7

Water supply needs

Quick facts

If no additional water supplies are developed, water users face a potential water shortage of 4.8 million acre-feet per year in 2020 and 8.9 million acre-feet per year in 2070 in the event of a repeat of the drought of record.

Without additional supplies, approximately one-third of Texas' population would have less than half of the municipal water supplies they will require in 2070.

Municipal water users may face water shortages over six times greater in 2070 (approximately 3.4 million acre-feet) than in 2020 (approximately 511,000 acre-feet).

Without additional water supplies, the annual economic losses resulting from water shortages would range from approximately $73 billion in 2020 to $151 billion in 2070.

When the existing water supply is less than the projected demand (the total water required to support regular economic and domestic activities), there is the potential for a water shortage. The TWDB refers to this potential shortage as a water need.

Water shortages pose enormous risks to the Texas economy and the public's health and safety. The perception of a lack of water can bias decision makers against expanding to or starting their businesses in Texas. Water shortages resulting from inadequate planning and implementation can also strain those state water resources that have already been developed as water supplies.

To determine if our existing water supply is adequate to support the demands of Texas' rapidly growing population, expanding economy, and vital natural resources, the regional water planning groups compared projected water demand to existing water supply. More than 15,000 comparisons revealed where and when to expect either a water supply surplus or potential shortage in a repeat of the drought of record based on existing supplies.

Once planning groups have identified water needs (potential shortages), they recommend water management strategies and associated projects, such as conservation, groundwater wells, or new reservoirs (Chapter 8), to meet the water supply needs. The discussion in this chapter, however, focuses on the total needs and does not assume that any of the water management strategies are implemented.

Planning groups also reported the economic and social impacts of not implementing water management strategies and summarized specific water needs that, unfortunately, cannot feasibly be met during drought of record conditions.

7.1 Identification of water needs

The state water plan identifies water needs for all water use categories and water user groups for each decade over the next 50 years. While the existing water supply may, in aggregate, appear sufficient to meet the water needs of an entire region, it is not distributed evenly across each region. Therefore, some areas may experience shortages while others have ample supplies. In these situations, water needs may be met by implementing water management strategies such as the transfer of surplus water supplies from one water provider to another.

In 2020, Texas faces a potential water shortage of 4.8 million acre-feet in a drought of record. In 2070, that number grows by approximately 87 percent to 8.9 million acre-feet (Table 7.1). These needs vary considerably by water use category (Figure 7.1).

Table 7.1 - Annual water needs by water use category (acre-feet)

Category	2020	2030	2040	2050	2060	2070	Percent change
Irrigation	3,522,000	3,582,000	3,655,000	3,610,000	3,530,000	3,603,000	2
Municipal	511,000	1,058,000	1,575,000	2,119,000	2,742,000	3,413,000	568
Manufacturing	394,000	550,000	637,000	733,000	825,000	953,000	142
Steam-electric	199,000	294,000	356,000	469,000	601,000	769,000	287
Mining	116,000	128,000	119,000	113,000	113,000	122,000	5
Livestock	18,000	22,000	22,000	28,000	32,000	32,000	74
Texas[a]	**4,760,000**	**5,634,000**	**6,364,000**	**7,072,000**	**7,843,000**	**8,892,000**	**87**

