121	133	145	157	157	158
Industrial Demand		0	0	0	0	0	0	0

Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		20	18	16	14	13	11	10
Mining Demand		0	13	9	5	2	0	0
Livestock Demand		135	139	139	139	139	139	139
Total Demand		371	291	297	303	311	307	307
Supply								
Groundwater		519	519	519	519	519	519	519
Local Surface&Ground		135	139	139	139	139	139	139
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		654	658	658	658	658	658	658
Surplus/Shortage		283	367	361	355	347	351	351
Colorado County Summary								
Columbus	Colorado Basin	864	986	1,004	1,037	1,107	1,168	1,232
Eagle Lake	Colorado Basin	298	360	351	351	366	381	392
Weimar	Colorado Basin	119	130	122	117	121	122	124
Rural	Colorado Basin	848	732	667	621	617	610	599
Eagle Lake	Brazos Colorado CB	298	361	352	352	367	382	393
Rural	Brazos Colorado CB	125	112	102	94	94	93	91
Weimar	Lavaca Basin	146	159	149	143	148	150	152
Rural	Lavaca Basin	229	232	211	196	195	193	189
Total Municipal Demand		2,927	3,072	2,958	2,911	3,015	3,099	3,172
Industrial Demand	Colorado Basin	1,073	1,143	1,215	1,285	1,353	1,418	1,481
Industrial Demand	Brazos Colorado CB	5	7	9	12	16	20	27
Industrial Demand	Lavaca Basin	0	0	0	0	0	0	0
Total Industral Demand		1,078	1,150	1,224	1,297	1,369	1,438	1,508
Steam-Electric Power Demand	Colorado Basin	0	0	0	0	0	0	0
Steam-Electric Power Demand	Brazos-Colo. CB	0	0	0	0	0	0	0
Steam-Electric Power Demand	Lavaca Basin	0	0	0	0	0	0	0
Total Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand	Colorado Basin	27,390	26,247	24,391	22,405	20,606	19,148	17,796
Irrigation Demand	Brazos Colorado CB	56,770	57,058	53,024	46,827	41,496	38,563	35,837
Irrigation Demand	Lavaca Basin	132,320	120,916	112,368	99,649	88,665	82,396	76,572
Total Irrigation Demand		216,480	204,222	189,784	168,881	150,767	140,108	130,205
Mining Demand	Colorado Basin	30,786	18,668	9,865	10,894	12,124	13,498	15,123
Mining Demand	Brazos Colorado CB	198	118	68	48	32	29	30
Mining Demand	Lavaca Basin	983	1,700	1,445	1,392	1,317	1,399	1,524
Total Mining Demand		31,967	20,486	11,378	12,334	13,473	14,926	16,677
Livestock Demand	Colorado Basin	855	885	885	885	885	885	885
Livestock Demand	Brazos Colorado CB	97	102	102	102	102	102	102
Livestock Demand	Lavaca Basin	443	460	460	460	460	460	460
Total Livestock Demand		1,395	1,447	1,447	1,447	1,447	1,447	1,447
Total Demand		253,847	230,377	206,791	186,870	170,071	161,018	153,009
Supply								
Groundwater		82,416	31,786	31,786	31,786	31,786	31,786	31,786
Local Surface&Ground		1,395	1,447	1,447	1,447	1,447	1,447	1,447
Surface Water/Streams	Lavaca Basin ROR rights	2,598	2,598	2,598	2,598	2,598	2,598	2,598
Surface Water/Streams	Ave.available(60%)3 LB	1,559	1,559	1,559	1,559	1,559	1,559	1,559

Surface Water/Streams	Ave.avali-dry(54%) LB	1,403	1,403	1,403	1,403	1,403	1,403	1,403
Surface Water/Streams	Min.Yr.Ave. (43%) LB	1,117	1,117	1,117	1,117	1,117	1,117	1,117
Surface Water/Streams	ROR rightsFrom Colo	144,863	144,863	144,863	144,863	144,863	144,863	144,863
Surface Water/Streams	Ave.available(59%)4	85,469	85,469	85,469	85,469	85,469	85,469	85,469
Surface Water/Streams	Ave.avali-dry(54%)	78,226	78,226	78,226	78,226	78,226	78,226	78,226
Surface Water/Streams	Min.Yr.Ave. (44%)	63,740	63,740	63,740	63,740	63,740	63,740	63,740
Total Supply	ROR rights	231,272	180,694	180,694	180,694	180,694	180,694	180,694
Total Supply	Ave.available	170,839	120,261	120,261	120,261	120,261	120,261	120,261
Total Supply	Ave.avali-dry	163,440	112,862	112,862	112,862	112,862	112,862	112,862
Total Supply	Min.Yr.Ave.	148,668	98,090	98,090	98,090	98,090	98,090	98,090
Surplus/Shortage	ROR rights	-22,575	-49,683	-26,097	-6,176	10,623	19,676	27,685
Surplus/Shortage	Ave.available	-83,008	-110,116	-86,530	-66,609	-49,810	-40,757	-32,748
Surplus/Shortage	Ave.avali-dry	-90,407	-117,515	-93,929	-74,008	-57,209	-48,156	-40,147
Surplus/Shortage	Min.Yr.Ave.	-105,179	-132,287	-108,701	-88,780	-71,981	-62,928	-54,919
Fayette (part)								
LaGrange		876	939	987	1,069	1,202	1,328	1,476
Rural		1,226	1,326	1,312	1,384	1,518	1,671	1,879
Total Municipal Demand		2,102	2,265	2,299	2,453	2,720	2,999	3,355
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		11,701	15,000	20,000	25,000	40,000	40,000	45,000
Irrigation Demand		379	353	327	304	283	263	245
Mining Demand		4	8	6	12	5	4	3
Livestock Demand		1,511	1,942	1,942	1,942	1,942	1,942	1,942
Total Demand		15,697	19,568	24,574	29,711	44,950	45,208	50,545
Supply								
Groundwater		34,803	34,803	34,803	34,803	34,803	34,803	34,803
Surface Water/HLakes*		38,101	38,101	38,101	38,101	38,101	38,101	38,101
Local Surface&Ground		1,511	1,942	1,942	1,942	1,942	1,942	1,942
Surface Water/Streams	ROR rights	4,262	4,262	4,262	4,262	4,262	4,262	4,262
Surface Water/Streams	Ave.available(42%)5	1,790	1,790	1,790	1,790	1,790	1,790	1,790
Surface Water/Streams	Ave.avali-dry(35%)	1,492	1,492	1,492	1,492	1,492	1,492	1,492
Surface Water/Streams	Min.Yr.Ave. (28%)	1,193	1,193	1,193	1,193	1,193	1,193	1,193
Total Supply	ROR rights	78,677	79,108	79,108	79,108	79,108	79,108	79,108
Total Supply	Ave.available(42%)	76,205	76,636	76,636	76,636	76,636	76,636	76,636
Total Supply	Ave.avali-dry(35%)	75,907	76,338	76,338	76,338	76,338	76,338	76,338
Total Supply	Min.Yr.Ave. (28%)	75,608	76,039	76,039	76,039	76,039	76,039	76,039
Surplus/Shortage	ROR rights	62,980	59,540	54,534	49,397	34,158	33,900	28,563
Surplus/Shortage	Ave.available(42%)	60,508	57,068	52,062	46,925	31,686	31,428	26,091
Surplus/Shortage	Ave.avali-dry(35%)	60,210	56,770	51,764	46,627	31,388	31,130	25,793
Surplus/Shortage	Min.Yr.Ave. (28%)	59,911	56,471	51,465	46,328	31,089	30,831	25,494
Hays (part)								
Buda		207	222	238	244	295	352	418
Dripping Springs		161	189	196	198	237	281	334
Rural		1,536	2,487	3,215	3,815	4,779	5,814	6,352
Total Municipal Demand		1,904	2,898	3,649	4,257	5,311	6,447	7,104
Industrial Demand		236	288	340	389	435	478	523
Steam-Electric Power Demand		0	0	0	0	0	0	0

Irrigation Demand	22	22	22	22	22	21	21
Mining Demand	0	12	8	4	1	0	0
Livestock Demand	298	213	213	213	213	213	213
Total Demand	2,460	3,433	4,232	4,885	5,982	7,159	7,861
Supply							
Groundwater	2,162	344	344	344	344	344	344
Local Surface&Ground	298	213	213	213	213	213	213
Surface Water/Streams ROR rights	0	0	0	0	0	0	0
Total Supply	2,460	557	557	557	557	557	557
Surplus/Shortage	0	-2,876	-3,675	-4,328	-5,425	-6,602	-7,304
Kendall (part)							
Rural	20	22	21	22	23	25	28
Total Municipal Demand	20	22	21	22	23	25	28
Industrial Demand	0	0	0	0	0	0	0
Steam-Electric Power Demand	0	0	0	0	0	0	0
Irrigation Demand	0	0	0	0	0	0	0
Mining Demand	0	13	9	5	1	0	0
Livestock Demand	12	17	17	17	17	17	17
Total Demand	32	52	47	44	41	42	45
Supply							
Groundwater	97	97	97	97	97	97	97
Local Surface&Ground	12	17	17	17	17	17	17
Surface Water/Streams ROR rights	0	0	0	0	0	0	0
Total Supply	109	114	114	114	114	114	114
Surplus/Shortage	77	62	67	70	73	72	69
Kerr (part)							
Rural	78	86	85	90	98	104	110
Total Municipal Demand	78	86	85	90	98	104	110
Industrial Demand	0	0	0	0	0	0	0
Steam-Electric Power Demand	0	0	0	0	0	0	0
Irrigation Demand	0	0	0	0	0	0	0
Mining Demand	0	13	9	5	1	0	0
Livestock Demand	98	135	135	135	135	135	135
Total Demand	176	234	229	230	234	239	245
Supply							
Groundwater	294	294	294	294	294	294	294
Local Surface&Ground	98	135	135	135	135	135	135
Surface Water/Streams ROR rights	0	0	0	0	0	0	0
Total Supply	392	429	429	429	429	429	429
Surplus/Shortage	216	195	200	199	195	190	184
Lee (part)							
Giddings	975	997	1,025	1,049	1,115	1,183	1,263
Rural	738	413	416	422	445	472	503
Total Municipal Demand	1,713	1,410	1,441	1,471	1,560	1,655	1,766
Industrial Demand	5	6	7	8	9	11	12
Steam-Electric Power Demand	0	0	0	0	0	0	0

Irrigation Demand		60	58	56	54	53	51	49
Mining Demand		0	14	10	6	3	1	0
Livestock Demand		227	279	279	279	279	279	279
Total Demand		2,005	1,767	1,793	1,818	1,904	1,997	2,106
Supply								
Groundwater		10,476	10,476	10,476	10,476	10,476	10,476	10,476
Local Surface&Ground		227	279	279	279	279	279	279
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		10,703	10,755	10,755	10,755	10,755	10,755	10,755
Surplus/Shortage		8,698	8,988	8,962	8,937	8,851	8,758	8,649
Llano (all)								
Llano		941	1,022	955	901	859	883	904
Rural		1,547	1,775	1,675	1,699	1,732	1,786	1,946
Total Municipal Demand		2,488	2,797	2,630	2,600	2,591	2,669	2,850
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		937	1,000	2,000	2,000	2,000	2,000	2,000
Irrigation Demand		1,122	1,092	1,064	1,036	1,008	982	956
Mining Demand		65	143	112	99	95	92	95
Livestock Demand		908	689	689	689	689	689	689
Total Demand		5,520	5,721	6,495	6,424	6,383	6,432	6,590
Supply								
Groundwater		11,882	11,882	11,882	11,882	11,882	11,882	11,882
Surface Water/HLakes*		16,818	16,818	16,818	16,818	16,818	16,818	16,818
Local Surface&Ground		908	689	689	689	689	689	689
Surface Water/Streams	ROR rights	6,702	6,702	6,702	6,702	6,702	6,702	6,702
Surface Water/Streams	Ave.available(96%)2	6,434	6,434	6,434	6,434	6,434	6,434	6,434
Surface Water/Streams	Ave.avali-dry(91%)	6,099	6,099	6,099	6,099	6,099	6,099	6,099
Surface Water/Streams	Min.Yr.Ave. (75%)	5,027	5,027	5,027	5,027	5,027	5,027	5,027
Total Supply	ROR rights	36,310	36,091	36,091	36,091	36,091	36,091	36,091
Total Supply	Ave.available(96%)	36,042	35,823	35,823	35,823	35,823	35,823	35,823
Total Supply	Ave.avali-dry(91%)	35,707	35,488	35,488	35,488	35,488	35,488	35,488
Total Supply	Min.Yr.Ave. (75%)	34,635	34,416	34,416	34,416	34,416	34,416	34,416
Surplus/Shortage	ROR rights	30,790	30,370	29,596	29,667	29,708	29,659	29,501
Surplus/Shortage	Ave.available(96%)	30,522	30,102	29,328	29,399	29,440	29,391	29,233
Surplus/Shortage	Ave.avali-dry(91%)	30,187	29,767	28,993	29,064	29,105	29,056	28,898
Surplus/Shortage	Min.Yr.Ave. (75%)	29,115	28,695	27,921	27,992	28,033	27,984	27,826
Matagorda County Summary								
Rural	Colorado Basin	318	310	309	312	331	354	385
Bay City	Brazos-Colorado CB	2,730	3,228	3,291	3,406	3,726	4,101	4,515
Van Vleck	Brazos-Colorado CB	225	299	305	315	348	381	424
Rural	Brazos-Colorado CB	494	668	664	674	729	799	891
Palacios	Colorado-Lavaca CB	792	797	811	842	924	1,019	1,133
Rural	Colorado-Lavaca CB	666	550	547	556	603	663	743
Total Municipal Demand		5,225	5,852	5,927	6,105	6,661	7,317	8,091
Industrial Demand	Colorado Basin	4,956	5,363	5,733	5,864	5,950	6,323	6,682
Industrial Demand	Brazos-Colorado CB	1,847	1,998	2,136	2,186	2,217	2,357	2,490
Industrial Demand	Colorado-Lavaca CB	4	5	7	9	12	16	21

Total Industrial Demand		6,807	7,366	7,876	8,059	8,179	8,696	9,193
Steam-Electric Power Demand	Colorado Basin	35,915	35,000	35,000	35,000	35,000	35,000	35,000
Steam-Electric Power De	Brazos-Colorado CB	0	0	0	0	0	0	0
Steam-Electric Power Demand	Colorado-Lavaca	0	0	0	0	0	0	0
Total Steam-Electric Power Demand		35,915	35,000	35,000	35,000	35,000	35,000	35,000
Irrigation Demand	Colorado Basin	12,622	12,241	11,416	10,434	9,731	9,073	8,462
Irrigation Demand	Brazos-Colorado CB	91,018	85,234	79,487	70,180	63,502	59,220	55,226
Irrigation Demand	Colorado-Lavaca CB	91,902	83,233	77,618	69,083	62,796	58,560	54,610
Total Irrigation Demand		195,542	180,708	168,521	149,698	136,030	126,853	118,298
Mining Demand	Colorado Basin	0	0	0	0	0	0	0
Mining Demand	Brazos-Colorado CB	0	9	6	4	1	0	0
Mining Demand	Colorado-Lavaca CB	250	290	250	241	241	242	249
Total Mining Demand		250	299	256	245	242	242	249
Livestock Demand	Colorado Basin	133	123	123	123	123	123	123
Livestock Demand	Brazos-Colorado CB	516	470	470	470	470	470	470
Livestock Demand	Colorado-Lavaca CB	471	430	430	430	430	430	430
Total Livestock Demand		1,120	1,023	1,023	1,023	1,023	1,023	1,023
Total Demand	Colorado Basin	53,944	53,037	52,581	51,733	51,135	50,873	50,652
Total Demand	Brazos-Colorado CB	96,830	91,906	86,359	77,235	70,993	67,328	64,016
Total Demand	Colorado-Lavaca CB	94,085	85,305	79,663	71,161	65,006	60,930	57,186
Total Demand		244,859	230,248	218,603	200,130	187,135	179,131	171,854
Supply								
Groundwater		26,000	26,000	26,000	26,000	26,000	26,000	26,000
Surface Water/HLakes*		33,743	33,743	33,743	33,743	33,743	33,743	33,743
Local Surface&Ground		1,120	1,023	1,023	1,023	1,023	1,023	1,023
Surface Water/Streams	ROR rights	360,800	360,800	360,800	360,800	360,800	360,800	360,800
Surface Water/Streams	Ave.available(40%)6	144,320	144,320	144,320	144,320	144,320	144,320	144,320
Surface Water/Streams	Ave.avali-dry(28%)	101,024	101,024	101,024	101,024	101,024	101,024	101,024
Surface Water/Streams	Min.Yr.Ave. (10%)	36,080	36,080	36,080	36,080	36,080	36,080	36,080
Total Supply	ROR rights	421,663	421,566	421,566	421,566	421,566	421,566	421,566
Total Supply	Ave.available(40%)	205,183	205,086	205,086	205,086	205,086	205,086	205,086
Total Supply	Ave.avali-dry(28%)	161,887	161,790	161,790	161,790	161,790	161,790	161,790
Total Supply	Min.Yr.Ave. (10%)	96,943	96,846	96,846	96,846	96,846	96,846	96,846
Surplus/Shortage	ROR rights	176,804	191,318	202,963	221,436	234,431	242,435	249,712
Surplus/Shortage	Ave.available(40%)	-39,676	-25,162	-13,517	4,956	17,951	25,955	33,232
Surplus/Shortage	Ave.avali-dry(28%)	-82,972	-68,458	-56,813	-38,340	-25,345	-17,341	-10,064
Surplus/Shortage	Min.Yr.Ave. (10%)	-147,916	-133,402	-121,757	-103,284	-90,289	-82,285	-75,008
San Saba (all)								
San Saba		913	1,214	1,118	1,031	992	967	935
Rural		359	385	339	305	289	274	266
Total Municipal Demand		1,272	1,599	1,457	1,336	1,281	1,241	1,201
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		5,734	5,502	5,279	5,065	4,859	4,663	4,474
Mining Demand		86	172	133	124	123	122	126
Livestock Demand		1,121	1,200	1,200	1,200	1,200	1,200	1,200
Total Demand		8,213	8,473	8,069	7,725	7,463	7,226	7,001

Supply								
Groundwater		30,224	30,224	30,224	30,224	30,224	30,224	30,224
Surface Water/HLakes*		20	20	20	20	20	20	20
Local Surface&Ground		1,121	1,200	1,200	1,200	1,200	1,200	1,200
Surface Water/Streams	ROR rights	17,290	17,290	17,290	17,290	17,290	17,290	17,290
Surface Water/Streams	Ave.available(96%)2	16,598	16,598	16,598	16,598	16,598	16,598	16,598
Surface Water/Streams	Ave.avali-dry(91%)	15,734	15,734	15,734	15,734	15,734	15,734	15,734
Surface Water/Streams	Min.Yr.Ave. (75%)	12,968	12,968	12,968	12,968	12,968	12,968	12,968
Total Supply	ROR rights	48,655	48,734	48,734	48,734	48,734	48,734	48,734
Total Supply	Ave.available(96%)	47,963	48,042	48,042	48,042	48,042	48,042	48,042
Total Supply	Ave.avali-dry(91%)	47,099	47,178	47,178	47,178	47,178	47,178	47,178
Total Supply	Min.Yr.Ave. (75%)	44,333	44,412	44,412	44,412	44,412	44,412	44,412
Surplus/Shortage	ROR rights	40,442	40,261	40,665	41,009	41,271	41,508	41,733
Surplus/Shortage	Ave.available(96%)	39,750	39,569	39,973	40,317	40,579	40,816	41,041
Surplus/Shortage	Ave.avali-dry(91%)	38,886	38,705	39,109	39,453	39,715	39,952	40,177
Surplus/Shortage	Min.Yr.Ave. (75%)	36,120	35,939	36,343	36,687	36,949	37,186	37,411
Travis (part)								
Austin		93,507	143,633	161,468	188,986	221,582	240,794	264,564
Garfield		170	242	262	287	344	380	426
Jonestown		179	224	239	261	311	343	378
Lago Vista		654	960	1,034	1,130	1,346	1,482	1,632
Lakeway		812	1,026	1,122	1,228	1,484	1,643	1,819
Manor		180	223	263	289	325	348	373
Pflugerville		776	961	1,034	1,129	1,358	1,499	1,654
Rollingwood		327	408	436	483	560	604	660
West Lake Hills		1,034	1,493	1,817	2,235	2,728	3,049	3,418
Rural		17,020	22,993	23,845	25,835	29,075	30,913	33,052
Total Municipal Demand		114,659	172,163	191,520	221,863	259,113	281,055	307,976
Industrial Demand		5,992	6,931	7,801	8,419	9,152	10,026	11,226
Steam-Electric Power Demand		6,198	7,000	7,000	7,000	7,000	7,000	10,000
Irrigation Demand		800	731	667	609	557	508	464
Mining Demand		2,288	4,880	4,746	5,246	5,791	6,407	7,116
Livestock Demand		906	870	870	870	870	870	870
Total Demand		130,843	192,575	212,604	244,007	282,483	305,866	337,652
Supply								
Groundwater		8,766	8,766	8,766	8,766	8,766	8,766	8,766
Surface Water/HLakes*		294,553	294,553	294,553	294,553	294,553	294,553	294,553
Local Surface&Ground		906	870	870	870	870	870	870
Surface Water/Streams	ROR rights	337,710	337,710	337,710	337,710	337,710	337,710	337,710
Surface Water/Streams	Ave.available(65%)7	219,512	219,512	219,512	219,512	219,512	219,512	219,512
Surface Water/Streams	Ave.avali-dry(50%)	168,855	168,855	168,855	168,855	168,855	168,855	168,855
Surface Water/Streams	Min.Yr.Ave. (30%)	101,313	101,313	101,313	101,313	101,313	101,313	101,313
Total Supply	ROR rights	641,935	641,899	641,899	641,899	641,899	641,899	641,899
Total Supply	Ave.available(65%)	523,737	523,701	523,701	523,701	523,701	523,701	523,701
Total Supply	Ave.avali-dry(50%)	473,080	473,044	473,044	473,044	473,044	473,044	473,044
Total Supply	Min.Yr.Ave. (30%)	405,538	405,502	405,502	405,502	405,502	405,502	405,502
Surplus/Shortage	ROR rights	511,092	449,324	429,295	397,892	359,416	336,033	304,247
Surplus/Shortage	Ave.available(65%)	392,894	331,126	311,097	279,694	241,218	217,835	186,049

Surplus/Shortage	Ave.avali-dry(50%)	342,237	280,469	260,440	229,037	190,561	167,178	135,392
Surplus/Shortage	Min.Yr.Ave. (30%)	274,695	212,927	192,898	161,495	123,019	99,636	67,850
Wharton County Summary								
El Campo	Colorado Basin	155	182	173	169	173	179	186
Wharton	Colorado Basin	135	143	143	147	157	168	180
Rural	Colorado Basin	729	852	841	847	901	962	1,031
East Bernard	Brazos-Colorado CB	276	305	305	310	331	355	381
Wharton	Brazos-Colorado CB	1,404	1,493	1,495	1,530	1,638	1,756	1,882
Rural	Brazos-Colorado CB	1,562	1,285	1,268	1,278	1,359	1,452	1,555
El Campo	Colorado-Lavaca CB	1,396	1,641	1,557	1,519	1,561	1,611	1,677
Rural	Colorado-Lavaca CB	200	233	230	232	246	262	280
Rural	Lavaca Basin	361	410	405	408	434	464	497
Total Municipal Demand		6,218	6,544	6,417	6,440	6,800	7,209	7,669
Industrial Demand	Colorado Basin	170	189	207	227	247	266	286
Industrial Demand	Brazos-Colorado CB	42	50	59	64	70	80	88
Industrial Demand	Colorado-Lavaca CB	116	130	142	148	152	157	163
Industrial Demand	Lavaca Basin	68	73	78	82	85	93	100
Total Industrial Demand		396	442	486	521	554	596	637
Steam-Electric Power Demand Colorado Basin		0	0	0	0	0	0	0
Steam-Electric Power Demand Brazos-Colo CB		0	0	0	0	0	0	0
Steam-Electric Power Demand Colo-Lavaca CB		0	0	0	0	0	0	0
Steam-Electric Power Demand Lavaca Basin		0	0	0	0	0	0	0
Total Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand	Colorado Basin	69,086	65,177	60,803	56,042	51,718	48,247	45,009
Irrigation Demand	Brazos-Colorado CB	134,661	132,057	123,194	109,675	97,965	91,389	85,256
Irrigation Demand	Colorado-Lavaca CB	35,759	42,228	39,394	36,749	34,284	31,982	29,835
Irrigation Demand	Lavaca Basin	79,703	91,846	85,681	79,616	74,013	69,044	64,410
Total Irrigation Demand		319,209	331,308	309,071	282,082	257,978	240,662	224,510
Mining Demand	Colorado Basin	2	2	1	1	0	0	0
Mining Demand	Brazos-Colorado CB	2,648	2,349	2,414	2,492	2,565	2,641	2,720
Mining Demand	Colorado-Lavaca CB	0	19	13	7	2	0	0
Mining Demand	Lavaca Basin	0	4	3	2	1	0	0
Total Mining Demand		2,650	2,374	2,431	2,502	2,568	2,641	2,720
Livestock Demand	Colorado Basin	311	286	286	286	286	286	286
Livestock Demand	Brazos-Colorado CB	403	371	371	371	371	371	371
Livestock Demand	Colorado-Lavaca CB	202	187	187	187	187	187	187
Livestock Demand	Lavaca Basin	297	274	274	274	274	274	274
Total Livestock Demand		1,213	1,118	1,118	1,118	1,118	1,118	1,118
Total Demand	Colorado Basin	70,588	66,831	62,454	57,719	53,482	50,108	46,978
Total Demand	Brazos-Colorado CB	140,996	137,910	129,106	115,720	104,299	98,044	92,253
Total Demand	Colorado-Lavaca CB	37,673	44,438	41,523	38,842	36,432	34,199	32,142
Total Demand	Lavaca Basin	80,429	92,607	86,441	80,382	74,807	69,875	65,281
Total Demand		329,686	341,786	319,523	292,663	269,018	252,226	236,654
Supply								
Groundwater		153,260	100,000	100,000	100,000	100,000	100,000	100,000
Local Surface&Ground		1,213	1,118	1,118	1,118	1,118	1,118	1,118
Surface Water/Streams	Lavaca Basin ROR rights	30,757	30,757	30,757	30,757	30,757	30,757	30,757

