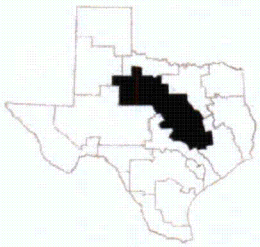
2 Summary of Brazos G Region



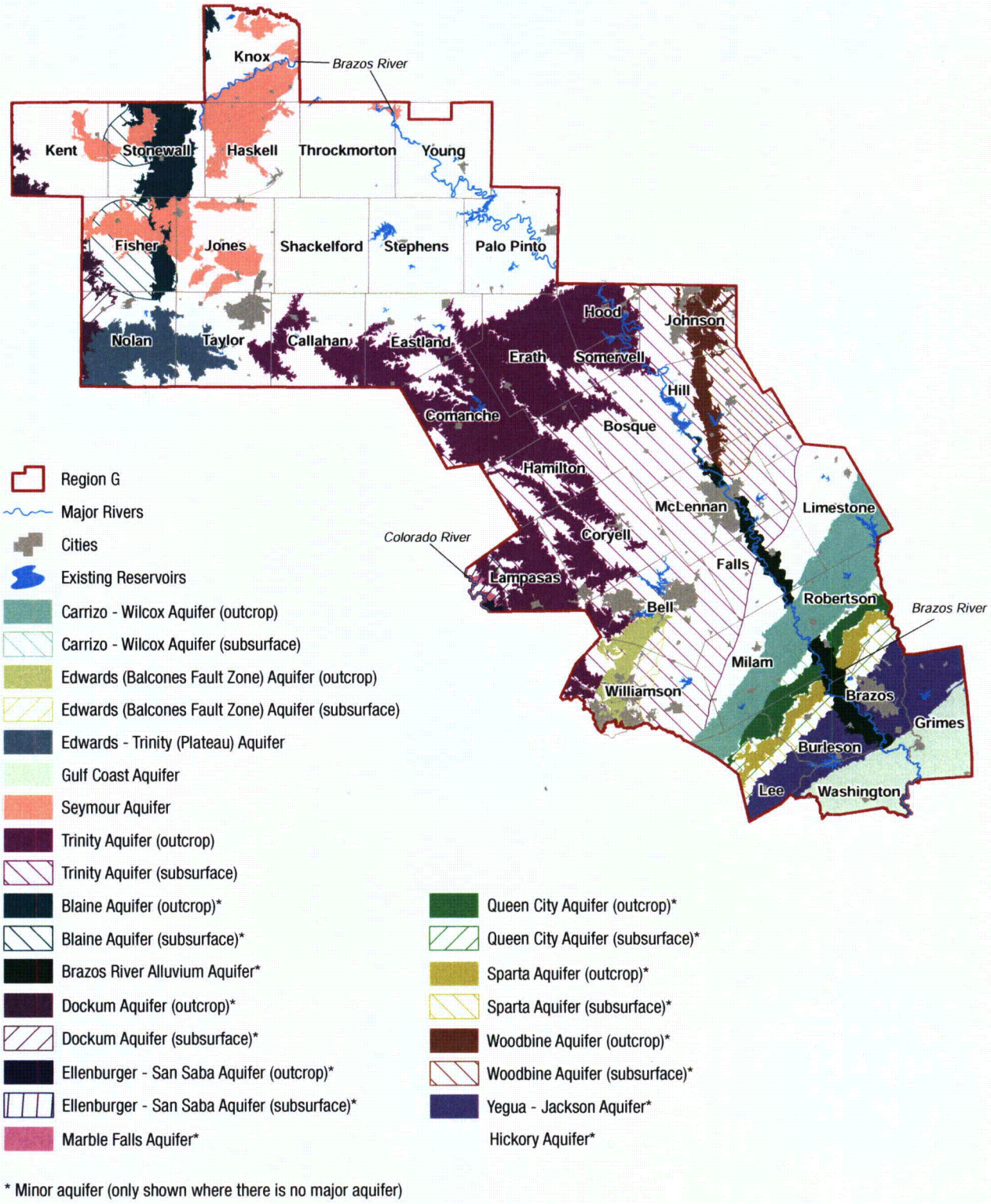
The Brazos G Regional Water Planning Area includes all or parts of 37 counties.

The Brazos G Regional Water Planning Area includes all or parts of 37 counties (Figure G.1). Over 90 percent of the region lies within the Brazos River Basin, with the Brazos River being the region's primary source of water. The largest economic sectors in the region are service, manufacturing, and retail trade. Major cities in the region include Abilene, Bryan, College Station, Killeen, Round Rock, Temple, and Waco. The 2011 Brazos (G) Regional Water Plan can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/3rdRound/2011_RWP/RegionG/.

PLAN HIGHLIGHTS

- Additional supply needed in 2060—390,732 acre-feet per year
- Recommended water management strategy volume in 2060—587,084 acre-feet per year
- Total capital cost—$3.2 billion
- Conservation accounts for 7 percent of 2060 strategy volumes
- Five new major reservoirs (Brushy Creek, Cedar Ridge, Millers Creek Augmentation,* Turkey Peak*, Coryell County Reservoir*); three sites indicated * also recommended for designation as unique reservoir sites (Figure ES.7)
- Conjunctive use strategies account for 12 percent of 2060 strategy volumes
- Brazos River Authority System Operation strategy accounts for 14 percent of strategy volumes
- Unmet irrigation and mining needs in all decades; limited unmet steam-electric power and municipal needs in 2010 decade

FIGURE G.1. BRAZOS G REGIONAL WATER PLANNING AREA.



* Minor aquifer (only shown where there is no major aquifer)

POPULATION AND WATER DEMANDS

Approximately 8 percent of the state's 2010 population resided in the Brazos G Region. Between 2010 and 2060, the region's population is projected to increase 76 percent (Table G.1). By 2060, the total water demands for the region are projected to increase 43 percent (Table G.1). Municipal water use makes up the largest share of these demands in all decades and is projected to increase by 75 percent (Table G.1). Manufacturing and steam-electric power generation demands are also projected to grow by 61 percent and 90 percent, respectively (Table G.1). Irrigation water demand, however, declines 10 percent by 2060 because of projected reductions in irrigated land and technological advances in irrigation techniques (Table G.1, Figure G.2).

EXISTING WATER SUPPLIES

The Brazos G Region has a large number of surface water and groundwater supply sources, with over three-fourths of the existing water supply in the region associated with surface water (Table G.1). The principal surface water sources are the Brazos River, its tributaries, and the 40 major reservoirs throughout the region. There are six major aquifers in the region: the Seymour and Edwards-Trinity (Plateau) aquifers in the western portion of the region, the Trinity and Edwards (Balcones Fault Zone) aquifers in the central portion, and the Carrizo-Wilcox and Gulf Coast aquifers in the eastern portion. Although the surface water portion of total supply is expected to increase slightly over time due to increased return-flows, by 2060 the total water supply is projected to decline a little more than 1 percent (Table G.1, Figure G.2). This projected decline in groundwater supply is due to a greater emphasis on sustainable use of groundwater resources in the region.

NEEDS

Although on a region-wide basis it might appear that the Brazos G Region has enough water supply to meet demands through 2040, with only small deficits in 2050 and 2060, the total water supply volume is not accessible to all water users throughout the region (Table G.1). Consequently, in the event of drought, Region G would be projected to have a total water supply need of 131,489 acre-feet in 2010 (Table G.1). Irrigation accounts for nearly half of those needs at 59,571 acre-feet. By 2060, overall water needs are expected to increase to 390,732 acre-feet, with almost half of this need associated with municipal users (Table G.1, Figure G.2).

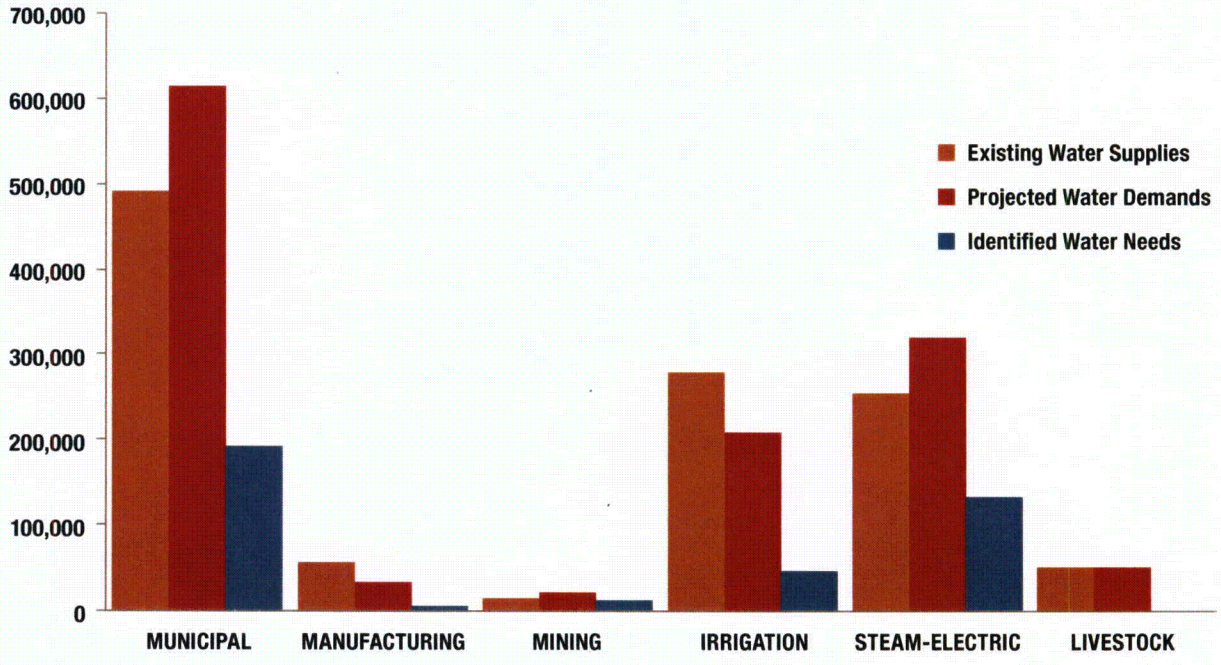
RECOMMENDED WATER MANAGEMENT STRATEGIES AND COST

The Brazos G Planning Group recommended a variety of water management strategies that would provide more water than is required to meet future needs (Figures G.3 and G.4). In all, the strategies would provide 587,084 acre-feet of additional water supply by the year 2060 at a total capital cost of $3.2 billion (Appendix A). Some of this water could be made available to other regions with needs. Because there were no economically feasible strategies identified to meet their needs, six counties in the region have unmet irrigation needs (ranging from 49,973 acre-feet in 2010 to 33,932 acre-feet by 2060). Some mining needs go unmet in each decade (ranging from 1,800 acre-feet in 2010 to 2,567 acre-feet in 2060) due to a lack of feasible strategies. Some municipal (Abilene, Round Rock, and Cedar Park) needs (totaling 2,196 acre-feet) and some steam-electric needs (36,086 acre-feet) would be unmet in case of drought in 2010 because infrastructure is not yet in place to access the supply.

TABLE G.1. POPULATION, WATER SUPPLY, DEMAND, AND NEEDS 2010–2060

	2010	2020	2030	2040	2050	2060
Projected Population	1,957,767	2,278,243	2,576,783	2,873,382	3,164,776	3,448,879
Existing Supplies (acre-feet per year)						
Surface water	790,543	787,031	791,011	792,331	792,252	792,258
Groundwater	355,337	355,256	355,151	344,052	336,931	336,798
Reuse	17,344	17,344	17,344	17,344	17,344	17,344
Total Water Supplies	**1,163,224**	**1,159,631**	**1,163,506**	**1,153,727**	**1,146,527**	**1,146,400**
Demands (acre-feet per year)						
Municipal	328,006	382,974	430,635	477,748	524,700	572,602
County-other	33,413	34,488	35,471	37,403	40,327	42,881
Manufacturing	19,787	23,201	25,077	26,962	30,191	31,942
Mining	36,664	37,591	38,037	27,251	20,744	21,243
Irrigation	232,541	227,697	222,691	217,859	213,055	208,386
Steam-electric	168,193	221,696	254,803	271,271	300,859	319,884
Livestock	51,576	51,576	51,576	51,576	51,576	51,576
Total Water Demands	**870,180**	**979,223**	**1,058,290**	**1,110,070**	**1,181,452**	**1,248,514**
Needs (acre-feet per year)						
Municipal	20,549	53,971	76,295	109,962	147,780	188,632
County-other	395	361	299	997	2,753	3,835
Manufacturing	2,762	3,441	4,108	4,783	5,393	6,054
Mining	9,670	10,544	10,963	11,301	11,704	12,158
Irrigation	59,571	56,961	54,422	51,942	49,527	47,181
Steam-electric	38,542	71,483	82,891	93,599	117,616	132,872
Total Water Needs	**131,489**	**196,761**	**228,978**	**272,584**	**334,773**	**390,732**

FIGURE G.2. 2060 BRAZOS (G) EXISTING SUPPLIES, PROJECTED DEMANDS, AND IDENTIFIED WATER NEEDS BY WATER USE CATEGORY (ACRE-FEET PER YEAR).



CONSERVATION RECOMMENDATIONS

Conservation strategies represent 7 percent of the total volume of water associated with all recommended strategies in 2060. Water conservation was recommended for every municipal water user group that had both a need and water use greater than 140 gallons per capita per day.

SELECT MAJOR WATER MANAGEMENT STRATEGIES

- Groundwater/Surface Water Conjunctive Use (Lake Granger Augmentation) will provide up to 70,246 acre-feet per year of water starting in the year 2010 with a capital cost of $644 million.
- Brazos River Authority Systems Operations Permit will provide up to 84,899 acre-feet year of water in 2060 with a capital cost of $204 million.
- (Lake) Belton to Stillhouse (Lake) Pipeline will provide 30,000 acre-feet per year of water starting in 2020 with a capital cost of $36 million.
- Millers Creek Augmentation (new dam) will provide 17,582 acre-feet per year of water starting in 2010 with a capital cost of $47 million.
- Cedar Ridge Reservoir will provide 23,380 acre-feet per year of water starting in 2020 with a capital cost of $285 million.

REGION-SPECIFIC STUDIES

The Regional Water Planning Group developed five region-specific studies during the initial phase of the third planning cycle. The final reports documenting the findings can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/rwp_study.asp#g .

- Updated Drought of Record and Water Quality Implications for Reservoirs Upstream of Possum Kingdom Reservoir
- Groundwater Availability Model of the Edwards-Trinity (Plateau) and Dockum Aquifer in Western Nolan and Eastern Mitchell Counties, Texas
- Regionalization Strategies to Assist Small Water Systems in Meeting New Safe Drinking Water Act Requirements
- Brazos G Activities in Support of Region C's Water Supply Study for Ellis, Johnson, Southern Dallas, and Southern Tarrant Counties (Four County Study)
- Updated Water Management Strategies for Water User Groups in McLennan County

BRAZOS G PLANNING GROUP MEMBERS AND INTERESTS REPRESENTED

Voting members during adoption of the 2011 Regional Water Plan:

Dale Spurgin (Chair), agriculture; Tom Clark, municipalities; Alva Cox, municipalities; Scott Diermann, electric generating utilities; Phil Ford, river authorities; Scott Mack, public; Mike McGuire, water districts; Tommy O'Brien, municipalities; Gail Peek, small business; Sheril Smith, environmental; Wiley Stem, III, municipalities; Mike Sutherland, counties; Randy Waclawczyk, industries; Kathleen J. Webster, water districts; Wayne Wilson, agriculture

Former voting members during the 2006 – 2011 planning cycle:

Jon Burrows, counties; Stephen Stark, environmental; Scott Mack, public; Horace Grace, small business; Terry Kelley, water districts; Kent Watson, water utilities

FIGURE G.3. RECOMMENDED WATER MANAGEMENT STRATEGY WATER SUPPLY VOLUMES FOR 2010–2060 (ACRE-FEET PER YEAR).

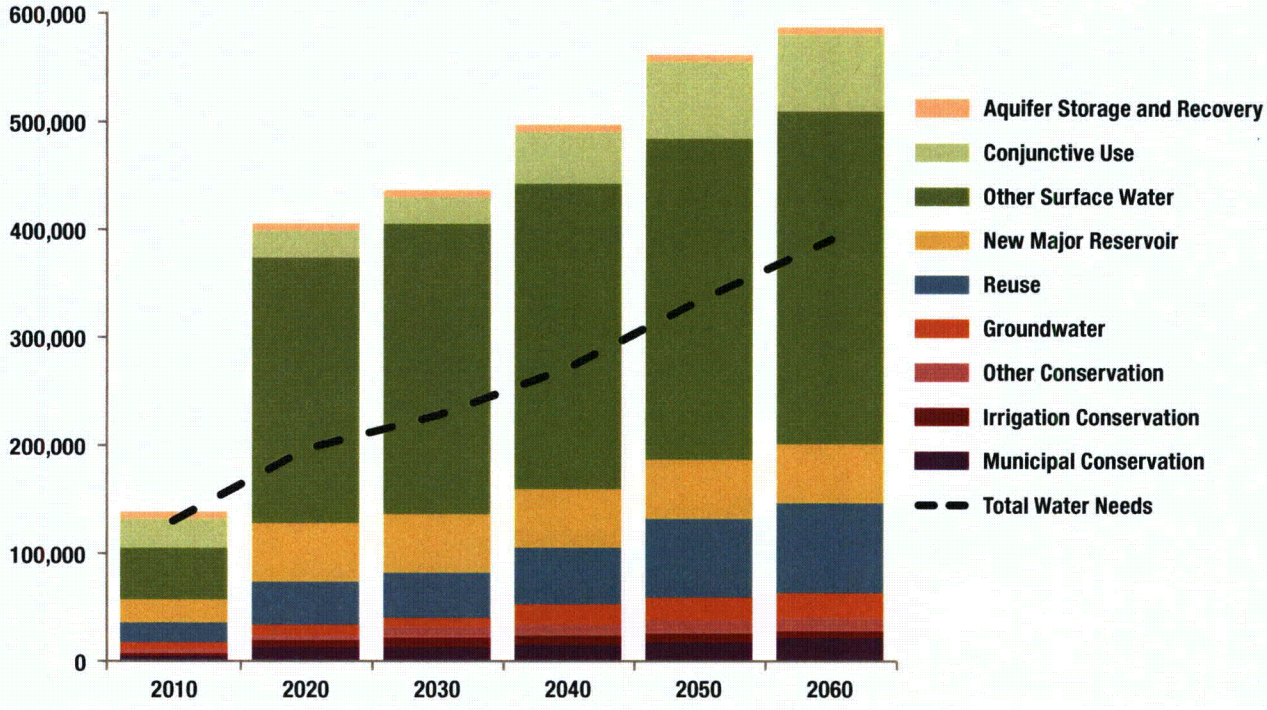
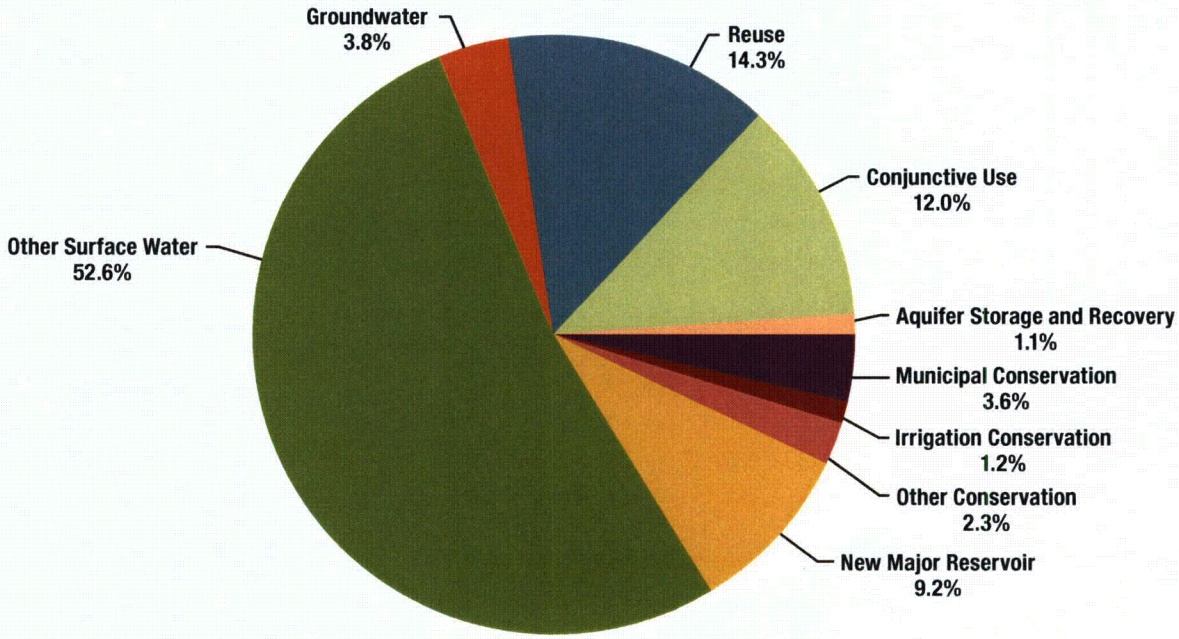
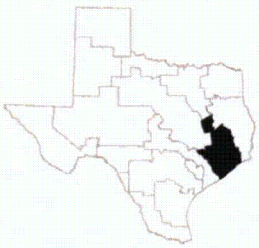


FIGURE G.4. 2060 RECOMMENDED WATER MANAGEMENT STRATEGIES–RELATIVE SHARE OF SUPPLY.



2 Summary of Region H



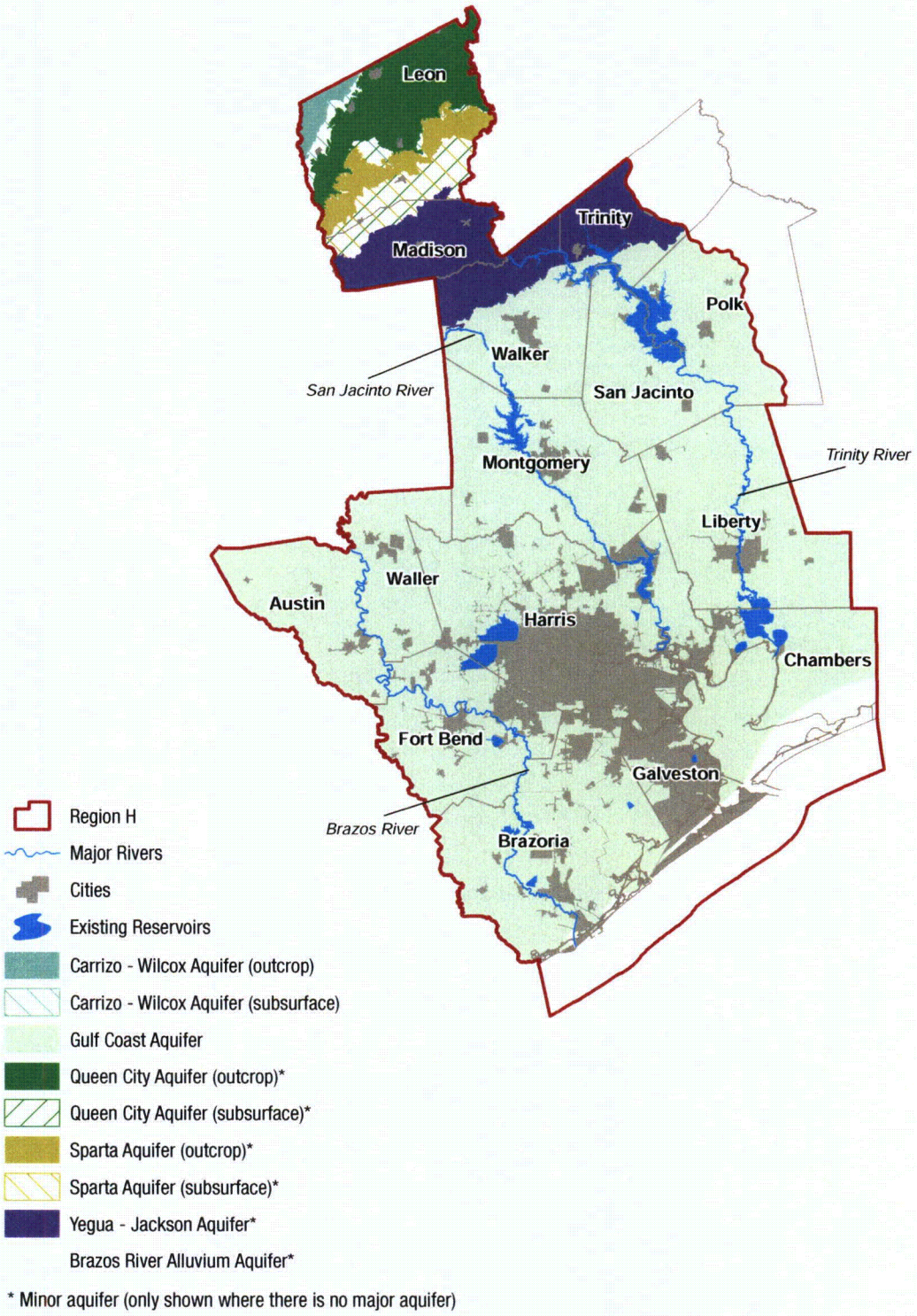
The Region H Regional Water Planning Area is composed of all or parts of 15 counties and includes portions of the Trinity, San Jacinto, Brazos, Neches, and Colorado river basins.