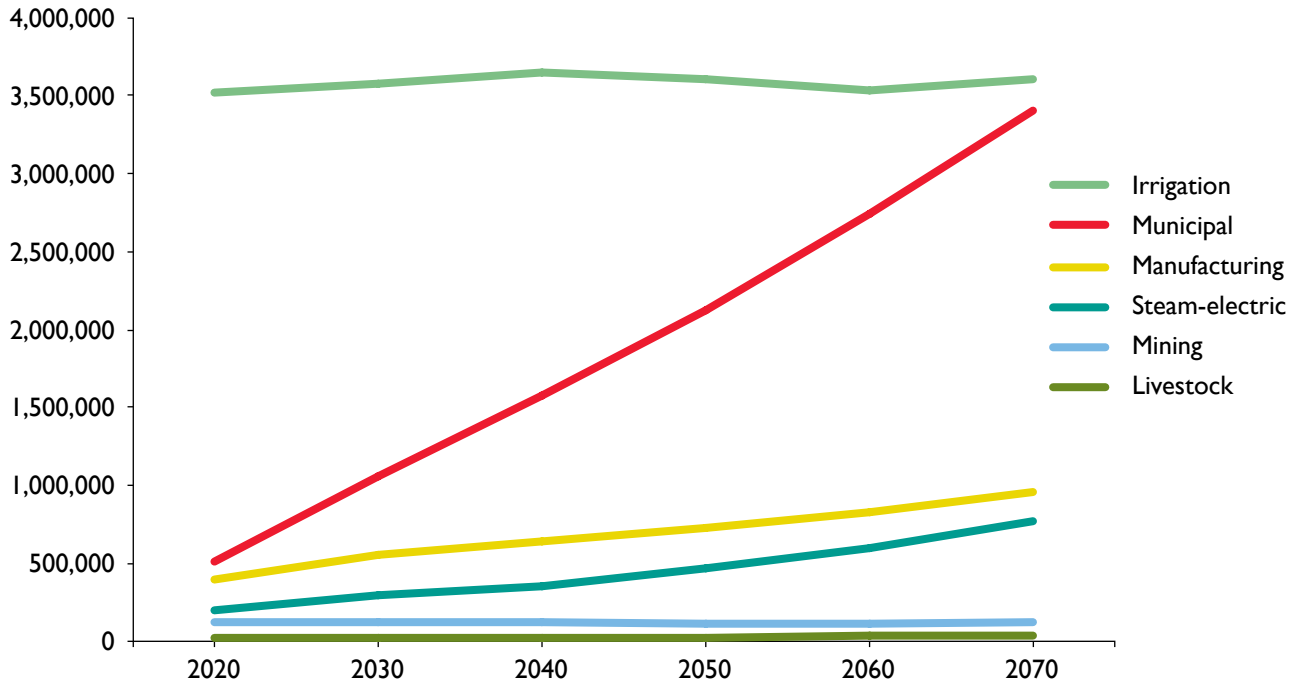
[a] *Statewide totals may vary between tables due to rounding.*

Although all 16 regions face water needs in all planning decades, the magnitude of needs varies significantly between regional water planning areas (Table 7.2). Region C faces the greatest rate of increase with nearly a 10-fold increase in needs between 2020 and 2070, whereas Region P anticipates no increase in its water needs over the planning horizon.

7.2 Municipal needs

Municipal water users face the greatest increase in water needs, from approximately 11 percent of all state water needs in 2020 to 38 percent in 2070 (Table 7.1). Except for Region P, each region faces potential municipal water shortages for the next 50 years. Municipal water needs are second only to irrigation needs in all decades.

Figure 7.1 - Annual water needs by water use category (acre-feet)



In 2020, Region H has the highest annual municipal needs (142,000 acre-feet) and in 2070, Region C has the highest (more than 1.2 million acre-feet) (Appendix C.1). In 2070, municipal needs would vary widely across the state, with 11 counties facing municipal water needs of more than 100,000 acre-feet (Figure 7.2).

Texas' population faces varying degrees of potential municipal water shortages over the next 50 years (Figure 7.3), with the severity of shortages ranging widely among individual water users. If no recommended municipal water management strategies were implemented by the onset of another drought of record,

- approximately 82 percent (41.6 million) of all Texans in 2070 would face at least a 10 percent water shortage in their cities and residences,
- approximately 34 percent (17.2 million) of all Texans in 2070 would have less than half of the municipal water supplies they require, and
- the estimated population who might have less than 10 percent of the water supplies they require grows from more than 100,000 in 2020 to more than half a million in 2070.

7.3 Non-municipal needs

From 2020 to 2070, of the non-municipal water use categories, irrigation has the most water needs statewide and livestock has the least (Appendix C.1).

Irrigation water needs remain above 3.5 million acre-feet per year, continuing to exceed all other water use categories from 2020 through 2070. The vast majority of irrigation water needs are in Region O.