Surface Water/Streams	Ave.available(60%)4 LB	18,454	18,454	18,454	18,454	18,454	18,454	18,454
Surface Water/Streams	Ave.avali-dry(54%) LB	16,609	16,609	16,609	16,609	16,609	16,609	16,609
Surface Water/Streams	Min.Yr.Ave. (43%) LB	13,226	13,226	13,226	13,226	13,226	13,226	13,226
Surface Water/Streams	ROR rights From Colo	283,025	283,025	283,025	283,025	283,025	283,025	283,025
Surface Water/Streams	Ave.available (51%)8	144,343	144,343	144,343	144,343	144,343	144,343	144,343
Surface Water/Streams	Ave.avali-dry (39%)	110,380	110,380	110,380	110,380	110,380	110,380	110,380
Surface Water/Streams	Min.Yr.Ave. (31%)	87,738	87,738	87,738	87,738	87,738	87,738	87,738
Total Supply	ROR rights	468,255	414,900	414,900	414,900	414,900	414,900	414,900
Total Supply	Ave.available	317,270	263,915	263,915	263,915	263,915	263,915	263,915
Total Supply	Ave.avali-dry	281,462	228,107	228,107	228,107	228,107	228,107	228,107
Total Supply	Min.Yr.Ave.	255,436	202,081	202,081	202,081	202,081	202,081	202,081
Surplus/Shortage	ROR rights	138,569	73,114	95,377	122,237	145,882	162,674	178,246
Surplus/Shortage	Ave.available	-12,416	-77,871	-55,608	-28,748	-5,104	11,689	27,261
Surplus/Shortage	Ave.avali-dry	-48,224	-113,679	-91,416	-64,557	-40,912	-24,119	-8,548
Surplus/Shortage	Min.Yr.Ave.	-74,250	-139,704	-117,442	-90,582	-66,937	-50,145	-34,573
Lower Colorado Basin and Adjacent								
Coastal Basins Summary								
Municipal Demand		148,325	210,947	232,048	264,719	306,406	332,133	362,739
Industrial Demand		15,657	17,462	19,151	20,255	21,410	23,112	25,124
Steam-Electric Power Demand		57,718	62,500	72,000	77,000	92,000	92,000	100,000
Irrigation Demand		740,655	725,192	675,887	608,759	552,487	514,968	480,018
Mining Demand		38,248	29,449	20,103	21,603	23,344	25,508	28,100
Livestock Demand		10,920	11,200	11,200	11,200	11,200	11,200	11,200
In-Stream Flows		31,800	31,800	31,800	31,800	31,800	31,800	31,800
Basin Total Demand		1,043,323	1,088,550	1,062,189	1,035,336	1,038,647	1,030,721	1,038,981
Supply								
Groundwater		419,314	313,606	313,606	313,606	313,606	313,606	313,606
Surface Water/HLakes/In-Basin/Firm*		403,736	403,736	403,736	403,736	403,736	403,736	403,736
Local Surface&Ground		10,920	11,200	11,200	11,200	11,200	11,200	11,200
Surface Water/HLakes/In-Stream/Firm*		31,800	31,800	31,800	31,800	31,800	31,800	31,800
Surface Water/Streams	Lavaca Basin ROR rights	33,355	33,355	33,355	33,355	33,355	33,355	33,355
Surface Water/Streams	Ave.available(60%)4 LB	20,013	20,013	20,013	20,013	20,013	20,013	20,013
Surface Water/Streams	Ave.avali-dry(54%) LB	18,012	18,012	18,012	18,012	18,012	18,012	18,012
Surface Water/Streams	Min.Yr.Ave. (43%) LB	14,343	14,343	14,343	14,343	14,343	14,343	14,343
Surface Water/Streams	ROR rightsFrom Colo	1,178,396	1,178,396	1,178,396	1,178,396	1,178,396	1,178,396	1,178,396
Surface Water/Streams	Ave.available	635,177	635,177	635,177	635,177	635,177	635,177	635,177
Surface Water/Streams	Ave.avali-dry	497,108	497,108	497,108	497,108	497,108	497,108	497,108
Surface Water/Streams	Min.Yr.Ave.	320,571	320,571	320,571	320,571	320,571	320,571	320,571
Total Supply	ROR rights	2,077,521	1,972,093	1,972,093	1,972,093	1,972,093	1,972,093	1,972,093
Total Supply	Ave.available	1,520,960	1,415,532	1,415,532	1,415,532	1,415,532	1,415,532	1,415,532
Total Supply	Ave.avali-dry	1,380,890	1,275,462	1,275,462	1,275,462	1,275,462	1,275,462	1,275,462
Total Supply	Min.Yr.Ave.	1,200,684	1,095,256	1,095,256	1,095,256	1,095,256	1,095,256	1,095,256
Surplus/Shortage	ROR rights	1,034,198	883,543	909,904	936,757	933,446	941,372	933,112
Surplus/Shortage	Ave.available	477,637	326,982	353,343	380,196	376,885	384,811	376,551
Surplus/Shortage	Ave.avali-dry	337,567	186,911	213,272	240,126	236,814	244,740	236,481
Surplus/Shortage	Min.Yr.Ave.	157,361	6,706	33,067	59,920	56,609	64,535	56,275
See Footnotes on Next Page								

Lower Colorado Basin Water Supply Summary							
Highland Lakes Yield/Allocation to Counties*							
San Saba County	20	20	20	20	20	20	20
Llano County	1,818	1,818	1,818	1,818	1,818	1,818	1,818
Gillespie County	18	18	18	18	18	18	18
Burnet County	8,901	8,901	8,901	8,901	8,901	8,901	8,901
Travis County/ City of Austin--M&I	148,300	148,300	148,300	148,300	148,300	148,300	148,300
Travis County/ Other Utilities--M&I	41,286	41,286	41,286	41,286	41,286	41,286	41,286
Reserved	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Uncomitted	54,967	54,967	54,967	54,967	54,967	54,967	54,967
Total included in Travis County Comparison	294,553	294,553	294,553	294,553	294,553	294,553	294,553
Bastrop County	850	850	850	850	850	850	850
Fayette County	63,863	63,863	63,863	63,863	63,863	63,863	63,863
Matagorda County	33,743	33,743	33,743	33,743	33,743	33,743	33,743
Surface Water/HLakes/In-Basin/Firm*	403,766	403,766	403,766	403,766	403,766	403,766	403,766
Surface Water/HLakes/In-Stream/Firm*	31,800	31,800	31,800	31,800	31,800	31,800	31,800
Surface Water/HLakes/Out-Basin/Firm*9	9,700	9,700	9,700	9,700	9,700	9,700	9,700
Surface Water/HLakes/Firm*	445,266	445,266	445,266	445,266	445,266	445,266	445,266
Surface Water/Streams/In-Basin/ROR rights*	679,246	679,246	679,246	679,246	679,246	679,246	679,246
Surface Water/Streams/Out of Basin/RORrights*10	499,150	499,150	499,150	499,150	499,150	499,150	499,150
Surface Water/Streams/ROR rights*	1,178,396	1,178,396	1,178,396	1,178,396	1,178,396	1,178,396	1,178,396

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.

* Firm Supply from Highland Lakes; "Water Management for the Lower Colorado River Basin," Lower Colorado River Authority, Austin, Texas, June, 1993. ROR means Run-of-Rights.

1 Used availability estimates for City of Austin's most junior steam-electric right.

2 Used 1995 availibility estimates for neighboring Kendall County.

3 Weighted average of Garwood and Pierce Ranch right for availibility estimates.

4 Weighted average of Lakeside and Garwood Irrigation rights.

5 Used availability estimates for City of Austin's most junior steam-electric right.

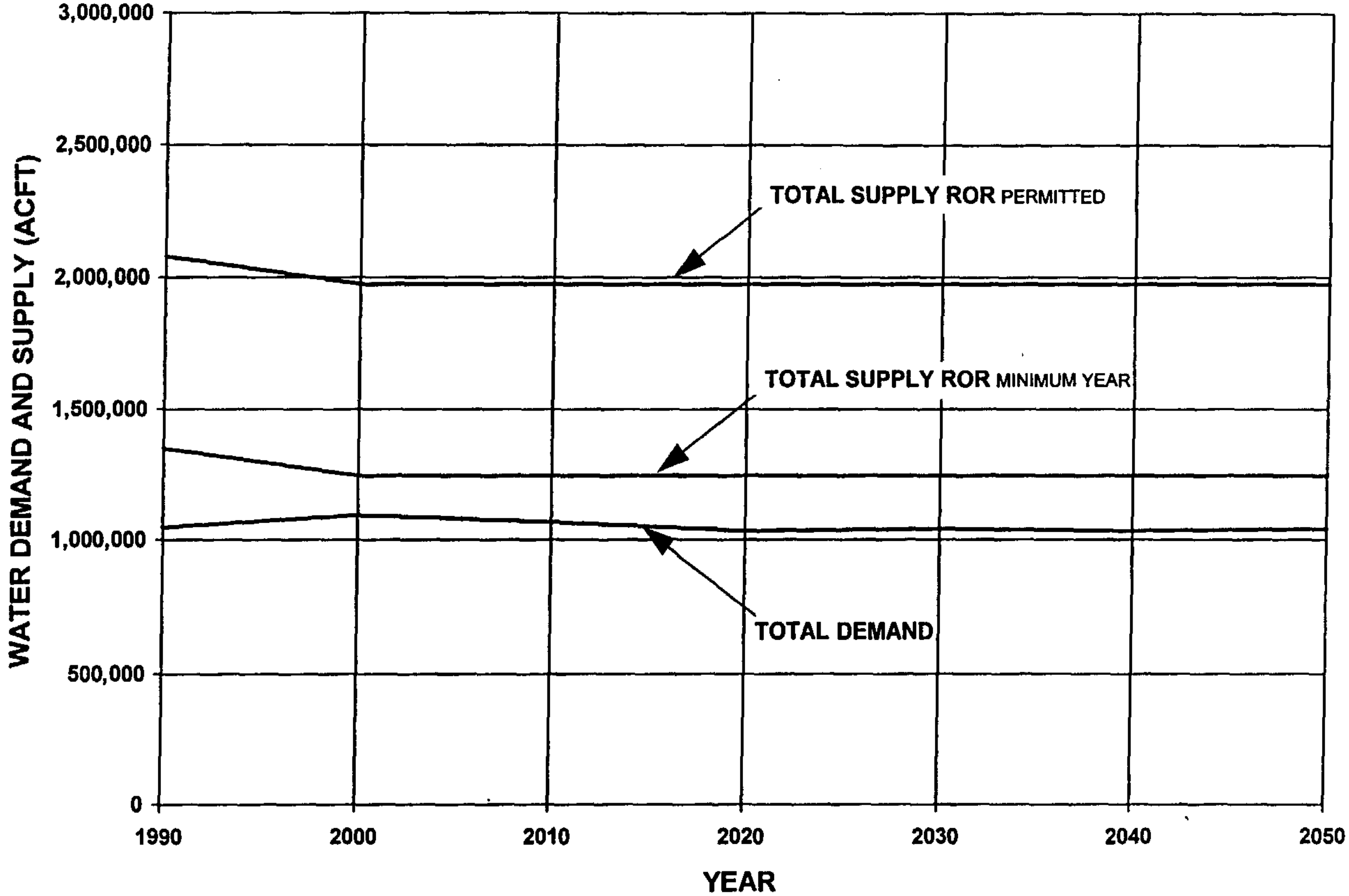
6 Average of Gulf Coast Irrigation and South Texas Project rights (South Texas Project availibility was estimated at 45% for average conditions, 31% for 1946-56 drought, and 3 % for minimum year; TWDB Report LP-60, 1978).

7 Weighted average of availibility estimates for Austin's run of river rights.

8 Weighted average of Pierce Ranch Irrigation, Pierce Ranch LCRA, and Garwood Irrigation rights.

9 Sales of Highland Lakes Firm Yield to neighboring cities in Williamson County (Cedar Park and Leander).

10 Run of River Rights which are diverted into neighboring coastal basins (See Table 4-5;Brazos-Colorado and Colorado-Lavaca Coastal Basins, and the Lavaca Basin Tables.



- Total Supply ROR is the sum of groundwater, firm yields of reservoirs, if any, and run-of-river permits at maximum permitted quantities.
- Total Supply ROR Minimum Year is the sum of groundwater, firm yields of reservoirs, if any, and quantities from run-of-river permits during driest year of record.

HDR

HDR Engineering, Inc.

TRANS TEXAS WATER PROGRAM /
WEST CENTRAL STUDY AREA

LOWER COLORADO AND ADJACENT COASTAL BASINS PROJECTIONS WATER DEMAND/WATER SUPPLY

FIGURE 4-4

4.5 Projected Water Demand and Water Supply Comparisons for Brazos Basin, Colorado-Lavaca Coastal Basin (Part), Lavaca Basin (Part), and San Antonio-Nueces Coastal Basin Counties of West Central Trans-Texas Study Area

In this section, water demand and water supply projections are presented for those parts of 10 study area counties that are located in adjacent river and coastal basins. Tablulations are shown for parts of Bastrop, Burnet, Lee, and Travis Counties that are located in the Brazos River Basin (Table 4-5) (Refer to Table 4-01 for an explanation of how to read Table 4-5). Tabulations are also shown for that part of Calhoun County that is located in the Colorado-Lavaca Coastal Basin; parts of Fayette and Gonzales Counties of the Lavaca River Basin; and parts of Calhoun, Goliad, Karnes, and Refugio Counties located in the San Antonio-Nueces Coastal Basin. The population of the study area located in the Brazos River Basin was 13,758 in 1990, with projections to 25,719 in 2050 (Appendix A: Table 5). The population of that part of Calhoun County located in the Colorado-lavaca Coastal Basin was 1,596 in 1990 and is projected at 2,664 in 2050 (Appendix A: Table 5).

The population of the parts of Fayette and Gonzales Counties located in the Lavaca River Basin was 4,906 in 1990 and is projected at 9,031 in 2050 (Appendix A: Table 5). In 1990, the population of the San Antonio-Nueces Coastal Basin included in the West Central Trans-Texas study are was 8,610, with 2050 projections to 9,797 (Appendix A: Table 5).

The comparison of projected water demands with projected water supplies for the parts of study area counties mentioned above shows that projected supplies available in each of the parts of counties are adequate to meet projected demands to 2050, except for the small area of Travis County that is located in the Brazos River Basin (Table 4-5). In the case of that part of Travis County located in the Brazos River Basin, water use in 1990 was 335 acft/yr, with 2050 projected demands of 639 acft/yr. The only locally available water supply is about 80 acft/yr of groundwater, leaving a projected shortage of 559 acft/yr in 2050 (Table 4-5). In most other cases for this group of county parts of the study area, projected supply in 2050 is at least 50 percent higher than 2050 projected demands (Table 4-5). However, as is the case elsewhere, there may be local area shortages in addition to the Travis County area mentioned above.

Table 4-5 Comparison of Water Demand and Water Supply Projections Adjacent River and Coastal Basin Areas* West Central Trans Texas Study Area Trans-Texas Water Program								
		Total Use	Projections					
Basin/County/Water Utility*		in 1990	2000	2010	2020	2030	2040	2050
		acft	acft	acft	acft	acft	acft	acft
Brazos Basin								
Bastrop (part)								
Rural		170	299	344	389	449	486	497
Total Municipal Demand		170	299	344	389	449	486	497
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		36	31	27	23	20	17	15
Mining Demand		0	16	11	6	2	0	0
Livestock Demand		237	253	253	253	253	253	253
Total Demand		443	599	635	671	724	756	765
Supply								
Groundwater		1,745	1,745	1,745	1,745	1,745	1,745	1,745
Local Surface&Ground		237	253	253	253	253	253	253
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		1,982	1,998	1,998	1,998	1,998	1,998	1,998
Surplus/Shortage		1,539	1,399	1,363	1,327	1,274	1,242	1,233
Burnet (part)								
Rural		546	622	646	698	780	802	824
Total Municipal Demand		546	622	646	698	780	802	824
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		14	32	27	22	19	19	20
Livestock Demand		400	386	386	386	386	386	386
Total Demand		960	1,040	1,059	1,106	1,185	1,207	1,230
Supply								
Groundwater		2,442	2,442	2,442	2,442	2,442	2,442	2,442
Local Surface&Ground		400	386	386	386	386	386	386
Surface Water/Streams	ROR rights	1	1	1	1	1	1	1
Total Supply		2,843	2,829	2,829	2,829	2,829	2,829	2,829
Surplus/Shortage		1,883	1,789	1,770	1,723	1,644	1,622	1,599
Lee (part)								
Giddings		324	332	341	349	371	394	420
Lexington		226	230	231	234	247	262	279
Rural		728	1,149	1,157	1,176	1,238	1,315	1,399
Total Municipal Demand		1,278	1,711	1,729	1,759	1,856	1,971	2,098
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0

Irrigation Demand	223	215	208	201	193	187	181
Mining Demand	0	16	11	7	2	0	0
Livestock Demand	1,171	1,432	1,432	1,432	1,432	1,432	1,432
Total Demand	2,672	3,374	3,380	3,399	3,483	3,590	3,711
Supply							
Groundwater	14,467	14,467	14,467	14,467	14,467	14,467	14,467
Local Surface&Ground	1,171	1,432	1,432	1,432	1,432	1,432	1,432
Surface Water/Streams ROR rights	1	1	1	1	1	1	1
Total Supply	15,639	15,900	15,900	15,900	15,900	15,900	15,900
Surplus/Shortage	12,967	12,526	12,520	12,501	12,417	12,310	12,189
Travis (part)							
Round Rock	8	25	34	46	59	68	78
Rural	76	128	133	144	163	174	187
Total Municipal Demand	84	153	167	190	222	242	265
Industrial Demand	251	278	303	324	342	359	374
Steam-Electric Power Demand	0	0	0	0	0	0	0
Irrigation Demand	0	0	0	0	0	0	0
Mining Demand	0	0	0	0	0	0	0
Livestock Demand	0	0	0	0	0	0	0
Total Demand	335	431	470	514	564	601	639
Supply							
Groundwater	335	80	80	80	80	80	80
Local Surface&Ground	0	0	0	0	0	0	0
Surface Water/Streams ROR rights	0	0	0	0	0	0	0
Total Supply	335	80	80	80	80	80	80
Surplus/Shortage	0	-351	-390	-434	-484	-521	-559
Brazos Basin Summary							
Total Municipal Demand	2,078	2,785	2,886	3,036	3,307	3,501	3,684
Industrial Demand	251	278	303	324	342	359	374
Steam-Electric Power Demand	0	0	0	0	0	0	0
Irrigation Demand	259	246	235	224	213	204	196
Mining Demand	14	64	49	35	23	19	20
Livestock Demand	1,808	2,071	2,071	2,071	2,071	2,071	2,071
Brazos Basin Total Demand	4,410	5,444	5,544	5,690	5,956	6,154	6,345
Supply							
Groundwater	18,989	18,734	18,734	18,734	18,734	18,734	18,734
Local Surface&Ground	1,808	2,071	2,071	2,071	2,071	2,071	2,071
Surface Water/Streams ROR rights	2	2	2	2	2	2	2
Total Supply	20,799	20,807	20,807	20,807	20,807	20,807	20,807
Surplus/Shortage	16,389	15,363	15,263	15,117	14,851	14,653	14,462
Colorado-Lavaca Coastal Basin (1)							
Calhoun (part)							
Point Comfort	137	171	160	155	160	169	176
Rural	80	247	259	270	294	319	353
Total Municipal Demand	217	418	419	425	454	488	529
Industrial Demand	6,343	16,538	20,391	22,590	25,036	27,669	30,494

Steam-Electric Power Demand	62	100	100	100	100	100	100
Irrigation Demand	0	0	0	0	0	0	0
Mining Demand	0	1	1	0	0	0	0
Livestock Demand	13	15	15	15	15	15	15
Total Demand	6,635	17,072	20,926	23,130	25,605	28,272	31,138
Supply							
Groundwater	294	294	294	294	294	294	294
Local Surface&Ground	13	15	15	15	15	15	15
Surface Water Lake Texana	7,000	32,000	32,000	32,000	32,000	32,000	32,000
Total Supply	7,307	32,309	32,309	32,309	32,309	32,309	32,309
Surplus/Shortage	672	15,237	11,383	9,179	6,704	4,037	1,171
Lavaca Basin (Study Area Parts of Counties) (2)							
Fayette (part)							
Schulenburg	610	607	618	619	676	742	815
Rural	297	333	330	348	381	420	472
Total Municipal Demand	907	940	948	967	1,057	1,162	1,287
Industrial Demand	32	37	44	50	55	63	71
Steam-Electric Power Demand	0	0	0	0	0	0	0
Irrigation Demand	21	19	18	17	15	14	13
Mining Demand	3	5	4	2	1	0	0
Livestock Demand	395	509	509	509	509	509	509
Total Demand	1,358	1,510	1,523	1,545	1,637	1,748	1,880
Supply							
Groundwater	1,891	1,891	1,891	1,891	1,891	1,891	1,891
Local Surface&Ground	395	509	509	509	509	509	509
Surface Water/Streams In-Basin	1	1	1	1	1	1	1
Total Supply	2,287	2,401	2,401	2,401	2,401	2,401	2,401
Surplus/Shortage	929	891	878	856	764	653	521
Gonzales (part)							
Rural	8	14	13	13	13	13	13
Total Municipal Demand	8	14	13	13	13	13	13
Industrial Demand	0	0	0	0	0	0	0
Steam-Electric Power Demand	0	0	0	0	0	0	0
Irrigation Demand	0	0	0	0	0	0	0
Mining Demand	0	4	3	1	0	0	0
Livestock Demand	36	46	46	46	46	46	46
Total Demand	44	64	62	60	59	59	59
Supply							
Groundwater	466	466	466	466	466	466	466
Local Surface&Ground	36	46	46	46	46	46	46
Surface Water/Streams In-Basin	0	0	0	0	0	0	0
Total Supply	502	512	512	512	512	512	512
Surplus/Shortage	458	448	450	452	453	453	453
Lavaca Basin Summary (2)							
Total Municipal Demand	915	954	961	980	1,070	1,175	1,300
Industrial Demand	32	37	44	50	55	63	71

Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		21	19	18	17	15	14	13
Mining Demand		3	9	7	3	1	0	0
Livestock Demand		431	555	555	555	555	555	555
Lavaca Basin /Subtotal Demand		1,402	1,574	1,585	1,605	1,696	1,807	1,939
Supply								
Groundwater		2,357	2,357	2,357	2,357	2,357	2,357	2,357
Local Surface&Ground		431	555	555	555	555	555	555
Surface Water/Streams	In-BasinRORrights	1	1	1	1	1	1	1
Surface Water/Streams	Ave.available	2,789	2,913	2,913	2,913	2,913	2,913	2,913
Surface Water/Streams	Ave.avali-dry	1,387	1,339	1,328	1,308	1,217	1,106	974
Surface Water/Streams	Min.Yr.Ave.	0	0	0	0	0	0	0
Surface Water/Streams	ROR rightsFrom Colo	0	0	0	0	0	0	0
Surface Water/Streams	Ave.available	923	968	974	993	1,083	1,188	1,313
Surface Water/Streams	Ave.avali-dry	40	51	57	63	68	76	84
Surface Water/Streams	Min.Yr.Ave.	0	0	0	0	0	0	0
Total Supply	ROR rights	21	19	18	17	15	14	13
Total Supply	Ave.available	3	9	7	3	1	0	0
Total Supply	Ave.avali-dry	431	559	558	556	555	555	555
Total Supply	Min.Yr.Ave.	1,438	1,620	1,631	1,651	1,742	1,853	1,985
Surplus/Shortage	ROR rights	44	64	62	60	59	59	59
Surplus/Shortage	Ave.available	2,357	2,357	2,357	2,357	2,357	2,357	2,357
Surplus/Shortage	Ave.avali-dry	897	1,021	1,021	1,021	1,021	1,021	1,021
Surplus/Shortage	Min.Yr.Ave.	37	47	47	47	47	47	47
San Antonio-Nueces Coastal Basin								
Goliad (part)								
Rural		59	58	55	53	52	53	56
Total Municipal Demand		59	58	55	53	52	53	56
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	5	3	1	1	0	0
Livestock Demand		344	470	470	470	470	470	470
Total Demand		403	533	528	524	523	523	526
Supply								
Groundwater		384	384	384	384	384	384	384
Local Surface&Ground		344	470	470	470	470	470	470
Surface Water/Streams	ROR rights	480	480	480	480	480	480	480
Surface Water/Streams	Ave.available(95%) 3	456	456	456	456	456	456	456
Surface Water/Streams	Ave.avali-dry(85%)	408	408	408	408	408	408	408
Surface Water/Streams	Min.Yr.Ave. (55%)	264	264	264	264	264	264	264
Total Supply	ROR rights	1,208	1,334	1,334	1,334	1,334	1,334	1,334
Total Supply	Ave.available(95%)	1,184	1,310	1,310	1,310	1,310	1,310	1,310
Total Supply	Ave.avali-dry(85%)	1,136	1,262	1,262	1,262	1,262	1,262	1,262
Total Supply	Min.Yr.Ave. (55%)	992	1,118	1,118	1,118	1,118	1,118	1,118
Surplus/Shortage	ROR rights	805	801	806	810	811	811	808
Surplus/Shortage	Ave.available(95%)	781	777	782	786	787	787	784
Surplus/Shortage	Ave.avali-dry(85%)	733	729	734	738	739	739	736

Surplus/Shortage	Min.Yr.Ave. (55%)	589	585	590	594	595	595	592
Karnes (part)								
Rural		58	54	50	50	52	55	55
Total Municipal Demand		58	54	50	50	52	55	55
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		0	8	6	4	3	2	0
Livestock Demand		71	70	70	70	70	70	70
Total Demand		129	132	126	124	125	127	125
Supply								
Groundwater		751	751	751	751	751	751	751
Local Surface&Ground		71	70	70	70	70	70	70
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		822	821	821	821	821	821	821
Surplus/Shortage		693	689	695	697	696	694	696
Refugio (part)								
Refugio		569	638	626	608	604	599	589
Woodsboro		309	328	317	304	298	293	288
Rural		338	352	323	299	288	277	265
Total Municipal Demand		1,216	1,318	1,266	1,211	1,190	1,169	1,142
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		77	44	26	19	11	4	4
Livestock Demand		542	391	391	391	391	391	391
Total Demand		1,835	1,753	1,683	1,621	1,592	1,564	1,537
Supply								
Groundwater		7,613	7,613	7,613	7,613	7,613	7,613	7,613
Local Surface&Ground		542	391	391	391	391	391	391
Surface Water/Streams	ROR rights	0	0	0	0	0	0	0
Total Supply		8,155	8,004	8,004	8,004	8,004	8,004	8,004
Surplus/Shortage		6,320	6,251	6,321	6,383	6,412	6,440	6,467
San Antonio-Nueces Coastal Basin Summary								
Total Municipal Demand		1,333	1,430	1,371	1,314	1,294	1,277	1,253
Industrial Demand		0	0	0	0	0	0	0
Steam-Electric Power Demand		0	0	0	0	0	0	0
Irrigation Demand		0	0	0	0	0	0	0
Mining Demand		77	57	35	24	15	6	4
Livestock Demand		957	931	931	931	931	931	931
San Antonio-Nueces Basin /Subtotal Dem		2,367	2,418	2,337	2,269	2,240	2,214	2,188
Supply								
Groundwater		8,748	8,748	8,748	8,748	8,748	8,748	8,748
Local Surface&Ground		957	931	931	931	931	931	931
Surface Water/Streams	ROR rights	480	480	480	480	480	480	480
Surface Water/Streams	Ave.available	456	456	456	456	456	456	456

Surface Water/Streams	Ave.avali-dry	408	408	408	408	408	408	408
Surface Water/Streams	Min.Yr.Ave.	264	264	264	264	264	264	264
Total Supply	ROR rights	10,185	10,159	10,159	10,159	10,159	10,159	10,159
Total Supply	Ave.available	10,161	10,135	10,135	10,135	10,135	10,135	10,135
Total Supply	Ave.avali-dry	10,113	10,087	10,087	10,087	10,087	10,087	10,087
Total Supply	Min.Yr.Ave.	9,969	9,943	9,943	9,943	9,943	9,943	9,943
Surplus/Shortage	ROR rights	7,818	7,741	7,822	7,890	7,919	7,945	7,971
Surplus/Shortage	Ave.available	7,794	7,717	7,798	7,866	7,895	7,921	7,947
Surplus/Shortage	Ave.avali-dry	7,746	7,669	7,750	7,818	7,847	7,873	7,899
Surplus/Shortage	Min.Yr.Ave.	7,602	7,525	7,606	7,674	7,703	7,729	7,755

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case, below normal rainfall and advanced water conservation.