The Region H Regional Water Planning Area is composed of all or parts of 15 counties and includes portions of the Trinity, San Jacinto, Brazos, Neches, and Colorado river basins (Figure H.1). The Houston metropolitan area is located within this region. The largest economic sector in Region H is the petrochemical industry, which accounts for two-thirds of the petrochemical production in the United States. Other major economic sectors in the region include medical services, tourism, government, agriculture, fisheries, and transportation, with the Port of Houston being the nation's second largest port. The 2011 Region H Regional Water Plan can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/3rdRound/2011_RWP/RegionH/.

PLAN HIGHLIGHTS

- Additional supply needed in 2060—1,236,335 acre-feet per year
- Recommended water management strategy volume in 2060—1,501,180 acre-feet per year
- Total capital cost—$12 billion
- Conservation accounts for 12 percent of 2060 strategy volumes
- Five new major reservoirs (Allens Creek, Dow Off-Channel, Gulf Coast Water Authority Off-Channel, Brazoria Off-Channel, Fort Bend Off-Channel)
- Reuse accounts for 19 percent of 2060 strategy volumes

FIGURE H.1. REGION H REGIONAL WATER PLANNING AREA.



POPULATION AND WATER DEMANDS

Approximately 24 percent of the state's population was projected to reside in the region in 2010. By 2060, Region H is projected to grow 89 percent to 11.3 million. Total demand for the region is projected to increase 48 percent by 2060 (Table H.1). The largest consumers of water in the region are municipal entities, and municipal demand is expected to grow 61 percent by 2060 (Table H.1). Manufacturing also constitutes a large share of the region's demand and is projected to grow 31 percent over the planning period (Table H.1, Figure H.2).

EXISTING WATER SUPPLIES

In 2010, the total water supply was projected to be 2,621,660 acre-feet, decreasing by approximately 0.6 percent by 2060 (Table H.1). The region's reliance on groundwater from the Gulf Coast Aquifer will be reduced primarily because of subsidence district regulations. The decline in groundwater supply will be offset by the increased use of surface water to meet future needs. In 2010, surface water was projected to provide 1,843,815 acre-feet of supplies and groundwater 777,845 acre-feet (Table H.1). By 2060, surface water is projected to provide 2,021,690 acre-feet, groundwater 569,361 acre-feet, and reuse 14,866 acre-feet of supplies (Table H.1, Figure H.2). The largest supply of available surface water in the region comes from the Lake Livingston/Wallisville System in the Trinity River Basin and run-of-river water rights in the Trinity and Brazos river basins.

NEEDS

In 2010, Region H was projected to have a need of 290,890 acre-feet, with municipalities accounting for approximately 19 percent of the total and irrigated agriculture accounting for 52 percent (Table H.1). By 2060, water supply needs are projected to total 1,236,335 acre-feet. Municipal users will account for 61 percent of that need and irrigated agriculture will account for 12 percent. Total manufacturing needs are projected to be 26 percent of total needs in 2010 and 21 percent of total needs by 2060 (Table H.1, Figure H.2).

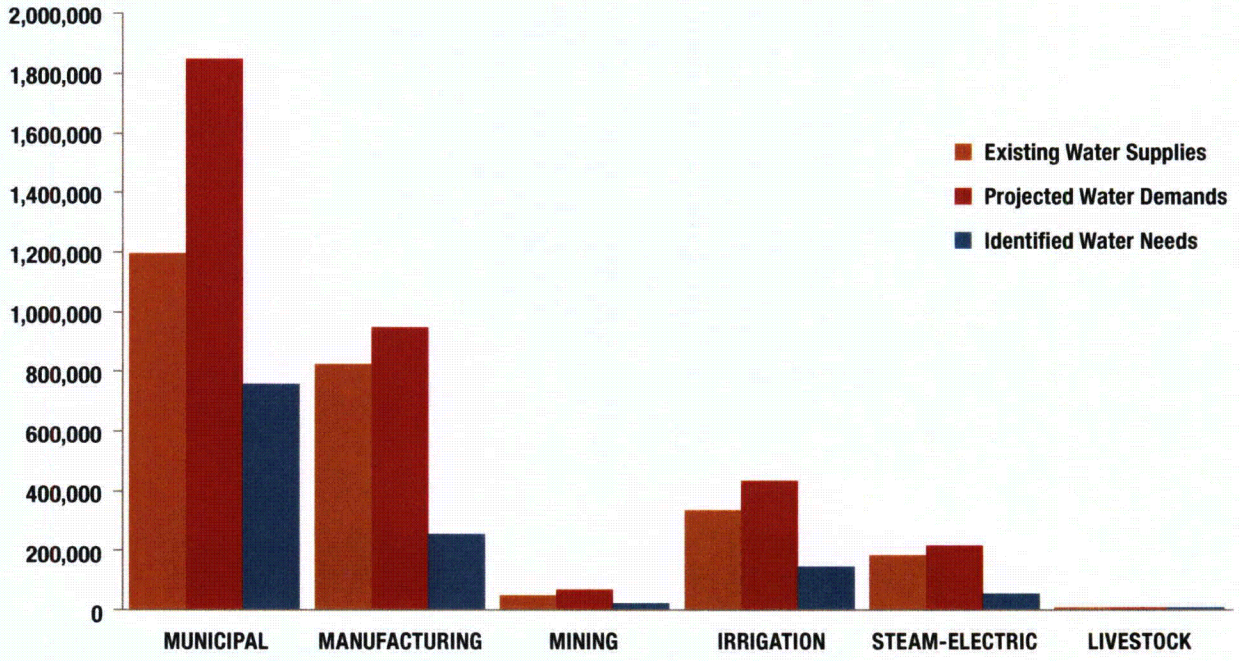
RECOMMENDED WATER MANAGEMENT STRATEGIES AND COST

The Region H Planning Group's recommended water management strategies would provide 1,501,180 acre-feet of additional water supply to meet all projected needs by the year 2060 (Figures H.3 and H.4) at a total capital cost of $12 billion (Appendix A). Contracts and conveyance of existing supplies provide the largest share of strategy supply in the region, followed by reuse projects and new supplies from five new major reservoirs in the lower Brazos basin. Recommended strategies also include new groundwater supplies, conservation programs, and seawater desalination at a facility in Freeport (Figures H.3 and H.4).

TABLE H.1. POPULATION, WATER SUPPLY, DEMAND, AND NEEDS 2010–2060

	2010	2020	2030	2040	2050	2060
Projected Population	6,020,078	6,995,442	7,986,480	8,998,002	10,132,237	11,346,082
Existing Supplies (acre-feet per year)						
Surface water	1,843,815	1,899,087	1,932,954	1,971,925	2,013,605	2,021,690
Groundwater	777,845	641,359	591,590	586,814	578,644	569,361
Reuse	0	0	438	14,799	14,840	14,866
Total Water Supplies	**2,621,660**	**2,540,446**	**2,524,982**	**2,573,538**	**2,607,089**	**2,605,917**
Demands (acre-feet per year)						
Municipal	968,949	1,117,677	1,236,037	1,341,483	1,444,026	1,558,706
County-other	73,915	75,235	102,549	144,360	211,236	286,111
Manufacturing	722,873	783,835	836,597	886,668	927,860	950,102
Mining	57,043	60,782	63,053	65,285	67,501	69,457
Irrigation	450,175	438,257	433,686	430,930	430,930	430,930
Steam-electric	91,231	112,334	131,332	154,491	182,720	217,132
Livestock	12,228	12,228	12,228	12,228	12,228	12,228
Total Water Demands	**2,376,414**	**2,600,348**	**2,815,482**	**3,035,445**	**3,276,501**	**3,524,666**
Needs (acre-feet per year)						
Municipal	42,081	206,131	317,539	367,712	428,499	534,252
County-other	13,070	21,975	42,697	85,430	150,770	224,682
Manufacturing	75,164	131,531	168,597	202,219	231,118	255,604
Mining	5,992	10,595	13,850	16,278	18,736	20,984
Irrigation	151,366	141,232	137,995	137,113	140,733	144,802
Steam-electric	3,203	12,609	18,058	24,726	34,976	55,972
Livestock	14	64	40	40	40	39
Total Water Needs	**290,890**	**524,137**	**698,776**	**833,518**	**1,004,872**	**1,236,335**

FIGURE H.2. 2060 REGION H EXISTING SUPPLIES, PROJECTED DEMANDS, AND IDENTIFIED WATER NEEDS BY WATER USE CATEGORY (ACRE-FEET PER YEAR).



CONSERVATION RECOMMENDATIONS

The planning group considered conservation strategies for water user groups with needs. Recommended municipal, irrigation, and industrial water conservation strategies provide savings of 183,933 acre-feet per year. Municipal conservation accounts for up to 105,494 acre-feet of savings; irrigation conservation is recommended to save up to 77,881 acre-feet; and industrial conservation will save 588 acre-feet per year by 2060.

SELECT MAJOR WATER MANAGEMENT STRATEGIES

- Luce Bayou Transfer of Trinity River Supplies would convey up to 270,742 acre-feet per year of water in the year 2060 with a capital cost of $253.9 million.
- Indirect Reuse by the City of Houston would provide up to 128,801 acre-feet per year of water in 2060 with a capital cost of $721.8 million.
- Allens Creek Reservoir would provide up to 99,650 acre-feet per year of water in 2060 with a capital cost of $222.8 million.
- Four off-channel reservoirs in Brazoria and Fort Bend Counties would collectively provide up to 131,243 acre-feet per year of water in 2060 with a total capital cost of $698.3 million.

REGION-SPECIFIC STUDIES

The Regional Water Planning Group developed three region-specific studies during the initial phase of the third planning cycle. The final reports documenting the findings can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/rwp_study.asp#h.

- Interruptible Supply Study
- Environmental Flows Study
- Drought Management Study

REGION H PLANNING GROUP MEMBERS AND INTERESTS REPRESENTED

Voting members during adoption of the 2011 Regional Water Plan:

Mark Evans (Chair), counties; Roosevelt Alexander, public; John R. Bartos, environmental; John Blount, counties; Robert Bruner, agriculture; Jun Chang, municipalities; Reed Eichelberger, P.E., river authorities; Robert Hebert, small business; Art Henson, counties; John Hofmann, river authorities; John Howard, small business; Robert Istre, municipalities; Gena Leathers, industries; Glynna Leiper, industries; Ted Long, electric generating utilities; Marvin Marcell, water districts; James Morrison, water utilities; Ron J. Neighbors, water districts; Jimmie Schindewolf, water districts; William Teer, P.E., water utilities; Steve Tyler, small business; Danny Vance, river authorities; C. Harold Wallace, water utilities; George "Pudge" Wilcox, agriculture

Former voting members during the 2006 – 2011 planning cycle:

Jim Adams, river authorities; John Baker, river authorities; Jason Fluharty, electric generating utilities; Mary Alice Gonzalez, small business; Jack Harris, counties; David Jenkins, agriculture; Carolyn Johnson, industries; James Murray, industries; Jeff Taylor, municipalities; Mike Uhl, industries

FIGURE H.3. RECOMMENDED WATER MANAGEMENT STRATEGY WATER SUPPLY VOLUMES FOR 2010–2060 (ACRE-FEET PER YEAR).

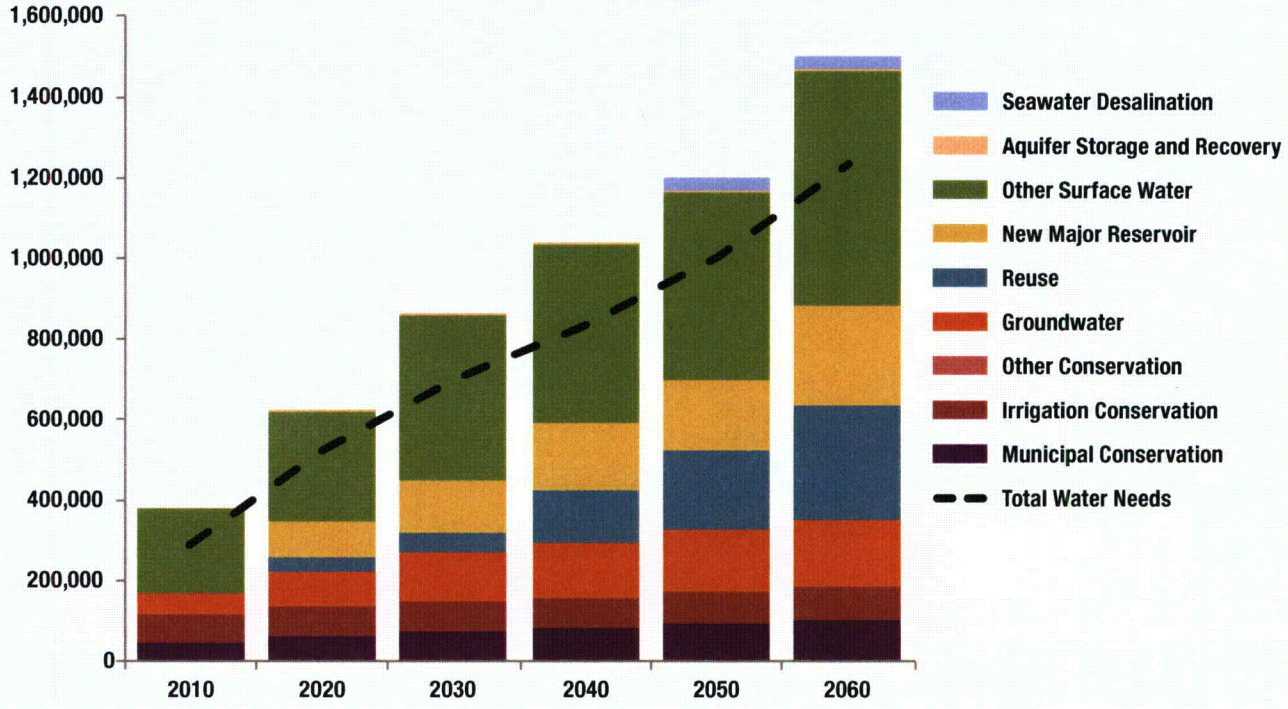
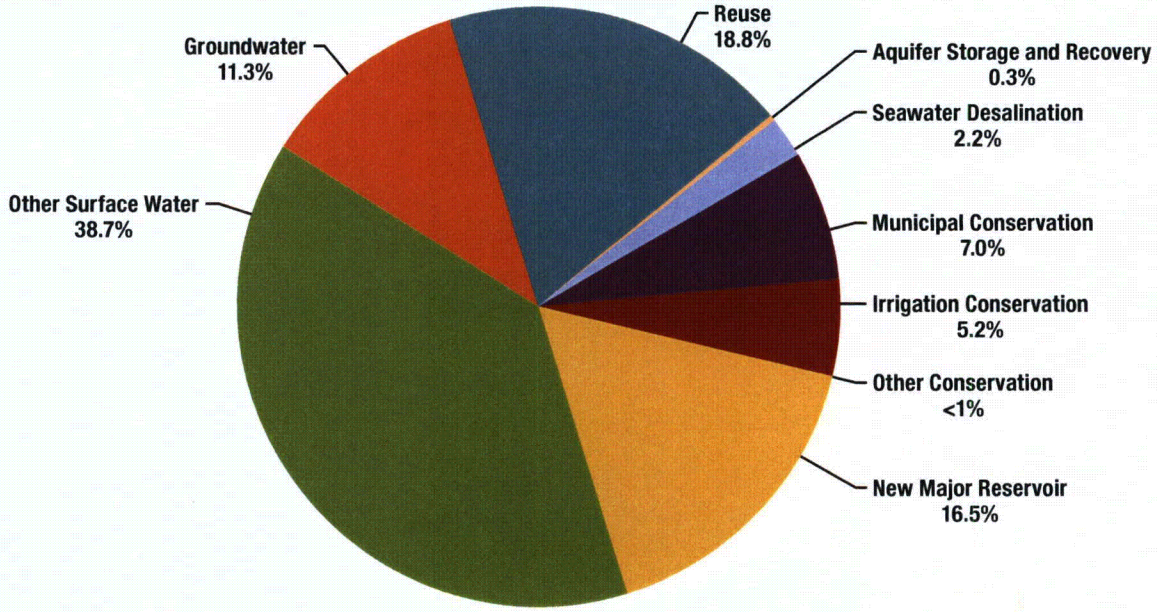
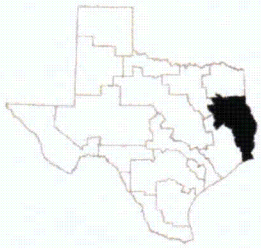


FIGURE H.4. 2060 RECOMMENDED WATER MANAGEMENT STRATEGIES–RELATIVE SHARE OF SUPPLY.



2 Summary of East Texas (I) Region



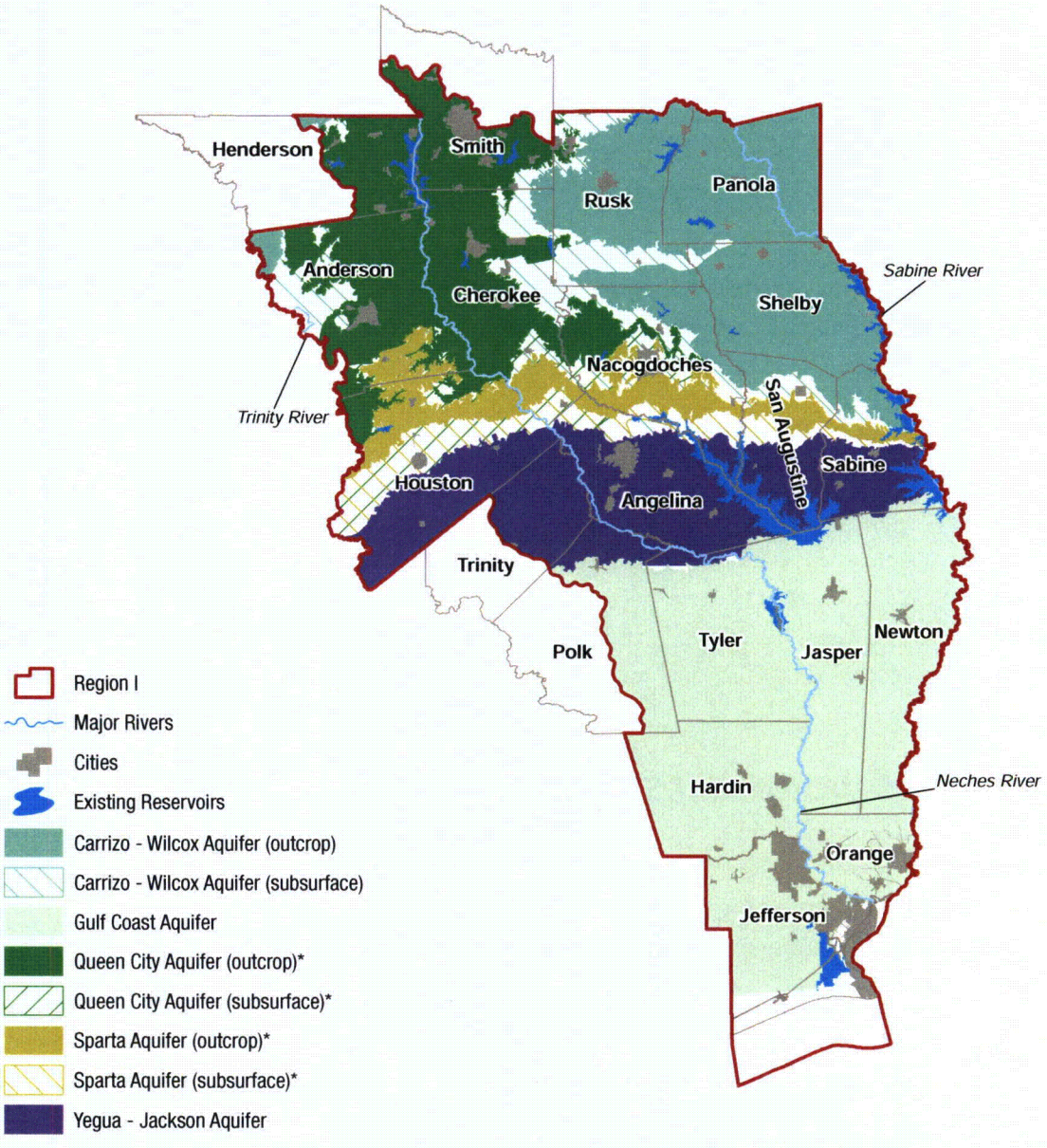
The East Texas Regional Water Planning Area is composed of all or parts of 20 counties.

The East Texas Regional Water Planning Area is composed of all or parts of 20 counties (Figure I.1). The largest cities include Beaumont, Tyler, Port Arthur, Nacogdoches, and Lufkin. The major economic sectors are petrochemical, timber, and agriculture. The principal surface water sources are the Sabine and Neches Rivers and their tributaries. The 2011 East Texas (I) Regional Water Plan can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/3rdRound/2011_RWP/RegionI/.

PLAN HIGHLIGHTS

- Additional supply needed in 2060—182,145 acre-feet per year
- Recommended water management strategy volume in 2060—638,076 acre-feet per year
- Total capital cost—$885 million
- Conservation accounts for 7 percent of 2060 strategy volumes
- Two new major reservoirs (Lake Columbia, Fastrill Replacement Project)
- Limited unmet steam-electric power and mining needs

FIGURE I.1. EAST TEXAS (I) REGIONAL WATER PLANNING AREA.



* Minor aquifer (only shown where there is no major aquifer)

POPULATION AND WATER DEMANDS

Approximately 4 percent of the state's population resided in the East Texas Region in 2010. By 2060, the region's population is projected to grow 36 percent to 1,482,448 (Table I.1). Water demands in the region are projected to more than double by 2060 (Table I.1). The greatest increase is in manufacturing water demand, which is projected to grow 198 percent by 2060 (Table I.1). Over the planning horizon, steam-electric power generation water demand is projected to increase 246 percent and municipal water demand is expected to grow 23 percent (Table I.1, Figure I.2).

EXISTING WATER SUPPLIES

The existing water supply in the East Texas Region is projected to increase over the planning horizon (Table I.1). Surface water supplies, which account for 74 percent of the total existing water supply in 2010, increase by 537,258 acre-feet, primarily due to additional surface water for manufacturing being made available through existing contracts. Groundwater from the Gulf Coast, Carrizo-Wilcox, and other aquifers remains relatively constant (Table I.1, Figure I.2).

NEEDS

Although the region as a whole appears to have enough supply to meet demands through 2040, the total water supply is not readily available to all water users. Between 2010 and 2060, the region's water needs will increase from 28,856 acre-feet to 182,145 acre-feet (Table I.1). The largest needs are projected for the steam-electric power generation industry with 85,212 acre-feet of needs by 2060, about half of the total needs for the region. The next largest volume of needs in 2060 is for the manufacturing sector, 49,588 acre-feet, or approximately 27 percent of total needs (Table I.1, Figure I.2).

RECOMMENDED WATER MANAGEMENT STRATEGIES AND COST

Water management strategies recommended in the East Texas Regional Water Plan result in 638,076 acre-feet of additional water supply to meet most projected needs by the year 2060 (Figures I.3 and I.4) at a total capital cost of $884.8 million (Appendix A). Because no feasible water management strategies could be identified, a portion of steam-electric needs in 2010 and mining needs in all decades in Hardin County, totaling 10,770 acre-feet by 2060, were not met.