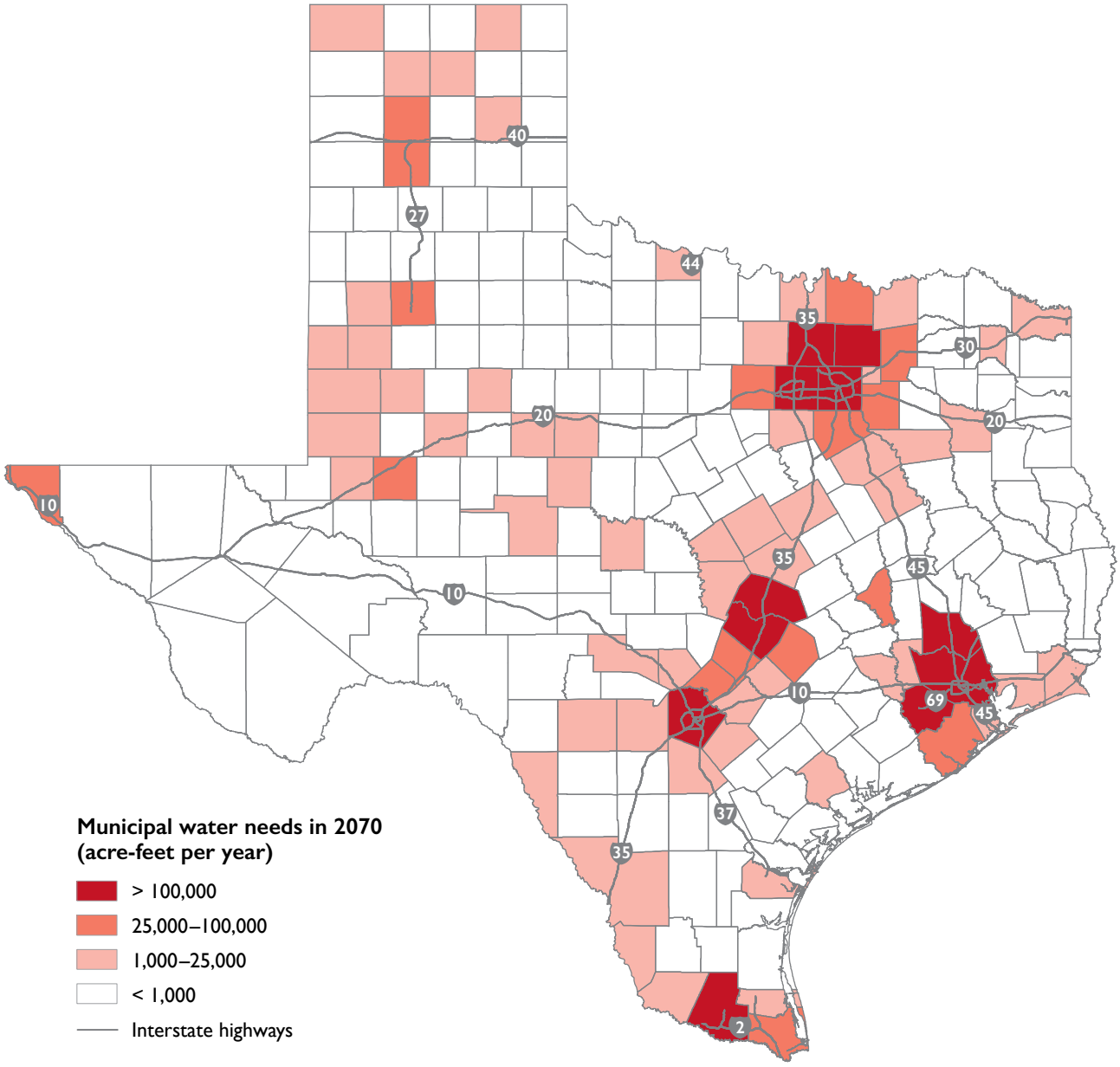
Manufacturing water needs are greatest in Region I and reach a statewide maximum of 953,000 acre-feet per year in 2070.

Table 7.2 - Annual water needs by region (acre-feet)

Region	2020	2030	2040	2050	2060	2070	Percent change
A	171,000	216,000	241,000	247,000	250,000	253,000	48
B	35,000	36,000	38,000	41,000	45,000	49,000	41
C	125,000	367,000	604,000	834,000	1,086,000	1,356,000	985
D	150,000	177,000	215,000	254,000	308,000	411,000	173
E	189,000	189,000	182,000	189,000	200,000	212,000	12
F	183,000	194,000	201,000	211,000	224,000	237,000	29
G	235,000	291,000	344,000	419,000	486,000	566,000	140
H	347,000	555,000	699,000	846,000	984,000	1,162,000	235
I	237,000	336,000	367,000	405,000	455,000	508,000	114
J	4,000	4,000	4,000	4,000	5,000	5,000	20
K	374,000	384,000	387,000	400,000	450,000	512,000	37
L	200,000	256,000	297,000	356,000	425,000	483,000	141
M	717,000	709,000	708,000	717,000	729,000	797,000	11
N	11,000	14,000	16,000	18,000	34,000	51,000	371
O	1,732,000	1,858,000	2,011,000	2,078,000	2,112,000	2,240,000	29
P	50,000	50,000	50,000	50,000	50,000	50,000	0
Texas[a]	**4,760,000**	**5,636,000**	**6,364,000**	**7,069,000**	**7,843,000**	**8,892,000**	**87**

[a] *Statewide totals may vary between tables due to rounding.*

Figure 7.2 - Projected municipal water needs by county in 2070



Steam-electric water needs are greatest in Region G and increase at a similar rate as manufacturing. Steam-electric needs will reach a statewide maximum of 769,000 acre-feet per year in 2070.