* Parts of counties located in the Brazos River Basin, Colorado-Lavaca Coastal Basin, Lavaca River Basin and San Antonio-Nueces Coastal Basin of West Central Trans-Texas Study Area.

(1) Parts of Matagorda and Wharton Counties of the Brazos-Colorado and Colorado-Lavaca Coastal Basins, and the Lavaca Basin are tabulated with the Lower Colorado Basin (See Table 4-4).

(2) Parts of DeWitt, Victoria, and Calhoun Counties located in the Lavaca-Guadalupe Coastal Basin are tabulated with the Guadalupe River Basin (See Table 4-3).

(3) Used availibility estimates for Gulf Coast Irrigation Rights of the neighboring Lower Colorado River Basin.

(This page intentionally left blank)

APPENDIX A

POPULATION PROJECTIONS

CITIES AND COUNTIES
RIVER BASIN AREAS
WEST CENTRAL TRANS-TEXAS STUDY AREA

Appendix A: Table 1 Population Projections Nueces River Basin Area West Central Trans Texas Study Area Trans-Texas Water Program							
County/City/Rural	Total in 1990	Projections					
		2000	2010	2020	2030	2040	2050
Atascosa (part)							
Charlotte	1,475	1,797	2,093	2,383	2,649	2,856	2,982
Jourdanton	3,220	3,770	4,377	4,952	5,477	5,880	6,313
Lytle	1,911	2,312	2,718	3,113	3,477	3,762	4,070
Pleasanton	7,678	9,031	10,482	11,904	13,212	14,221	15,307
Poteet	3,206	3,968	4,413	4,870	5,283	5,577	5,887
Rural	12,367	14,237	16,806	19,310	21,631	23,459	23,706
Total	29,857	35,115	40,889	46,532	51,729	55,755	58,265
Bandera (part)							
Rural	753	1,072	1,283	1,570	1,759	1,973	2,215
Total	753	1,072	1,283	1,570	1,759	1,973	2,215
Bexar (part)							
Lytle	4	4	4	4	4	4	4
Rural	2,747	4,086	5,264	6,674	8,157	9,510	8,916
Total	2,751	4,090	5,268	6,678	8,161	9,514	8,920
Frio (all)							
Dilley	2,632	3,041	3,423	3,746	3,928	4,089	4,209
Pearsall	6,924	7,933	8,928	9,770	10,246	10,665	10,979
Rural	3,916	4,447	5,005	5,477	5,744	5,979	6,155
Total	13,472	15,421	17,356	18,993	19,918	20,733	21,343
Karnes (part)							
Rural	314	357	356	388	411	432	444
Total	314	357	356	388	411	432	444
Kerr (part)							
Rural	228	228	256	298	329	354	378
Total	228	228	256	298	329	354	378
Medina (part)							
Devine	3,928	4,524	4,921	5,310	5,515	5,686	5,862
Hondo	6,018	7,032	7,880	8,782	9,268	9,574	9,890
Lytle	340	382	402	425	435	448	461
Natalia	1,216	1,703	1,909	2,126	2,244	2,318	2,394
Rural	10,379	12,861	14,972	16,662	17,839	18,817	20,231
Total	21,881	26,502	30,084	33,305	35,301	36,843	38,838
Uvalde (all)							
Sabinal	1,584	1,880	2,184	2,460	2,737	2,976	3,236
Uvalde	14,729	17,296	20,398	23,185	25,997	28,558	31,371
Rural	7,027	7,290	7,174	7,143	6,861	6,553	5,958
Total	23,340	26,466	29,756	32,788	35,595	38,087	40,565
Continued Next Page							

County/City/Rural	Total in 1990	Projections 2000	2010	2020	2030	2040	2050
Wilson (part)							
Rural	849	1,007	1,171	1,322	1,413	1,506	1,663
Total	849	1,007	1,171	1,322	1,413	1,506	1,663
Zavala (all)							
Crystal City	8,263	8,900	9,301	9,547	9,959	10,049	10,140
Rural	3,899	4,719	5,283	5,570	5,830	6,721	8,063
Total	12,162	13,619	14,584	15,117	15,789	16,770	18,203
WCTT Study Area Total	105,607	123,877	141,003	156,991	170,405	181,967	190,834
Dimmitt (part)*							
Asherton	1,608	1,747	1,927	2,113	2,355	2,617	2,908
Carrizo Springs	5,745	7,203	8,736	10,259	11,827	13,435	15,262
Rural	3,032	3,073	3,211	3,366	3,662	3,997	4,308
Total	10,385	12,023	13,874	15,738	17,844	20,049	22,478
Edwards (part)*							
Rocksprings	134	144	161	172	183	191	198
Rural	570	676	753	806	857	891	925
Total	704	820	914	978	1,040	1,082	1,123
Kinney (part)*							
Rural	489	552	611	651	582	502	433
Total	489	552	611	651	582	502	433
LaSalle (all)*							
Cotulla	3,694	4,178	4,684	5,096	5,315	5,537	5,768
Rural	1,560	1,914	2,064	2,189	2,247	2,317	2,266
Total	5,254	6,092	6,748	7,285	7,562	7,854	8,034
Maverick (part)*							
Rural	341	422	489	542	583	642	726
Total	341	422	489	542	583	642	726
Real (part)*							
Leakey	399	422	436	513	576	645	722
Rural	1,898	1,991	2,039	2,019	2,008	1,992	1,968
Total	2,297	2,413	2,475	2,532	2,584	2,637	2,690
Webb (part)*							
Rural	410	1,337	1,832	2,399	3,135	3,311	4,295
Total	410	1,337	1,832	2,399	3,135	3,311	4,295
Non-Study Area Total	19,880	23,659	26,943	30,125	33,330	36,077	39,779
Basin Subtotal**	125,487	147,536	167,946	187,116	203,735	218,044	230,613

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case.

* Not in West Central Trans-Texas study area.

**Does not include Nueces Basin Counties of South Central Trans-Texas Study Area (Duval, McMullen, Live Oak, Bee, San Patricio, Nueces, and Jim Wells).

Appendix A: Table 2 Population Projections San Antonio River Basin Area West Central Trans Texas Study Area Trans-Texas Water Program							
County/City/Rural	Total in 1990	Projections 2000	2010	2020	2030	2040	2050
Atascosa (part)							
Rural	676	778	918	1,055	1,182	1,282	1,295
Total	676	778	918	1,055	1,182	1,282	1,295
Bandera (part)							
Bandera	877	1,156	1,292	1,551	1,776	1,996	2,243
Rural	8,799	12,529	14,998	18,354	20,566	23,077	25,894
Total	9,676	13,685	16,290	19,905	22,342	25,073	28,137
Bexar (part)							
San Antonio	935,933	1,137,369	1,360,669	1,621,857	1,886,190	2,125,314	2,394,753
Balcones Heights	3,022	3,437	3,791	4,182	4,455	4,734	5,030
Terrell Hills	4,592	5,120	5,417	5,810	5,970	5,969	5,968
Olmos Park	2,161	2,438	2,669	2,920	3,086	3,253	3,429
Helotes	1,535	2,045	2,600	3,251	3,937	4,295	4,686
Leon Valley	9,581	12,455	12,704	12,577	12,748	12,919	13,694
Alamo Heights	6,502	7,039	7,391	7,759	7,868	7,959	8,051
Converse	8,887	13,658	20,424	27,634	35,537	42,763	51,458
Fair Oaks Ranch	1,640	2,318	3,070	3,952	4,899	5,762	6,777
Kirby	8,326	10,039	11,992	14,276	16,584	18,672	21,023
Live Oak Water Public Utility	10,023	12,439	15,199	18,430	21,756	24,774	28,211
Schertz (Part)	414	607	807	951	1,021	1,176	1,417
Schertz (Outside City) Estimated	3,165	4,111	5,026	6,383	7,767	8,926	10,330
Shavano Park	1,708	2,097	2,425	2,687	2,784	2,917	3,056
St. Hedwig	1,443	1,843	2,425	3,107	3,837	4,503	5,285
Universal City	13,057	15,992	19,452	23,502	27,658	31,426	35,707
Windcrest (WC&ID No. 10)	5,331	5,818	6,160	6,520	6,665	6,796	6,930
Castle Hills(BMWD)	4,198	4,967	5,328	5,667	5,778	5,742	5,706
Somerset(BMWD)	1,144	1,251	1,314	1,361	1,321	1,280	1,240
Hill Country/HollywPark(BMWD)	3,879	4,956	5,887	6,988	8,003	8,947	10,009
BMWD(Subdvisions) Estimated	108,988	125,751	167,041	207,920	245,492	284,585	307,993
Remainder of County	47,114	94,672	109,906	136,408	169,774	195,454	141,708
Total	1,182,643	1,470,422	1,771,697	2,124,142	2,483,130	2,808,166	3,072,461
Comal (part)							
Fair Oaks Ranch	51	88	127	180	241	294	359
Schertz (Part)	129	210	325	484	627	891	1,187
Rural	6,134	10,259	14,086	19,865	26,013	32,544	39,298
Total	6,314	10,557	14,538	20,529	26,881	33,729	40,844
Continued Next Page							

County/City/Rural	Total in 1990	Projections 2000	2010	2020	2030	2040	2050
Guadalupe (part)							
Cibolo	1,757	3,840	4,490	5,830	6,710	7,780	8,420
Schertz (Part)	10,747	12,894	18,720	24,890	32,574	42,421	55,231
Rural	6,556	11,659	14,562	17,623	22,270	24,744	27,782
Total	19,060	28,393	37,772	48,343	61,554	74,945	91,433
DeWitt (part)							
Rural	890	930	968	1,013	1,059	1,105	1,150
Total	890	930	968	1,013	1,059	1,105	1,150
Goliad (part)							
Goliad	1,946	2,140	2,266	2,368	2,392	2,461	2,636
Rural	2,119	2,242	2,373	2,480	2,505	2,578	2,761
Total	4,065	4,382	4,639	4,848	4,897	5,039	5,397
Karnes (part)							
Karnes City	2,916	3,453	3,564	3,949	4,259	4,518	4,793
Kenedy	3,763	4,478	4,604	5,092	5,479	5,807	6,155
Runge	1,139	1,379	1,403	1,544	1,652	1,746	1,845
Rural	3,977	4,518	4,515	4,921	5,206	5,477	5,627
Total	11,795	13,828	14,086	15,506	16,596	17,548	18,420
Kendall (part)							
Boerne	4,274	5,763	7,109	8,401	9,690	10,977	12,435
Fair Oaks Ranch	169	212	244	277	309	345	385
Rural	4,260	4,683	5,205	5,775	6,300	6,962	7,691
Total	8,703	10,658	12,558	14,453	16,299	18,284	20,511
Kerr (part)							
Rural	26	26	29	34	38	41	44
Total	26	26	29	34	38	41	44
Medina (part)							
Castroville	2,159	2,632	2,950	3,289	3,469	3,583	3,701
Lacoste	1,021	1,426	1,789	2,092	2,307	2,463	2,630
Rural	2,251	2,789	3,246	3,613	3,868	4,080	4,387
Total	5,431	6,847	7,985	8,994	9,644	10,126	10,718
Refugio (part)							
Rural	86	91	94	96	94	93	90
Total	86	91	94	96	94	93	90
Victoria (part)							
Rural	273	284	301	319	335	353	390
Total	273	284	301	319	335	353	390
Wilson (part)							
Floresville	5,247	5,998	6,834	7,631	8,109	8,596	9,112
Poth	1,642	1,926	2,229	2,507	2,678	2,850	3,114
Stockdale	1,268	1,471	1,702	1,915	2,045	2,177	2,378
Rural	13,089	15,518	18,055	20,359	21,784	23,218	25,619
Total	21,246	24,913	28,820	32,412	34,616	36,841	40,223
Basin Total	1,270,884	1,585,794	1,910,695	2,291,649	2,678,667	3,032,625	3,331,113

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case.

Appendix A; Table 3 Population Projections Guadalupe River Basin Area West Central Trans Texas Study Area Trans-Texas Water Program							
	Total	Projections					
County/City/Rural	in						
	1990	2000	2010	2020	2030	2040	2050
Bandera (part)							
Rural	133	190	228	279	312	351	393
Total	133	190	228	279	312	351	393
Bastrop(part)							
Rural	279	360	456	553	647	706	727
Total	279	360	456	553	647	706	727
Blanco (part)							
Blanco	1,238	1,328	1,348	1,341	1,334	1,285	1,238
Rural	1,761	2,314	2,915	3,584	4,084	4,362	4,282
Total	2,999	3,642	4,263	4,925	5,418	5,647	5,520
Caldwell (part)							
Lockhart	9,205	11,108	13,218	15,229	16,649	16,751	16,854
Luling	4,661	5,026	5,130	5,146	5,131	4,829	4,545
Rural	11,832	15,136	18,442	21,635	23,904	24,220	24,518
Total	25,698	31,270	36,790	42,010	45,684	45,800	45,917
Calhoun (part)							
Rural	23	28	31	35	38	41	46
Total	23	28	31	35	38	41	46
Comal (part)							
Garden Ridge	1,450	2,301	3,157	4,352	5,686	6,903	8,380
New Braunfels	27,091	38,126	49,873	65,003	82,894	95,424	109,848
Rural	16,977	28,394	38,990	54,985	72,003	90,077	108,771
Total	45,518	68,821	92,020	124,340	160,583	192,404	226,999
DeWitt (part)							
Cuero	6,700	7,170	7,485	7,869	8,261	8,658	9,074
Yorktown	2,207	2,430	2,596	2,786	3,002	3,218	3,450
Rural	5,760	6,021	6,260	6,559	6,853	7,153	7,442
Total	14,667	15,621	16,341	17,214	18,116	19,029	19,966
Fayette (part)							
Flatonia	1,295	1,475	1,628	1,787	1,985	2,199	2,436
Rural	519	583	647	743	833	928	1,056
Total	1,814	2,058	2,275	2,530	2,818	3,127	3,492
Goliad (part)							
Rural	1,465	1,550	1,640	1,714	1,732	1,782	1,908
Total	1,465	1,550	1,640	1,714	1,732	1,782	1,908
Gonzales (part)							
Gonzales	6,527	7,039	7,432	7,725	7,798	8,012	8,232
Nixon	1,995	2,142	2,263	2,353	2,377	2,443	2,511
Rural	8,617	8,570	8,884	9,157	9,160	9,317	9,476
Continued Next Page Total	17,139	17,751	18,579	19,235	19,335	19,772	20,219

County/City/Rural	Total in 1990	Projections 2000	2010	2020	2030	2040	2050
Guadalupe (part)							
New Braunfels	243	278	334	414	592	657	729
Seguin	18,853	20,364	21,983	27,040	33,125	36,934	41,181
Rural	26,717	37,633	51,348	64,573	81,602	90,665	101,796
Total	45,813	58,275	73,665	92,027	115,319	128,256	143,706
Hays (part)							
Kyle	2,225	2,427	2,574	2,803	3,167	3,702	4,327
San Marcos	28,743	33,751	40,281	47,370	56,741	68,141	81,831
Rural	20,510	31,460	44,873	57,739	72,998	89,662	98,896
Total	51,478	67,638	87,728	107,912	132,906	161,505	185,054
Karnes (part)							
Rural	116	132	132	143	152	160	164
Total	116	132	132	143	152	160	164
Kendall (part)							
Rural	5,724	6,293	6,996	7,762	8,468	9,357	10,336
Total	5,724	6,293	6,996	7,762	8,468	9,357	10,336
Kerr (part)							
Ingram	1,408	1,766	2,027	2,170	2,289	2,274	2,259
Kerrville	17,384	23,731	27,547	30,719	34,769	37,167	38,100
Rural	16,629	17,781	20,522	25,164	28,649	30,797	31,634
Total	35,421	43,278	50,096	58,053	65,707	70,238	71,993
Travis (part)							
Rural	532	563	641	758	863	931	1,004
Total	532	563	641	758	863	931	1,004
Victoria (part)							
Victoria	43,747	48,695	53,645	58,378	62,926	67,649	72,726
Rural	9,120	9,501	10,074	10,645	11,178	11,800	13,018
Total	52,867	58,196	63,719	69,023	74,104	79,449	85,744
Wilson (part)							
Rural	555	658	766	863	924	985	1,086
Total	555	658	766	863	924	985	1,086
Gillespie (part)							
Rural	69	85	95	107	114	132	143
Total	69	85	95	107	114	132	143
Lavaca (part)							
Rural	99	109	113	116	121	127	133
Total	99	109	113	116	121	127	133
Basin Total	302,409	376,518	456,574	549,599	653,361	739,799	824,550

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case.

◇◇◇◇

Appendix A: Table 4 Population Projections Lower Colorado River Basin Area West Central Trans Texas Study Area Trans-Texas Water Program							
	Total	Projections					
County/City/Rural	in						
	1990	2000	2010	2020	2030	2040	2050
Bastrop (part)							
Bastrop	4,044	5,083	6,320	7,631	8,904	9,688	11,896
Elgin	4,846	5,553	6,499	7,612	8,734	9,395	11,405
GarfieldCDP	103	150	187	227	265	288	354
Smithville	3,196	3,501	3,869	4,561	5,178	5,531	6,666
Rural	24,413	31,488	39,844	48,358	56,648	61,808	63,678
Total	36,602	45,775	56,719	68,389	79,729	86,710	93,999
Blanco (part)							
Johnson City	932	1,145	1,357	1,589	1,760	1,846	1,936
Rural	2,041	2,681	3,378	4,153	4,732	5,056	4,962
Total	2,973	3,826	4,735	5,742	6,492	6,902	6,898
Burnet (part)							
Burnet	3,423	3,960	5,005	5,764	6,419	6,613	6,813
Granit Shoals	1,378	1,929	2,642	3,359	3,924	4,161	4,412
Marble Falls	4,007	5,691	7,081	8,567	9,780	10,228	10,697
Rural	9,804	11,646	13,630	16,150	18,247	18,968	19,714
Total	18,612	23,226	28,358	33,840	38,370	39,970	41,636
Caldwell (part)							
Rural	694	888	1,082	1,269	1,402	1,420	1,438
Total	694	888	1,082	1,269	1,402	1,420	1,438
Colorado (part)							
Columbus	3,367	4,112	4,529	5,003	5,402	5,730	6,078
Eagle Lake	1,774	2,131	2,288	2,467	2,617	2,741	2,871
Weimar	922	1,024	1,076	1,135	1,186	1,227	1,259
Rural	6,359	6,332	6,453	6,589	6,705	6,801	6,759
Total	12,422	13,599	14,346	15,194	15,910	16,499	16,967
Fayette (part)							
LaGrange	3,951	4,606	5,278	6,158	6,970	7,799	8,727
Rural	9,490	10,648	11,815	13,560	15,204	16,936	19,260
Total	13,441	15,254	17,093	19,718	22,174	24,735	27,987
Hays (part)							
Buda	1,795	2,300	3,085	3,884	4,796	5,814	7,048
Dripping Springs	1,033	1,330	1,648	1,989	2,400	2,883	3,463
Rural	11,308	17,346	24,740	31,834	40,247	49,435	54,526
Total	14,136	20,976	29,473	37,707	47,443	58,132	65,037
Kendall (part)							
Rural	162	178	198	220	240	265	293
Total	162	178	198	220	240	265	293
Continued Next Page							

County/City/Rural	Total in 1990	Projections					
		2000	2010	2020	2030	2040	2050
Kerr (part)							
Rural	629	630	704	824	908	978	1,046
Total	629	630	704	824	908	978	1,046
Lee (part)							
Giddings	3,071	3,358	3,703	4,036	4,311	4,611	4,945
Rural	2,064	2,274	2,508	2,733	2,920	3,123	3,349
Total	5,135	5,632	6,211	6,769	7,231	7,734	8,294
Llano (all)							
Llano	2,962	3,404	3,466	3,527	3,409	3,520	3,635
Rural	8,669	9,483	9,906	11,011	11,391	11,841	13,110
Total	11,631	12,887	13,372	14,538	14,800	15,361	16,745
Matagorda (part)							
Rural	1,947	2,189	2,458	2,747	3,069	3,423	3,893
Total	1,947	2,189	2,458	2,747	3,069	3,423	3,893
San Saba (all)							
San Saba	2,626	2,682	2,668	2,644	2,560	2,509	2,434
Rural	2,775	2,815	2,802	2,775	2,687	2,635	2,555
Total	5,401	5,497	5,470	5,419	5,247	5,144	4,989
Travis (part)							
Austin	463,178	616,478	743,040	916,934	1,080,959	1,187,665	1,304,904
Garfield	1,233	1,769	2,295	2,984	3,655	4,091	4,579
Jonestown	1,250	1,853	2,396	3,108	3,800	4,251	4,756
Lago Vista	2,199	3,680	4,569	5,764	6,907	7,649	8,471
Lakeway	4,044	5,945	7,643	9,880	12,047	13,457	15,032
Manor	1,041	1,424	1,862	2,208	2,523	2,728	2,950
Pflugerville	4,444	6,452	8,244	10,611	12,900	14,390	16,052
Rollingwood	1,388	1,860	2,201	2,678	3,123	3,412	3,728
West Lake Hills	2,542	3,875	5,069	6,628	8,146	9,133	10,240
Rural	93,964	99,495	113,268	133,770	152,338	164,418	177,383
Total	575,283	742,831	890,587	1,094,565	1,286,398	1,411,194	1,548,095
Wharton (part)							
El Campo	1,051	1,085	1,136	1,196	1,249	1,310	1,374
Wharton	788	862	947	1,030	1,120	1,211	1,308
Rural	5,808	6,182	6,764	7,344	7,965	8,592	9,298
Total	7,647	8,129	8,847	9,570	10,334	11,113	11,980
Basin Total	706,715	901,517	1,079,653	1,316,511	1,539,747	1,689,580	1,849,297

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case.

Appendix A: Table 5 Population Projections Adjacent River and Coastal Basin Areas West Central Trans Texas Study Area Trans-Texas Water Program							
Basin/County/City/Rural*	Total in 1990	Projections					
		2000	2010	2020	2030	2040	2050
Brazos Basin							
Bastrop (part)							
Rural	1,382	1,782	2,255	2,737	3,207	3,499	3,605
Total	1,382	1,782	2,255	2,737	3,207	3,499	3,605
Burnet (part)							
Rural	4,065	4,829	5,652	6,696	7,566	7,864	8,174
Total	4,065	4,829	5,652	6,696	7,566	7,864	8,174
Lee (part)							
Giddings	1,022	1,118	1,233	1,343	1,435	1,535	1,646
Lexington	953	1,052	1,160	1,264	1,351	1,445	1,549
Rural	5,744	6,331	6,982	7,608	8,127	8,694	9,323
Total	7,719	8,501	9,375	10,215	10,913	11,674	12,518
Travis (part)							
Round Rock	40	102	154	221	286	330	381
Rural	552	584	665	785	894	965	1,041
Total	592	686	819	1,006	1,180	1,295	1,422
Basin Subtotal	13,758	15,798	18,101	20,654	22,866	24,332	25,719
Brazos-Colorado							
Colorado (part)							
Eagle Lake	1,777	2,136	2,293	2,472	2,623	2,747	2,877
Rural	993	988	1,007	1,028	1,046	1,061	1,054
Total	2,770	3,124	3,300	3,500	3,669	3,808	3,931
Matagorda (part)							
Bay City	18,170	20,013	22,261	24,721	27,488	30,513	33,871
Van Vleck	1,534	1,767	1,973	2,198	2,449	2,723	3,055
Rural	5,838	6,565	7,371	8,239	9,206	10,267	11,677
Total	25,542	28,345	31,605	35,158	39,143	43,503	48,603
Wharton (part)							
East Bernard	1,544	1,851	2,033	2,212	2,404	2,598	2,808
Wharton	8,223	9,006	9,886	10,758	11,696	12,640	13,662
Rural	11,386	12,122	13,270	14,414	15,639	16,876	18,257
Total	21,153	22,979	25,189	27,384	29,739	32,114	34,727
Basin Subtotal	49,465	54,448	60,094	66,042	72,551	79,425	87,261
Continued Next Page							

Basin/County/City/Rural*	Total in 1990	Projections 2000	2010	2020	2030	2040	2050
Colorado-Lavaca							
Calhoun (part)							
Point Comfort	956	1,090	1,116	1,169	1,233	1,309	1,390
Rural	640	771	866	956	1,050	1,145	1,274
Total	1,596	1,861	1,982	2,125	2,283	2,454	2,664
Matagorda (part)							
Palacios	4,418	4,838	5,402	6,016	6,703	7,455	8,362
Rural	5,021	5,646	6,340	7,087	7,919	8,830	10,044
Total	9,439	10,484	11,742	13,103	14,622	16,285	18,406
Wharton (part)							
El Campo	9,460	9,766	10,219	10,765	11,237	11,790	12,370
Rural	1,521	1,618	1,771	1,923	2,085	2,249	2,434
Total	10,981	11,384	11,990	12,688	13,322	14,039	14,804
Basin Subtotal	22,016	23,729	25,714	27,916	30,227	32,778	35,874
Lavaca							
Colorado (part)							
Weimar	1,130	1,253	1,317	1,391	1,452	1,503	1,541
Rural	2,061	2,052	2,091	2,136	2,173	2,204	2,191
Total	3,191	3,305	3,408	3,527	3,625	3,707	3,732
DeWitt (part)							
Yoakum	2,154	2,511	2,671	2,855	3,061	3,267	3,487
Rural	1,129	1,155	1,200	1,258	1,314	1,372	1,427
Total	3,283	3,666	3,871	4,113	4,375	4,639	4,914
Fayette (part)							
Schulenburg	2455	2619	2872	3053	3372	3723	4111
Rural	2385	2680	2973	3413	3826	4262	4847
Total	4,840	5,299	5,845	6,466	7,198	7,985	8,958
Gonzales (part)							
Rural	66	66	68	70	70	71	73
Total	66	66	68	70	70	71	73
Victoria (part)							
Rural	174	181	192	203	213	225	248
Total	174	181	192	203	213	225	248
Wharton (part)							
Rural	174	181	192	203	213	225	248
Total	174	181	192	203	213	225	248
Basin Subtotal	11,728	12,698	13,576	14,582	15,694	16,852	18,173

Continued Next Page

Basin/County/City/Rural*	Total in 1990	Projections 2000	2010	2020	2030	2040	2050
Lavaca-Guadalupe							
Calhoun (part)							
Port Lavaca	10,886	12,054	12,822	13,784	14,810	15,924	17,122
Seadrift	1,277	1,649	1,896	2,212	2,474	2,730	3,012
Rural	5,271	6,301	7,078	7,812	8,575	9,355	10,411
Total	17,434	20,004	21,796	23,808	25,859	28,009	30,545
DeWitt (part)							
Rural	24	25	26	27	29	30	31
Total	24	25	26	27	29	30	31
Victoria (part)							
Bloomington	1888	2480	2785	3174	3660	4032	4442
Victoria	11329	12610	13892	15118	16296	17519	18834
Rural	7830	8158	8650	9140	9597	10132	11178
Total	21,047	23,248	25,327	27,432	29,553	31,683	34,454
Basin Subtotal	38,505	43,277	47,149	51,267	55,441	59,722	65,030
San Antonio-Nueces							
Calhoun (part)							
Rural	40	48	55	59	65	72	79
Total	40	48	55	59	65	72	79
Goliad (part)							
Rural	450	476	505	527	532	547	587
Total	450	476	505	527	532	547	587
Karnes (part)							
Rural	230	261	261	285	301	317	325
Total	230	261	261	285	301	317	325
Refugio (part)							
Refugio	3158	3330	3562	3717	3742	3737	3732
Woodsboro	1731	1828	1913	1964	1954	1938	1922
Rural	3001	3172	3275	3333	3291	3252	3152
Total	7,890	8,330	8,750	9,014	8,987	8,927	8,806
Basin Subtotal	8,610	9,115	9,571	9,885	9,885	9,863	9,797

Source: Texas Water Development Board; 1996 Consensus Water Plan, Most Likely Case.