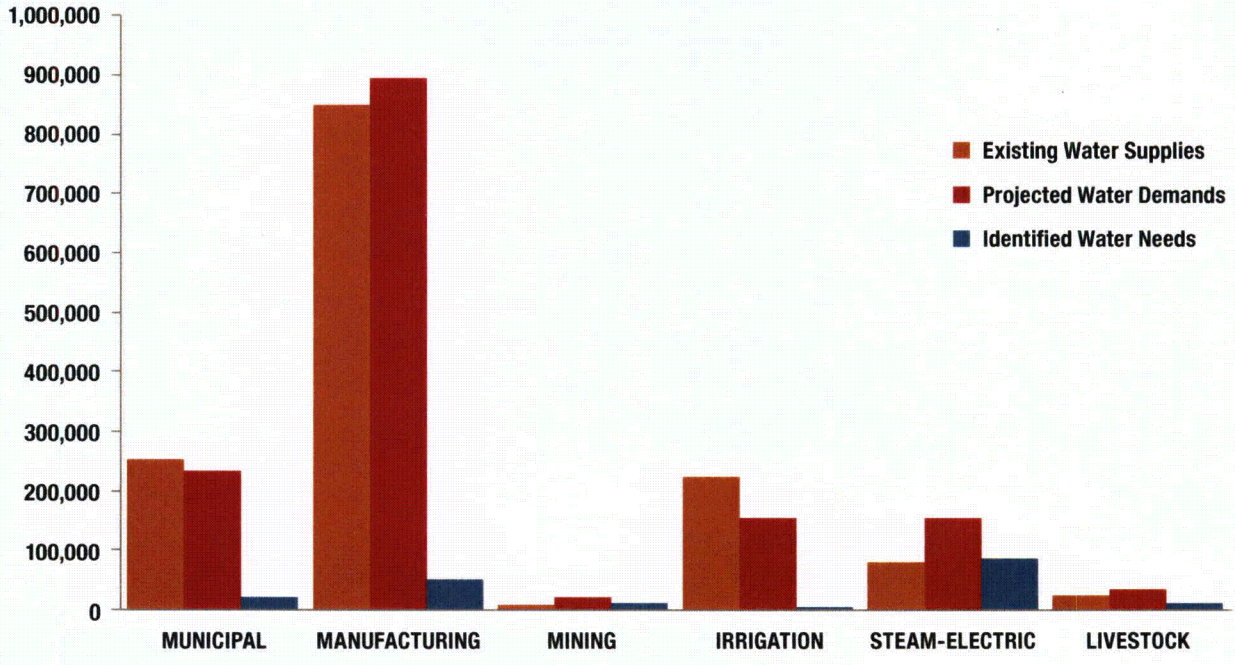
CONSERVATION RECOMMENDATIONS

Water conservation was evaluated for every municipal water user group with a need and water use greater than 140 gallons per capita per day. Municipal conservation accounts for 1,701 acre-feet of savings by 2060, and most municipal needs will be partially met through conservation. Water conservation in the East Texas Regional Water Planning Area is driven largely by economics, and is not always the most cost-effective strategy for a water user group with a need where plentiful supplies are available.

TABLE I.1. POPULATION, WATER SUPPLY, DEMAND, AND NEEDS 2010–2060

	2010	2020	2030	2040	2050	2060
Projected Population	1,090,382	1,166,057	1,232,138	1,294,976	1,377,760	1,482,448
Existing Supplies (acre-feet per year)						
Surface water	661,511	941,613	1,123,982	1,151,585	1,172,399	1,198,769
Groundwater	220,676	220,883	220,855	220,805	220,753	220,689
Reuse	18,077	15,220	15,233	15,246	15,257	15,271
Total Water Supplies	**900,264**	**1,177,716**	**1,360,070**	**1,387,636**	**1,408,409**	**1,434,729**
Demands (acre-feet per year)						
Municipal	153,520	159,266	164,327	169,332	178,627	191,273
County-other	36,039	37,562	38,434	38,861	40,078	42,349
Manufacturing	299,992	591,904	784,140	821,841	857,902	893,476
Mining	21,662	37,297	17,331	18,385	19,432	20,314
Irrigation	151,100	151,417	151,771	152,153	152,575	153,040
Steam-electric	44,985	80,989	94,515	111,006	131,108	155,611
Livestock	23,613	25,114	26,899	29,020	31,546	34,533
Total Water Demands	**730,911**	**1,083,549**	**1,277,417**	**1,340,598**	**1,411,268**	**1,490,596**
Needs (acre-feet per year)						
Municipal	3,340	5,548	7,042	9,049	12,214	16,408
County-other	1,072	1,803	2,272	2,584	3,152	4,101
Manufacturing	3,392	16,014	24,580	33,256	40,999	49,588
Mining	14,812	29,744	9,395	10,075	10,748	11,276
Irrigation	1,675	1,805	2,156	2,536	2,955	3,416
Steam-electric	3,588	25,922	33,615	43,053	62,778	85,212
Livestock	977	2,196	4,093	6,347	9,020	12,144
Total Water Needs	**28,856**	**83,032**	**83,153**	**106,900**	**141,866**	**182,145**

FIGURE I.2. 2060 EAST TEXAS (I) EXISTING SUPPLIES, PROJECTED DEMANDS, AND IDENTIFIED WATER NEEDS BY WATER USE CATEGORY (ACRE-FEET PER YEAR).



SELECT MAJOR WATER MANAGEMENT STRATEGIES

- Lake Columbia will provide 75,700 acre-feet per year of water starting in the year 2020 with a capital cost of $232 million
- New wells in the Carrizo Wilcox Aquifer will provide up to 21,403 acre-feet per year of water in 2060 with a capital cost of $40 million.
- Lake Palestine Infrastructure (diversion facilities and pipelines) will provide 16,815 acre-feet per year of water starting in 2030 with a capital cost of $79 million.
- Lake Kurth Regional System will provide up to 18,400 acre-feet per year of water starting in 2010, with a capital cost of $56 million.

REGION-SPECIFIC STUDIES

The Regional Water Planning Group developed five region-specific studies during the initial phase of the third planning cycle. The final reports documenting the findings can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/rwp_study.asp#i .

- Inter-Regional Coordination on the Toledo Bend Project
- Regional Solutions for Small Water Suppliers
- Study of Municipal Water Uses to Improve Water Conservation Strategies and Projections
- Lake Murvaul Study
- Liquefied Natural Gas and Refinery Expansions Jefferson County

EAST TEXAS PLANNING GROUP MEMBERS AND INTERESTS REPRESENTED

Voting members during adoption of the 2011 Regional Water Plan:

Kelley Holcomb (Chair), water utilities; David Alders, agriculture; Jeff Branick, counties; David Brock, municipalities; George P. Campbell, other; Jerry Clark, river authorities; Josh David, other; Chris Davis, counties; Scott Hall, river authorities; Michael Harbordt, industries; William Heugel, public; Joe Holcomb, small business; Bill Kimbrough, other; Glenda Kindle, public; Duke Lyons, municipalities; Dale Peddy, electric generating utilities; Hermon E. Reed, Jr., agriculture; Monty Shank, river authorities; Darla Smith, industries; Worth Whitehead, water districts; J. Leon Young, environmental; Mark Dunn, small business

Former voting members during the 2006 – 2011 planning cycle:

Ernest Mosby, small business; Mel Swoboda, industries; John Windham, small business

FIGURE I.3. RECOMMENDED WATER MANAGEMENT STRATEGY WATER SUPPLY VOLUMES FOR 2010–2060 (ACRE-FEET PER YEAR).

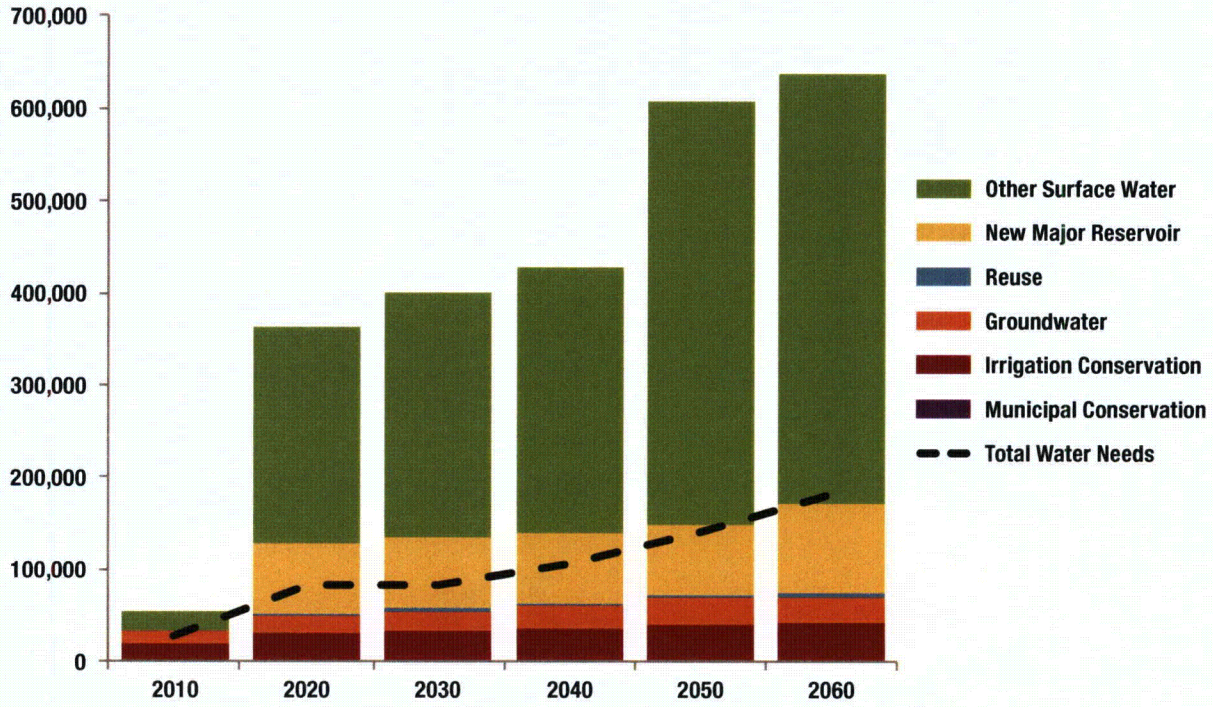
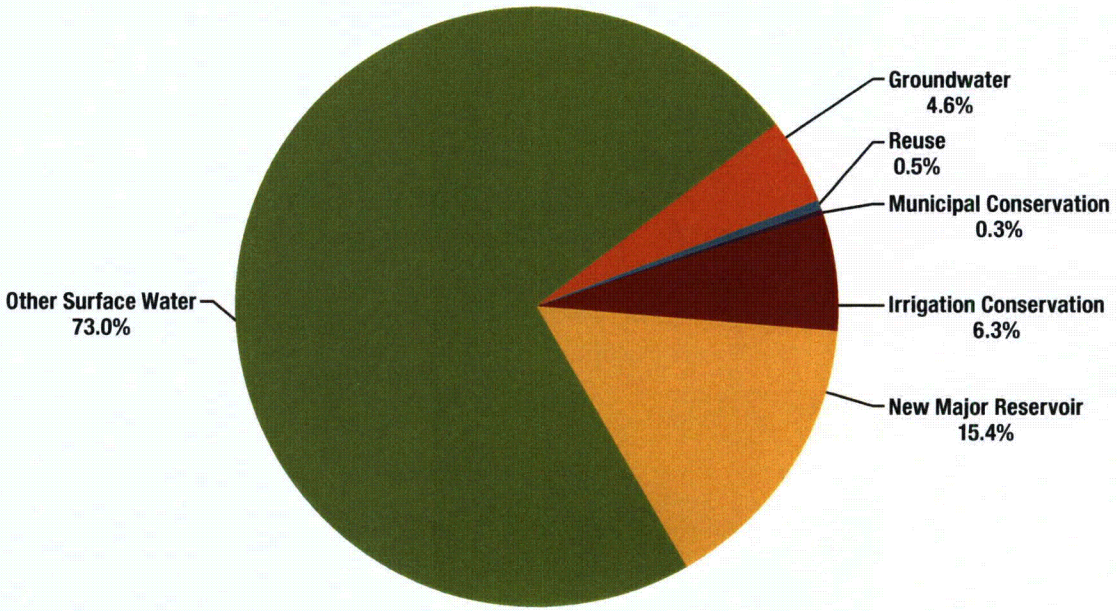
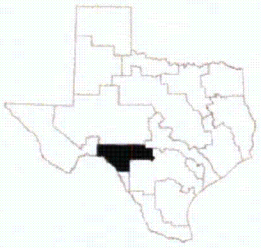


FIGURE I.4. 2060 RECOMMENDED WATER MANAGEMENT STRATEGIES–RELATIVE SHARE OF SUPPLY.



2 Summary of Plateau (J) Region



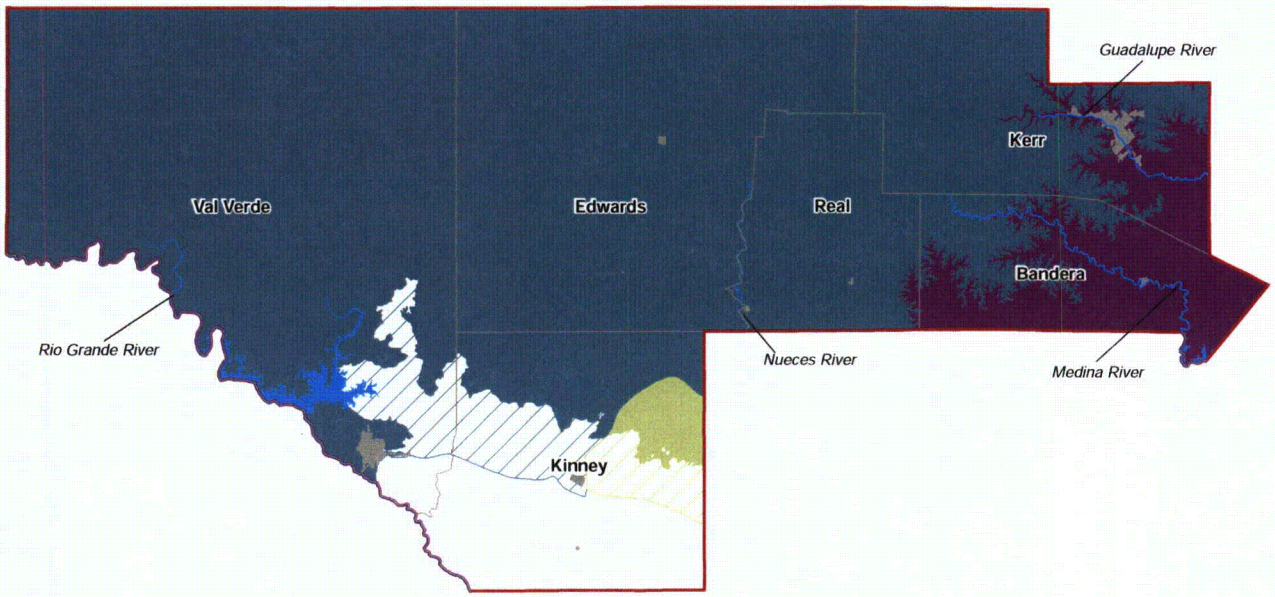
Located on the southern edge of the Edwards Plateau, the Plateau Regional Water Planning Area covers six counties.

Located on the southern edge of the Edwards Plateau, the Plateau Regional Water Planning Area covers six counties (Figure J.1). The region includes portions of the Colorado, Guadalupe, Nueces, Rio Grande, and San Antonio river basins. Land use in the western portion of the planning area is primarily range land, while the eastern portion is a mix of forest land, range land, and agricultural areas. The economy of this region is based primarily on tourism, hunting, ranching, and government (primarily Laughlin Air Force Base in Del Rio). Major cities in the region include Kerrville and Del Rio. The 2011 Plateau (J) Regional Water Plan can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/3rdRound/2011_RWP/RegionJ/.

PLAN HIGHLIGHTS

- Additional supply needed in 2060—2,389 acre-feet per year
- Recommended water management strategy volume in 2060—23,010 acre-feet per year
- Total capital cost—$55 million
- Conservation accounts for 3 percent of 2060 strategy volumes
- Brush control strategy supply not available during drought of record conditions
- Aquifer Storage and Recovery accounts for 21 percent of 2060 strategy volumes

FIGURE J.1. PLATEAU (J) REGIONAL WATER PLANNING AREA.



- Region J
- Major Rivers
- Cities
- Existing Reservoirs
- Edwards (Balcones Fault Zone) Aquifer (outcrop)
- Edwards (Balcones Fault Zone) Aquifer (subsurface)
- Edwards - Trinity (Plateau) Aquifer (outcrop)
- Edwards - Trinity (Plateau) Aquifer (subsurface)
- Trinity Aquifer
- Ellenburger - San Saba Aquifer*
- Hickory Aquifer*

* Minor aquifer (only shown where there is no major aquifer)

POPULATION AND WATER DEMANDS

Less than 1 percent of the state's population resided in the Plateau Region in 2010. By 2060, the region's population is projected to increase 52 percent (Table J.1). The greatest area of population growth is projected to occur in Bandera County, with an anticipated 129 percent increase in population by 2060, which will primarily be associated with areas around San Antonio. Total water demands, however, will increase by only 13 percent by 2060 (Table J.1). The greatest increase is in county-other demand (68 percent), followed by municipal water demand, increasing over the planning horizon by 21 percent (Table J.1, Figure J.2).

EXISTING WATER SUPPLIES

Over 80 percent of the region's existing water supply is obtained from groundwater. Throughout the planning period, the Plateau Planning Group estimates that regional groundwater and surface water supplies will remain constant at 85,439 acre-feet and 19,269 acre-feet, respectively (Table J.1, Figure J.2). There are three aquifers in the region: the Edwards-Trinity (Plateau) Aquifer, underlying much of the region; the Trinity Aquifer in the southeastern portions of Kerr and Bandera counties; and the Edwards (Balcones Fault Zone) Aquifer in southern Kinney County. The principal sources of surface water in the region are San Felipe Springs, Las Moras Creek, the Frio River, the Upper Guadalupe River, Cienagas Creek, and the Nueces River.

NEEDS

Although the region as a whole appears to have enough water supply to meet demands during drought of record conditions, the total existing water supply is not accessible to all water users. The cities of Kerrville and Camp Wood are projected to have needs in all decades, up to 2,389 acre-feet by 2060 (Table J.1, Figure J.2).

RECOMMENDED WATER MANAGEMENT STRATEGIES AND COST

Water management strategies recommended by the Plateau Planning Group include municipal conservation, groundwater development, brush control, and aquifer storage and recovery. These recommended strategies result in 13,713 acre-feet of water in 2010 and 23,010 acre-feet of additional water supply available by the year 2060 to meet all needs (Figures J.3 and J.4) at a total capital cost of $54.8 million (Appendix A).

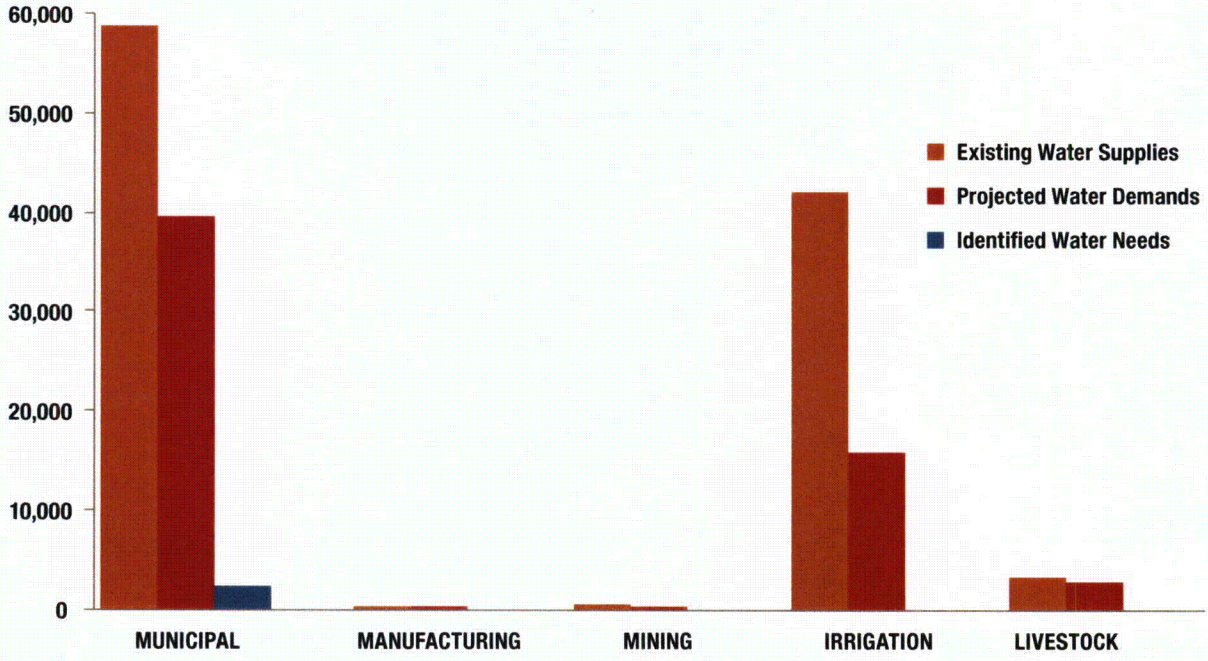
CONSERVATION RECOMMENDATIONS

Conservation strategies represent 3 percent of the total volume of water associated with all recommended strategies. Municipal water conservation was recommended for municipal water user groups with identified needs, which is anticipated to result in water savings of 579 acre-feet in the 2010 decade and 681 acre-feet by 2060.

TABLE J.1. POPULATION, WATER SUPPLY, DEMAND, AND NEEDS 2010–2060

	2010	2020	2030	2040	2050	2060
Projected Population	135,723	158,645	178,342	190,551	198,594	205,910
Existing Supplies (acre-feet per year)						
Surface water	19,269	19,269	19,269	19,269	19,269	19,269
Groundwater	85,439	85,439	85,439	85,439	85,439	85,439
Total Water Supplies	**104,708**	**104,708**	**104,708**	**104,708**	**104,708**	**104,708**
Demands (acre-feet per year)						
Municipal	20,695	22,068	23,101	23,795	24,563	25,106
County-other	8,625	10,515	12,170	13,178	13,836	14,526
Manufacturing	30	33	36	39	41	44
Mining	403	394	389	385	381	378
Irrigation	19,423	18,645	17,897	17,183	16,495	15,837
Livestock	2,752	2,752	2,752	2,752	2,752	2,752
Total Water Demands	**51,928**	**54,407**	**56,345**	**57,332**	**58,068**	**58,643**
Needs (acre-feet per year)						
Municipal	1,494	1,878	2,044	2,057	2,275	2,389
Total Water Needs	**1,494**	**1,878**	**2,044**	**2,057**	**2,275**	**2,389**

FIGURE J.2. 2060 PLATEAU (J) EXISTING SUPPLIES, PROJECTED DEMANDS, AND IDENTIFIED WATER NEEDS BY WATER USE CATEGORY (ACRE-FEET PER YEAR).



SELECT MAJOR WATER MANAGEMENT STRATEGIES

- Surface water acquisition, treatment, and aquifer storage and recovery is projected to produce up to 2,624 acre-feet per year of water in the year 2060 with a capital cost of $37 million.
- Additional groundwater wells are expected to produce 222 acre-feet per year of water starting in 2010 with a capital cost of $240,350.

REGION-SPECIFIC STUDIES

The Plateau Water Planning Group developed three region-specific studies during the initial phase of the third planning cycle. The final reports documenting the findings can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/rwp_study.asp#j.