Mining needs are greatest in Region G and reach a statewide maximum of 128,000 acre-feet per year in 2030.

Livestock needs are greatest in Region O but remain no more than 32,000 acre-feet per year statewide.

7.4 Wholesale water provider needs

Some wholesale water providers—such as river authorities, municipal utility districts, and water supply corporations—deliver and sell large volumes of untreated and treated water for municipal, manufacturing, irrigation, and steam-electric use on a wholesale or retail basis. The water needs of wholesale water providers are based on aggregating the water needs of their customer water user groups and, therefore, aren't added to the overall water user group needs.

Of the wholesale water providers that serve at least some municipal entities, 132 face shortages with annual total statewide shortages of approximately 1.4 million acre-feet in 2020 increasing to 5.6 million acre-feet in 2070.

7.5 Impacts of not meeting identified water needs

Insufficient water supplies would negatively impact not only existing businesses and industry, but also ongoing economic development efforts in Texas. An unreliable water supply also disrupts activity in homes, schools, and government and endangers public health and safety. For these reasons, planning groups are required to evaluate the social and economic impacts of not meeting the identified water needs in their regional water plans.

In response to requests from the planning groups, the TWDB performed an evaluation of the socioeconomic impacts of not meeting water needs for each region. The analysis is based on a static input-output modeling approach that relies on the proprietary software known as IMPLAN™.

The analysis represents a snapshot of the temporary socioeconomic impacts that might occur during a single year in drought of record conditions if identified water needs (potential shortages) were not met.

The evaluation assumed that the structure of the economy would remain the same from 2020 to 2070 and focused primarily on direct economic impacts such as reduced economic activity and job losses. As part of the analysis, the TWDB estimated the resulting social impacts, including losses in population and school enrollment.

It is the relative magnitudes of impacts between sectors as well as the changes in these impacts over time that should be the focus rather than the absolute numbers. High-level analyses of this type are better at predicting the overall magnitude of economic impacts due to a water shortage than the precise size of the impact.

In drought of record conditions, assuming that potential water shortages are not met, Texas could suffer significant, immediate, and direct economic losses as well as losses in future economic growth