* Parts of counties located in Colorado, Guadalupe, San Antonio, or Nueces River Basins of West Central Trans-Texas Study Area.

APPENDIX B

WATER AVAILIBILITY FOR EXISTING RIGHTS
NUECES RIVER BASIN

Appendix B

Water Availability for Existing Rights
Nueces River Basin

Introduction

The Nueces River Basin Model, developed under previous contracts with the Nueces River Authority, the City of Corpus Christi, and others[1] was used to analyze the availability of surface water under existing rights in the Nueces River Basin. More specifically, the run-of-the-river water rights in Uvalde, Zavala, Medina, Frio, and Atascosa Counties were analyzed to evaluate their dependability.

Water rights total 530,036 acft/yr for diversions from the Nueces River and all its tributaries. The City of Corpus Christi (83.7%) and Zavala-Dimmit County WCID #1 (5.3%) control 89% of the total rights in the basin. Priority dates for rights in the Nueces Basin which were analyzed as part of this study range from December, 1885 through 1989. A cumulative plot of the water rights versus priority date is presented in Figure B1.

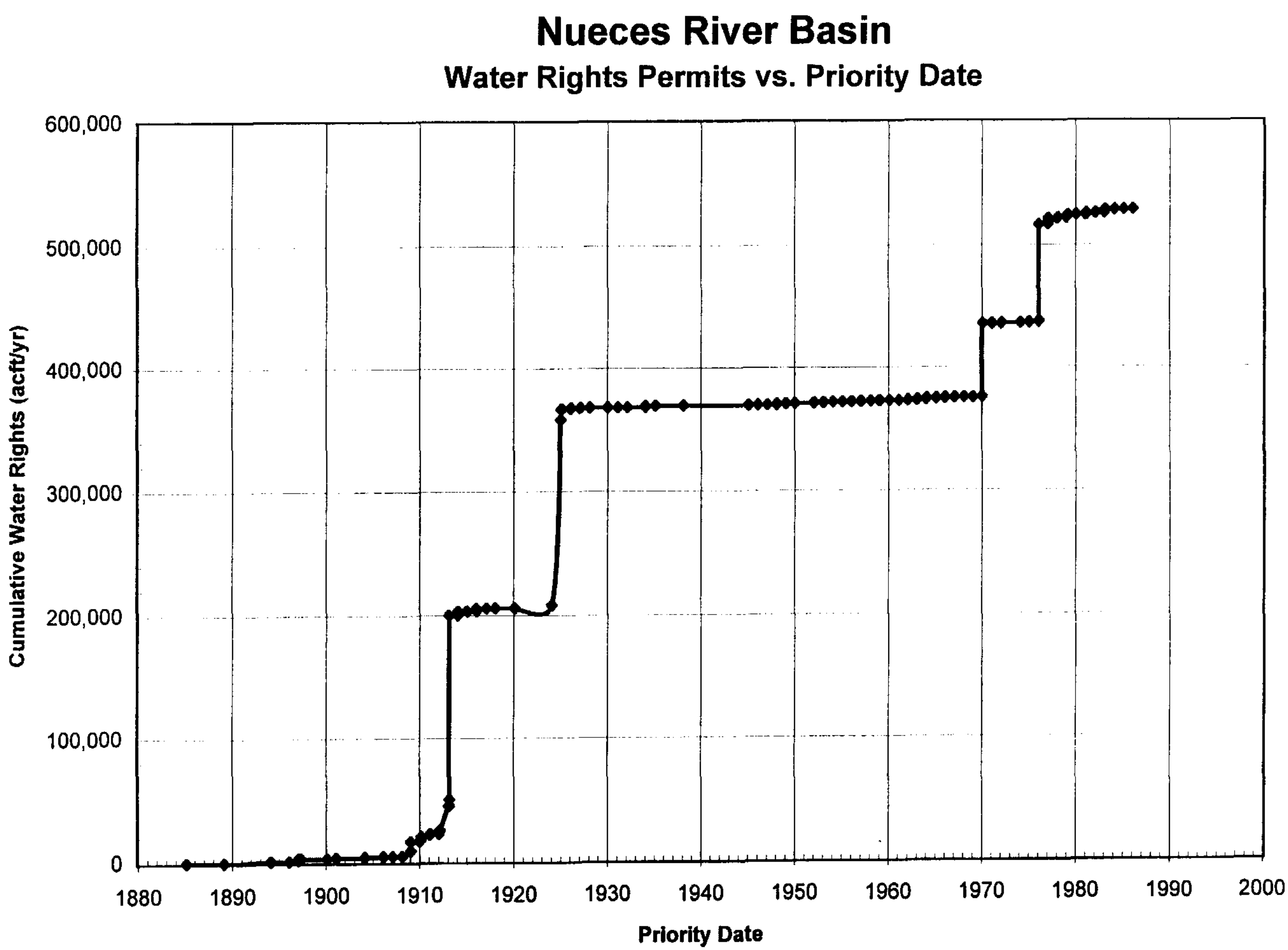
As shown in Figure B1, there are three distinct water rights growth periods in the Nueces Basin. The first period runs from 1885 to December, 1913 and includes the primarily irrigation water rights in the upper reaches of the Nueces Basin. The majority of Zavala-Dimmit WCID #1's water rights have priority dates in this period. The break-point between the first two periods is the granting of the water rights permits for Lake Corpus Christi in 1913 and 1925. By 1925, the City of Corpus Christi was granted permits for 304,872 acft of water rights at Lake Corpus Christi and Calallen Reservoir. The third major water rights appropriation in the Nueces River Basin occurred in the 1970's with the granting of 138,800 acft of water rights permits to the City of Corpus Christi including the permits to construct Choke Canyon Reservoir on the Frio River.

Simulation of Water Rights in the Nueces River Basin Model

The Nueces River Basin Model simulates streamflow within the basin in an upstream to downstream fashion beginning with the headwaters of the Nueces River, proceeding downstream to the confluence with the Frio River, simulating the Frio River including the Leona, Dry Frio, Sabinal and Atascosa Rivers and Hondo, Seco, and Verde Creeks, and finally, the remainder of the Nueces River downstream to the Nueces Estuary. The basin model has twenty-nine control points where streamflows are adjusted to reflect water rights diversions and channel losses in delivery of water from the next upstream control point(s).

---

[1] HDR Engineering, Inc. et al, "Regional Water Supply Planning Study - Phase I, Nueces River Basin," Nueces River Authority et al, May, 1991.



Nueces River Basin
Water Rights Permits vs. Priority Date
600,000
500,000
400,000
300,000
200,000
100,000
0
Cumulative Water Rights (acft/yr)
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Priority Date

Figure B1

Water rights diversions are grouped by control point and subdivided at each control point by type of use (i.e. municipal, industrial, irrigation or mining). The model does not presently consider the relative seniority of one water right as compared to another. For the purposes this analysis, full consideration of relative seniority of individual water rights would not greatly affect the results because: 1) Rights above the upstream limits of the Edwards Aquifer Recharge Zone are few in number, and losses to the aquifer over the recharge zone are so great that, even if the water were allowed to pass by the upstream permit holders, it would not make it across the recharge zone; and 2) Losses in the Nueces and Frio Rivers are so great that diversions upstream have limited effect on the large senior water rights downstream (Lake Corpus Christi).

Analysis of Water Availability for Existing Rights

For a general assessment of water availability for existing rights in selected counties within the Nueces River Basin, simulations were performed for three groups or periods of water rights: Period 1 - water rights with priority dates November, 1913 and earlier; Period 2 - water rights with priority dates January, 1925 and earlier; and Period 3 - all water rights with priority dates December, 1989 and earlier. During each simulation, the water rights shortages were tabulated and converted to availabilities. Figures B2 and B3 show the reliability of water rights versus priority date for the Nueces River near Asherton (USGS Gage No. 08193000) and Frio River near Derby (USGS Gage No. 08205500), respectively. Each of the graphs shows a percent available curve for the long term (1934-89) average, the worst 10-year drought (1947-56) average, and the minimum year of availability.

In addition to these two control points, the following control points were also included in the analysis to evaluate water rights in the aforementioned counties:

- Nueces River at Laguna (USGS Gage No. 08190000);
- Frio River at Concan (USGS Gage No. 08195000);
- Dry Frio River near Reagan Wells (USGS Gage No. 08196000);
- Sabinal River near Sabinal (USGS Gage No. 08198000);
- Leona River at Uvalde (USGS Gage No. 08204000);
- Frio River at Calliham (USGS Gage No. 08207000);
- Atascosa River at Whitsett (USGS Gage No. 08208000);
- San Miguel Creek at Tilden (USGS Gage No. 08206700).

Due primarily to the short period of gaged record for San Miguel Creek at Tilden, this gage was not developed as a full control point in previous studies. Therefore, a complete natural flow set for the period of record used in the Nueces River Basin Model (1934-89) has never been developed. In the Model, water rights on San Miguel Creek (a total of 2,865 acft/year) are prorated and lumped with the water rights at a control point on the Frio River. In order to more realistically simulate the water rights on San Miguel Creek, special provisions were made in these analyses. Due to similarities in the San Miguel Creek and Atascosa River basins, the San Miguel water rights availabilities were assessed using the Atascosa River at Whitsett control point as a surrogate.

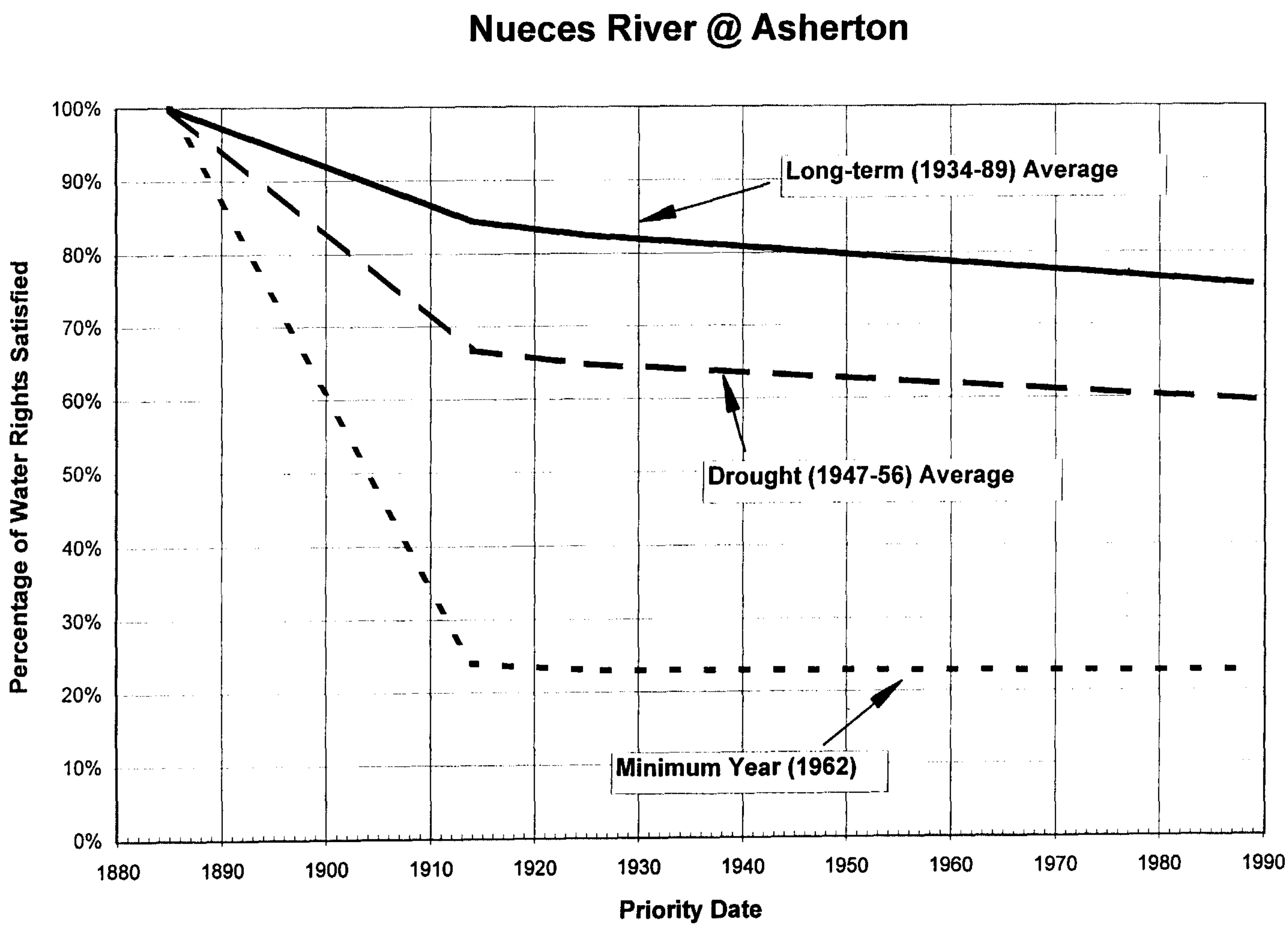


Figure B2

HDR

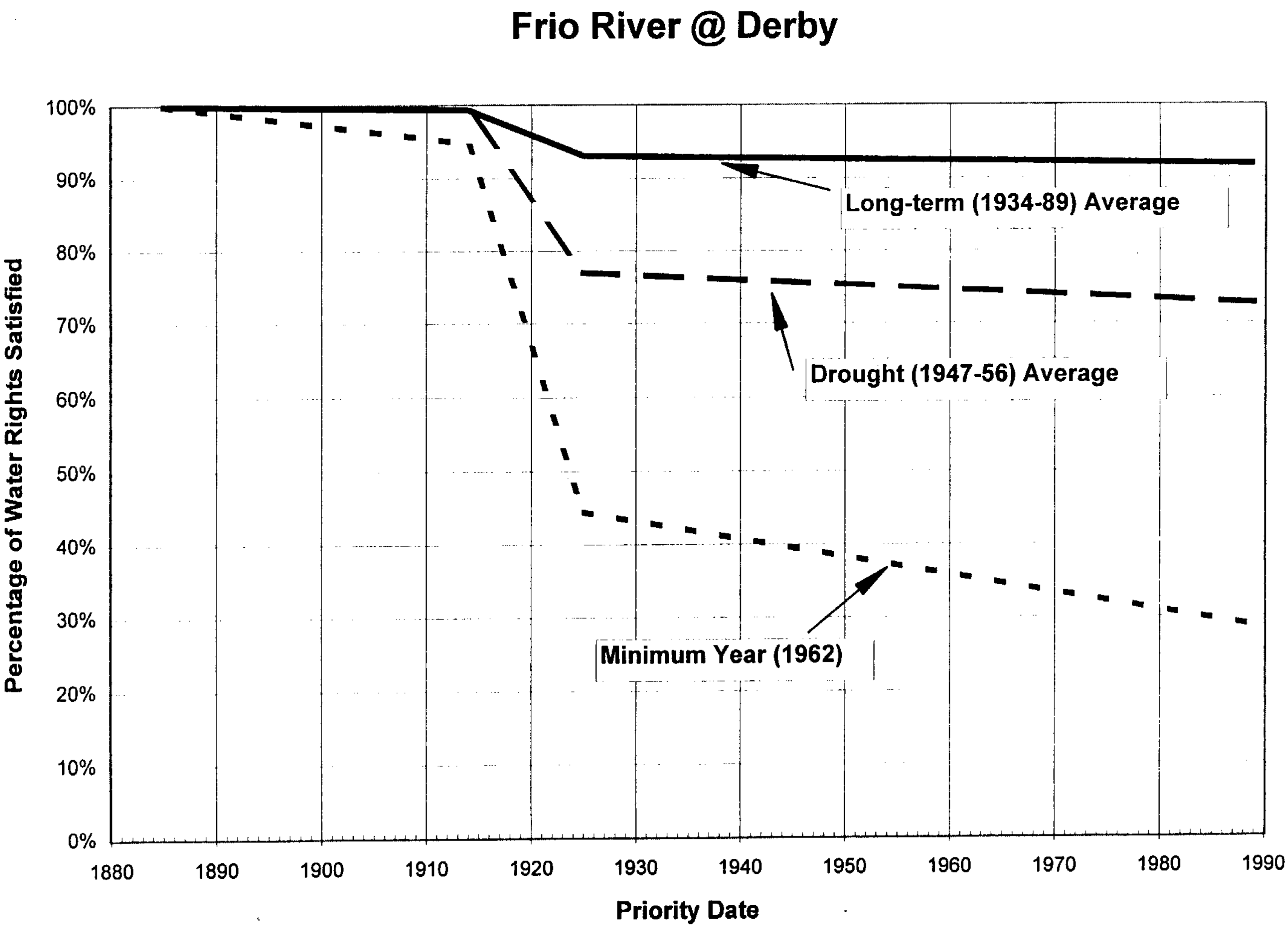


Figure B3

HDR

Since many control point segments in the Nueces River Basin Model include water rights located in more than one county, the resulting availability at each of the control points was prorated to an availability representative of the counties in which the rights are located. The attached Figures B4 through B8 present the resulting availability versus priority date curves for the five Nueces Basin counties in the West Central Study Area. This data was used as the basis for the water supply summaries presented in the main body of this report.

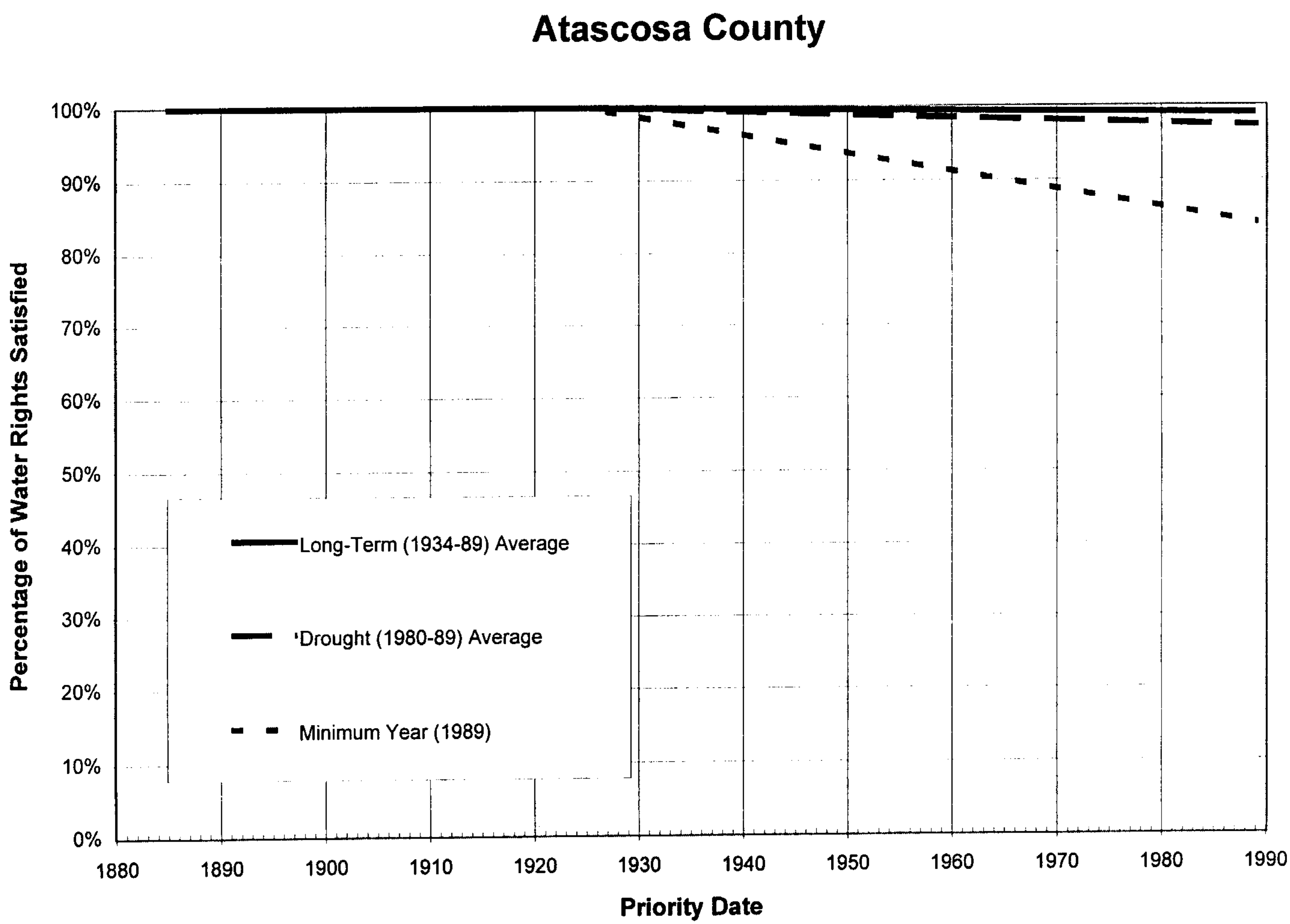
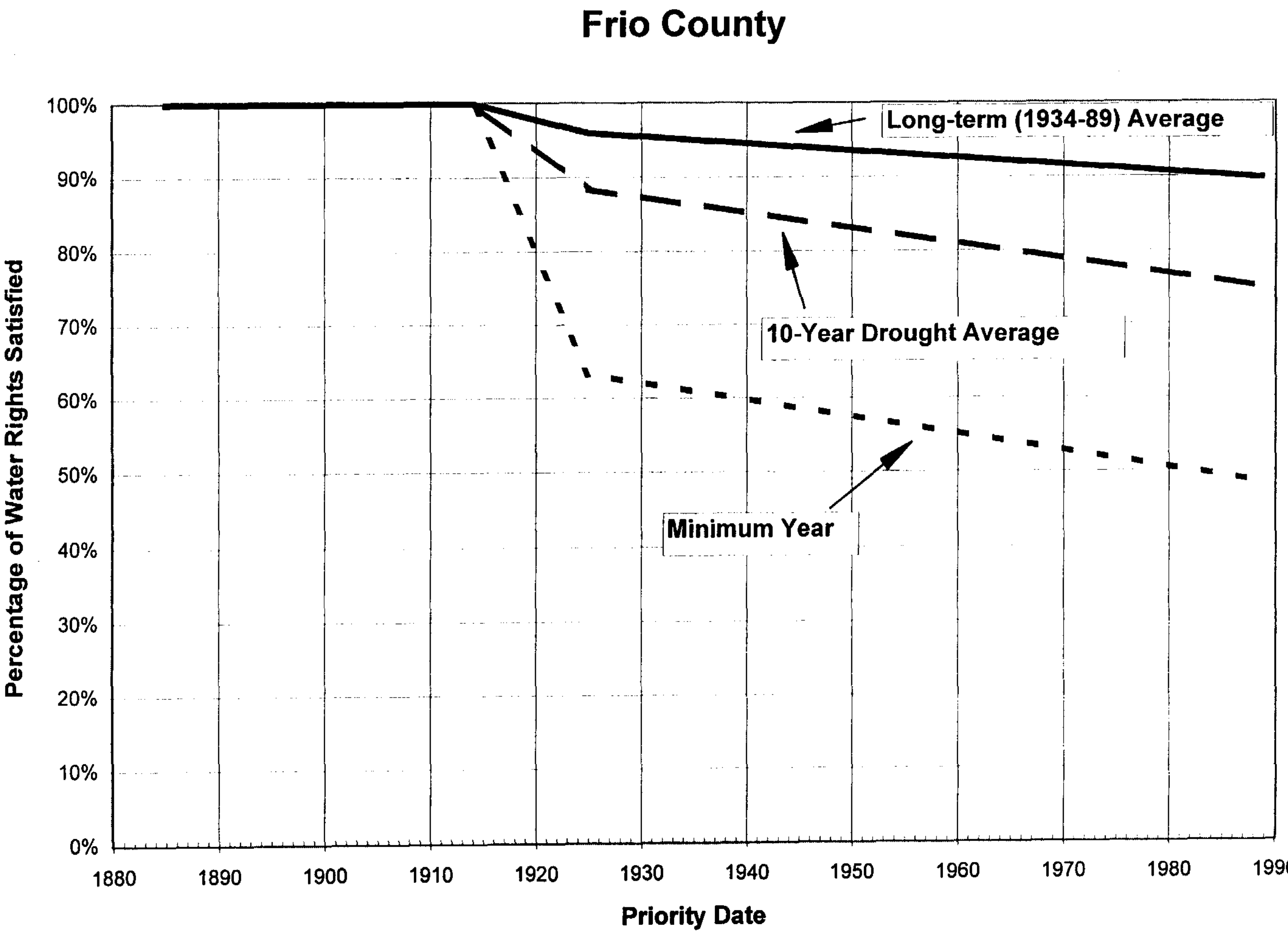

Atascosa County
Percentage of Water Rights Satisfied
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
Priority Date
Long-Term (1934-89) Average
Drought (1980-89) Average
Minimum Year (1989)

Figure B4



Frio County
Long-term (1934-89) Average
10-Year Drought Average
Minimum Year
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percentage of Water Rights Satisfied
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
Priority Date