- Groundwater Data Acquisition in Edwards, Kinney, and Val Verde Counties, Texas
- Aquifer Storage and Recovery Feasibility in Bandera County
- Water Rights Analysis and Aquifer Storage and Recovery Feasibility in Kerr County

PLATEAU PLANNING GROUP MEMBERS AND INTERESTS REPRESENTED

Voting members during adoption of the 2011 Regional Water Plan:

Jonathan Letz (Chair), small business; Stuart Barron, municipalities; Ray Buck, river authorities; Perry Bushong, water districts; Zack Davis, agriculture; Otila Gonzalez, municipalities; Howard Jackson, municipalities; David Jeffery, water districts; Mitch Lomas, municipalities; Kent Lowery, water districts; Ronnie Pace, industries; Thomas M. Qualia, public; Tully Shahan, environmental; Jerry Simpton, other; Homer T. Stevens, Jr., travel/tourism; Lee Sweeten, counties; Charlie Wiedenfeld, water utilities; Gene Williams, water districts; William Feathergail Wilson, other

Former voting members during the 2006 – 2011 planning cycle:

Alejandro A. Garcia, municipalities; Lon Langley, water districts; Carl Meek, municipalities; W.B. Sansom, counties; Cecil Smith, water districts; Gene Smith, municipalities; Diana Ward, water districts

XEROX

Administrator

Document Name:	Water for Texas 2012 State Water Plan
Printing Time:	08/30/12 14:27:09
Copies Requested:	1
Account:	
Virtual Printer:	DC80000AP/slips-sheets
Printed For:	Administrator

Administrator

FIGURE J.3. RECOMMENDED WATER MANAGEMENT STRATEGY WATER SUPPLY VOLUMES FOR 2010–2060 (ACRE-FEET PER YEAR).

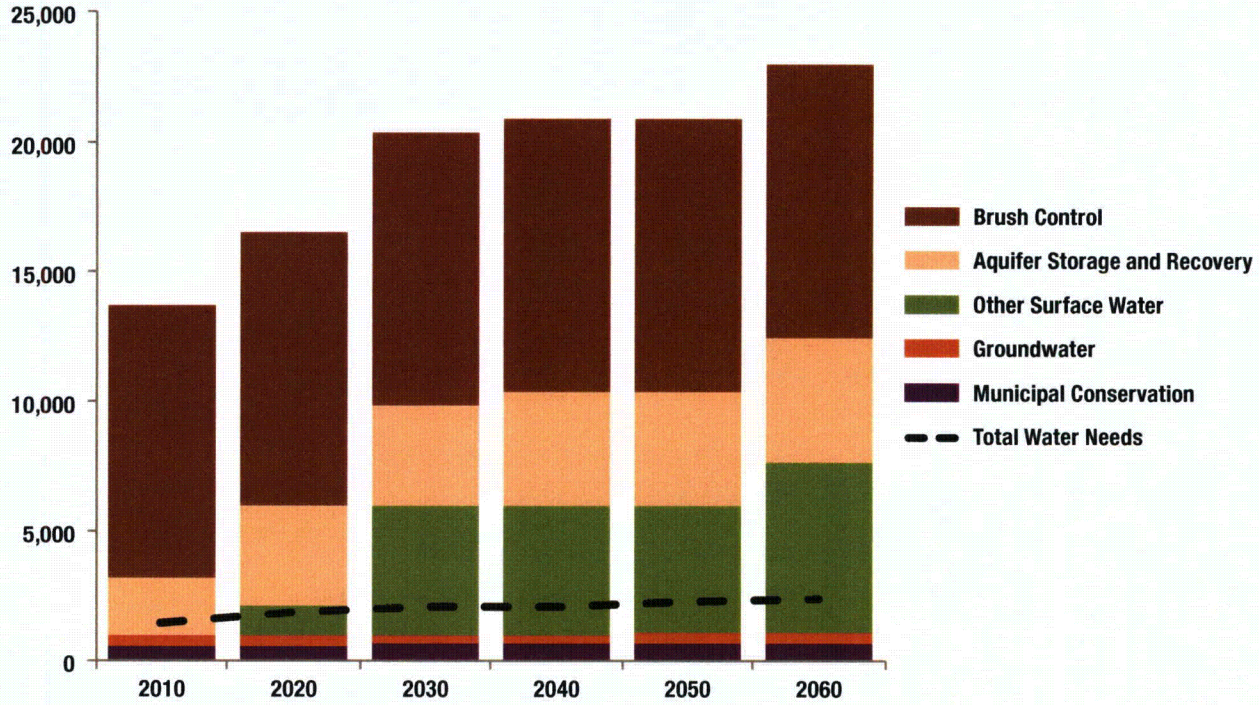
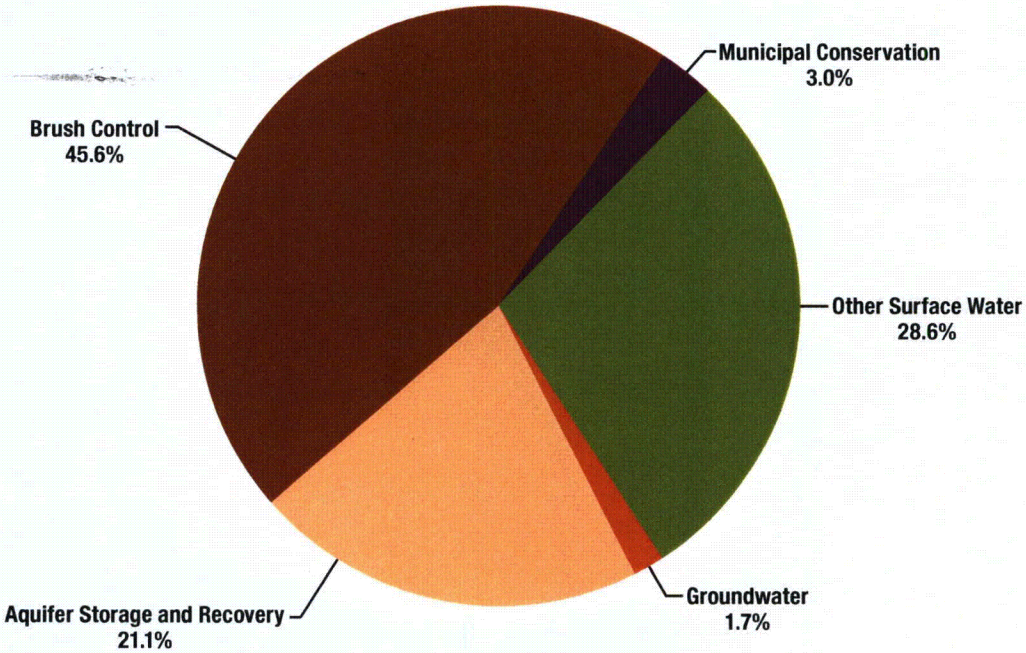
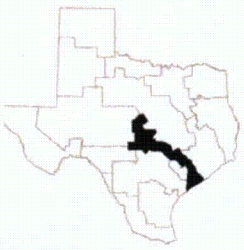


FIGURE J.4. 2060 RECOMMENDED WATER MANAGEMENT STRATEGIES–RELATIVE SHARE OF SUPPLY.



2 Summary of Lower Colorado (K) Region



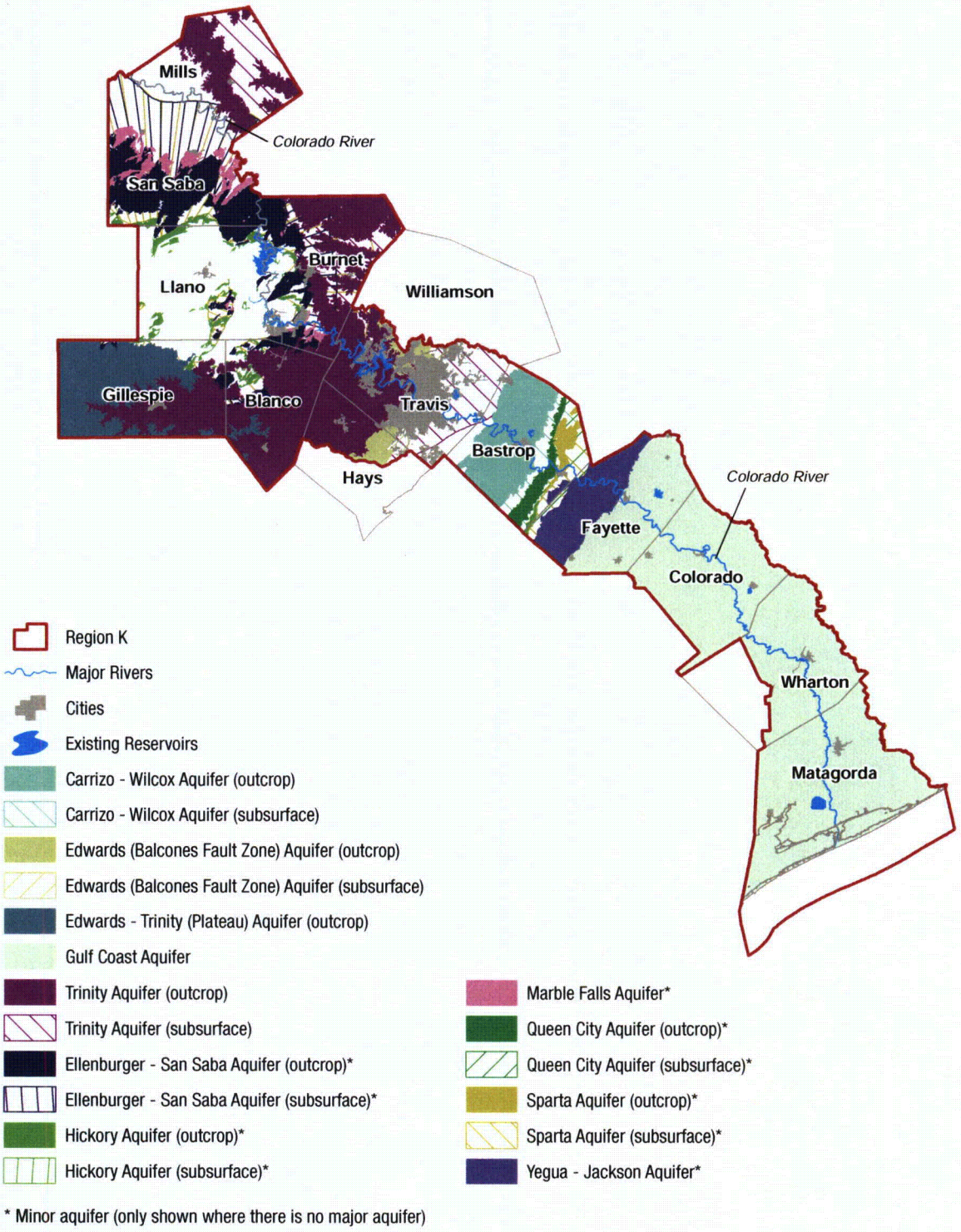
The Lower Colorado Regional Water Planning Area is composed of all or parts of 14 counties, portions of 6 river and coastal basins, and Matagorda Bay.

The Lower Colorado Regional Water Planning Area is composed of all or parts of 14 counties, portions of 6 river and coastal basins, and Matagorda Bay (Figure K.1). Most of the region is located in the Colorado River Basin. Major cities in the region include Austin, Bay City, Pflugerville, and Fredericksburg. The largest economic sectors in the region include agriculture, government, service, manufacturing, and retail trade. The manufacturing sector is primarily concentrated in the technology and semiconductor industry in the Austin area. Oil, gas, petrochemical processing and mineral production are found primarily in Wharton and Matagorda counties near the coast. The 2011 Lower Colorado (K) Regional Water Plan can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/3rdRound/2011_RWP/RegionK/.

PLAN HIGHLIGHTS

- Additional supply needed in 2060—367,671 acre-feet per year
- Recommended water management strategy volume in 2060—646,167 acre-feet per year
- Total capital cost—$907 million
- Conservation accounts for 37 percent of 2060 strategy volumes
- One new major reservoir (Lower Colorado River Authority/San Antonio Water System Project Off-Channel)
- Reuse accounts for 21 percent of 2060 strategy volumes

FIGURE K.1. LOWER COLORADO (K) REGIONAL WATER PLANNING AREA.



POPULATION AND WATER DEMANDS

In 2010, nearly 6 percent of the state's total population resided in the Lower Colorado Region, and between 2010 and 2060 its population is projected to increase by 100 percent to 2,831,937. Water demands, however, are projected to increase less significantly. By 2060, the region's total water demand is projected to increase by 27 percent (Table K.1, and Figure K.1). Agricultural irrigation water use accounts for the largest share of demands through 2050, but by 2060, municipal demand in all forms (including county-other) is expected to surpass irrigation (Table K.1; Figure K.1). Demands for manufacturing and steam-electric generation are also projected to increase substantially.

EXISTING WATER SUPPLIES

The region has a large number of surface water and groundwater sources available. In 2010, surface water was projected to provide about 77 percent of supplies and groundwater about 23 percent. The principal surface water supply sources are the Colorado River and its tributaries, including the Highland Lakes system. There are nine reservoirs in the Lower Colorado region that provide water supply. In determining water supply from the Colorado River, the planning group assumed that its major senior water rights would not exercise a priority call on water rights in Region F and would otherwise honor agreements with certain Region F water right holders. Except where formal agreements exist to support these assumptions, these planning assumptions used to determine existing supplies from the Colorado River have no legal effect. There are 11 major and minor aquifers that supply groundwater to users in the region. The five major aquifers providing groundwater supplies are the Edwards-Trinity (Plateau) and Trinity in the western portion of the region, the Edwards (Balcones Fault Zone) and Carrizo-Wilcox in the central portion, and the Gulf Coast in the eastern portion. The total supply to the planning area is estimated to be 1,162,884 acre-feet in 2010, increasing less than 1 percent to 1,169,071 acre-feet in 2060, because of an expected increase in small, local water supplies (Table K.1, Figure K.2).

NEEDS

Water user groups in the Lower Colorado Region were anticipated to need 255,709 acre-feet of additional water in 2010 and 367,671 acre-feet by 2060 under drought conditions (Table K.1, Figure K.2). All six water use sectors show needs for additional water by 2060. In 2010, the agricultural irrigation sector would have the largest needs in the event of drought (92 percent of total). However, by 2060, municipal needs are expected to increase, largely due to population growth over the planning period, and irrigation needs are expected to decline. These sectors would each represent approximately 37 percent of the total needs.

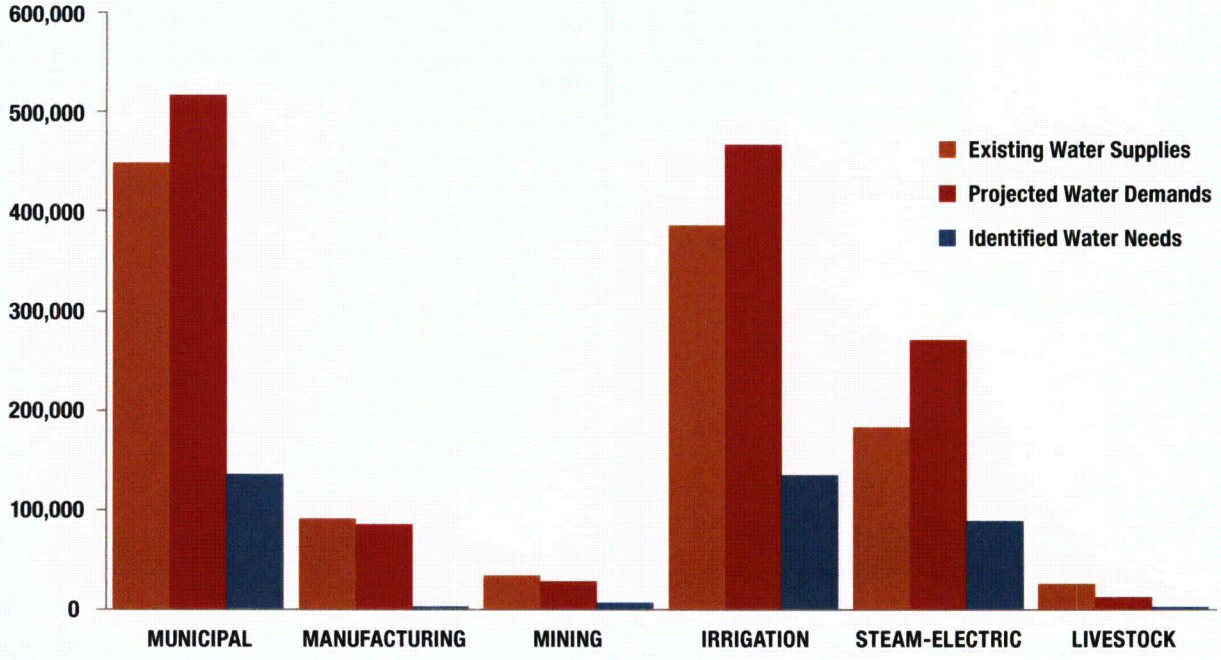
RECOMMENDED WATER MANAGEMENT STRATEGIES AND COST

Water management strategies included in the Lower Colorado regional water plan would provide 646,167 acre-feet of additional water supply by the year 2060 (Figures K.3 and K.4) at a total capital cost of $907.2 million for the region's portion of the project (Appendix A). The primary recommended water management strategy is the Lower Colorado River Authority/San Antonio Water System project that consists of off-channel reservoirs, agricultural water conservation, additional groundwater development, and new and/or amended surface water rights. The costs associated with this project would be paid for by San Antonio and are included in the 2011 South Central Texas Regional Water Plan. If this project is not implemented jointly by the participants, a number of the individual components are recommended as alternate water management strategies to meet Lower Colorado Region needs. There are no unmet needs in the plan.

TABLE K.1. POPULATION, WATER SUPPLY, DEMAND, AND NEEDS 2010–2060

	2010	2020	2030	2040	2050	2060
Projected Population	1,412,834	1,714,282	2,008,142	2,295,627	2,580,533	2,831,937
Existing Supplies (acre-feet per year)						
Surface water	892,327	892,689	894,886	897,359	900,286	900,477
Groundwater	270,557	270,268	269,887	268,936	268,527	268,594
Total Water Supplies	**1,162,884**	**1,162,957**	**1,164,773**	**1,166,295**	**1,168,813**	**1,169,071**
Demands (acre-feet per year)						
Municipal	239,013	288,152	336,733	382,613	428,105	467,075
County-other	29,630	33,820	36,697	40,438	44,673	49,273
Manufacturing	38,162	44,916	56,233	69,264	77,374	85,698
Mining	30,620	31,252	31,613	26,964	27,304	27,598
Irrigation	589,705	567,272	545,634	524,809	504,695	468,763
Steam-electric	146,167	201,353	210,713	258,126	263,715	270,732
Livestock	13,395	13,395	13,395	13,395	13,395	13,395
Total Water Demands	**1,086,692**	**1,180,160**	**1,231,018**	**1,315,609**	**1,359,261**	**1,382,534**
Needs (acre-feet per year)						
Municipal	6,671	17,867	25,289	36,420	76,771	120,999
County-other	223	1,725	4,347	8,128	11,610	14,892
Manufacturing	146	298	452	605	741	934
Mining	13,550	13,146	12,366	6,972	5,574	5,794
Irrigation	234,738	217,011	198,717	181,070	164,084	135,822
Steam-electric	193	53,005	53,175	76,430	81,930	89,042
Livestock	188	188	188	188	188	188
Total Water Needs	**255,709**	**303,240**	**294,534**	**309,813**	**340,898**	**367,671**

FIGURE K.2. 2060 LOWER COLORADO (K) EXISTING SUPPLIES, PROJECTED DEMANDS, AND IDENTIFIED WATER NEEDS BY WATER USE CATEGORY (ACRE-FEET PER YEAR).



CONSERVATION RECOMMENDATIONS

Conservation strategies represent up to 37 percent of the total amount of water resulting from all recommended water management strategies. Water conservation was included as a strategy for every municipal water user group with a need and water use greater than 140 gallons per capita per day. A demand reduction of 1 percent per year was assumed until the water user reached 140 gallons per capita per day. Conservation was recommended beginning in 2010 regardless of the decade when needs first occur to have significant effects on demand by the time the needs were realized. In addition to municipal conservation, the plan recommends significant irrigation conservation programs and projects.

SELECT MAJOR WATER MANAGEMENT STRATEGIES

- Off-channel reservoir project (Lower Colorado River Authority/San Antonio Water System) would provide 47,000 acre-feet per year of water in the year 2060 at no cost to the region if it is paid for by project sponsors located in Region L (see Region L summary for cost assumptions).
- Wastewater return flows would provide up to 78,956 acre-feet per year of water in 2060 with no assumed capital cost since no additional infrastructure is needed.
- Municipal conservation and enhanced municipal/industrial conservation would provide up to 76,594 acre-feet per year of water in 2060 with no assumed capital cost, while irrigation conservation would provide up to 124,150 acre-feet per year of water in 2060 at a capital cost of approximately $3.8 million.
- Reuse of treated wastewater would provide up to 58,783 acre-feet per year of water in 2060 with a capital cost in excess of $620 million.

REGION-SPECIFIC STUDIES

The Regional Water Planning Group developed three region-specific studies during the initial phase of the third planning cycle. The final reports documenting the findings can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/rwp_study.asp#k.

- Surface Water Availability Modeling Study
- Environmental Impacts of Water Management Strategies Study
- Evaluation of High Growth Areas Study

LOWER COLORADO PLANNING GROUP MEMBERS AND INTERESTS REPRESENTED

Voting members during adoption of the 2011 Regional Water Plan:

John E. Burke (Chair), water utilities; Jim Barho, environmental; Sandra Dannhardt, electric generating utilities; Finley deGraffenried, municipalities; Ronald G. Fieseler, water districts; Ronald Gertson, small business; Karen Haschke, public; Barbara Johnson, industries; James Kowis, river authorities; Teresa Lutes, municipalities; Bill Neve, counties; W.R. (Bob) Pickens, other; Doug Powell, recreation; W.A. (Billy) Roeder, counties; Rob Ruggiero, small business; Haskell Simon, agriculture; James Sultemeier, counties; Byron Theodosis, counties; Paul Tybor, water districts; David Van Dresar, water districts; Roy Varley, other; Jennifer Walker, environmental

Former voting members during the 2006 – 2011 planning cycle:

David Deeds, municipalities; Rick Gangluff, electric generating utilities; Mark Jordan, river authorities; Chris King, counties; Julia Marsden, public; Laura Marbury, public; Bill Miller, agriculture; Harold Streicher, small business; Del Waters, recreation

FIGURE K.3. RECOMMENDED WATER MANAGEMENT STRATEGY WATER SUPPLY VOLUMES FOR 2010–2060 (ACRE-FEET PER YEAR).