Figure 7.3 - Municipal water needs for statewide population in 2020 and 2070

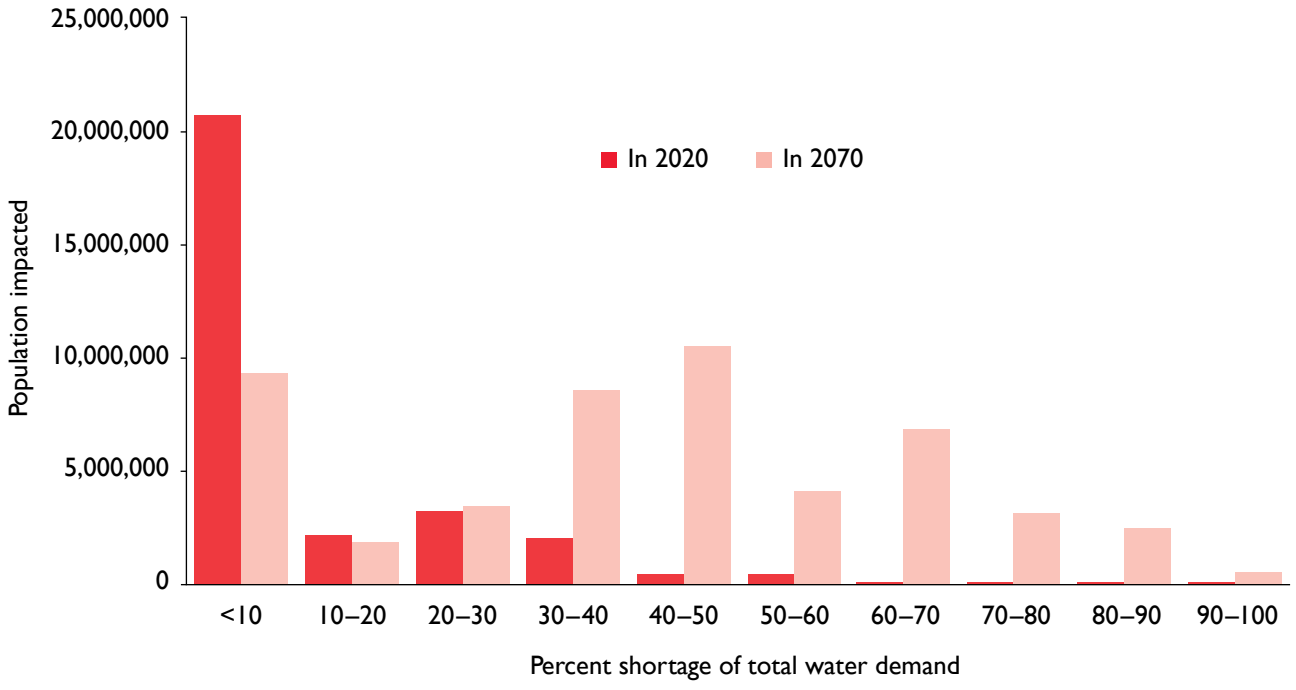


Table 7.3 - Statewide annual socioeconomic impacts from not meeting water needs

Impact	2020	2030	2040	2050	2060	2070
Income lost (billions of dollars)	$73	$91	$93	$99	$119	$151
Jobs lost	424,000	515,000	573,000	674,000	924,000	1,273,000
Population loss	78,000	95,000	105,000	124,000	170,000	234,000
School enrollment decline	14,000	17,000	19,000	23,000	31,000	43,000

(Table 7.3). Results of the TWDB analysis indicate that Texas businesses and employees could lose $73 billion in income in 2020 and more than $151 billion in 2070, with these impacts accumulating each consecutive year of a multi-year drought. The analysis also indicates that temporary job losses due to a drought of record could total approximately 424,000 in 2020 and 1.3 million in 2070. This estimate does not include additional drought impacts such as those to dry land farming and other activities not associated directly with water needs identified by the plan, nor does it include the potential for greater impacts due to a drought worse than the drought of record.

7.6 Uncertainty of future water needs

Potential water shortages during drought of record conditions are more difficult to predict than either water demand or water supply alone; the uncertainty of potential shortages is compounded by all of the uncertainties that already affect both water demand and water supply. For example, higher-than-projected per capita water demand combined with lower-than-anticipated water supply could result in a much greater water need than either factor could have caused independently.

Ultimately, future water needs will be impacted by numerous unpredictable forces including shifts in social values, legal changes, climate variability, economic trends, improvements in water use efficiency, energy costs, and advances in technology. Instead of attempting to predict the long-term positive or negative impacts of each of these changes on Texas' overall water needs, regional and state water planning incorporates the emerging impacts of these complex changes, as a whole, into the regional and state water plans during each five-year planning cycle.