Figure B5

Medina County

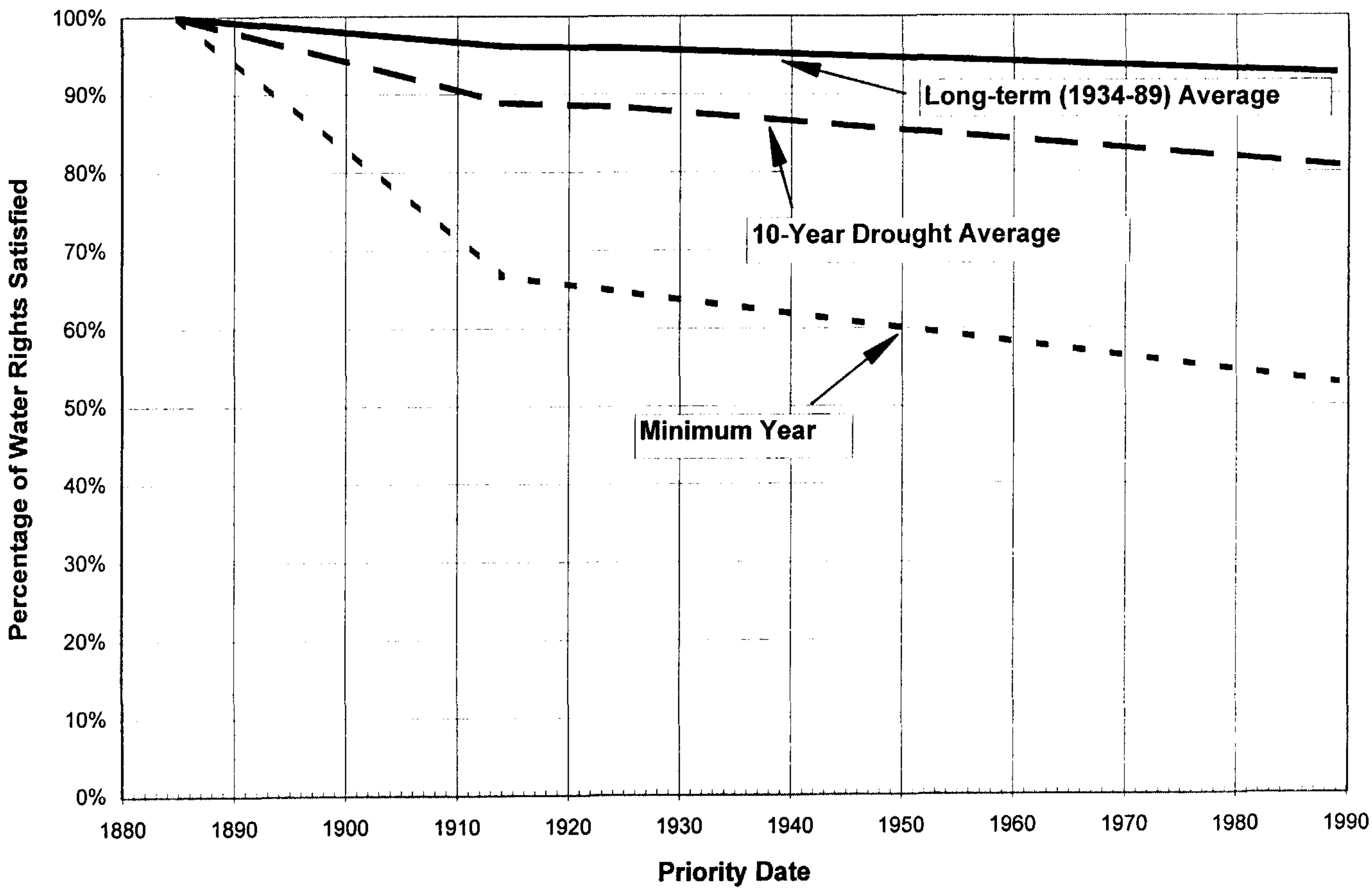


Figure B6

HDR

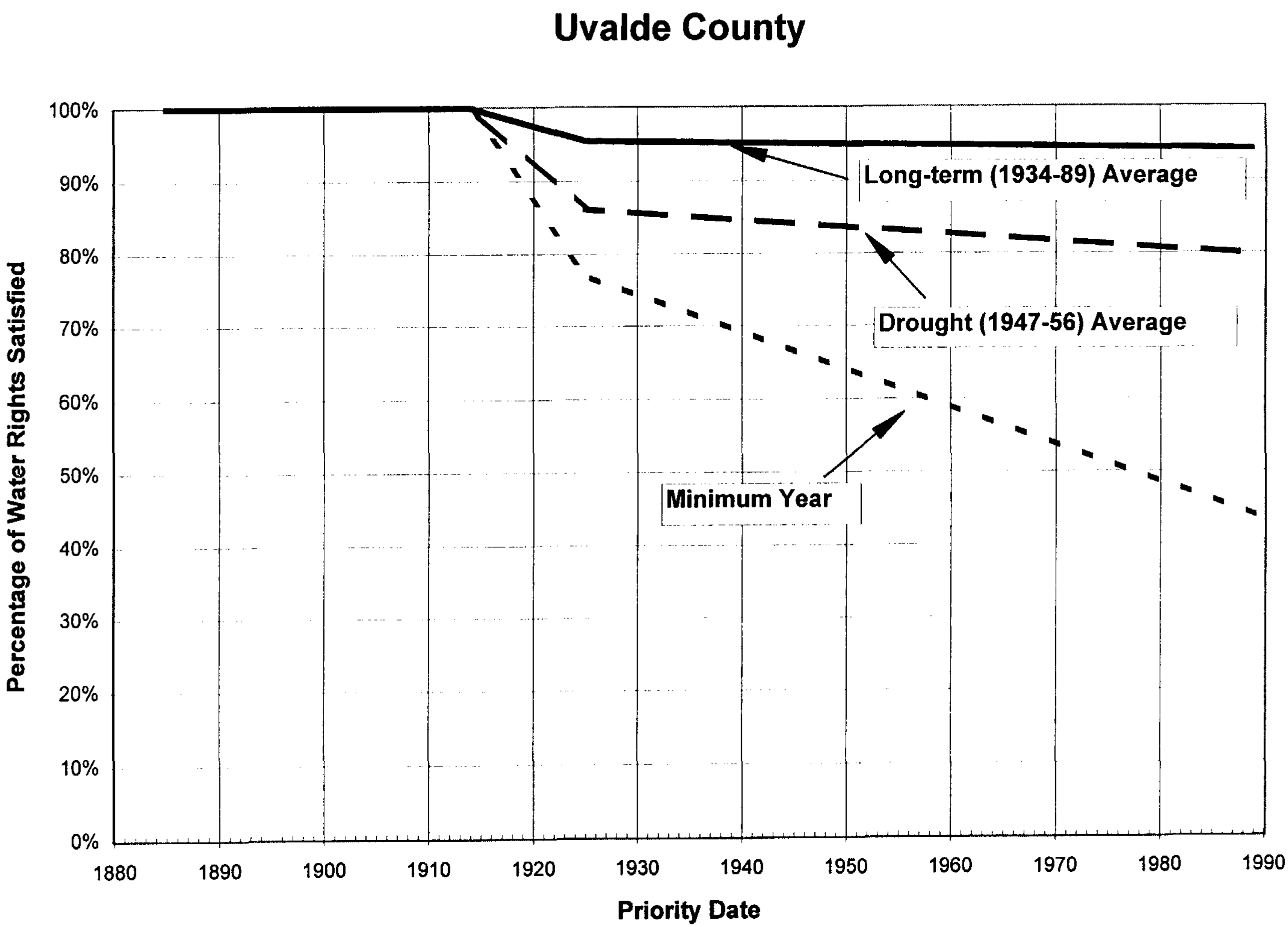
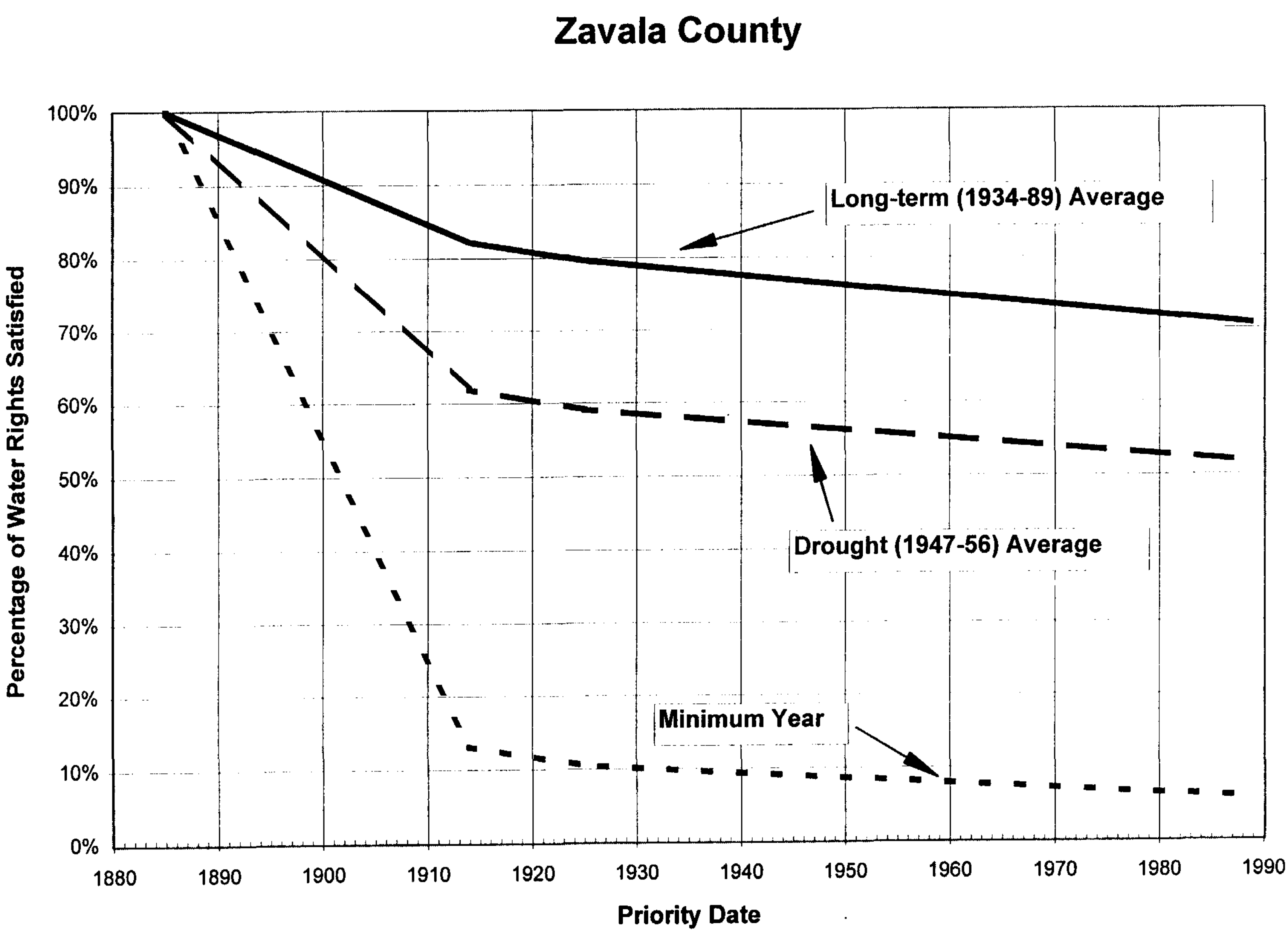

Uvalde County
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Percentage of Water Rights Satisfied
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
Priority Date
Long-term (1934-89) Average
Drought (1947-56) Average
Minimum Year

Figure B7



Zavala County
Percentage of Water Rights Satisfied
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
Priority Date
Long-term (1934-89) Average
Drought (1947-56) Average
Minimum Year

Figure B8

APPENDIX C

WATER AVAILIBILITY FOR EXISTING RIGHTS
SAN ANTONIO AND GUADALUPE RIVER BASINS

Appendix C

Water Availability for Existing Rights
San Antonio and Guadalupe River Basins

Introduction

The Guadalupe-San Antonio River Basin Model[1] (GSA model), developed under a previous contract with the Edwards Underground Water District (presently the Edwards Aquifer Authority), was used to analyze the availability of surface water under existing rights in the Guadalupe and San Antonio River Basins. More specifically, the run-of-the-river water rights in Bandera, Bexar, Blanco, Caldwell, Calhoun, Comal, DeWitt, Goliad, Gonzales, Guadalupe, Hays, Karnes, Kendall, Kerr, Medina, Victoria, and Wilson Counties within the Guadalupe and San Antonio River Basins were analyzed to evaluate their dependability.

About 580 individual water rights currently exist in the San Marcos, Guadalupe, Blanco, Medina, and San Antonio Rivers, and their tributaries. The Guadalupe-Blanco River Authority (GBRA) controls about 42% of the total permitted diversions in the combined basins; the City of San Antonio, 16%; the Bexar-Medina-Atascosa Water District, 13%; the Dupont Chemical Company, 6%; and Central Power and Light, 4%. No other single permit holder controls more than 2% of the permitted diversions. Priority dates for rights in the combined basins range from 1732 to 1993. A cumulative plot of the water rights versus priority date for the combined basins is presented in Figure C1.

There are several distinct water rights growth periods apparent in Figure C1, although no individual growth period is as large as the three identified in the Nueces River Basin (Appendix B). Water rights increased in 1910 from 24,030 acft/yr to 89,860 acft/yr with the granting of the Bexar-Medina-Atascosa Counties Water Control and Improvement District 1 rights on the Medina River. No other large increases in total water rights occurred until 1944. From 1944 until 1993, the total permitted diversions in the combined basins increased steadily, with the largest increase occurring between 1954 and 1956 with the granting of the GBRA rights on the lower Guadalupe River in Calhoun County, and the GBRA rights associated with Canyon Lake.

Simulation of Water Rights in the Guadalupe and San Antonio River Basins Model

The GSA model simulates streamflows within the combined basins in an upstream to downstream fashion beginning with the headwaters of the Blanco, San Marcos, Guadalupe, Medina and San Antonio Rivers. Water rights and monthly naturalized streamflows are aggregated to 38 control points, which usually represent streamflow gage or reservoir locations. Water rights are subdivided at each control point by type of use (municipal, industrial, irrigation, or mining). The annual permitted diversions are

[1] HDR Engineering, Inc. et al, "Guadalupe-San Antonio River Basin Recharge Enhancement Study," Edwards Underground Water District, September, 1993.

distributed to monthly demands using distribution factors which vary by type of use and by location in the basin.

Springflow from the San Marcos, Heuco, Comal, San Antonio, and San Pedro Springs are modeled using the historical measured springflows. These springflows can be adjusted from the historical sequence to reflect various levels of pumpage from the Edwards Aquifer.

The model adjusts streamflows at each control point to reflect water rights diversions and channel losses in delivery of water from upstream control points. Generally, the model does not consider the relative seniority of one water right as compared to another, except in the case of the GBRA rights at Canyon Lake. The model makes a first pass and adjusts streamflows for rights senior to Canyon Lake. The model then simulates the GBRA's Canyon Lake diversion right, including meeting downstream contractual commitments. Finally, the model simulates the rights junior to the Canyon Lake diversion right. When the diversion rights at a control point cannot be met completely in a month of the simulation, a diversion shortage is computed at that control point.

Analysis of Water Availability for Existing Rights

Water rights appropriations in the combined basins were divided into nine groups by date of priority. The breakpoints between priority groups were selected at the priority date of the water right immediately prior to the next substantial increase in appropriations. The breakpoints selected are 1900, 1909, 1944, 1948, 1954, 1956, 1967, 1978, and 1994, and are shown in Figure C1. A model simulation was performed for each group of water rights having priority dates senior or equal to each of the date breakpoints. The simulations were performed using the period of record naturalized streamflows (1934-89). The shortages calculated reflect the availability of water to rights having dates of priority senior or equal to the breakpoint date of the simulation.

During each simulation, the water rights shortages were tabulated and converted to availabilities. The reliability of water rights versus priority date are shown in Figure C2 for the Guadalupe River at the Saltwater Barrier. The graph shows a percent-available curve for the long term (1934-89) average, the worst 10-year drought (1947-56) average, and the minimum year of availability in the basin (basin critical year). These curves were computed for each pertinent control point in the basin.

Several complicating factors exist with respect to water management in the Guadalupe and San Antonio River Basins, and the following assumptions were adopted throughout the modeling to account for these factors:

1) A series of low-head, run-of-the-river hydroelectric power generation plants are operated on the Guadalupe River downstream from Canyon Lake. These non-consumptive rights generally are senior to Canyon Lake, and can call on Canyon Lake inflows to be passed downstream. For the purposes of this analysis, all hydropower, including the City of Seguin right, was subordinated to Canyon Lake in the model;

i.e. Canyon Lake was not required to pass inflows to meet any downstream hydropower requirements.

2) Springflows were adjusted to reflect a constant aquifer pumpage rate of 400,000 acft/yr without drought management. These adjustments were based upon simulation results from the Texas Water Development Board's model of the Edwards Aquifer.
3) Return flows were excluded from the simulation to allow for conservative estimates of water availability.
4) The Canyon Lake permit (50,000 acft/yr) was simulated as a 10,000 acft/yr lakeside diversion and a 40,000 acft/yr diversion near New Braunfels. Operation of Canyon Lake does not affect water rights senior to the Canyon Lake priority date of March 19, 1956.
5) Central Power and Light owns a non-consumptive right to divert water from the Guadalupe River for once-through cooling. This right was not included in the model.
6) All rights associated with Applewhite Reservoir have been abandoned and were not included in the model.

Many control point segments in the GSA model include water rights located in more than one county. The availability of water at each control point was prorated to each county based upon the percentage of water rights in a county that were aggregated to each control point. The resulting availability versus priority date curves for the 17 Guadalupe and San Antonio River Basin counties in the West Central Study Area are shown in Figures C7 through C23. These data were used as the basis for the water supply summaries presented in the main body of this report.

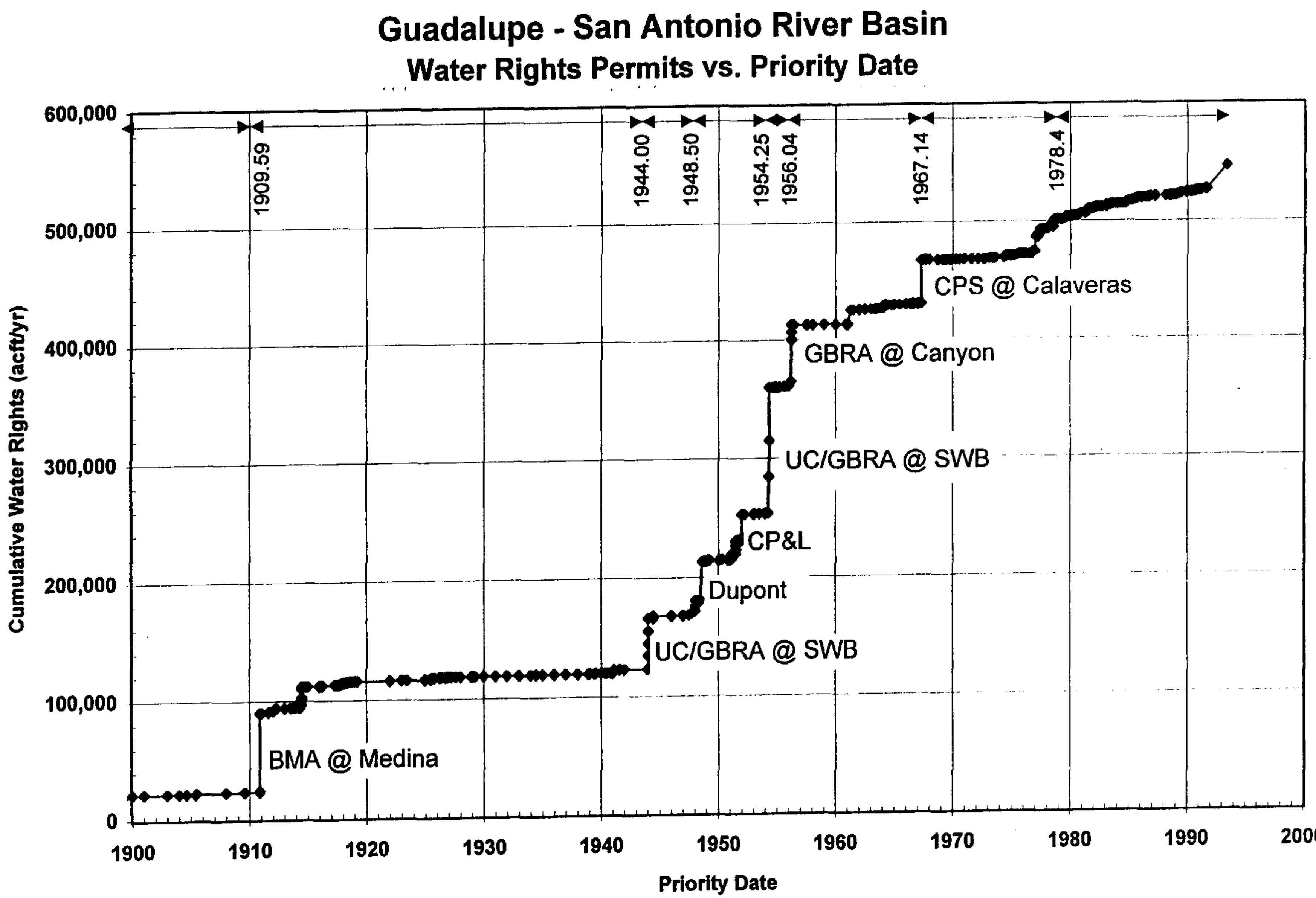
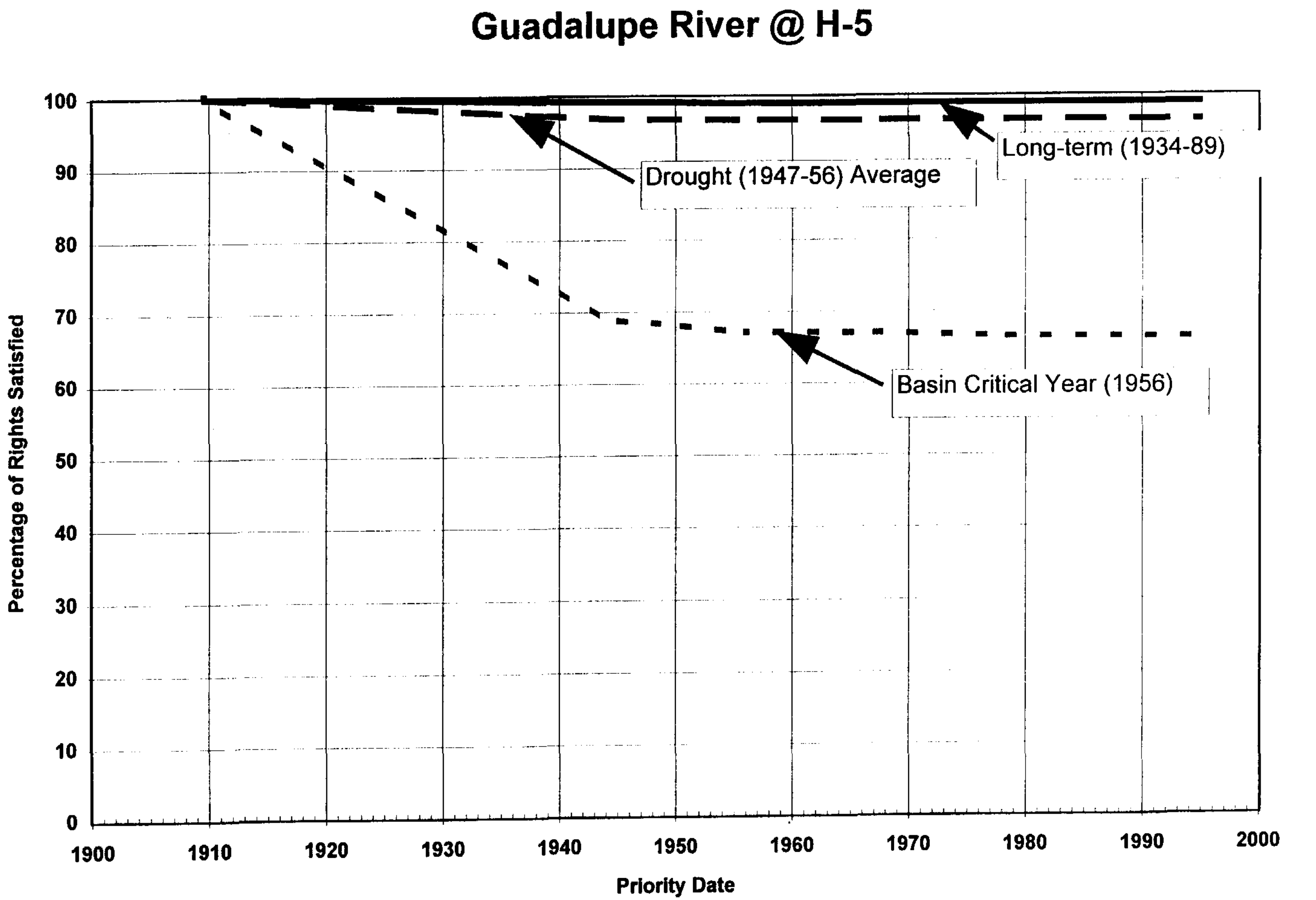