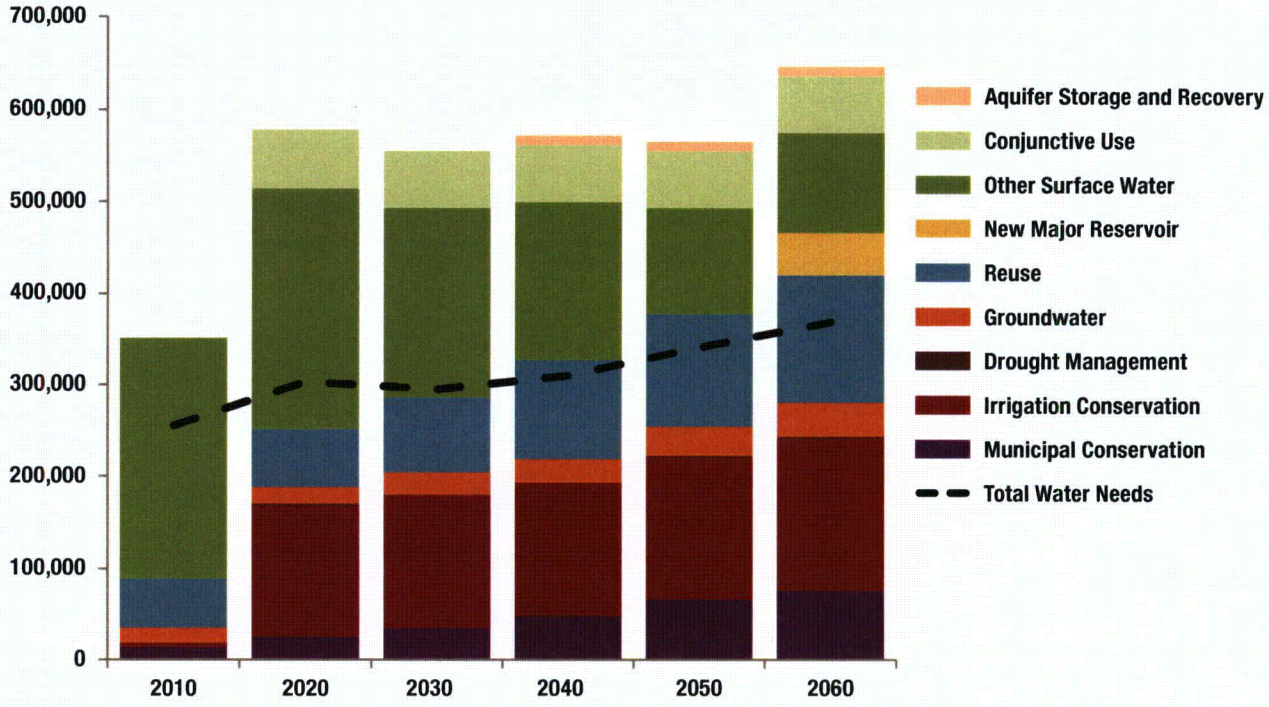
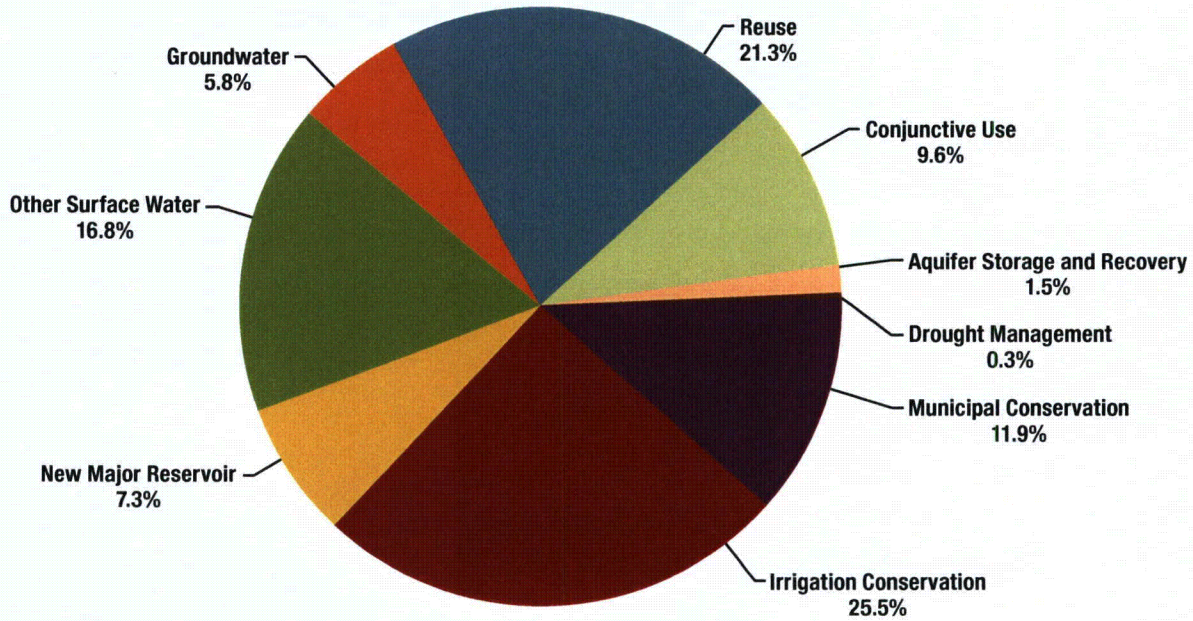
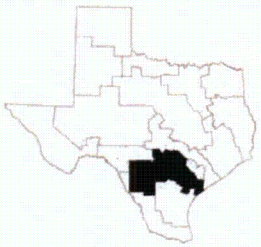


FIGURE K.4. 2060 RECOMMENDED WATER MANAGEMENT STRATEGIES–RELATIVE SHARE OF SUPPLY.



2 Summary of South Central Texas (L) Region



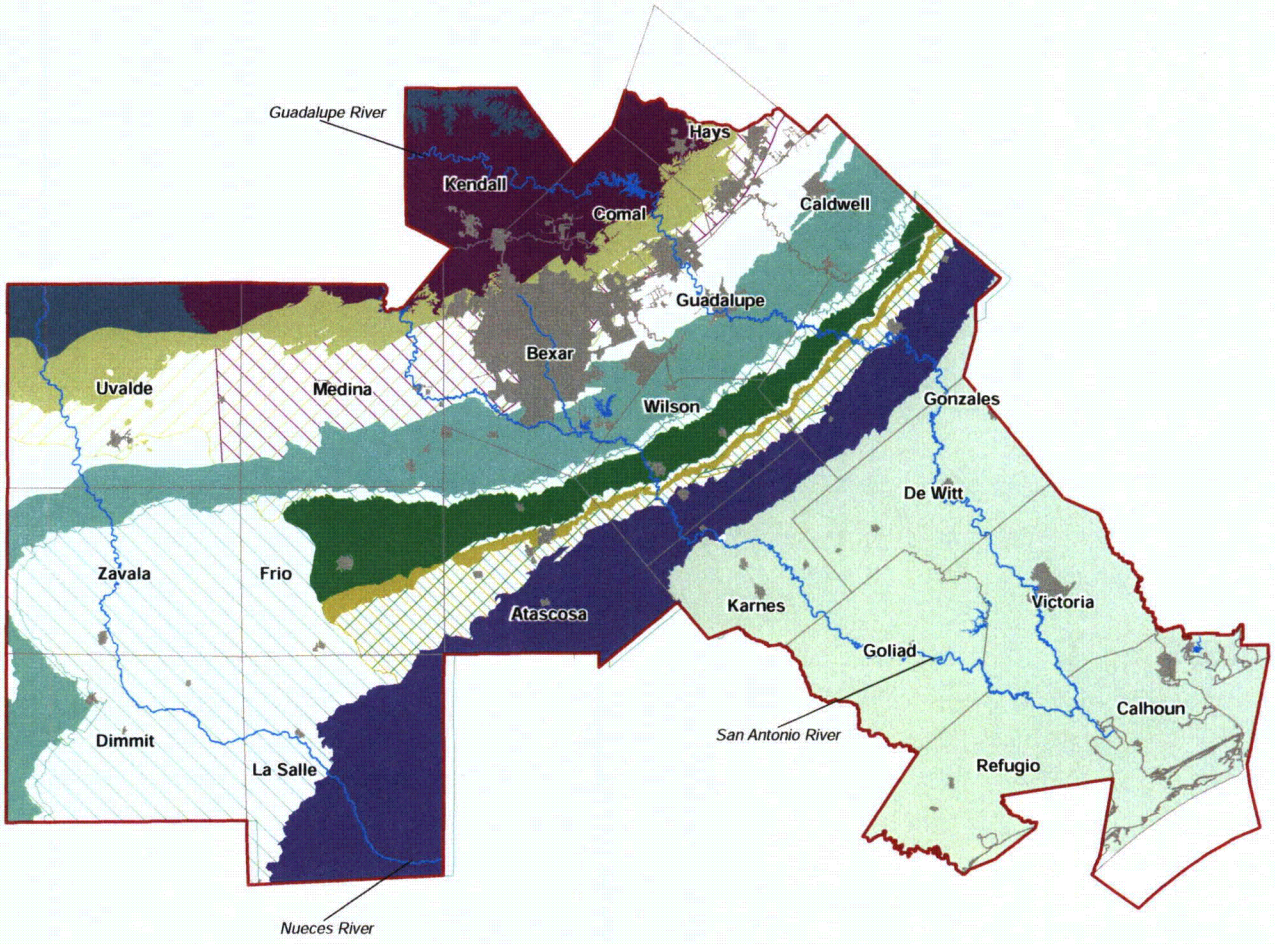
The South Central Texas Regional Water Planning Area includes all or parts of 21 counties, portions of nine river and coastal basins, the Guadalupe Estuary, and San Antonio Bay.

The South Central Texas Regional Water Planning Area includes all or parts of 21 counties, portions of nine river and coastal basins, the Guadalupe Estuary, and San Antonio Bay (Figure L.1). The largest cities in the region are San Antonio, Victoria, San Marcos, and New Braunfels. The region's largest economic sectors are tourism, military, medical, service, manufacturing, and retail trade. The region contains the two largest springs in Texas: Comal and San Marcos. Water planning in the region is particularly complex because of the intricate relationships between the region's surface and groundwater resources. The 2011 South Central Texas (L) Regional Water Plan can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/3rdRound/2011_RWP/RegionL/.

PLAN HIGHLIGHTS

- Additional supply needed in 2060—436,751 acre-feet per year
- Recommended water management strategy volume in 2060—765,738 acre-feet per year
- Total capital cost—$7.6 billion
- Conservation accounts for 11 percent of 2060 strategy volumes
- Five new, major off-channel reservoirs (Guadalupe-Blanco River Authority: Mid-Basin, Exelon, and Lower Basin New Appropriation Projects; Lower Colorado River Authority/San Antonio Water System Project Off-Channel; Lavaca Off-Channel)
- Significant Carrizo-Wilcox Aquifer development
- Five unique stream segments recommended for designation (Figure ES.7)
- Limited unmet irrigation needs

FIGURE L.1. SOUTH CENTRAL TEXAS (L) REGIONAL WATER PLANNING AREA.



- Region L
- Major Rivers
- Cities
- Existing Reservoirs
- Carrizo - Wilcox Aquifer (outcrop)
- Carrizo - Wilcox Aquifer (subsurface)
- Edwards (Balcones Fault Zone) Aquifer (outcrop)
- Edwards (Balcones Fault Zone) Aquifer (subsurface)
- Edwards - Trinity (Plateau) Aquifer
- Gulf Coast Aquifer
- Trinity Aquifer (outcrop)
- Trinity Aquifer (subsurface)
- Queen City Aquifer (outcrop)*
- Queen City Aquifer (subsurface)*
- Sparta Aquifer (outcrop)*
- Sparta Aquifer (subsurface)*
- Yegua - Jackson Aquifer*
- Ellenburger - San Saba Aquifer*
- Hickory Aquifer*

* Minor aquifer (only shown where there is no major aquifer)

POPULATION AND WATER DEMANDS

Approximately 10 percent of the state's total population resided in Region L in the year 2010, and between 2010 and 2060 its population is projected to increase by 75 percent (Table L.1). By 2060, the total water demands for the region are projected to increase 32 percent (Table L.1). Starting in 2020, municipal water use makes up the largest share of these demands in all decades and is projected to experience the greatest increase over the planning period; a 62 percent increase (Table L.1, Figure L.2). Agricultural irrigation water demand will remain significant but is projected to decline 20 percent over the planning period.

EXISTING WATER SUPPLIES

The Edwards Aquifer is projected to provide approximately half of the region's existing groundwater supply in 2010, with the Carrizo-Wilcox Aquifer providing approximately 40 percent of the groundwater supplies. There are five major aquifers supplying water to the region, including the Edwards (Balcones Fault Zone), Carrizo-Wilcox, Trinity, Gulf Coast, and Edwards-Trinity (Plateau). The two minor aquifers supplying water are the Sparta and Queen City aquifers. The region includes portions of six river basins and three coastal basins. The principal surface water sources in the region are the Guadalupe, San Antonio, Lavaca, and Nueces rivers. The region's existing water supply is expected to decline slightly between 2010 and 2060 as groundwater use is reduced in certain areas (Table L.1, Figure L.2).

NEEDS

Because total water supplies are not accessible by all water users throughout the region, in the event of drought, the South Central Texas Region faces water supply needs of up to 174,235 acre-feet as early as 2010 (Table L.1, Figure L.2). In 2010 these water supply needs consist primarily of municipal (55 percent) and irrigated agricultural needs (39 percent). By the year 2060, the water needs are significantly larger and are dominated to an even greater extent (68 percent) by municipal water users.

RECOMMENDED WATER MANAGEMENT STRATEGIES AND COST

The South Central Texas Planning Group recommended a variety of water management strategies to meet water supply needs (Figures L.3 and L.4). Implementing all the water management strategies recommended in the Region L plan would result in 765,738 acre-feet of additional water supplies in 2060 at a total capital cost of $7.6 billion (Appendix A). Because there were no economically feasible strategies identified to meet the needs, Atascosa and Zavala Counties have limited projected unmet irrigation needs.

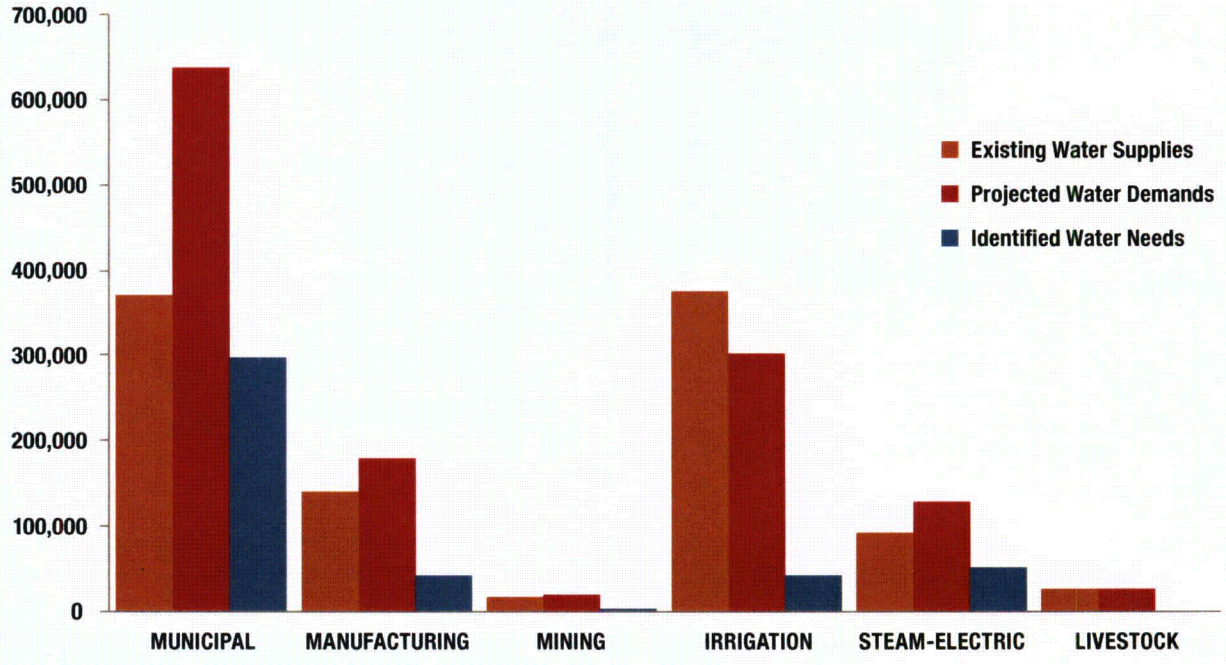
CONSERVATION RECOMMENDATIONS

Conservation strategies account for 11 percent of the total amount of water that would be provided by the region's recommended water management strategies. Water conservation was recommended in general for all municipal and non-municipal water user groups. In instances where the municipal water conservation goals could be achieved through anticipated use of low-flow plumbing fixtures, additional conservation measures were not recommended.

TABLE L.1. POPULATION, WATER SUPPLY, DEMAND, AND NEEDS 2010–2060

	2010	2020	2030	2040	2050	2060
Projected Population	2,460,599	2,892,933	3,292,970	3,644,661	3,984,258	4,297,786
Existing Supplies (acre-feet per year)						
Surface water	301,491	301,475	299,956	295,938	295,922	295,913
Groundwater	717,263	716,541	712,319	711,521	710,539	709,975
Reuse	16,049	16,049	16,049	16,049	16,049	16,049
Total Water Supplies	**1,034,803**	**1,034,065**	**1,028,324**	**1,023,508**	**1,022,510**	**1,021,937**
Demands (acre-feet per year)						
Municipal	369,694	422,007	471,529	512,671	555,281	597,619
County-other	26,302	29,104	31,846	34,465	37,062	39,616
Manufacturing	119,310	132,836	144,801	156,692	167,182	179,715
Mining	14,524	15,704	16,454	17,212	17,977	18,644
Irrigation	379,026	361,187	344,777	329,395	315,143	301,679
Steam-electric	46,560	104,781	110,537	116,068	121,601	128,340
Livestock	25,954	25,954	25,954	25,954	25,954	25,954
Total Water Demands	**981,370**	**1,091,573**	**1,145,898**	**1,192,457**	**1,240,200**	**1,291,567**
Needs (acre-feet per year)						
Municipal	94,650	134,541	173,989	212,815	249,735	288,618
County-other	2,003	3,073	4,228	5,430	7,042	8,768
Manufacturing	6,539	13,888	20,946	27,911	34,068	43,072
Mining	521	726	1,771	1,992	2,293	2,493
Irrigation	68,465	62,376	56,519	50,894	45,502	41,782
Steam-electric	2,054	50,962	50,991	51,021	51,657	52,018
Livestock	3	1	0	0	0	0
Total Water Needs	**174,235**	**265,567**	**308,444**	**350,063**	**390,297**	**436,751**

FIGURE L.2. 2060 SOUTH CENTRAL TEXAS (L) EXISTING SUPPLIES, PROJECTED DEMANDS, AND IDENTIFIED WATER NEEDS BY WATER USE CATEGORY (ACRE-FEET PER YEAR).



SELECT MAJOR WATER MANAGEMENT STRATEGIES

- Three Brackish Groundwater Desalination (Wilcox Aquifer) projects would provide a total of up to 42,220 acre-feet per year of water in the year 2060 with a capital cost of $378 million.
- Hays/Caldwell Public Utility Agency Project would provide up to 33,314 acre-feet per year of groundwater (Carrizo Aquifer) in 2060 with a capital cost of $308 million.
- Guadalupe-Blanco River Authority Mid-Basin Project would provide 25,000 acre-feet per year of Guadalupe run-of-river supplies stored in an off-channel reservoir starting in 2020 with a capital cost of $547 million.
- Off-channel reservoir project (Lower Colorado River Authority/San Antonio Water System) would provide 90,000 acre-feet per year of water starting in 2030 with a capital cost of $2 billion.
- Recycled Water Programs would provide up to 41,737 acre-feet per year of water in 2060 with a capital cost of $465 million.
- Seawater Desalination Project would provide 84,012 acre-feet per year of water in 2060 with a capital cost of $1.3 billion.

REGION-SPECIFIC STUDIES

The Regional Water Planning Group developed five region-specific studies during the initial phase of the third planning cycle. The final reports documenting the findings can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/rwp_study.asp#l.

- Lower Guadalupe Water Supply Project for Guadalupe-Blanco River Authority Needs
- Brackish Groundwater Supply Evaluation
- Enhanced Water Conservation, Drought Management, and Land Stewardship
- Environmental Studies
- Environmental Evaluations of Water Management Strategies

SOUTH CENTRAL TEXAS PLANNING GROUP MEMBERS AND INTERESTS REPRESENTED

Voting members during adoption of the 2011 Regional Water Plan:

Con Mims (Chair), river authorities; Jason Ammerman, industries; Tim Andruss, water districts; Donna Balin, environmental; Evelyn Bonavita, public; Darrell Brownlow, Ph.D., small business; Velma Danielson, water districts; Garrett Engelking, water districts; Mike Fields, electric generating utilities; Bill Jones, agriculture; John Kight, counties; David Langford, agriculture; Mike Mahoney, water districts; Gary Middleton, municipalities; Jay Millikin, counties; Ron Naumann, water utilities; Illiana Pena, environmental; Robert Puente, municipalities; Steve Ramsey, water utilities; Suzanne B. Scott, river authorities; Milton Stolte, agriculture

Former voting members during the 2006 – 2011 planning cycle:

Doug Miller, small business; David Chardavoynne, municipalities; Gil Olivares, water districts

FIGURE L.3. RECOMMENDED WATER MANAGEMENT STRATEGY WATER SUPPLY VOLUMES FOR 2010–2060 (ACRE-FEET PER YEAR).

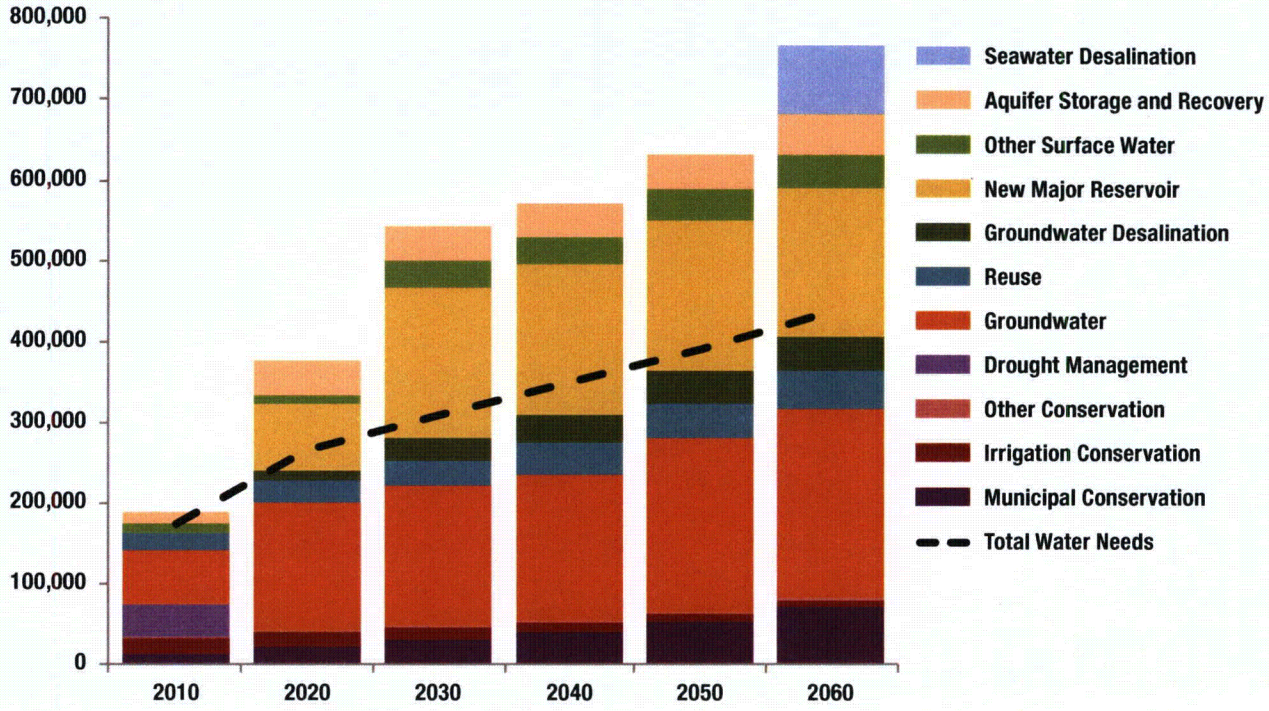
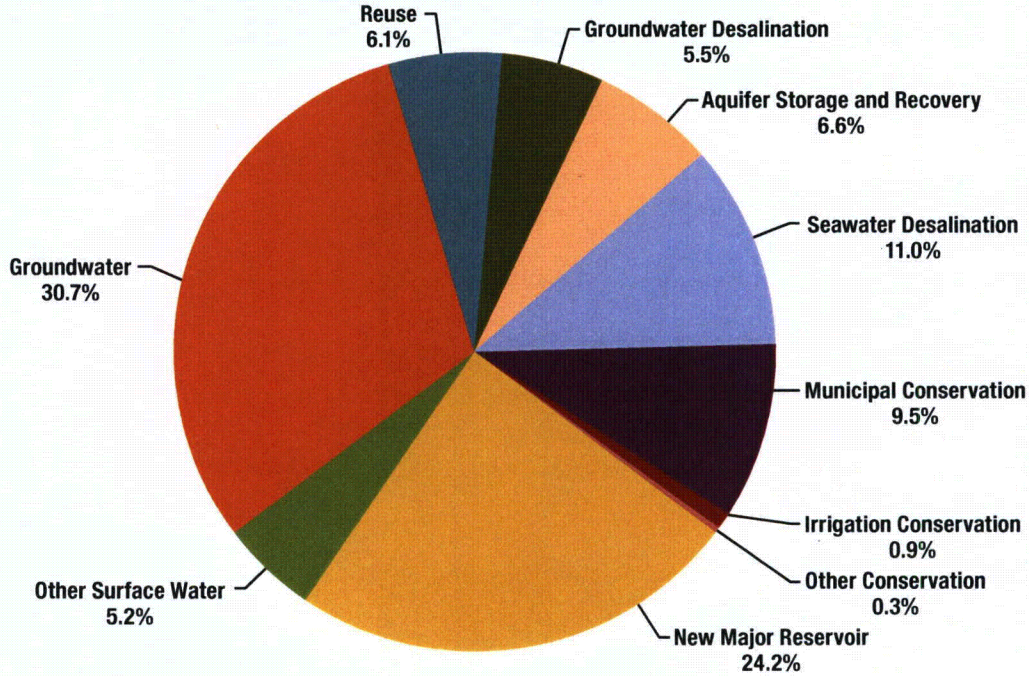
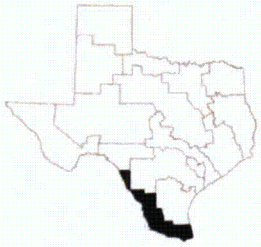


FIGURE L.4. 2060 RECOMMENDED WATER MANAGEMENT STRATEGIES–RELATIVE SHARE OF SUPPLY.