Figure C1

HDR



C-5

Figure C2

HDR

Guadalupe River @ Saltwater Barrier

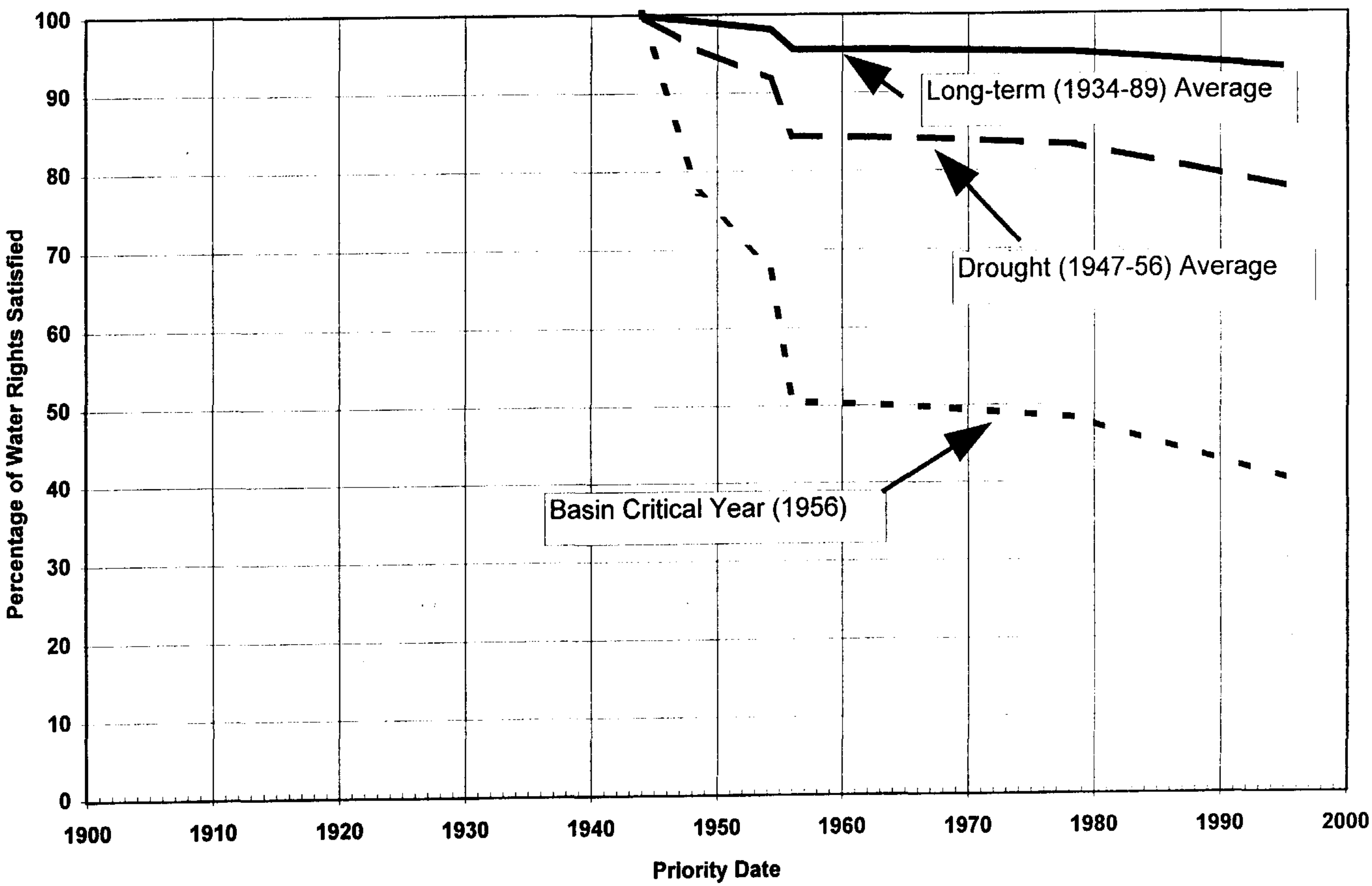


Figure C3

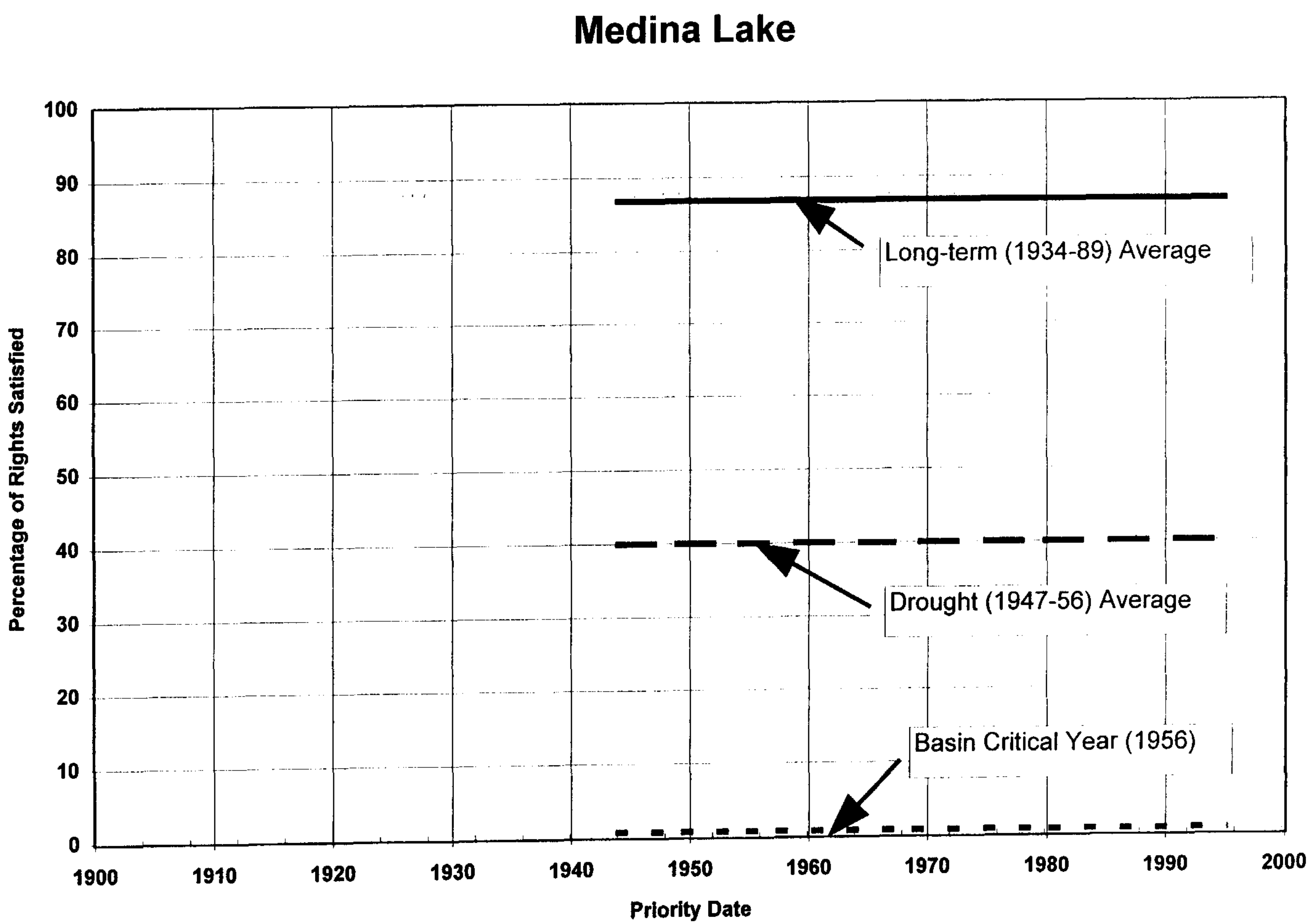


Figure C4

HDR

Medina River @ San Antonio

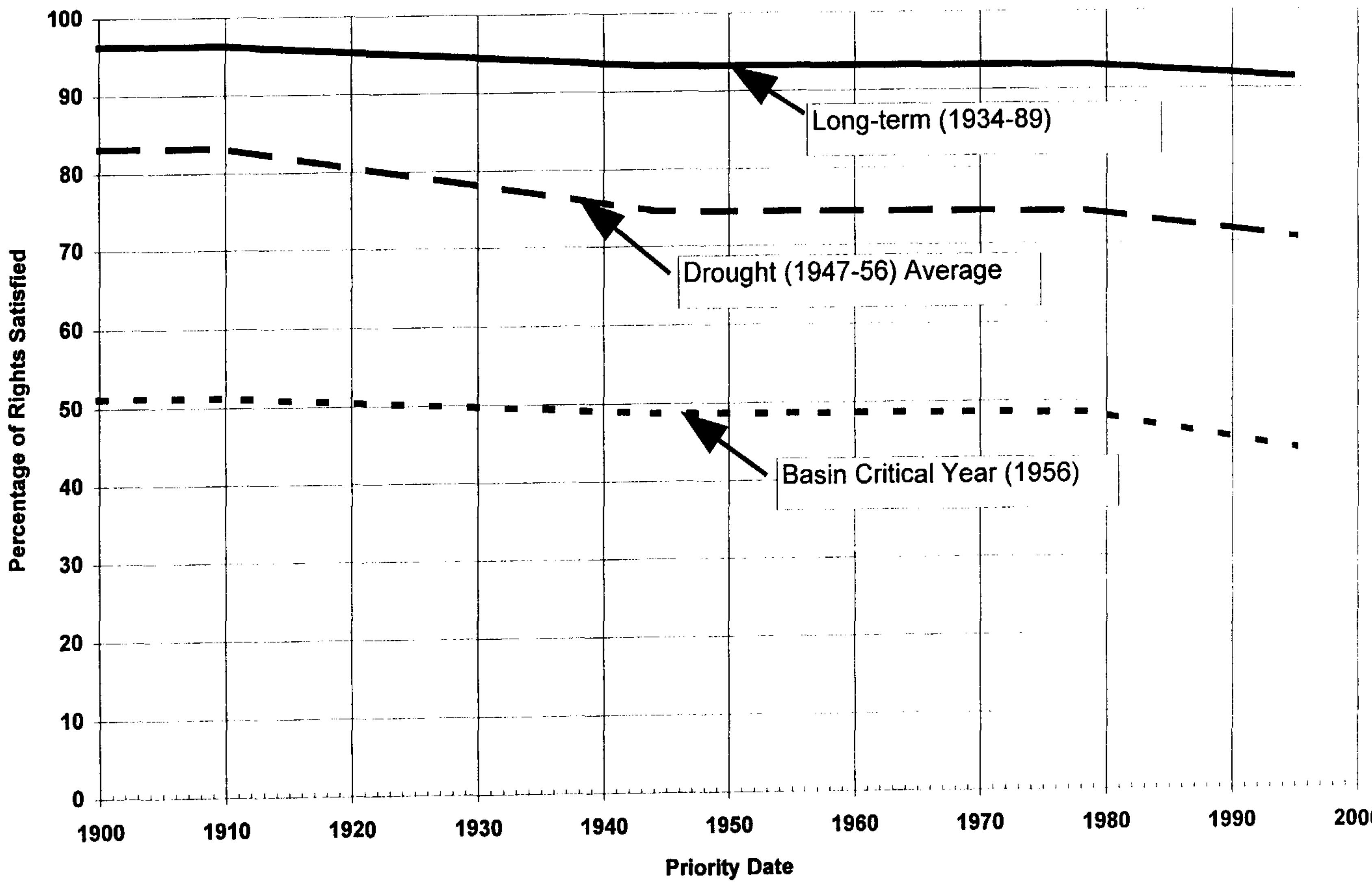


Figure C5

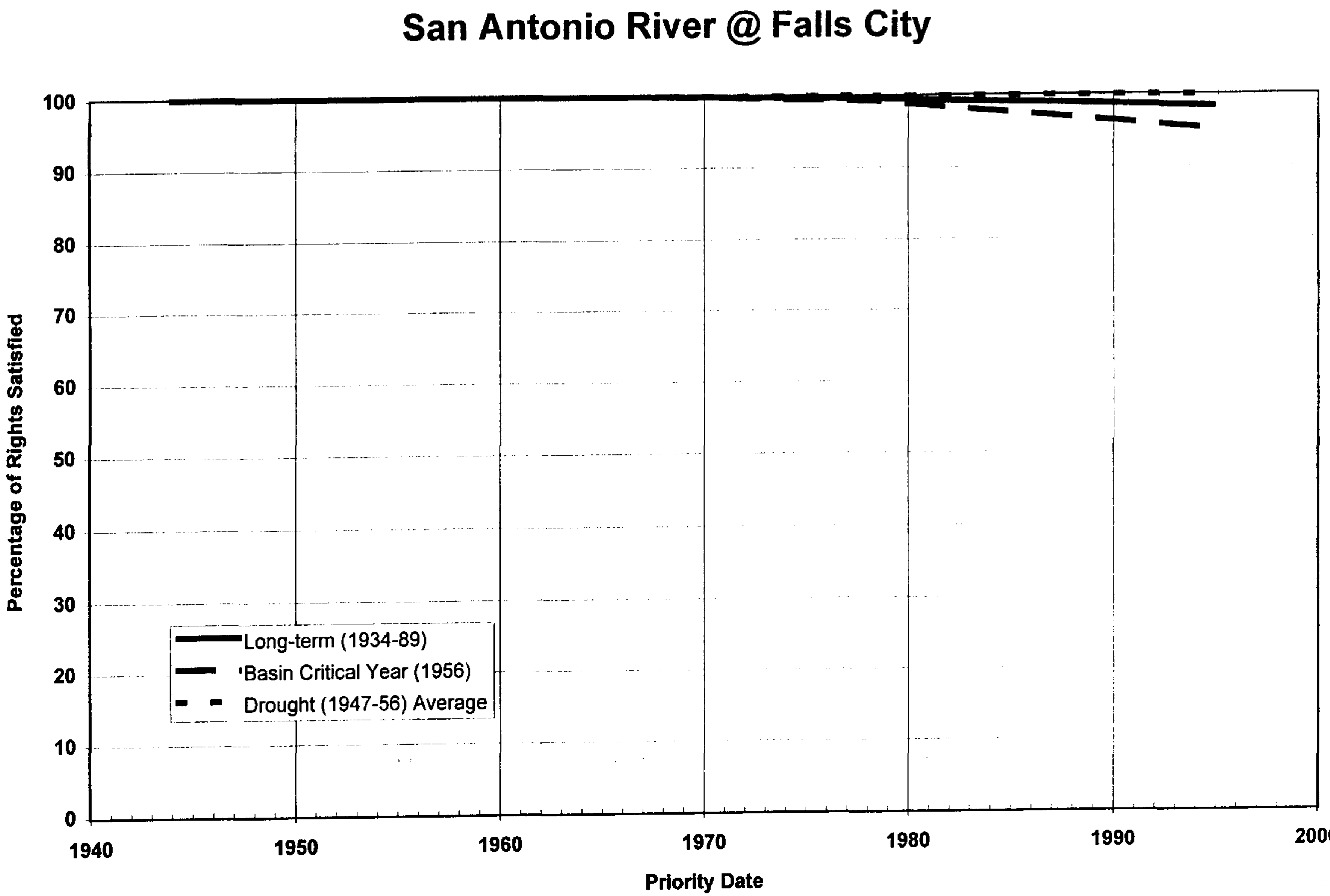


Figure C6

HDR

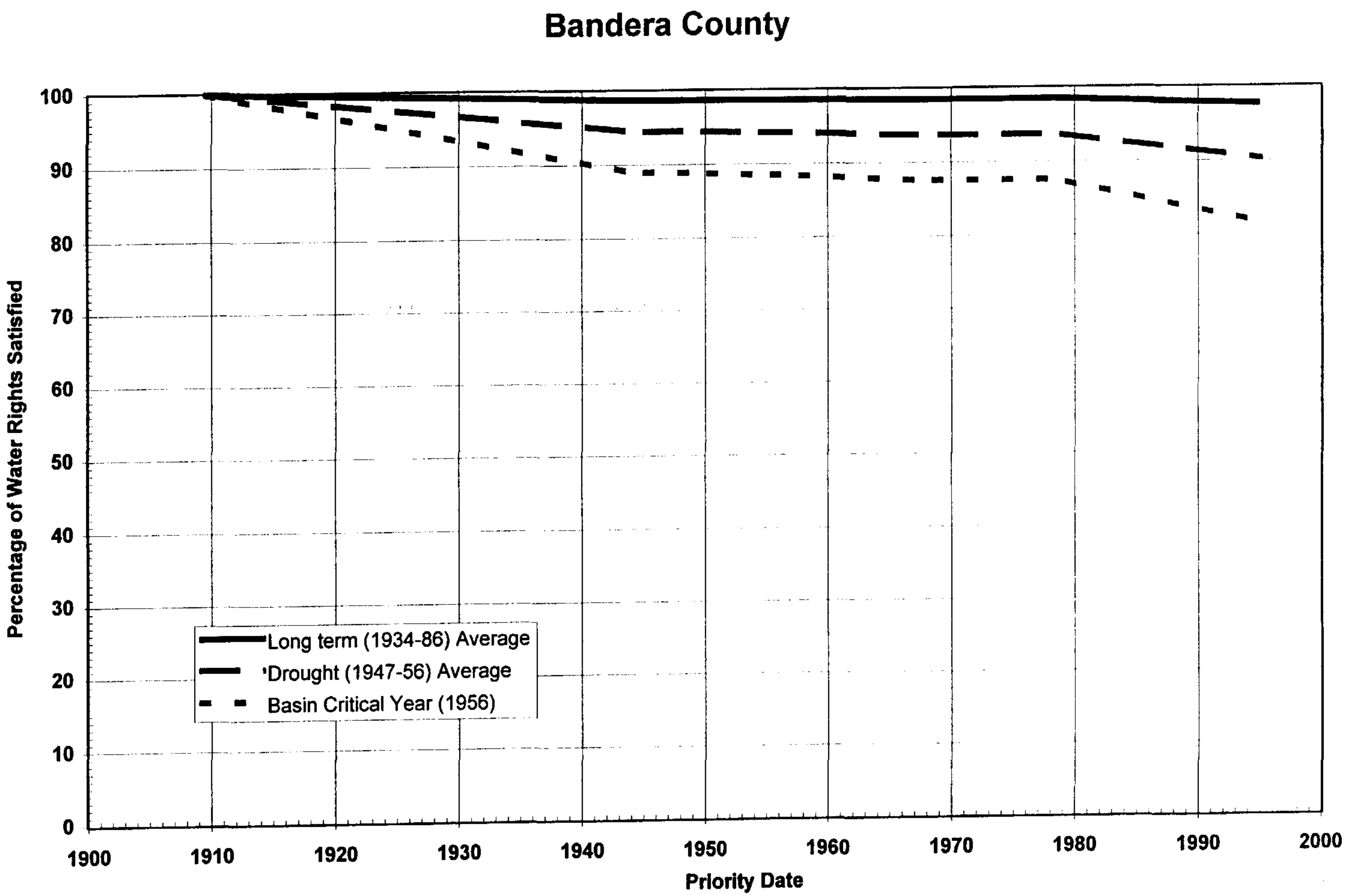


Figure C7

HDR

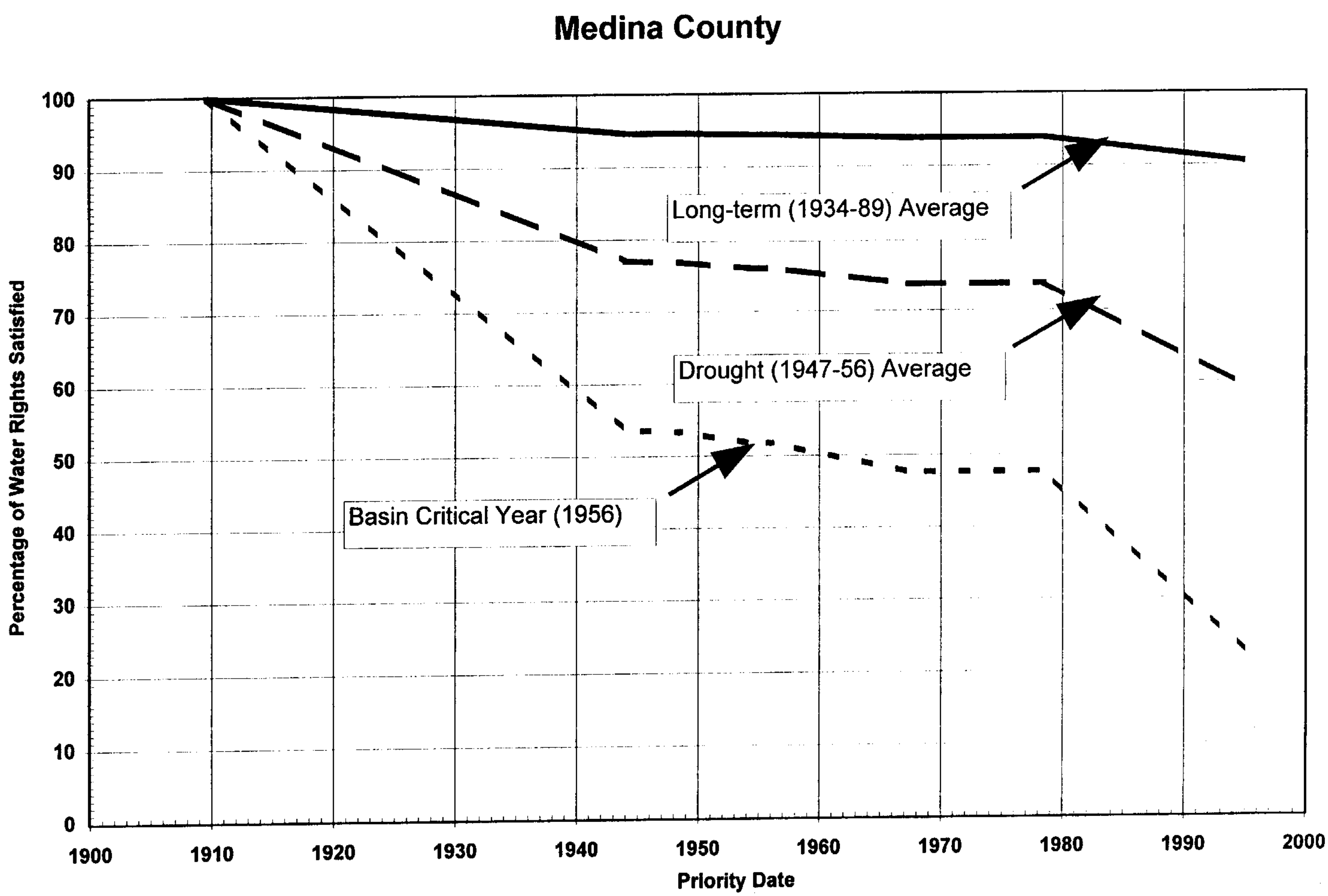


Figure C8

HDR

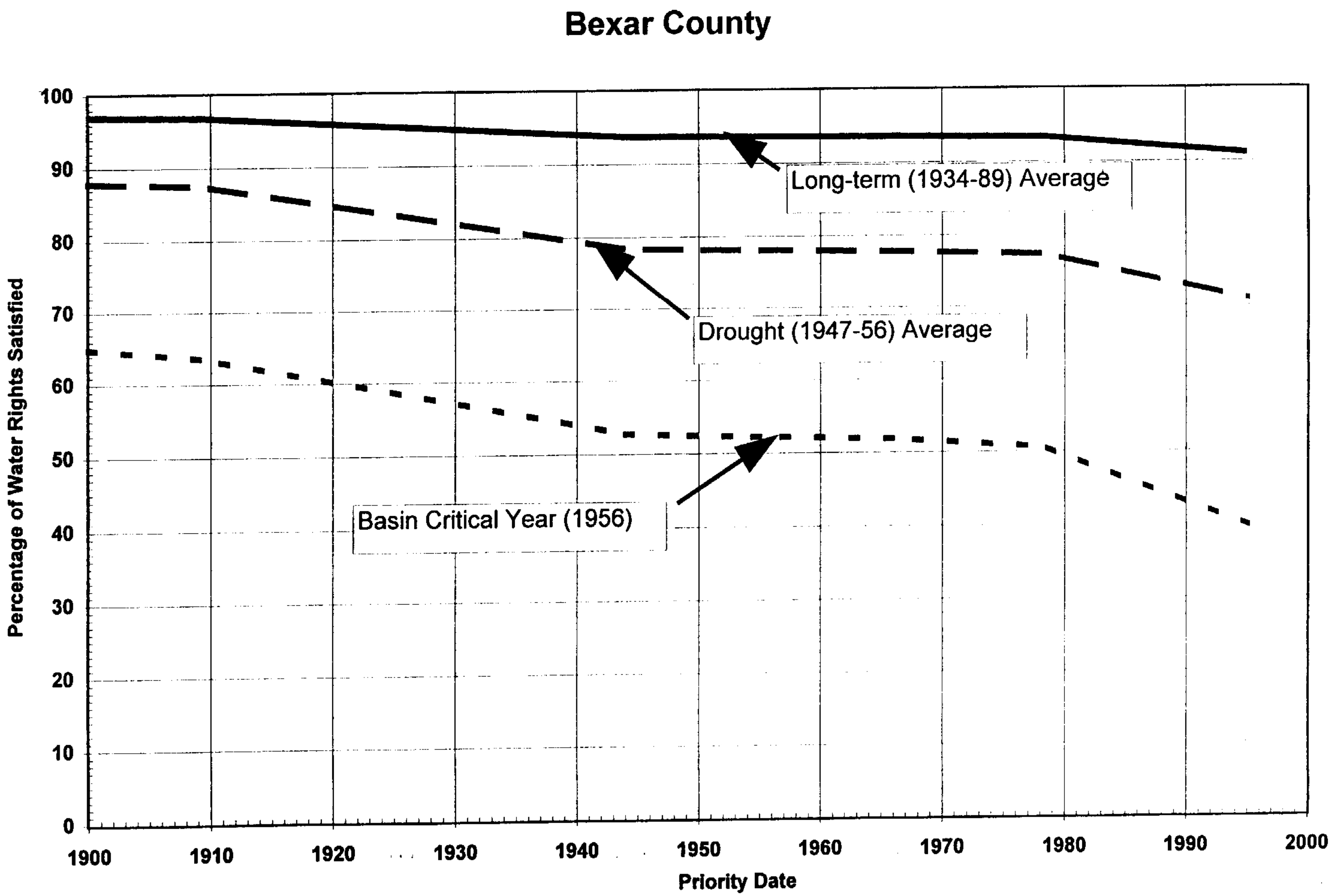


Figure C9

HDR

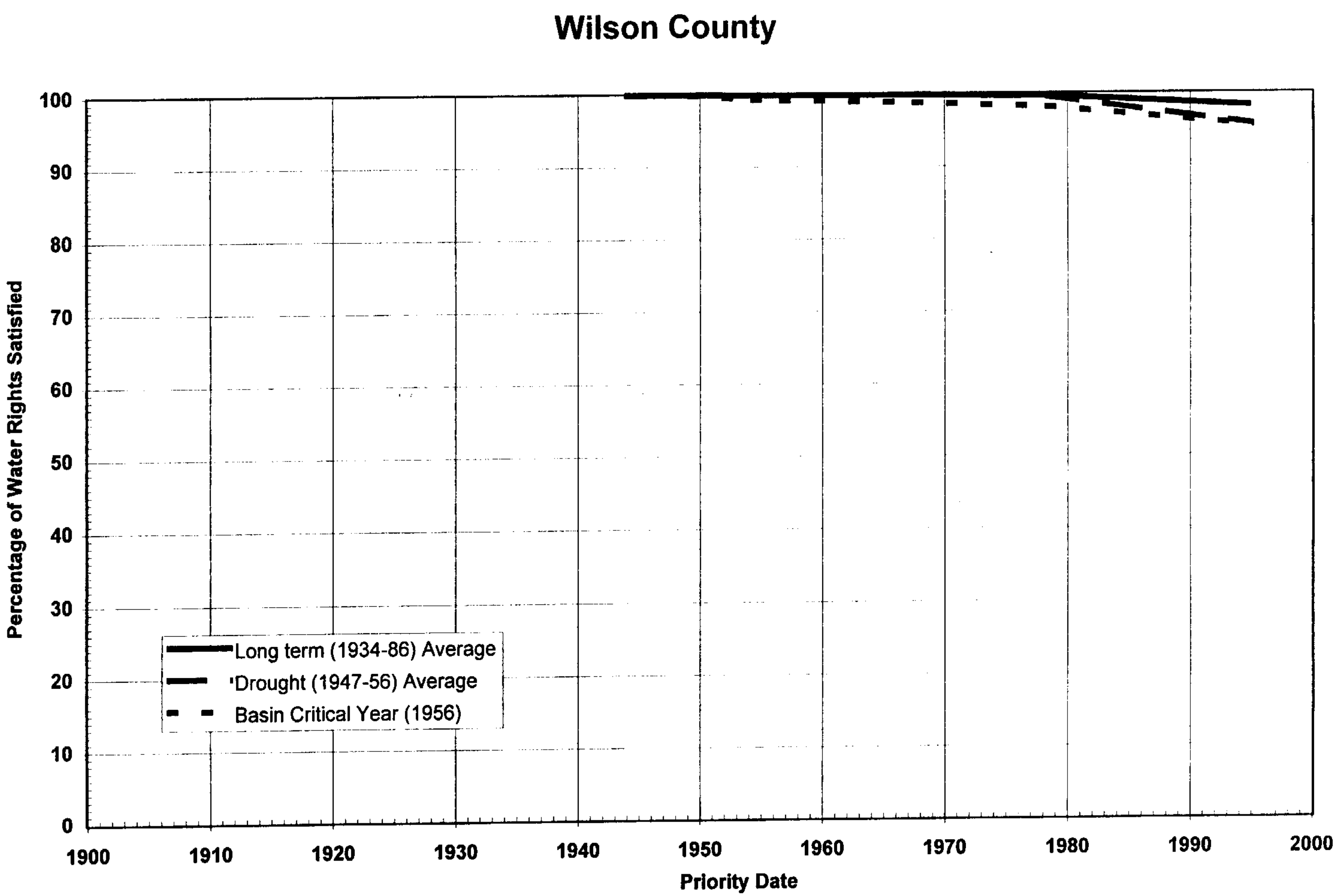
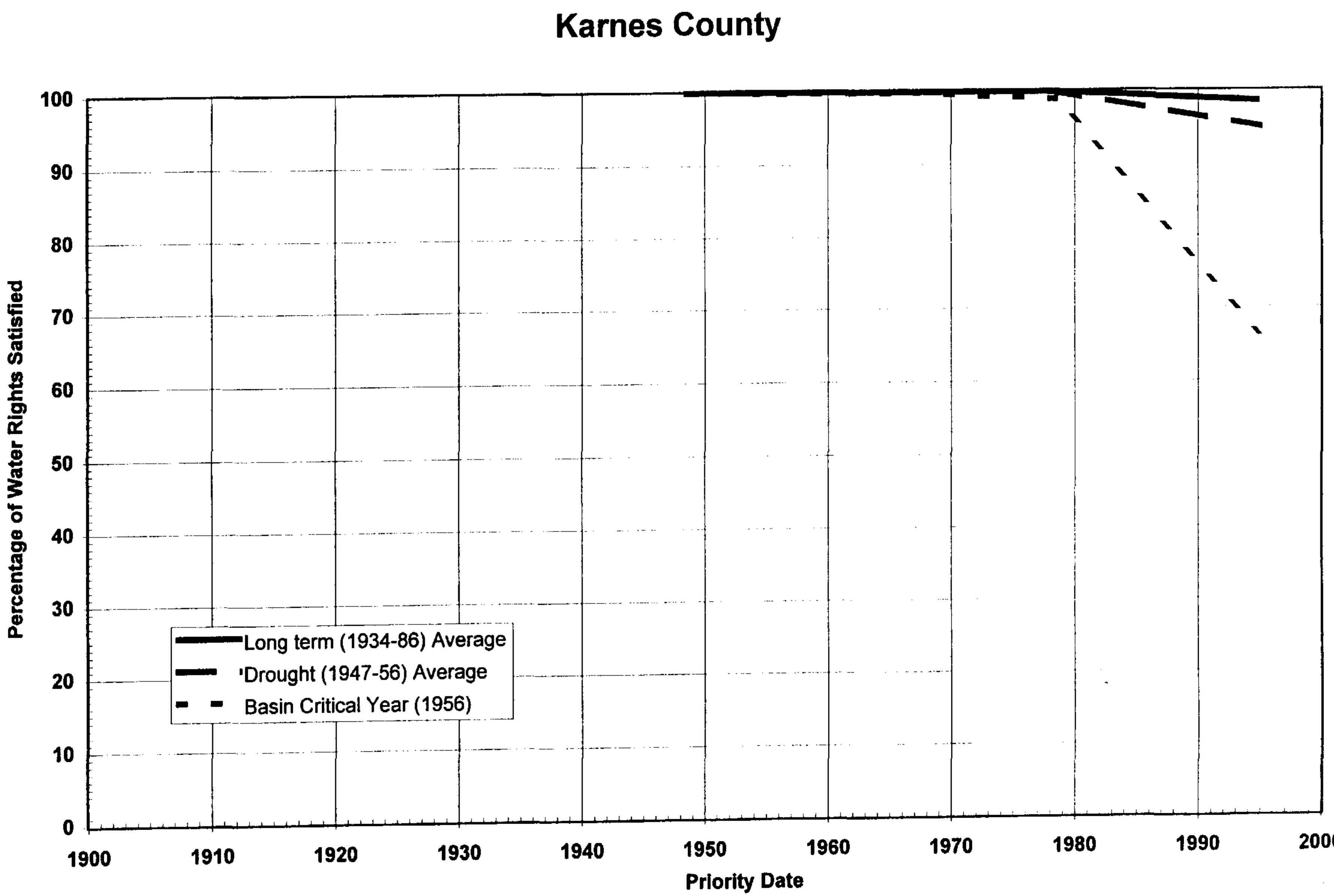


Figure C10

HDR



Karnes County
Percentage of Water Rights Satisfied
0
10
20
30
40
50
60
70
80
90
100
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Priority Date
Long term (1934-86) Average
Drought (1947-56) Average
Basin Critical Year (1956)