2 Summary of Rio Grande (M) Region



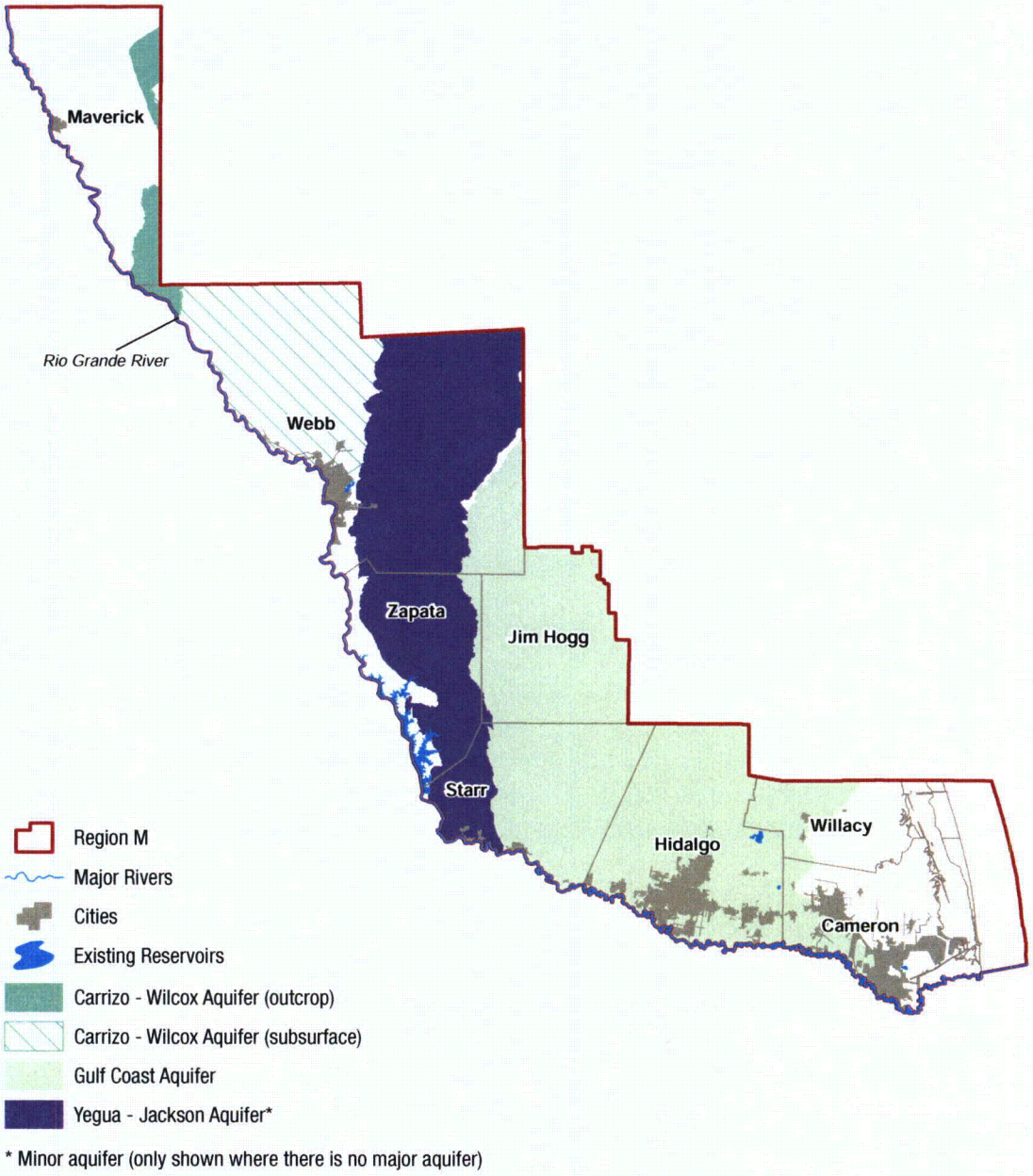
The Rio Grande Regional Water Planning Area includes eight counties, with over 60 percent of the region lying within the Rio Grande Basin.

The Rio Grande Regional Water Planning Area includes eight counties, with over 60 percent of the region lying within the Rio Grande Basin (Figure M.1). Its major cities include Brownsville, McAllen, and Laredo. The international reservoirs of the Rio Grande are the region's primary source of water. Portions of two major aquifers, the Gulf Coast and the Carrizo-Wilcox, lie under a large portion of the Rio Grande Region. The largest economic sectors in the region are agriculture, trade, services, manufacturing, and hydrocarbon production. The 2011 Rio Grande (M) Regional Water Plan can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/3rdRound/2011_RWP/RegionM/.

PLAN HIGHLIGHTS

- Additional supply needed in 2060—609,906 acre-feet per year
- Recommended water management strategy volume in 2060—673,846 acre-feet per year
- Total capital cost—$2.2 billion
- Conservation accounts for 43 percent of 2060 strategy volumes
- Two new major reservoirs (Brownsville Weir, Laredo Low Water Weir)
- Significant unmet irrigation needs

FIGURE M.1. RIO GRANDE (M) REGIONAL WATER PLANNING AREA.



POPULATION AND WATER DEMANDS

Approximately 6 percent of the state's total population resided in the Rio Grande Region in the year 2010, and between 2010 and 2060 the regional population is projected to increase 142 percent (Table M.1). By 2060, the total water demands for the region are projected to increase 13 percent (Table M.1). Agricultural irrigation water demand makes up the largest share of these demands in all decades and is projected to decrease 16 percent over the planning period due largely to urbanization (Table M.1, Figure M.2). Municipal water demand, however, is projected to increase 124 percent and county-other demand 126 percent by 2060.

EXISTING WATER SUPPLIES

Surface water provides over 90 percent of the region's water supply. The principal surface water source is the Rio Grande, its tributaries, and two major international reservoirs, one of which is located upstream above the planning area's northern boundary. The United States' share of the firm yield of these reservoirs is over 1 million acre-feet; however, sedimentation will reduce that yield by 3 percent (about 31,000 acre-feet of existing supply) over the planning period. About 87 percent of the United States' surface water rights in the international reservoirs go to the lower two counties in the planning area, Cameron and Hidalgo. There are two major aquifers in the region: the Carrizo-Wilcox and Gulf Coast. A large portion of the groundwater found in Region M's portion of the Gulf Coast Aquifer is brackish. By 2060, the total surface water and groundwater supply is projected to decline 2 percent (Table M.1, Figure M.2).

NEEDS

The region's surface water supplies from the Rio Grande depend on an operating system that guarantees municipal and industrial users' supplies over other categories (particularly agriculture). Thus, the total water supply volume is not accessible to all water users throughout the region, resulting in significant water needs occurring during drought across the region. In the event of drought conditions, total water needs of 435,922 acre-feet could have occurred across the region as early as 2010, and by 2060 these water needs are projected to increase to 609,906 acre-feet. The majority of the Rio Grande Region water needs are associated with irrigation and municipal uses. Irrigation accounted for 93 percent of the Rio Grande Region's total water needs in 2010 and is projected to decrease to 42 percent by 2060. During the same time period, municipal water needs increase from 6 percent to 54 percent of the region's total water needs. (Table M.1, Figure M.2).

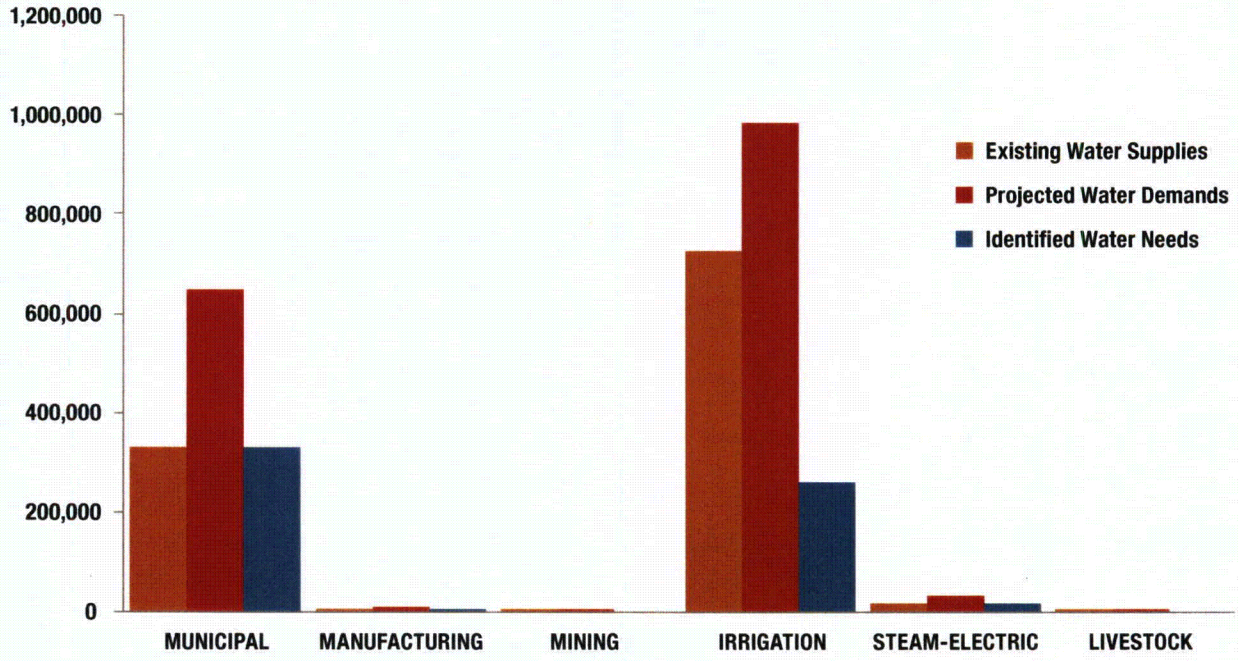
RECOMMENDED WATER MANAGEMENT STRATEGIES AND COST

The Rio Grande Planning Group recommended a variety of water management strategies to meet future needs including municipal and irrigation conservation, reuse, groundwater development, desalination, and surface water reallocation (Figures M.3 and M.4). The total needs for Region M are projected to decrease between 2010 and 2030 due to the rate of irrigation demand decrease being larger than the rate of municipal demand increase. However, after the year 2030 the rate of change for increasing municipal demand surpasses that of the decreasing irrigation demand resulting in the steady increase of total needs through the year 2060. Implementation of the recommended strategies will meet all regional needs (including all the needs associated with municipalities) for water users identified in the plan except for a significant portion of the region's irrigation needs, for which no economically feasible strategies were identified. This is estimated to be up to 394,896 acre-feet of unmet irrigation needs in 2010. In all, the recommended strategies would provide over 673,846 acre-feet of additional water supply by the year 2060 at a total capital cost of $2.2 billion (Appendix A).

TABLE M.1. POPULATION, WATER SUPPLY, DEMAND, AND NEEDS 2010–2060

	2010	2020	2030	2040	2050	2060
Projected Population	1,628,278	2,030,994	2,470,814	2,936,748	3,433,188	3,935,223
Existing Supplies (acre-feet per year)						
Surface water	1,008,597	1,002,180	996,295	990,244	983,767	977,867
Groundwater	81,302	84,650	86,965	87,534	87,438	87,292
Reuse	24,677	24,677	24,677	24,677	24,677	24,677
Total Water Supplies	**1,114,576**	**1,111,507**	**1,107,937**	**1,102,455**	**1,095,882**	**1,089,836**
Demands (acre-feet per year)						
Municipal	259,524	314,153	374,224	438,453	508,331	581,043
County-other	28,799	35,257	42,172	49,405	57,144	64,963
Manufacturing	7,509	8,274	8,966	9,654	10,256	11,059
Mining	4,186	4,341	4,433	4,523	4,612	4,692
Irrigation	1,163,634	1,082,232	981,748	981,748	981,748	981,748
Steam-electric	13,463	16,864	19,716	23,192	27,430	32,598
Livestock	5,817	5,817	5,817	5,817	5,817	5,817
Total Water Demands	**1,482,932**	**1,466,938**	**1,437,076**	**1,512,792**	**1,595,338**	**1,681,920**
Needs (acre-feet per year)						
Municipal	20,889	53,849	98,933	154,514	221,595	292,700
County-other	5,590	10,428	16,786	23,491	30,698	37,925
Manufacturing	1,921	2,355	2,748	3,137	3,729	4,524
Irrigation	407,522	333,246	239,408	245,896	252,386	258,375
Steam-electric	0	1,980	4,374	7,291	11,214	16,382
Total Water Needs	**435,922**	**401,858**	**362,249**	**434,329**	**519,622**	**609,906**

FIGURE M.2. 2060 RIO GRANDE (M) EXISTING SUPPLIES, PROJECTED DEMANDS, AND IDENTIFIED WATER NEEDS BY WATER USE CATEGORY (ACRE-FEET PER YEAR).



CONSERVATION RECOMMENDATIONS

Conservation strategies for municipal and irrigation water users account for approximately 43 percent of the water associated with the region's recommended strategies. Irrigation conservation strategies account for the majority of these savings, through Best Management Practices including water district conveyance system improvements and on-farm conservation practices. Municipal water conservation was recommended for almost all municipal water user groups with a need. Conservation was also recommended for several communities that do not anticipate a municipal water need during the planning horizon.

SELECT MAJOR WATER MANAGEMENT STRATEGIES

- Acquisition of water rights through purchase is projected to provide up to 151,237 acre-feet per year of water in the year 2060 with a capital cost of $631 million.
- Brackish Groundwater Desalination is expected to provide up to 92,212 acre-feet per year of water in 2060 with a capital cost of $267 million.
- Brownsville Weir and Reservoir is projected to provide up to 23,643 acre-feet per year of surface water in 2060 at a capital cost of $98 million.
- Seawater Desalination is projected to provide up to 7,902 acre-feet per year of water in 2060 at a capital cost of $186 million.
- Irrigation Conveyance System Conservation is expected to provide up to 139,217 acre-feet per year of water in 2060 at a capital cost of $132 million.

REGION-SPECIFIC STUDIES

The Rio Grande Regional Water Planning Group developed three region-specific studies during the initial phase of the third planning cycle. The final reports documenting the findings can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/rwp_study.asp#m.

- Evaluation of Alternate Water Supply Management Strategies Regarding the Use and Classification of Existing Water Rights on the Lower and Middle Rio Grande
- Classify Irrigation Districts as Water User Groups
- Analyze Results of Demonstration Projects

RIO GRANDE PLANNING GROUP MEMBERS AND INTERESTS REPRESENTED

Voting members during adoption of the 2011 Regional Water Plan:

Glenn Jarvis (Chair), other; Jorge Barrera, municipalities; John Bruciak, municipalities; Mary Lou Campbell, public; James (Jim) Darling, river authorities; Ella de la Rosa, electric generating utilities; Robert E. Fulbright, agriculture; Carlos Garza, small business; Dennis Goldsberry, water utilities; Joe Guerra, electric generating utilities; Sonny Hinojosa, water districts; Sonia Lambert, water districts; Donald K. McGhee, small business/industries; Sonia Najera, environmental; Ray Prewett, agriculture; Tomas Rodriguez, Jr., municipalities; Gary Whittington, industries/other; John Wood, counties

Former voting members during the 2006 – 2011 planning cycle:

Jose Aranda, counties; Charles (Chuck) Browning, water utilities; Karen Chapman, environmental; Kathleen Garrett, electric generating utilities; Robert Gonzales, municipalities; James R. Matz, other; Adrian Montemayor, municipalities; Xavier Villarreal, small business

FIGURE M.3. RECOMMENDED WATER MANAGEMENT STRATEGY WATER SUPPLY VOLUMES FOR 2010–2060 (ACRE-FEET PER YEAR).

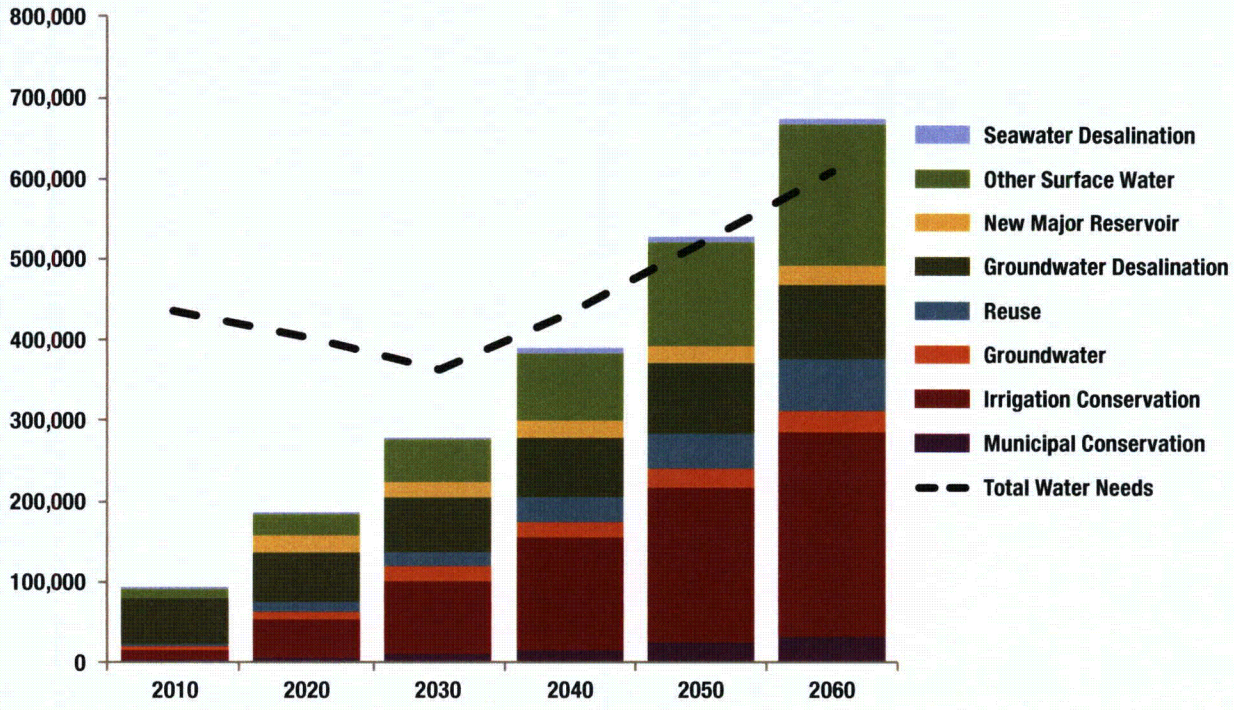
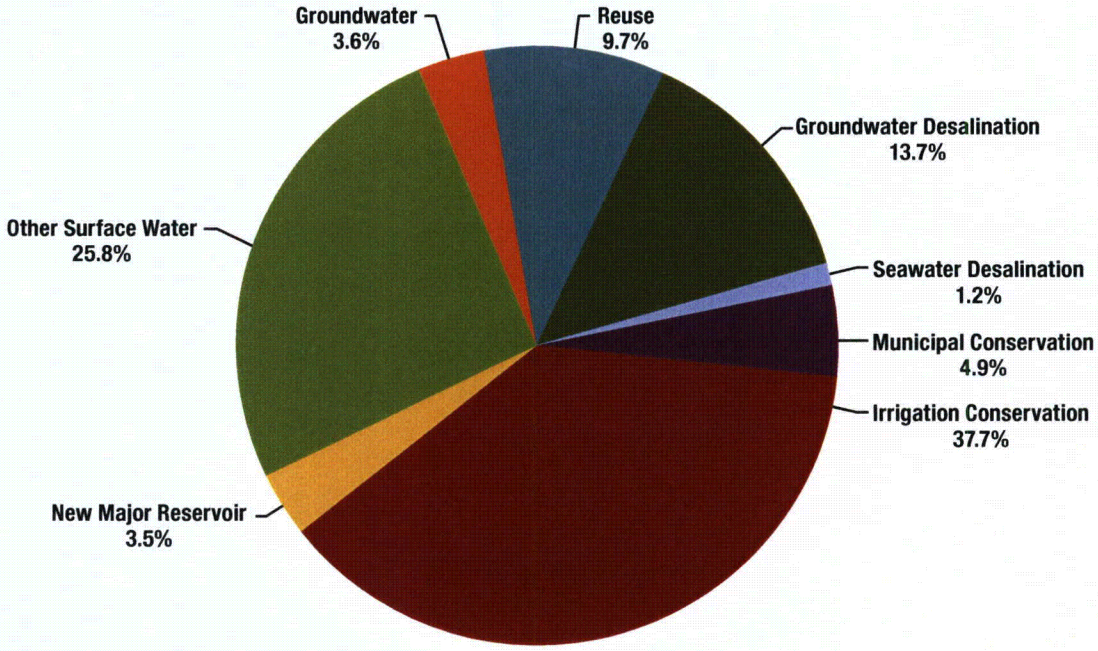
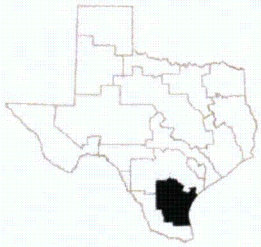


FIGURE M.4. 2060 RECOMMENDED WATER MANAGEMENT STRATEGIES–RELATIVE SHARE OF SUPPLY.



2 Summary of Coastal Bend (N) Region



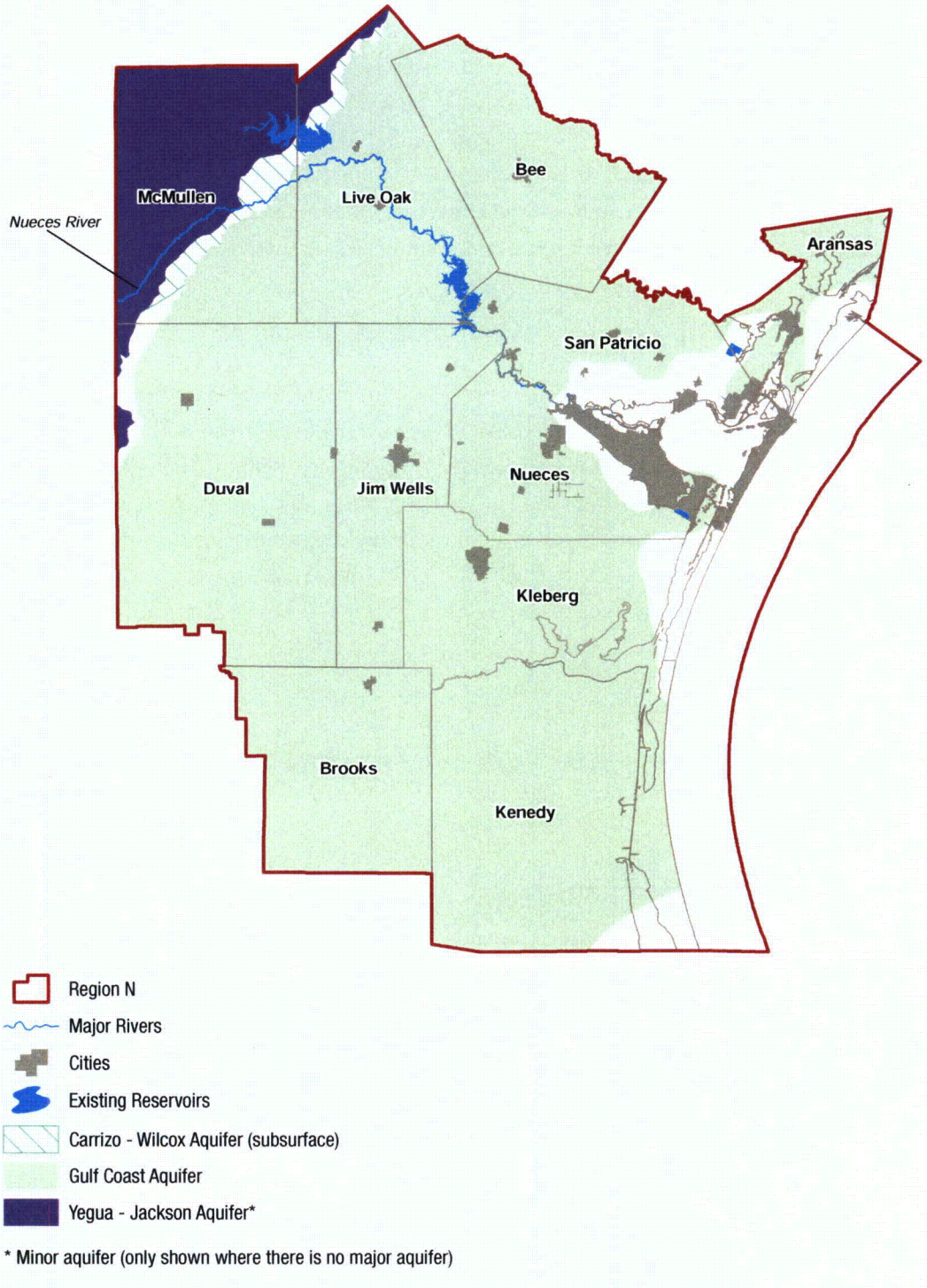
The Coastal Bend Regional Water Planning Area includes 11 counties, portions of the Nueces River Basin, and its adjoining coastal basins, including the Nueces Estuary.

The Coastal Bend Regional Water Planning Area includes 11 counties, portions of the Nueces River Basin, and its adjoining coastal basins, including the Nueces Estuary (Figure N.1). The region's largest economic sectors are service industries, retail trade, government, construction, manufacturing, and the petrochemical industry. Corpus Christi is the region's largest metropolitan area. The 2011 Coastal Bend (N) Regional Water Plan can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/3rdRound/2011_RWP/RegionN/.

PLAN HIGHLIGHTS

- Additional supply needed in 2060—75,744 acre-feet per year
- Recommended water management strategy volume in 2060—156,326 acre-feet per year
- Total capital cost—$656 million
- Conservation accounts for 5 percent of 2060 strategy volumes
- Two new major reservoirs (Lavaca Off-Channel, Nueces Off-Channel)
- Limited unmet mining needs

FIGURE N.1. COASTAL BEND (N) REGIONAL WATER PLANNING AREA.



POPULATION AND WATER DEMANDS

Approximately 3 percent of the state's total 2010 population resided in the Coastal Bend Region, and between 2010 and 2060 population is projected to increase by 44 percent to 885,665 (Table N.1). Ninety-three percent of this population growth is projected to occur in Nueces and San Patricio counties. By 2060, the total water demands for the region are projected to increase by 40 percent (Table N.1, Figure N.2). Municipal water use makes up the largest share of these demands in all decades and is projected to increase about 40 percent over the planning period. Rural municipal demand projections, represented by county-other, reflect a slight decrease as municipalities are anticipated to annex some of these rural areas. Manufacturing demands are also expected to grow significantly, increasing 38 percent. Though not the largest volumetric increase in the region, steam-electric demands are projected to increase 278 percent. Projected steam-electric demand increases are attributed to increased generating capacity in Nueces County.

EXISTING WATER SUPPLIES

Over three-fourths of the region's existing water supply is associated with surface water resources (Table N.1, Figure N.2). The majority of those supplies are provided by Nueces River Basin streamflows together with reservoirs in the Nueces River Basin and interbasin transfers from the Lavaca Region. The region relies on significant amounts of surface water transferred from the Lavaca River Basin. The two major (Gulf Coast and Carrizo-Wilcox) and two minor (Queen City and Sparta) aquifers provide groundwater to numerous areas within the region. As the primary groundwater source, the Gulf Coast Aquifer underlies at least a portion of every county in the region. Existing surface water supply is projected to increase as a result of future increases in existing water supply contracts from the Lake Corpus Christi-Choke Canyon Reservoir System.

NEEDS

The Coastal Bend Region faces water supply needs as early as 2010 in the event of drought (Table N.1, Figure N.2). Mining use accounts for approximately half of the 2010 needs (about 1,800 acre-feet). By the year 2060, the needs are dominated by manufacturing needs.

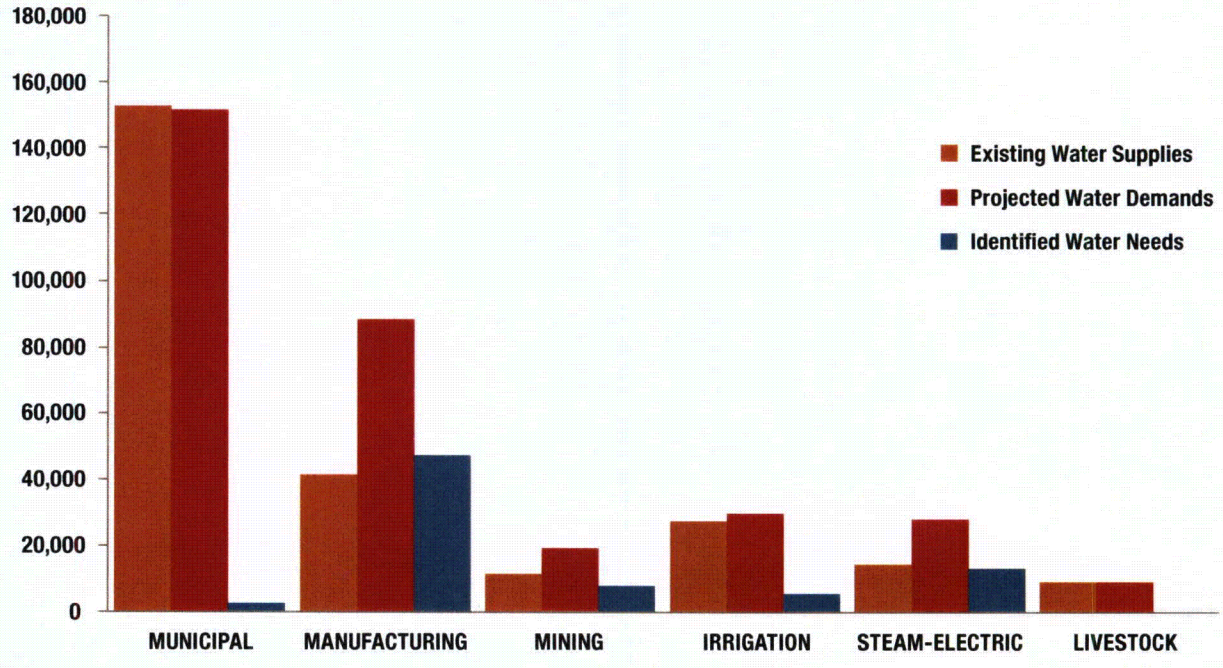
RECOMMENDED WATER MANAGEMENT STRATEGIES AND COST

The Coastal Bend Regional Water Planning Group recommended a variety of water management strategies to meet future needs including two proposed off-channel reservoirs, groundwater development, interbasin transfers of surface water from the Colorado River Basin, and conservation. Implementing all recommended strategies in the Coastal Bend plan would result in 156,326 acre-feet of additional water supplies in 2060 (Figures N.3 and N.4) at a total capital cost of $656.1 million (Appendix A). Implementation of these strategies would meet all projected water needs in the region except for 3,876 acre-feet of mining needs in 2060 that would be unmet because no feasible strategies were identified.

TABLE N.1. POPULATION, WATER SUPPLY, DEMAND, AND NEEDS 2010–2060

	2010	2020	2030	2040	2050	2060
Projected Population	617,143	693,940	758,427	810,650	853,964	885,665
Existing Supplies (acre-feet per year)						
Surface water	186,866	191,078	195,658	197,472	197,994	198,814
Groundwater	57,580	58,951	58,442	58,522	58,237	57,624
Total Water Supplies	**244,446**	**250,029**	**254,100**	**255,994**	**256,231**	**256,438**
Demands (acre-feet per year)						
Municipal	100,231	111,366	120,543	128,115	134,959	140,636
County-other	11,264	11,495	11,520	11,310	11,077	10,838
Manufacturing	63,820	69,255	73,861	78,371	82,283	88,122
Mining	15,150	16,524	16,640	17,490	18,347	19,114
Irrigation	25,884	26,152	26,671	27,433	28,450	29,726
Steam-electric	7,316	14,312	16,733	19,683	23,280	27,664
Livestock	8,838	8,838	8,838	8,838	8,838	8,838
Total Water Demands	**232,503**	**257,942**	**274,806**	**291,240**	**307,234**	**324,938**
Needs (acre-feet per year)						
Municipal	138	256	366	464	550	627
County-other	428	301	387	363	1,890	1,768
Manufacturing	409	7,980	15,859	25,181	34,686	46,905
Mining	1,802	2,996	4,471	6,166	6,897	7,584
Irrigation	627	569	1,264	2,316	3,784	5,677
Steam-electric	0	1,982	4,755	7,459	10,187	13,183
Total Water Needs	**3,404**	**14,084**	**27,102**	**41,949**	**57,994**	**75,744**

FIGURE N.2. 2060 COASTAL BEND (N) EXISTING SUPPLIES, PROJECTED DEMANDS, AND IDENTIFIED WATER NEEDS BY WATER USE CATEGORY (ACRE-FEET PER YEAR).



CONSERVATION RECOMMENDATIONS

Conservation strategies represent approximately 5 percent of the total amount of water that would be provided by all recommended water management strategies in 2060. Conservation strategies were recommended for municipal, irrigation, manufacturing, and mining water users. The Coastal Bend Region recommended that water user groups with and without shortages that exceed 165 gallons per capita per day should reduce consumption by 15 percent by 2060.

SELECT MAJOR WATER MANAGEMENT STRATEGIES

- O.N. Stevens Water Treatment Plant Improvements would provide up to 42,329 acre-feet per year of surface water starting in 2010 with a capital cost of $31 million.
- Garwood Pipeline would provide 35,000 acre-feet per year of surface water starting in 2020 with a capital cost of $113 million.
- Off–Channel Reservoir near Lake Corpus Christi would provide 30,340 acre-feet per year of water starting in the year 2030 with a capital cost of $301 million
- Construction of Lavaca River Off-Channel Diversion and Off-Chanel Reservoir Project would provide 16,242 acre-feet per year of water to Region N in 2060 with a capital cost of $139 million for Region N's portion of total project costs.

REGION-SPECIFIC STUDIES

The Regional Water Planning Group developed five region-specific studies during the initial phase of the third planning cycle. The final reports documenting the findings can be found on the TWDB Web-site at https://www.twdb.state.tx.us/wrpi/rwp/rwp_study.asp#n.

- Evaluation of Additional Potential Regional Water Supplies for Delivery through the Mary Rhodes Pipeline, Including Gulf Coast Groundwater and Garwood Project
- Optimization and Implementation Studies for Off-Channel Reservoir
- Implementation Analyses for Pipeline from Choke Canyon Reservoir to Lake Corpus Christi, Including Channel Loss Study Downstream of Choke Canyon Reservoir
- Water Quality Modeling of Regional Water Supply System to Enhance Water Quality and Improve Industrial Water Conservation
- Region-Specific Water Conservation Best Management Practices

COASTAL BEND PLANNING GROUP MEMBERS AND INTERESTS REPRESENTED

Voting members during adoption of the 2011 Regional Water Plan:

Carola Serrato (Co-Chair) water utilities; Scott Bledsoe, III (Co-Chair), water districts; Tom Ballou, industries; Chuck Burns, agriculture; Teresa Carrillo, environmental; Billy Dick, municipalities; Lavoyger Durham, counties; Gary Eddins, electric generating utilities; Pancho Hubert, small business; Pearson Knolle, small business; Robert Kunkel, industries; Bernard Paulson, other; Thomas Reding, Jr., river authorities; Charles Ring, agriculture; Mark Scott, municipalities; Kimberly Stockseth, public ; Bill Stockton, counties

Former voting members during the 2006 – 2011 planning cycle:

Bill Beck, electric generating utilities; Patrick Hubert, small business; Josephine Miller, counties; Bobby Nedbalek, agriculture

FIGURE N.3. RECOMMENDED WATER MANAGEMENT STRATEGY WATER SUPPLY VOLUMES FOR 2010–2060 (ACRE-FEET PER YEAR).

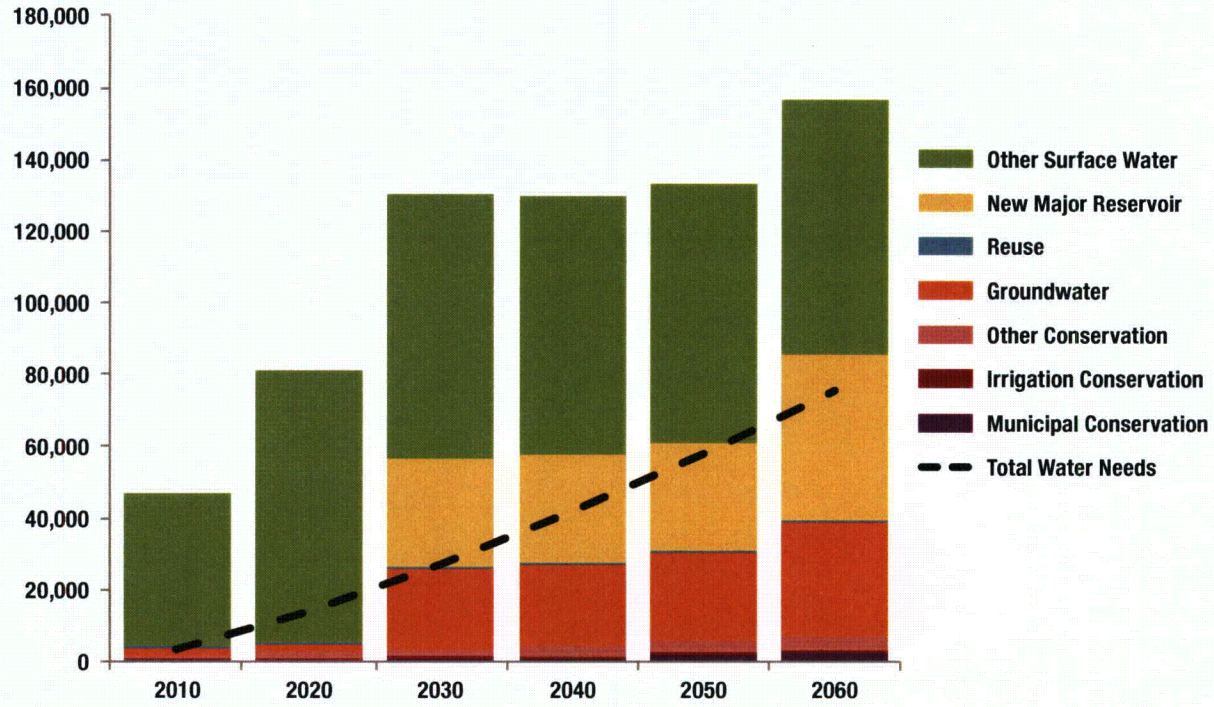
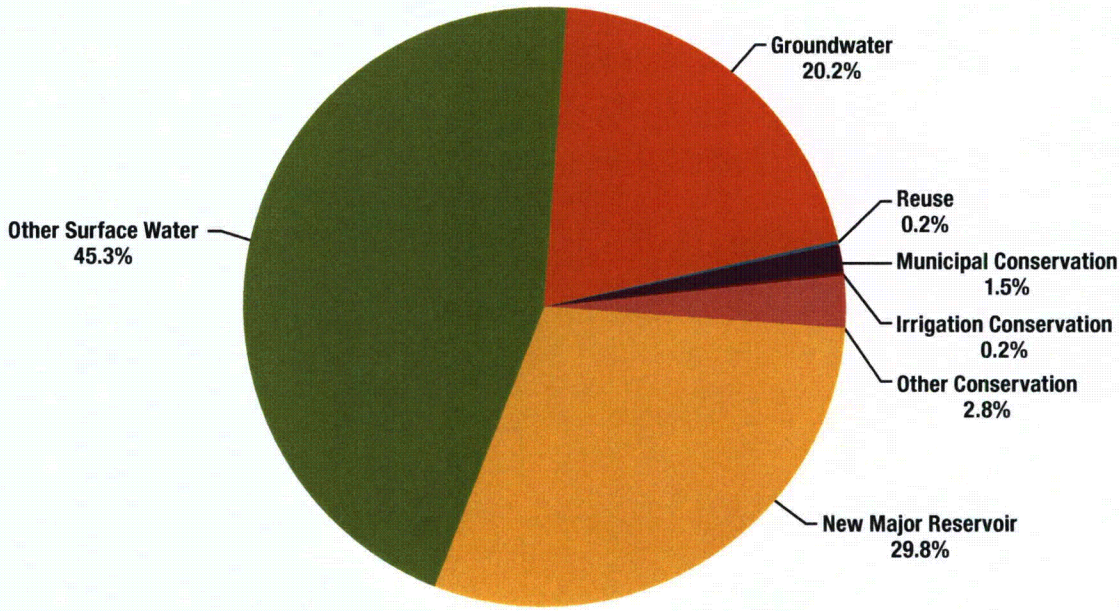
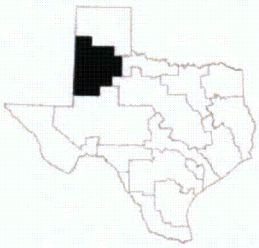


FIGURE N.4. 2060 RECOMMENDED WATER MANAGEMENT STRATEGIES–RELATIVE SHARE OF SUPPLY.



2 Summary of Llano Estacado (O) Region



The Llano Estacado Regional Water Planning Area encompasses 21 counties in the southern High Plains of Texas.

The Llano Estacado Regional Water Planning Area encompasses 21 counties in the southern High Plains of Texas (Figure O.1). The region lies within the upstream parts of four major river basins (Canadian, Red, Brazos, and Colorado). Groundwater from the Ogallala Aquifer is the region's primary source of water and is used at a rate that exceeds recharge. The largest economic sectors in the region are livestock and crop operations, producing about 60 percent of the state's total cotton crop. Major cities in the region include Lubbock, Plainview, Levelland, Lamesa, Hereford, and Brownfield. The 2011 Region O Regional Water Plan can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/3rdRound/2011_RWP/RegionO/.

PLAN HIGHLIGHTS

- Additional supply needed in 2060—2,366,036 acre-feet per year
- Recommended water management strategy volume in 2060—395,957 acre-feet per year
- Total capital cost—$1.1 billion
- Conservation accounts for 74 percent of 2060 strategy volumes
- Two new major reservoirs (Jim Bertram Lake 07, Post)
- Significant unmet irrigation and livestock needs

FIGURE 0.1. LLANO ESTACADO (0) REGIONAL WATER PLANNING AREA.

POPULATION AND WATER DEMANDS

Approximately 2 percent of the state's total population resided in the Llano Estacado Region in 2010, and by the year 2060 is projected to increase 12 percent (Table O.1). The region's water demands, however, will decrease. By 2060, the total water demands for the region are projected to decrease 15 percent because of declining irrigation water demands (Table O.1). Irrigation demand is projected to decline 17 percent by 2060 due to declining well yields and increased irrigation efficiencies. Municipal water use, however, increases 7 percent by 2060 (Table O.1, Figure O.2).

EXISTING WATER SUPPLIES

The Llano Estacado Planning Region depends primarily upon groundwater from the Ogallala Aquifer, with 97 percent of the region's supply in 2010 coming from this source. Approximately 94 percent of the water obtained from the aquifer is used for irrigation purposes. Other aquifers in the region (Seymour, Dockum, and Edwards-Trinity [High Plains]) constitute less than 1 percent of the supply. Surface water is supplied by White River Lake and Lake Meredith. Of these reservoirs, Lake Meredith, operated by the Canadian River Municipal Water Authority in the Panhandle Region, is the largest contributor. By 2060, the total surface water and groundwater supply is projected to decline 56 percent (Table O.1, Figure O.2). This projected decline in water supply is due to the managed depletion of the Ogallala Aquifer.

NEEDS

During times of drought, increased demands require pumping that exceeds the capacity of the Ogallala Aquifer, resulting in water needs occurring across the region as early as 2010. The needs for the Llano Estacado Region are projected to increase 86 percent by 2060 (Table O.1, Figure O.2). The plan identifies needs for irrigation of 1,264,707 acre-feet in 2010 and 2,318,004 acre-feet in 2060. Municipal needs also increase significantly, to 30,458 acre-feet in 2060.

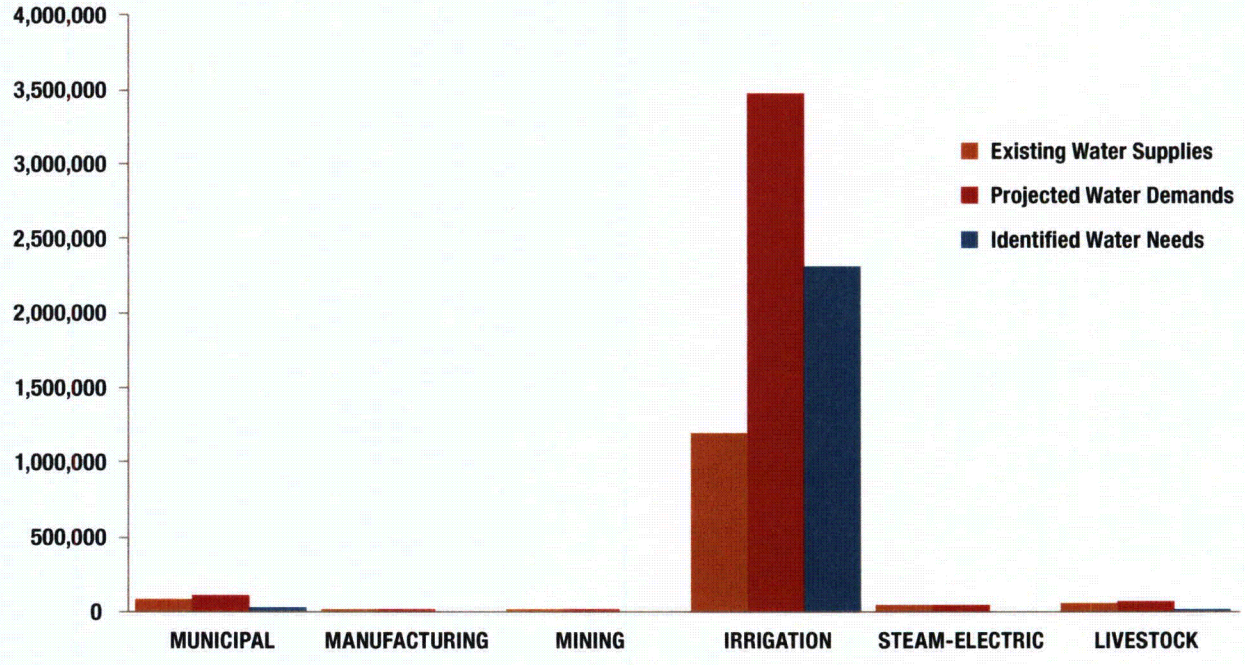
RECOMMENDED WATER MANAGEMENT STRATEGIES AND COST

The Llano Estacado Planning Group recommended a variety of water management strategies, providing 395,957 acre-feet of additional water supply by the year 2060 (Figures O.3 and O.4) at a total capital cost of $1.1 billion (Appendix A). The primary recommended water management strategy for the region is irrigation water conservation, which generates 72 percent of the volume of water from strategies in 2060, based on approximately 786,000 acres of irrigated crop land that did not have efficient irrigation systems. Unmet irrigation needs (2,043,247 acre-feet) remain in 21 counties in the region in 2060, because there were no economically feasible strategies identified to meet their needs.

TABLE 0.1. POPULATION, WATER SUPPLY, DEMAND, AND NEEDS 2010–2060

	2010	2020	2030	2040	2050	2060
Projected Population	492,627	521,930	540,908	552,188	553,691	551,758
Existing Supplies (acre-feet per year)						
Surface water	28,261	33,707	33,590	33,490	32,096	32,042
Groundwater	3,076,297	2,454,665	1,966,463	1,577,083	1,412,889	1,337,017
Reuse	51,514	35,071	35,822	36,737	37,853	39,213
Total Water Supplies	**3,156,072**	**2,523,443**	**2,035,875**	**1,647,310**	**1,482,838**	**1,408,272**
Demands (acre-feet per year)						
Municipal	87,488	91,053	92,823	93,459	93,458	93,935
County-other	11,949	12,420	12,652	12,583	12,399	12,005
Manufacturing	15,698	16,669	17,460	18,216	18,865	19,919
Mining	16,324	10,280	6,359	2,852	728	258
Irrigation	4,186,018	4,024,942	3,882,780	3,740,678	3,604,568	3,474,163
Steam-electric	25,645	25,821	30,188	35,511	42,000	49,910
Livestock	51,296	57,740	61,372	65,277	69,466	73,965
Total Water Demands	**4,394,418**	**4,238,925**	**4,103,634**	**3,968,576**	**3,841,484**	**3,724,155**
Needs (acre-feet per year)						
Municipal	10,349	14,247	20,116	23,771	28,489	30,458
Irrigation	1,264,707	1,735,399	2,084,569	2,331,719	2,361,813	2,318,004
Livestock	1	763	3,191	9,506	14,708	17,574
Total Water Needs	**1,275,057**	**1,750,409**	**2,107,876**	**2,364,996**	**2,405,010**	**2,366,036**

FIGURE 0.2. 2060 LLANO ESTACADO (0) EXISTING SUPPLIES, PROJECTED DEMANDS, AND IDENTIFIED WATER NEEDS BY WATER USE CATEGORY (ACRE-FEET PER YEAR).