Figure C11

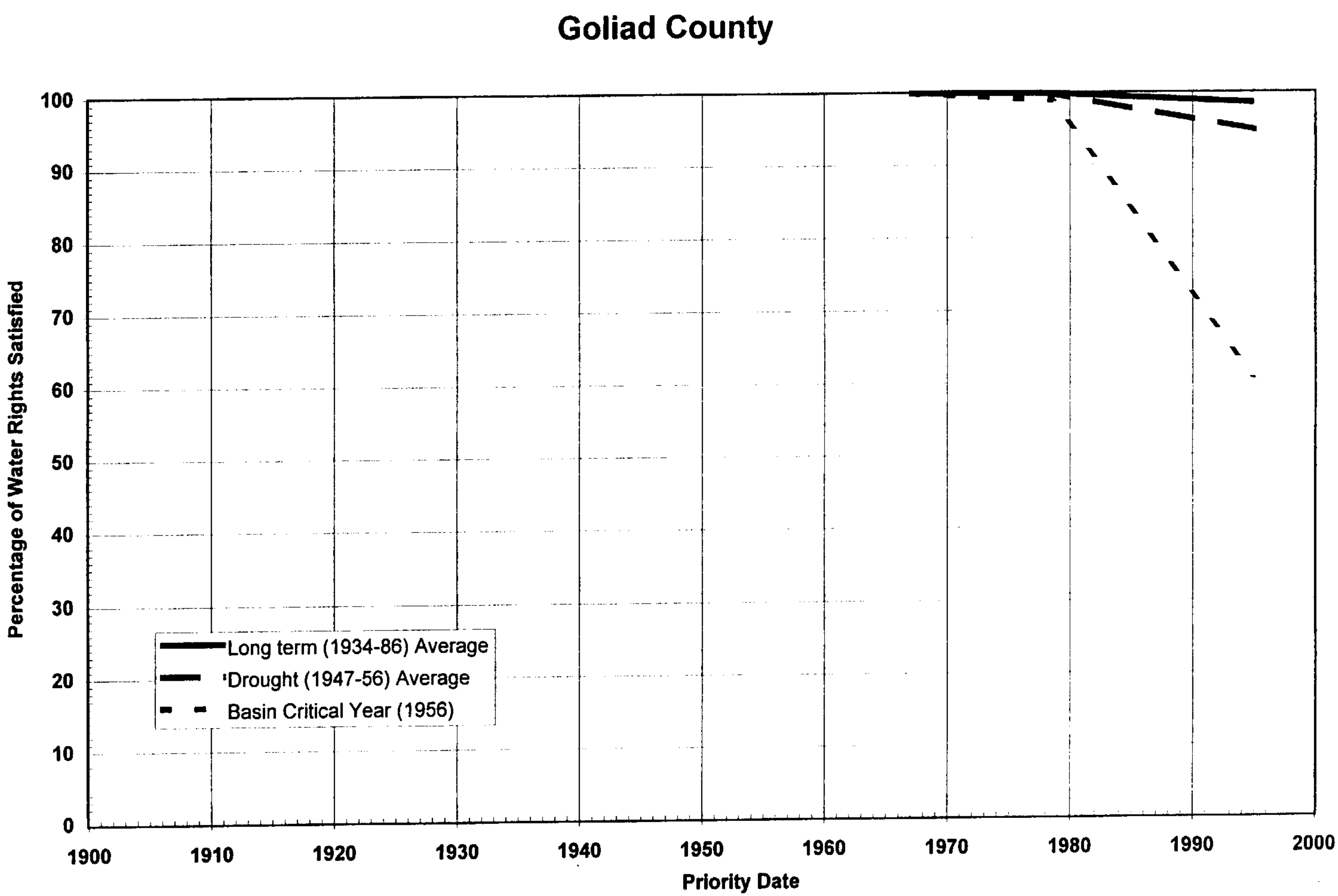


Figure C12

HDR

Kerr County

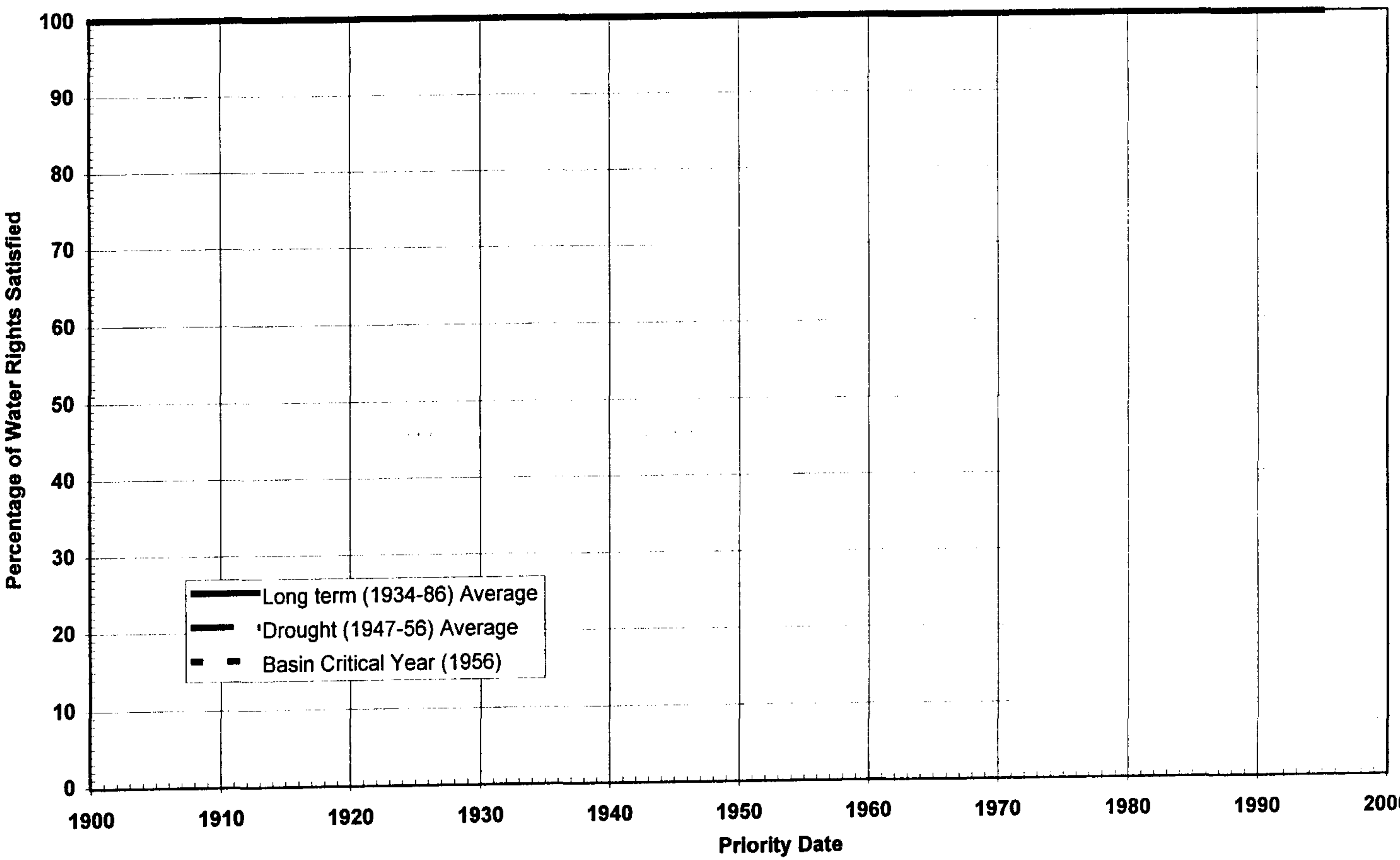


Figure C13

HDR

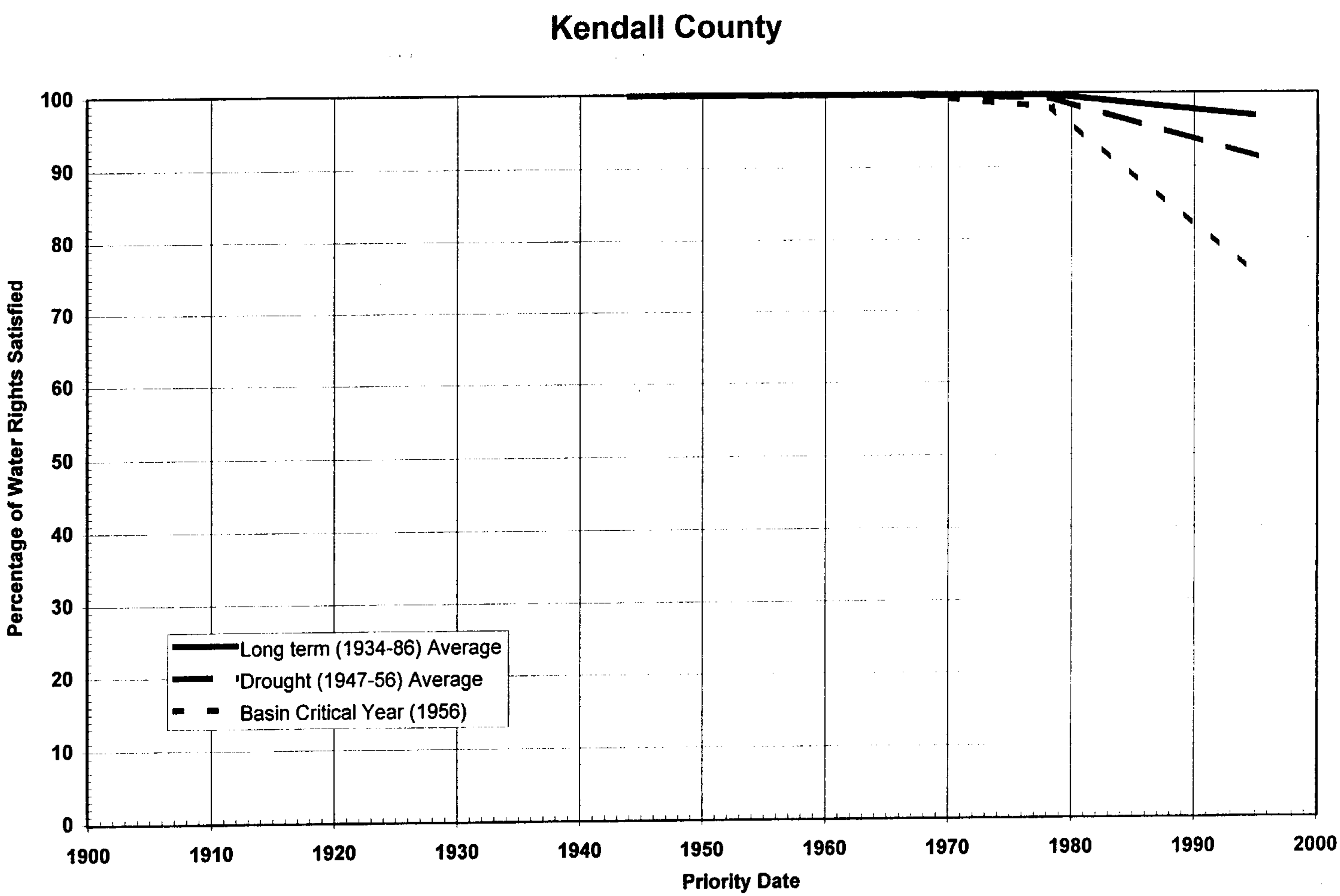


Figure C14

HDR

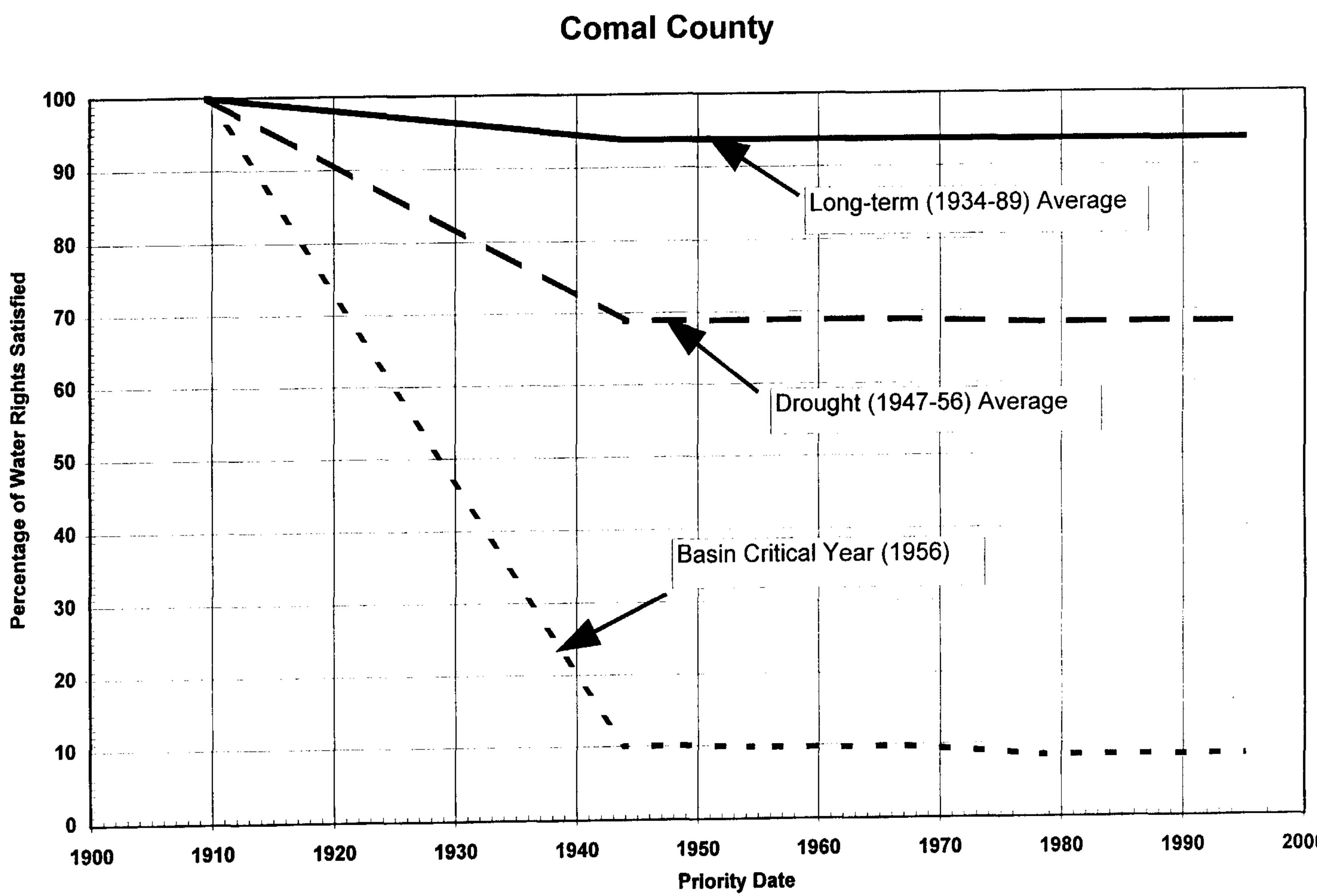


Figure C15

HDR

Blanco County

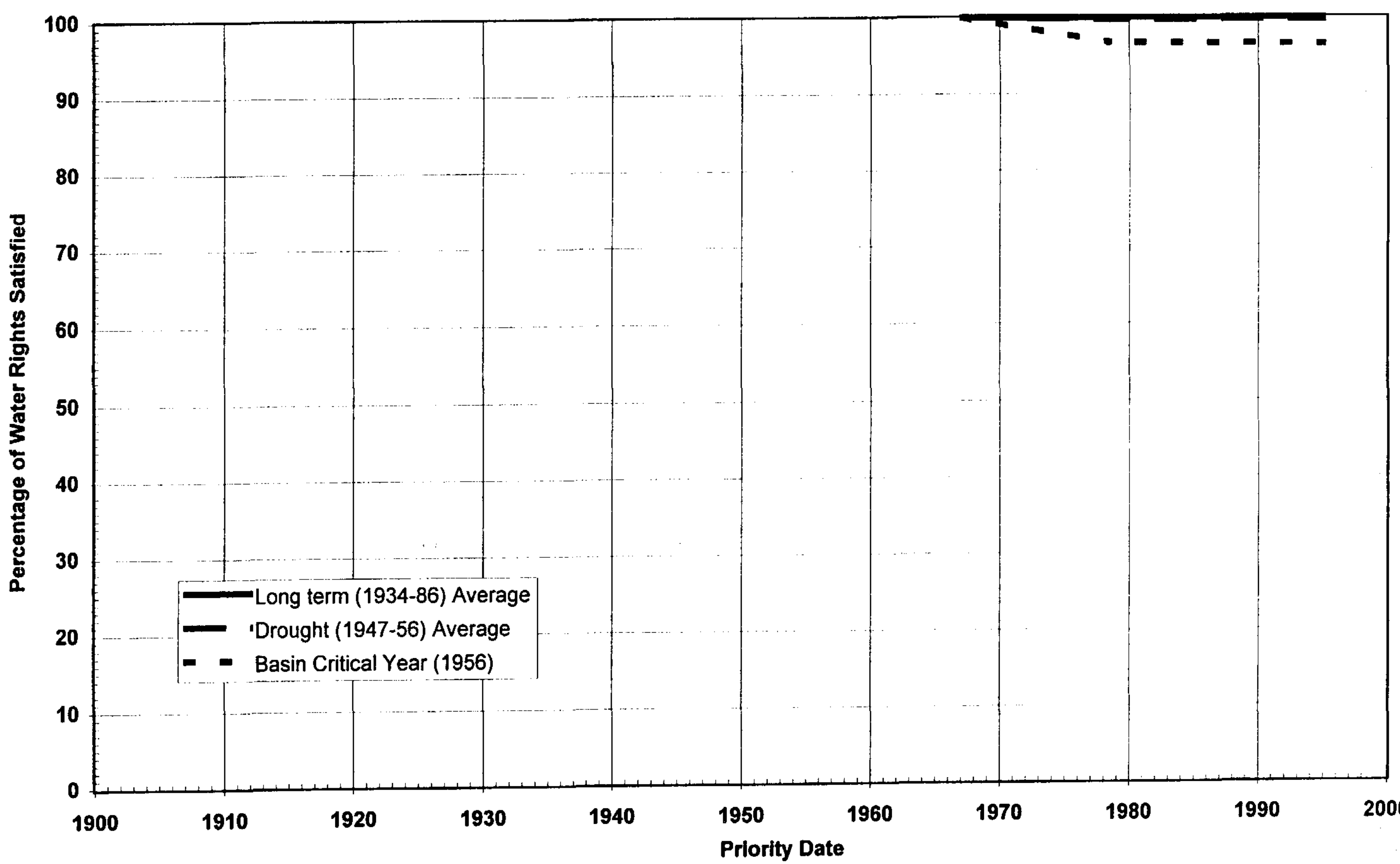


Figure C16

HDR

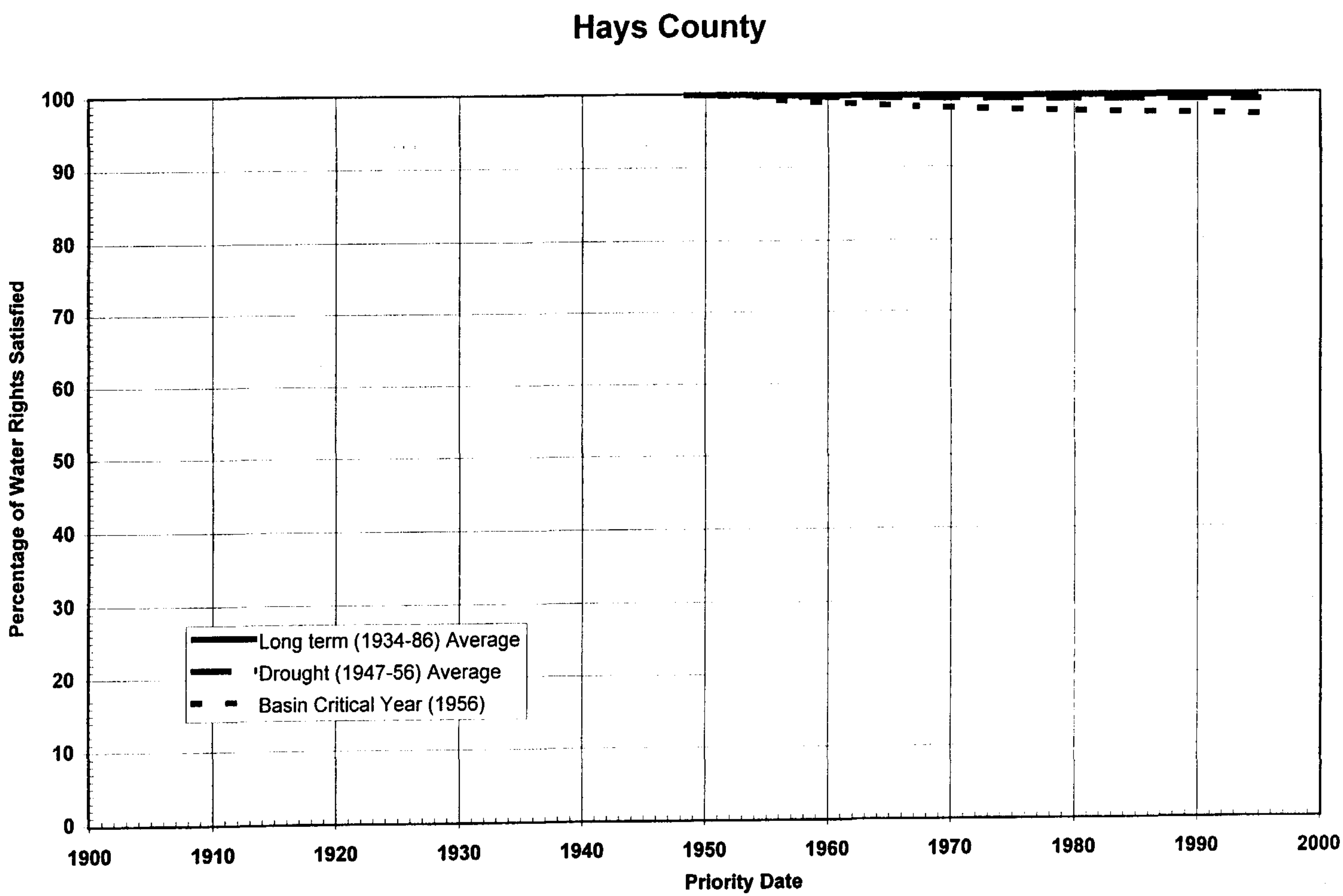


Figure C17

HDR

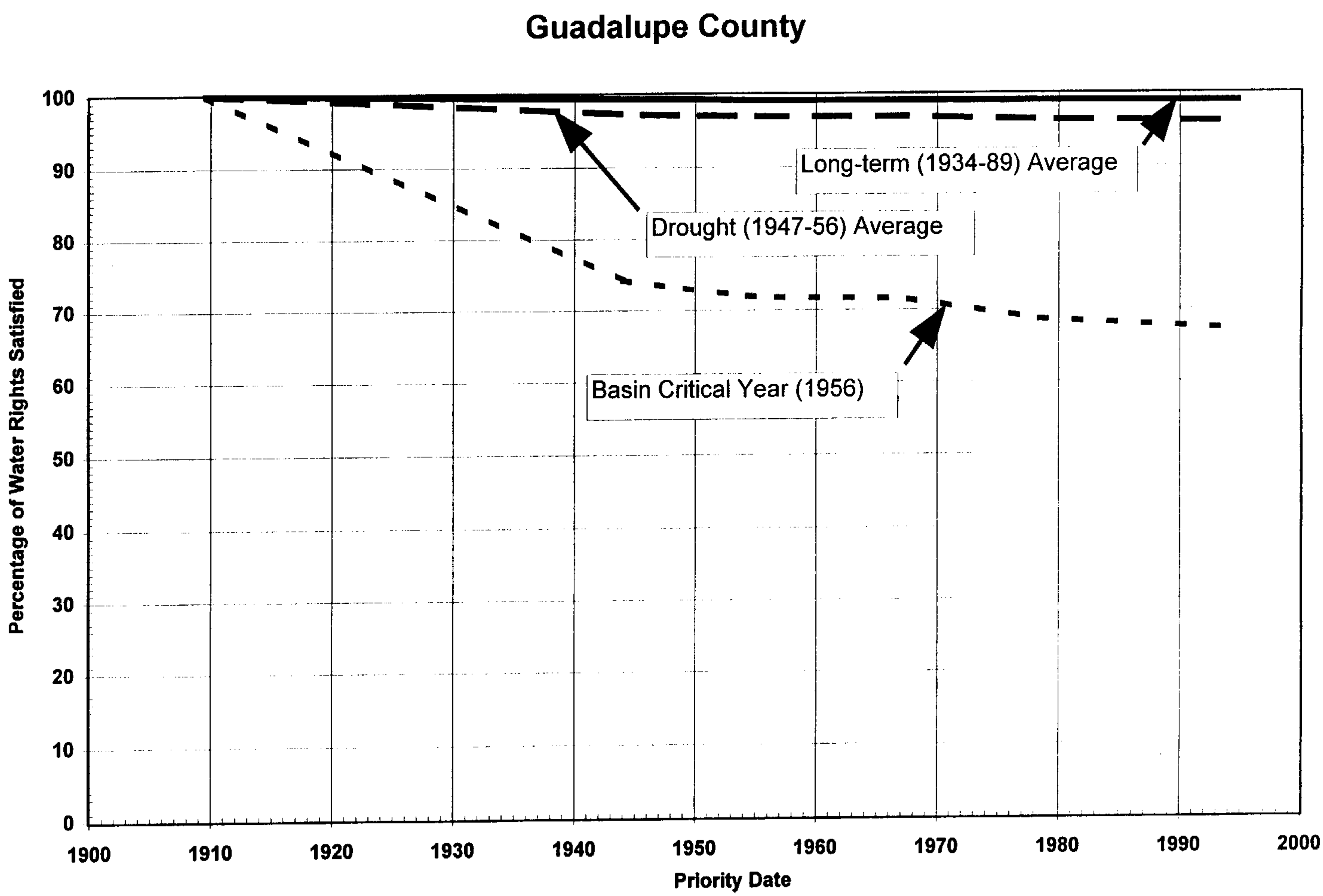


Figure C18

HDR

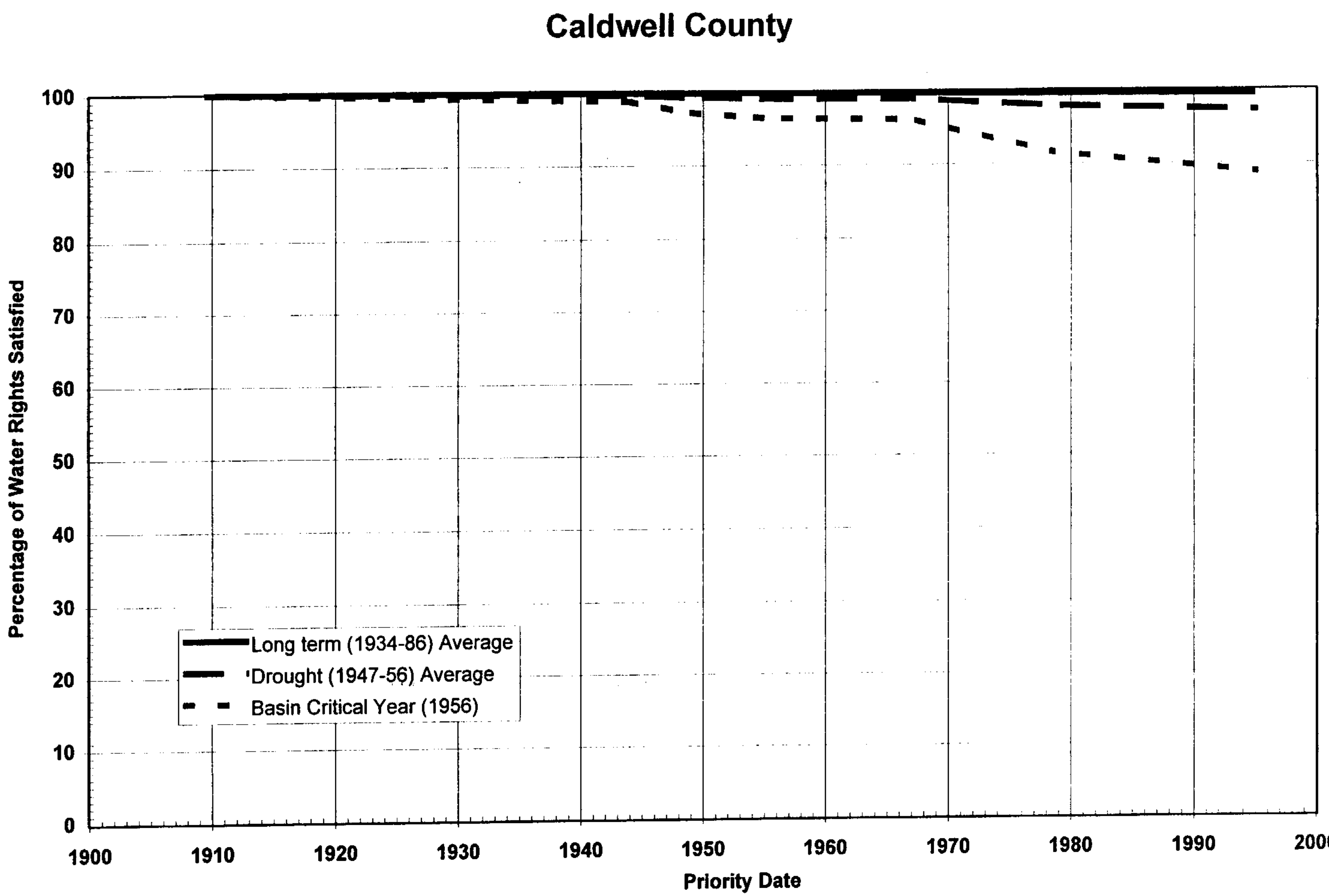
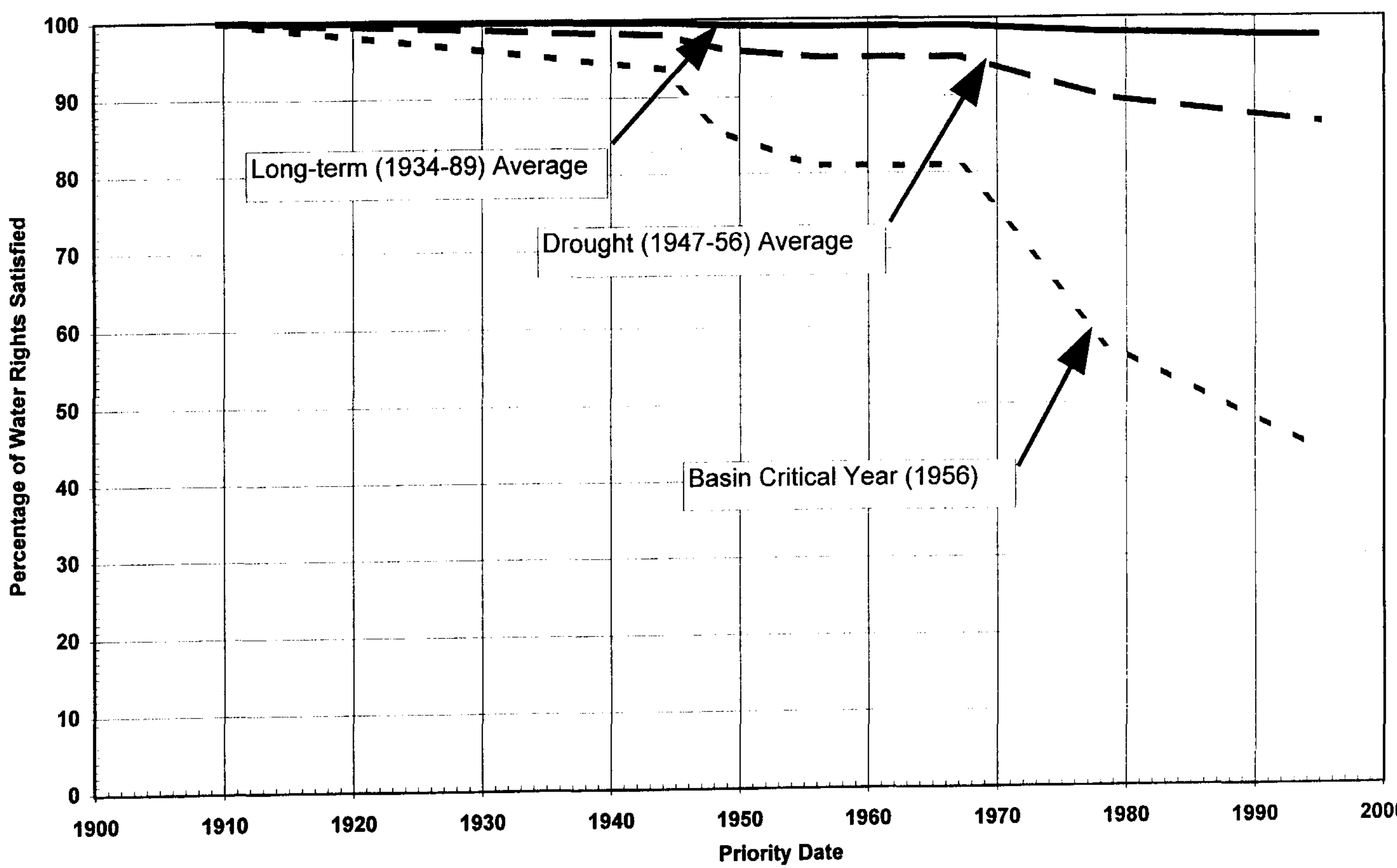


Figure C19

HDR

Gonzales County



C-23

Figure C20

HDR

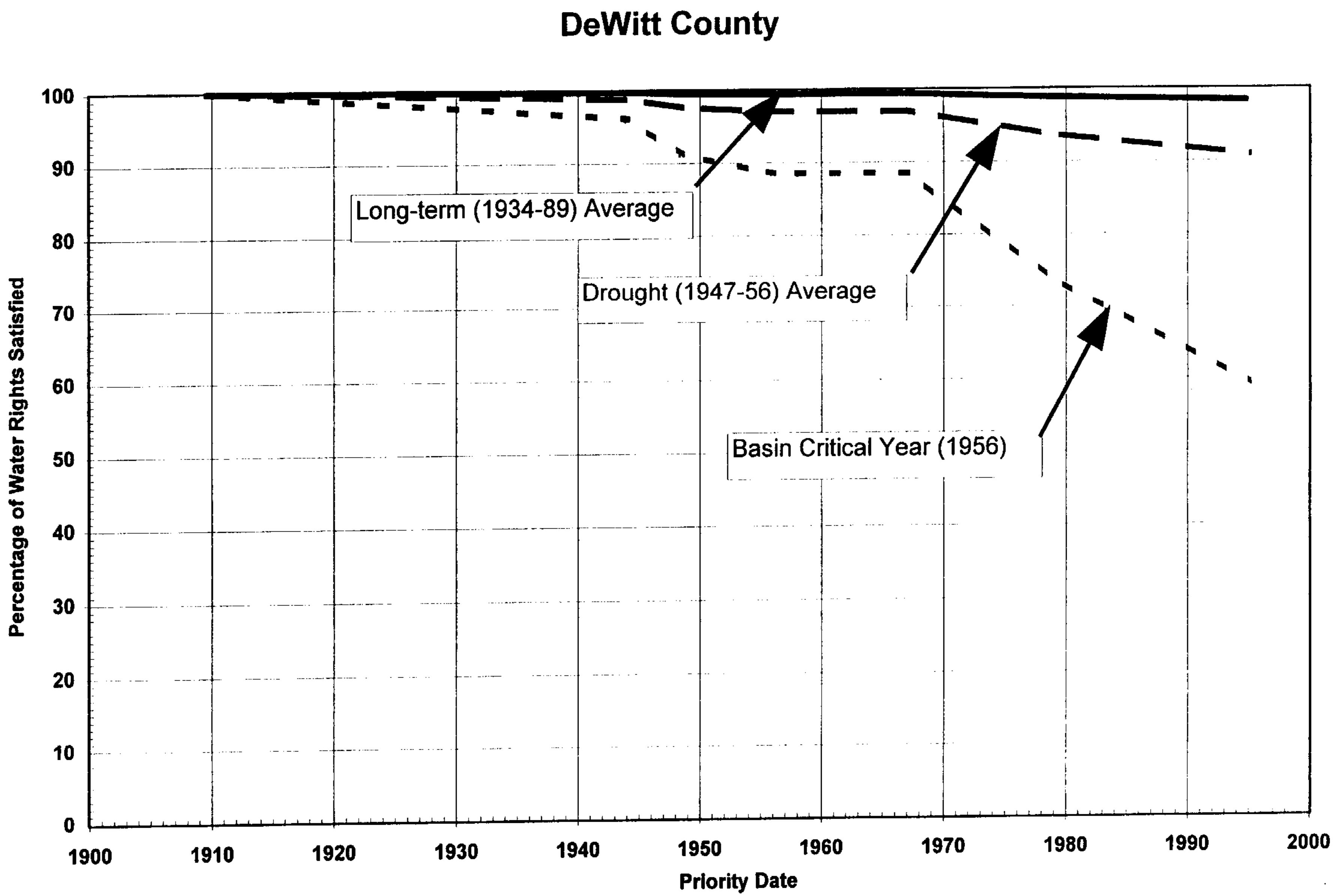


Figure C21

HDR

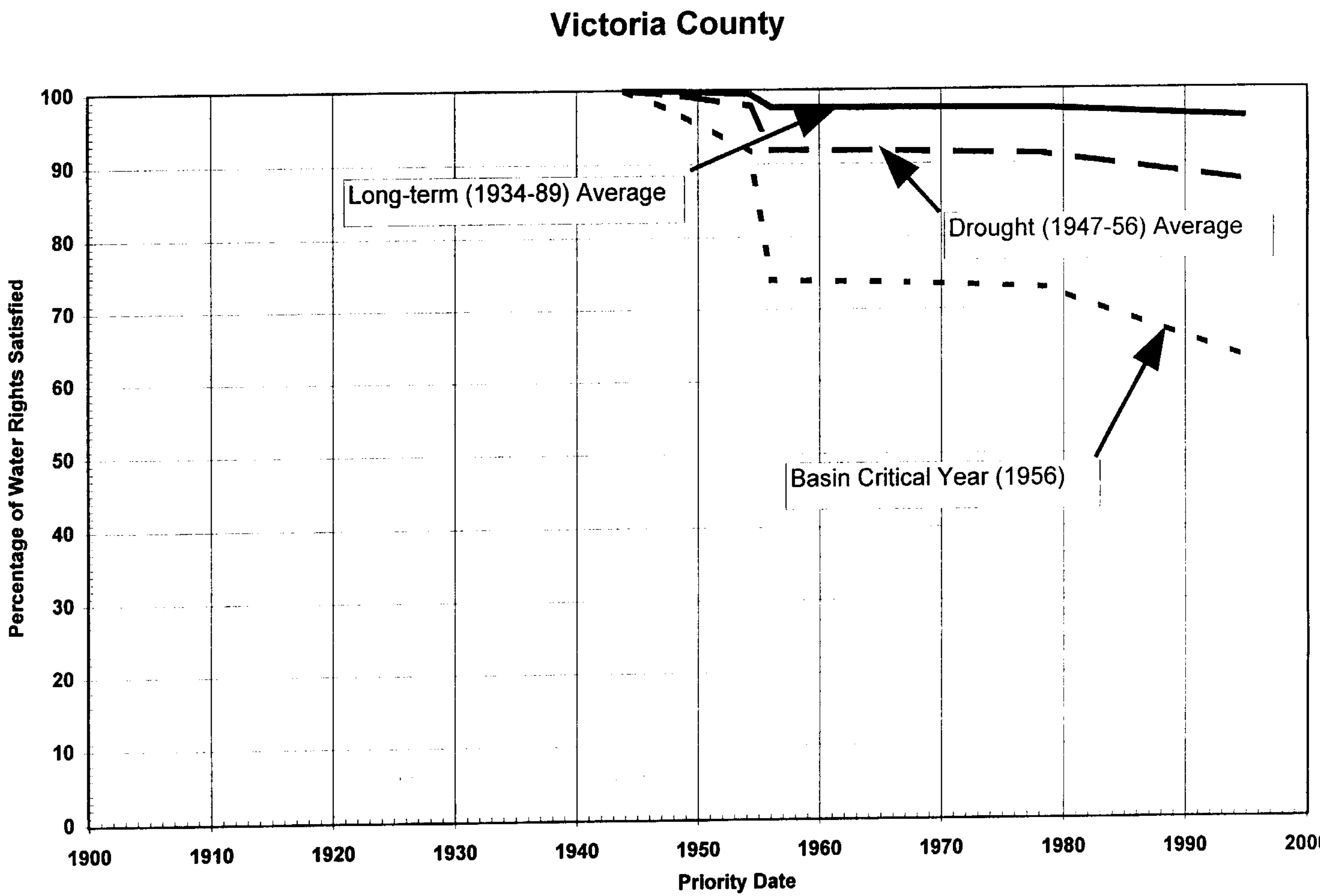


Figure C22

HDR

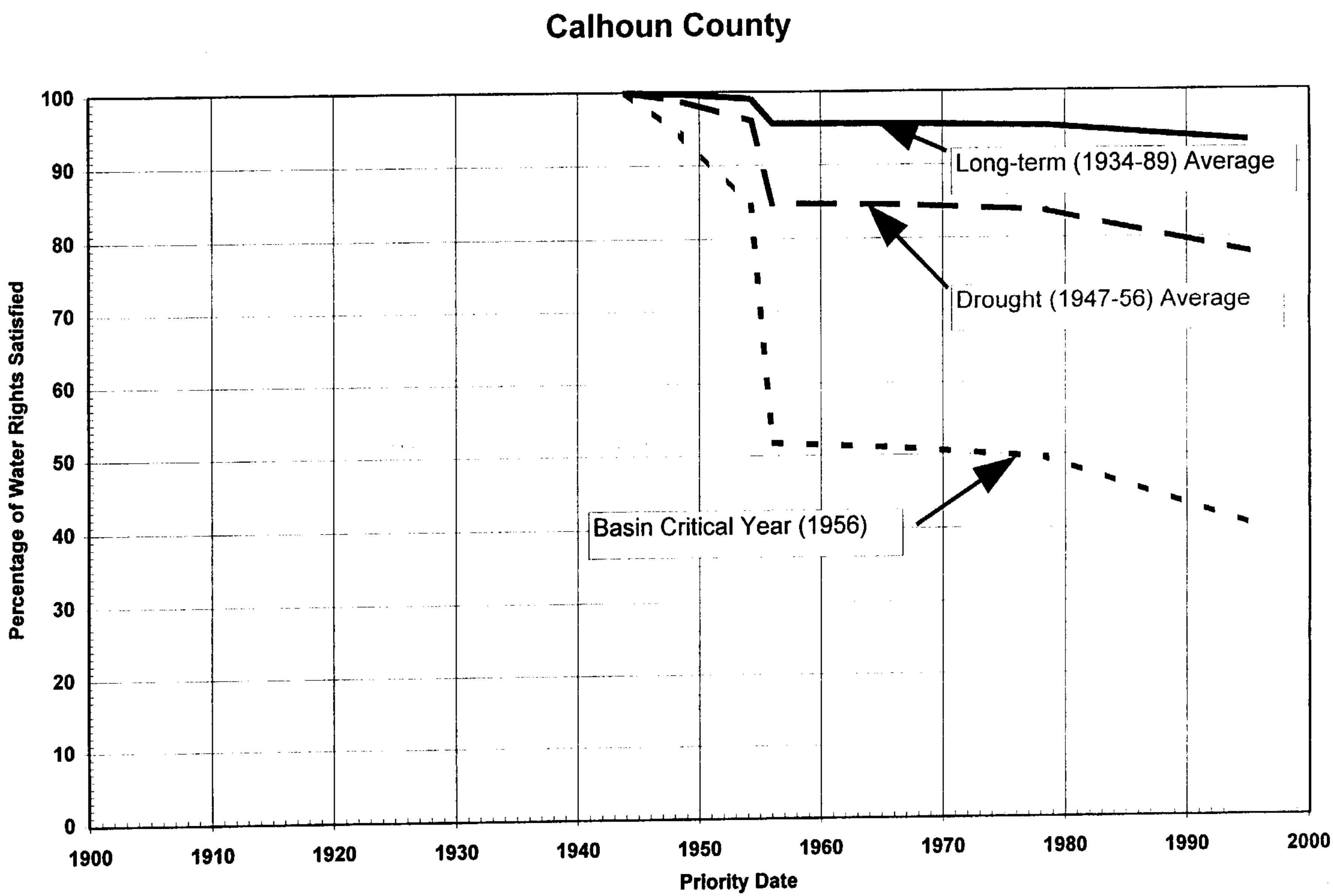


Figure C23

HDR

APPENDIX D

WATER AVAILIBILITY FOR EXISTING RIGHTS
LOWER COLORADO RIVER BASIN

APPENDIX TABLE D*

RUN-OF-RIVER (ROR) DIVERSIONS ANNUALLY by RIGHTS HOLDERS--LOWER COLORADO RIVER; 1941-1965 - Acre-Feet Per Year

Year	Austin 1	Austin 2	Austin 3	Austin 4	Lakeside	Garwood	Garwood Uniform	Pierce Ranch	Pierce Ranch/LCRA	Gulf Coast	Sum
1941	254,146	13,201	19,471	10,422	52,500	131,683	34,624	36,436	44,014	172,374	768,871
1942	234,861	8,689	17,805	6,680	52,500	122,863	32,893	33,000	37,571	152,875	699,737
1943	196,462	5,979	8,375	4,544	27,124	108,702	30,671	11,432	25,504	71,721	490,514
1944	227,085	9,307	14,078	7,260	52,500	126,684	33,280	24,459	38,173	132,597	665,423
1945	236,703	10,672	14,482	8,412	52,500	128,054	33,752	23,960	39,337	136,386	684,258
1946	221,999	10,662	15,119	8,407	52,500	119,687	32,950	25,755	38,041	144,577	669,697
1947	169,621	8,280	8,212	6,384	31,846	120,227	31,538	12,230	30,364	103,722	522,424
1948	167,955	6,367	5,996	4,879	30,977	115,546	30,571	13,787	27,187	81,114	484,379
1949	190,786	7,655	9,749	6,018	38,628	125,284	31,801	13,910	29,915	101,985	555,731
1950	156,204	8,144	5,733	6,296	29,638	121,595	31,291	11,322	29,129	79,344	478,696
1951	112,835	7,524	2,176	5,897	23,793	105,706	28,257	9,253	26,874	59,613	381,928