CONSERVATION RECOMMENDATIONS

Conservation strategies represent 74 percent of the total volume of water associated with all recommended water management strategies in 2060. Water conservation was recommended for every municipal water user group that had both a need and a water use greater than 172 gallons per capita per day (the regional average).

SELECT MAJOR WATER MANAGEMENT STRATEGIES

- Irrigation Water Conservation would provide up to 479,466 acre-feet per year of water in 2010 with a capital cost of $346 million.
- Lake Alan Henry Pipeline for the City of Lubbock would provide 21,880 acre-feet per year of water starting in 2010 with a capital cost of $294 million.
- Post Reservoir would provide 25,720 acre-feet per year of water starting in 2030 with a capital cost of $110 million.

REGION-SPECIFIC STUDIES

The Llano Estacado Regional Water Planning Group developed three region-specific studies during the initial phase of the third planning cycle. The final reports documenting the findings can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/rwp_study.asp#o.

- Estimates of Population and Water Demands for New Ethanol and Expanding Dairies
- Evaluation of Water Supplies and Desalination Costs of Dockum Aquifer Water
- Video Conferencing Facilities Available for Coordination between Region A and O

LLANO ESTACADO PLANNING GROUP MEMBERS AND INTERESTS REPRESENTED

Voting members during adoption of the 2011 Regional Water Plan:

Harold P. "Bo" Brown, (Chair), agriculture; Melanie Barnes, public; Delaine Baucum, agriculture; Alan Bayer, counties; Bruce Blalack, municipalities; Jim Conkwright, water districts; Delmon Ellison, Jr., agriculture; Harvey Everheart, water districts; Bill Harbin, electric generating utilities; Doug Hutcheson, water utilities ; Bob Josserand, municipalities; Mark Kirkpatrick, agriculture; Richard Leonard, agriculture; Michael McClendon, river authorities; Don McElroy, small business; E.W. (Gene) Montgomery, industries; Ken Rainwater, public; Kent Satterwhite, river authorities; Aubrey Spear, municipalities; Jim Steiert, environmental; John Taylor, municipalities

Former voting members during the 2006 – 2011 planning cycle:

Tom Adams, municipalities; Jim Barron, counties; Don Ethridge, agriculture; Wayne Collins, municipalities; Terry Lopas, river authorities; Jared Miller, municipalities

FIGURE 0.3. RECOMMENDED WATER MANAGEMENT STRATEGY WATER SUPPLY VOLUMES FOR 2010–2060 (ACRE-FEET PER YEAR).

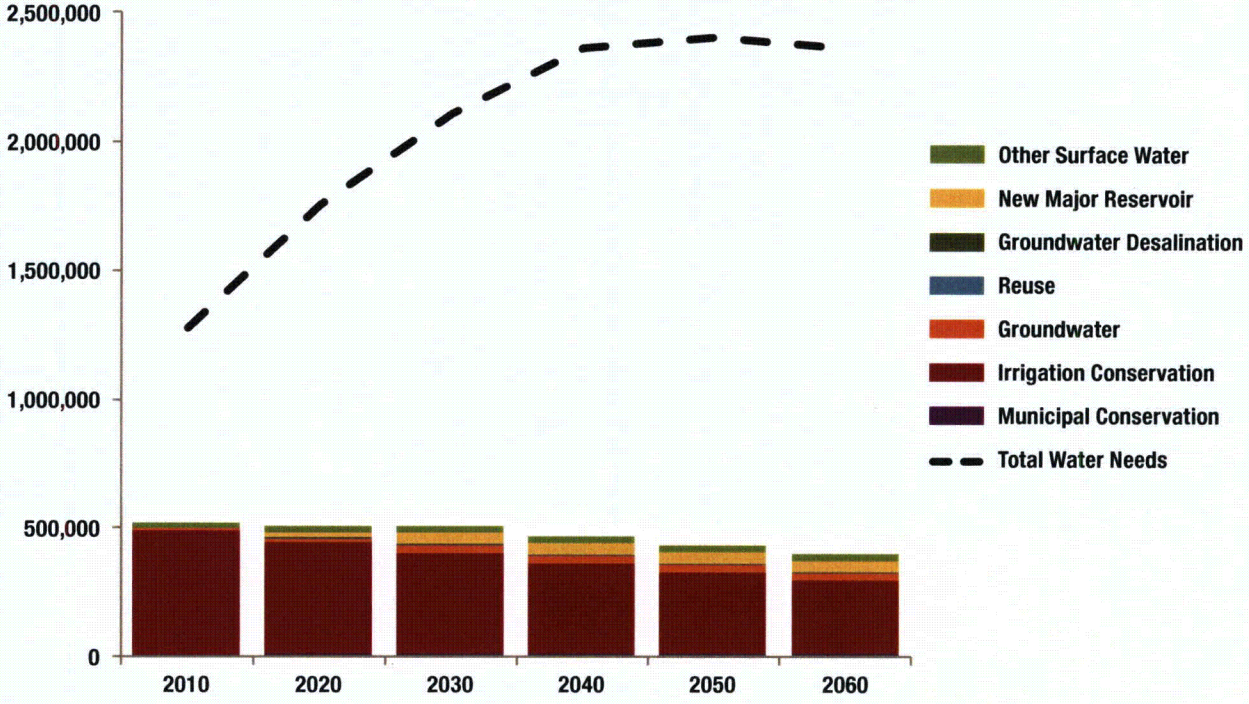
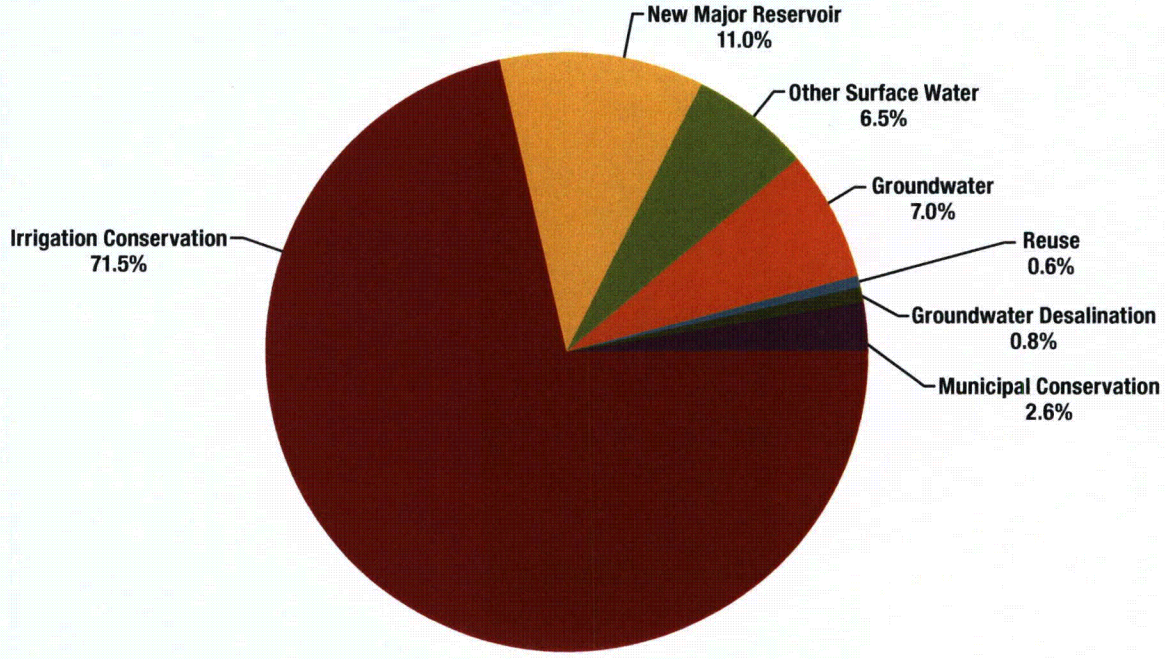
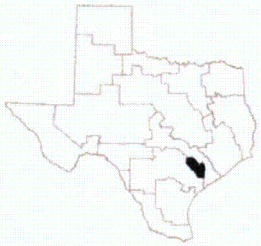


FIGURE 0.4. 2060 RECOMMENDED WATER MANAGEMENT STRATEGIES–RELATIVE SHARE OF SUPPLY.



2 Summary of Lavaca (P) Region



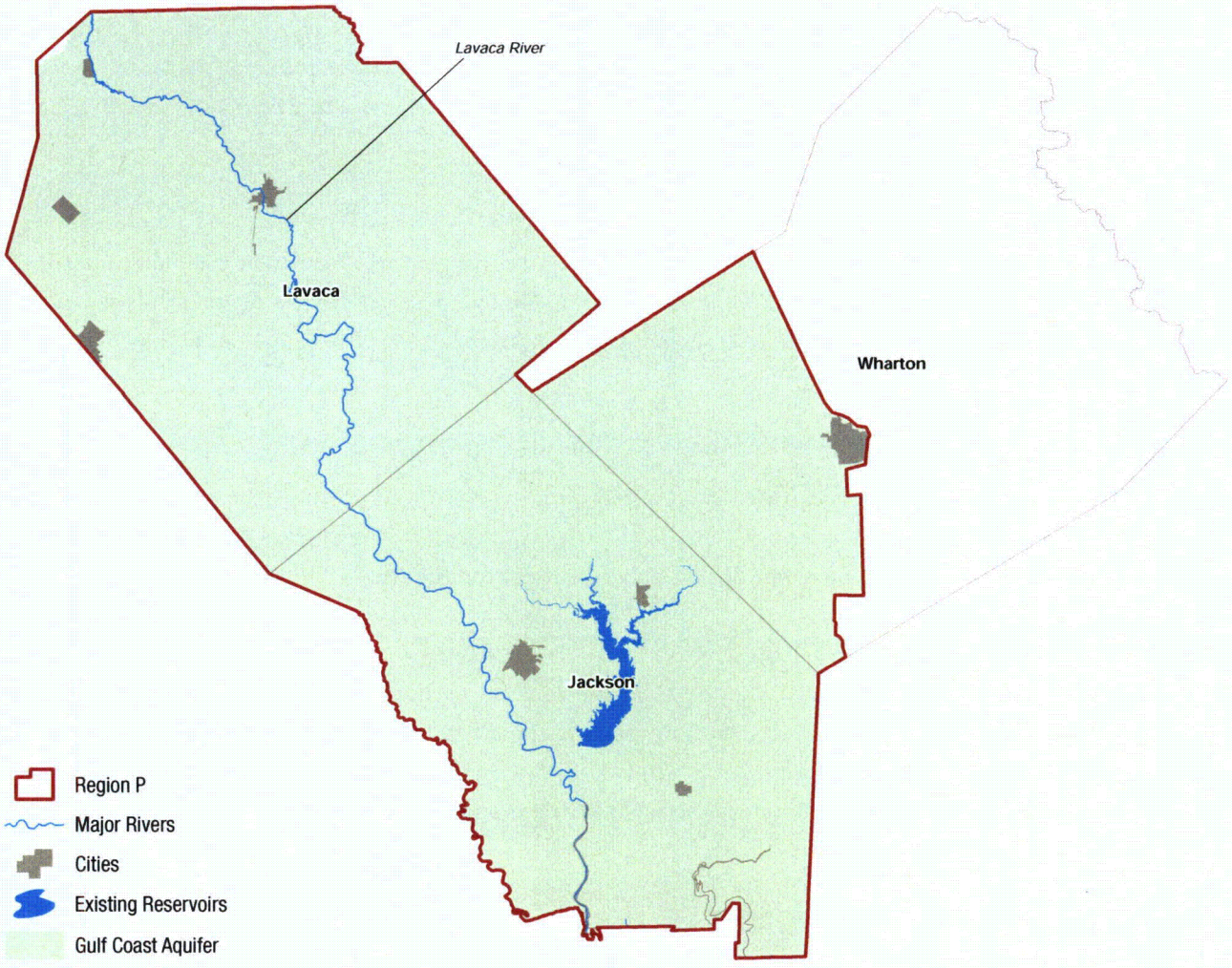
The Lavaca Regional Water Planning Area is composed of Jackson and Lavaca counties and Precinct Three of Wharton County, including the entire City of El Campo.

The Lavaca Regional Water Planning Area is composed of Jackson and Lavaca counties and Precinct Three of Wharton County, including the entire City of El Campo (Figure P.1). Other cities in the region include Edna, Yoakum, and Hallettsville. Most of the region lies in the Lavaca River Basin, with the Lavaca and Navidad Rivers being its primary source of surface water. Groundwater from the Gulf Coast Aquifer supplies most of the water for the planning area. The largest economic sector in the region is agribusiness, while manufacturing, oil and gas production, and mineral production also contribute to the region's economy. The 2011 Lavaca (P) Regional Water Plan can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/3rdRound/2011_RWP/RegionP/.

PLAN HIGHLIGHTS

- Additional supply needed in 2060—67,739 acre-feet per year
- Recommended water management strategy volume in 2060—67,739 acre-feet per year
- Total capital cost—none

FIGURE P.1. LAVACA REGIONAL WATER PLANNING AREA.



POPULATION AND WATER DEMANDS

In 2010, less than 1 percent of the state's total population resided in the Lavaca Region, and between 2010 and 2060, population is projected to increase by less than 1 percent (Table P.1). The region's total water demand is projected to increase by less than 1 percent, and agricultural irrigation demand will remain constant (Table P.1). By the year 2060, municipal demand is expected to increase by 5 percent and manufacturing demand is expected to increase by 31 percent, while county-other demands are expected to decrease by 24 percent (Table P.1, Figure P.2).

EXISTING WATER SUPPLIES

The region relies on the Gulf Coast Aquifer for groundwater supply, which is 99 percent of the total water supply in 2010. The principal surface water supply is Lake Texana, the only reservoir in the region. The total surface water and groundwater supply is projected to remain constant from 2010 to 2060 at 164,148 acre-feet (Table P.1, Figure P.2).

NEEDS

Irrigation is the only water use sector in the Lavaca Region anticipated to need additional water over the planning horizon (Table P.1, Figure P.2.). In each decade, 67,739 acre-feet of additional water is expected to be needed, when surface water supplies become unavailable due to drought conditions.

RECOMMENDED WATER MANAGEMENT STRATEGIES AND COST

The Lavaca Planning Group analyzed various strategies to meet needs, but the only one determined to be economically feasible was temporarily overdrafting the Gulf Coast Aquifer to provide additional irrigation water during drought. This strategy produces 67,739 acre-feet of water which is sufficient to meet the region's needs (Figures P.3 and P.4). There is no capital cost associated with this strategy because all necessary infrastructure is assumed to already be in place (Appendix A).

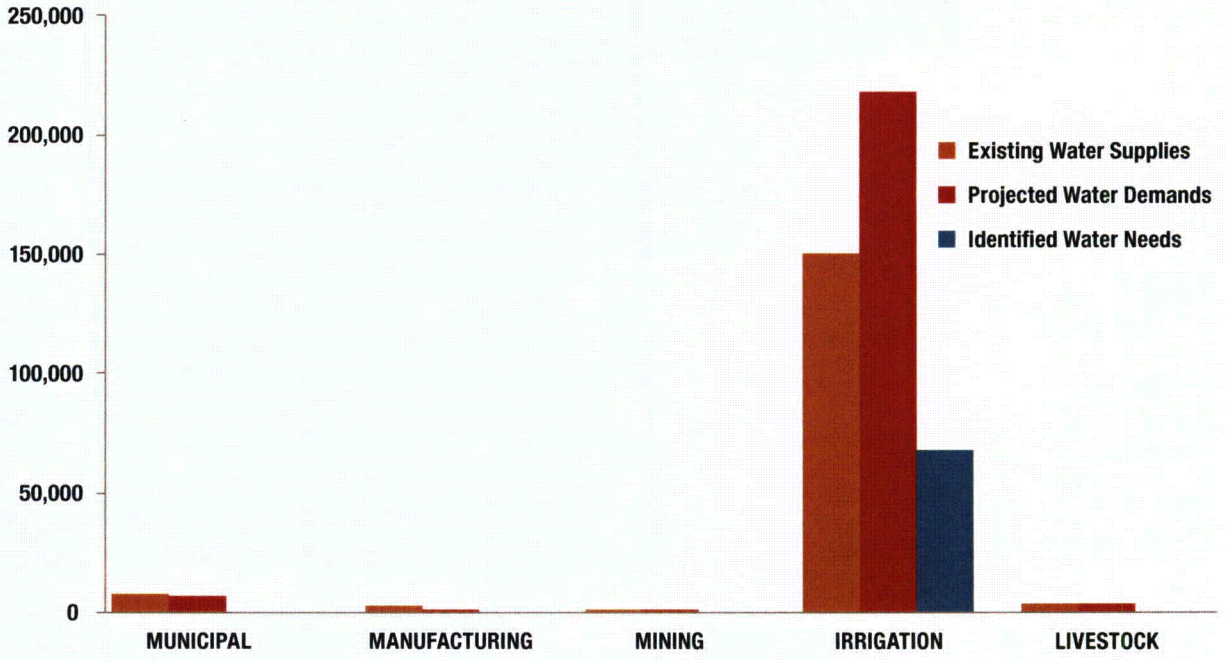
CONSERVATION RECOMMENDATIONS

Water conservation was not recommended as a strategy because it was not the most cost-effective method to meet irrigation needs, which are the only needs in the region. Since there were no municipal needs, no municipal conservation was recommended. However, the planning group did recommend that all municipal water user groups implement water conservation measures. The Lavaca Planning Group also recommended continued agricultural water conservation practices as one of its policy recommendations. The region supports state and federal programs that provide financial and technical assistance to agricultural producers and result in increased irrigation efficiency and overall water conservation.

TABLE P.1. POPULATION, WATER SUPPLY, DEMAND, AND NEEDS 2010–2060

	2010	2020	2030	2040	2050	2060
Projected Population	49,491	51,419	52,138	51,940	51,044	49,663
Existing Supplies (acre-feet per year)						
Surface water	1,832	1,832	1,832	1,832	1,832	1,832
Groundwater	162,316	162,316	162,316	162,316	162,316	162,316
Total Water Supplies	**164,148**	**164,148**	**164,148**	**164,148**	**164,148**	**164,148**
Demands (acre-feet per year)						
Municipal	4,841	4,927	4,975	4,996	5,032	5,092
County-other	2,374	2,378	2,283	2,119	1,957	1,800
Manufacturing	1,089	1,162	1,223	1,281	1,331	1,425
Mining	164	172	177	182	188	192
Irrigation	217,846	217,846	217,846	217,846	217,846	217,846
Livestock	3,499	3,499	3,499	3,499	3,499	3,499
Total Water Demands	**229,813**	**229,984**	**230,003**	**229,923**	**229,853**	**229,854**
Needs (acre-feet per year)						
Irrigation	67,739	67,739	67,739	67,739	67,739	67,739
Total Water Needs	**67,739**	**67,739**	**67,739**	**67,739**	**67,739**	**67,739**

FIGURE P.2. 2060 LAVACA (P) EXISTING SUPPLIES, PROJECTED DEMANDS, AND IDENTIFIED WATER NEEDS BY WATER USE CATEGORY (ACRE-FEET PER YEAR).



SELECT MAJOR WATER MANAGEMENT STRATEGIES

- Conjunctive Use of Groundwater (temporary overdraft) will provide 67,739 acre-feet of water starting in the year 2010 with no capital cost determined since it was assumed that all infrastructure was already in place.

REGION-SPECIFIC STUDY

The Lavaca Regional Water Planning Group developed a region-specific study during the initial phase of the third planning cycle. The final report documenting the findings can be found on the TWDB Web site at https://www.twdb.state.tx.us/wrpi/rwp/rwp_study.asp#p.

- Agricultural Water Demands Analysis

LAVACA PLANNING GROUP MEMBERS AND INTERESTS REPRESENTED

Voting members during adoption of the 2011 Regional Water Plan:

Harrison Stafford, II (Chair), counties; Calvin Bonzer, small business; Tommy Brandenberger, industries; Patrick Brzozowski, river authorities; John Butschek, municipalities; Gerald Clark, agriculture; Roy Griffin, electric generating utilities; Lester Little, agriculture; Jack Maloney, municipalities; Phillip Miller, counties; Richard Otis, industries; Edward Pustka, public; L.G. Raun, agriculture; Dean Schmidt, agriculture; Robert Shoemate, environmental; Michael Skalicky, water districts; David Wagner, counties; Larry Waits, agriculture; Ed Weinheimer, small business

Former voting members during the 2006 – 2011 planning cycle:

Pat Hertz, water utilities; Judge Ronald Leck, counties; Paul Morkovsky, industries; Wayne Popp, water districts; Dean Schmidt, agriculture; Bob Weiss, public

FIGURE P.3. RECOMMENDED WATER MANAGEMENT STRATEGY WATER SUPPLY VOLUMES FOR 2010–2060 (ACRE-FEET PER YEAR).

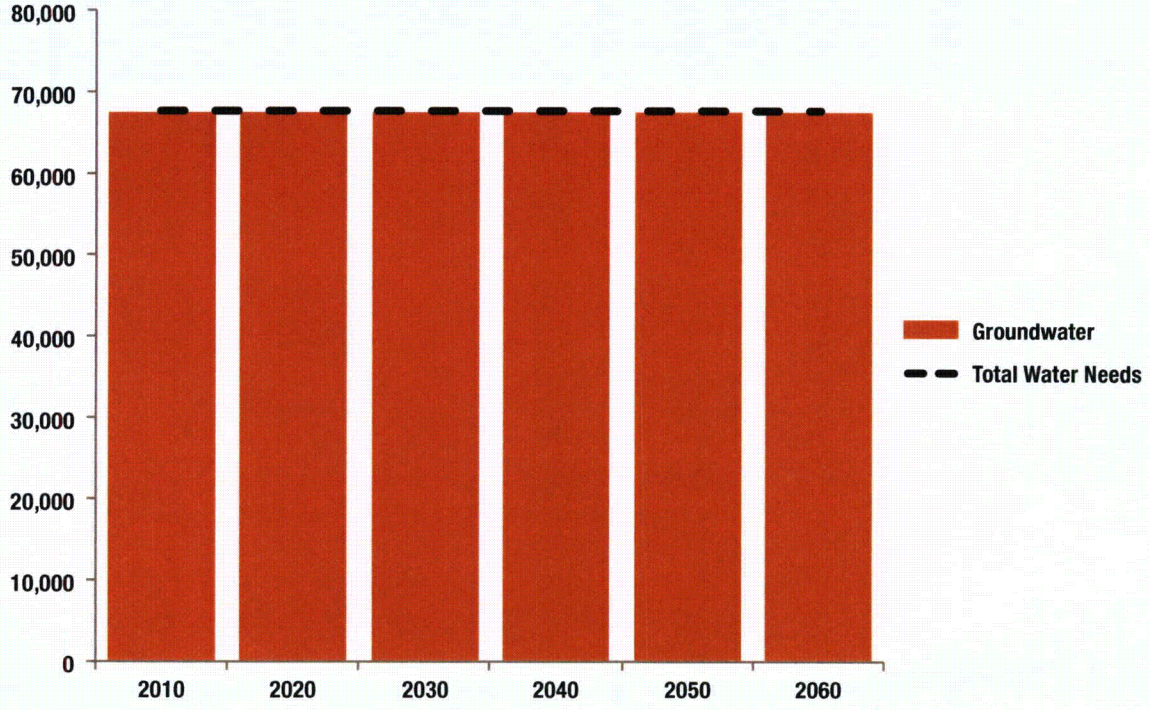


FIGURE P.4. 2060 RECOMMENDED WATER MANAGEMENT STRATEGIES–RELATIVE SHARE OF SUPPLY.