1952	139,517	7,516	5,095	5,887	31,059	112,948	30,772	12,691	29,485	71,973	446,943
1953	181,441	7,981	7,573	6,255	28,465	120,075	30,827	11,155	27,928	68,126	489,826
1954	89,398	6,998	1,936	5,536	13,698	105,782	26,132	5,462	25,177	39,642	319,761
1955	158,598	6,356	6,194	4,951	39,751	124,350	30,721	14,680	27,592	90,211	503,404
1956	116,372	6,778	2,652	5,160	14,222	114,754	29,229	4,423	25,632	35,401	354,623
1957	211,151	11,670	13,319	9,018	52,500	120,805	32,511	27,482	40,841	130,762	650,059
1958	245,391	12,366	17,624	9,791	52,500	131,337	34,521	28,066	43,472	149,374	724,442
1959	236,376	8,104	14,116	6,369	52,212	129,860	33,992	18,160	34,917	116,187	650,293
1960	227,849	10,023	13,503	7,839	47,872	128,844	33,638	17,037	34,765	112,258	633,628
1961	259,186	12,430	17,245	9,642	52,500	132,898	34,817	26,050	41,372	150,286	736,426
1962	184,898	8,089	8,720	6,310	21,367	119,847	31,289	9,198	28,565	63,468	481,751
1963	167,099	7,272	5,679	5,698	21,298	105,893	29,433	6,850	26,773	52,377	428,372
1964	165,868	8,097	10,129	6,382	17,915	108,790	28,906	7,427	29,079	43,275	425,868
1965	226,327	9,799	15,788	7,545	52,500	125,295	32,419	23,160	37,195	123,229	653,257
Total	4,778,128	219,959	260,769	171,582	942,365	3,007,509	790,835	427,385	818,902	2,482,877	13,900,311
Ave Yr(25)	191,125	8,798	10,431	6,863	37,695	120,300	31,633	17,095	32,756	99,315	556,012
1947--56	1,482,727	73,599	55,316	57,263	282,077	1,166,267	301,139	108,913	279,283	731,131	4,537,715
47/56Av10	148,273	7,360	5,532	5,726	28,208	116,627	30,114	10,891	27,928	73,113	453,772
Min Yr	89,398	5,979	1,936	4,544	13,698	105,706	26,132	4,423	25,177	35,401	319,761
Permit (P)	272,403	20,300	24,000	16,156	131,250	133,000	35,000	55,000	55,000	262,500	1,004,609
Ave%of P	0.70	0.43	0.43	0.42	0.29	0.90	0.90	0.31	0.60	0.38	0.55
47/56%of P	0.54	0.36	0.23	0.35	0.21	0.88	0.86	0.20	0.51	0.28	0.45
MinYr% P	0.33	0.29	0.08	0.28	0.10	0.79	0.75	0.08	0.46	0.13	0.32

* Source: "Colorado River Base Case Availibility," Unpublished, Lower Colorado River Authority, Austin Texas, June, 1997.