7.7 Water needs not met by the plan

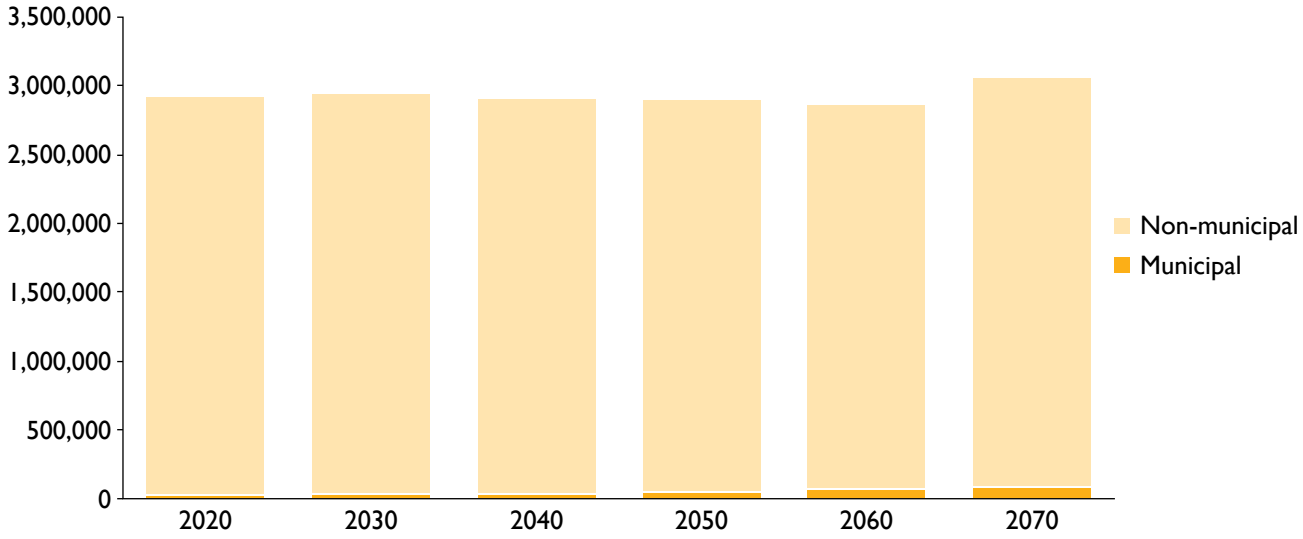
Planning groups identified some water needs that, in certain decades, could not be met because no feasible water management strategy could be identified. These are referred to as unmet needs. The vast majority of unmet needs are within the irrigation water use category (Table 7.4, Figure 7.4). For many irrigation water users, it is likely that there are insufficient returns on investment for the projects required to maintain the water supply in drought of record conditions.

Unmet municipal water needs were identified in Regions A, C, F, G, H, and I. Reasons for the planning groups not meeting certain municipal needs in the plans varied from lack of economically feasible supply alternatives to pending changes in local regulations. Statewide, unmet needs compose over 35 percent of the total projected irrigation demand and approximately 1 percent of the total municipal demand in 2070. Many of the unmet municipal needs are associated with the limits imposed by modeled available groundwater values associated with desired future conditions and, in practice, may be significantly less depending upon future regulatory decisions. An unmet need in a regional plan does not prevent an associated entity from pursuing development of additional water supplies. In some instances, portions of an underlying future increase in projected demand that is

Table 7.4 - Annual unmet water needs by region and water use category (acre-feet)

Region	Water user group	2020	2030	2040	2050	2060	2070
A	Irrigation	93,290	71,710	8,170	0	0	0
A	Municipal	0	0	0	0	0	540
B	Irrigation	1,870	1,590	1,670	3,790	6,860	9,920
B	Mining	560	210	110	60	10	10
B	Livestock	130	130	130	130	130	130
C	Municipal	0	0	0	0	0	1,860
C	Manufacturing	0	0	0	0	0	60
C	Mining	4,590	4,350	4,490	4,520	4,590	4,820
D	Irrigation	4,380	4,310	4,260	4,210	4,160	4,130
D	Manufacturing	0	0	0	0	0	86,360
D	Steam-electric	4,640	6,790	7,610	10,890	14,650	16,150
D	Mining	230	280	360	440	530	640
E	Irrigation	143,700	136,100	122,140	120,100	111,300	103,430
E	Mining	450	550	520	380	260	160
F	Irrigation	105,300	94,070	87,670	87,840	87,960	86,400
F	Municipal	1,510	2,200	4,630	9,540	14,680	19,340
F	Manufacturing	420	470	530	590	660	740
F	Mining	5,680	5,820	2,170	300	100	30
G	Irrigation	37,760	33,810	30,400	29,640	34,180	40,520
G	Municipal	10	0	0	0	0	0
G	Mining	19,140	26,180	27,720	32,170	37,830	44,830
H	Irrigation	56,480	56,000	57,970	59,520	61,080	62,560
H	Municipal	30,310	25,950	25,960	36,560	54,120	70,430
H	Manufacturing	3,150	4,510	3,370	8,200	3,910	3,950
H	Steam-electric	410	940	310	510	750	2,570
H	Mining	490	380	50	60	70	80
H	Livestock	1,980	2,250	2,500	2,650	2,780	2,910
I	Irrigation	330	330	330	330	330	330
I	Municipal	0	0	0	0	0	20
I	Manufacturing	4,720	0	0	0	0	0
I	Steam-electric	0	0	0	0	0	4,340
J	Irrigation	380	350	330	300	280	260
J	Manufacturing	0	0	0	10	10	10
J	Mining	50	50	70	70	80	80
K	Irrigation	120,820	113,480	102,190	76,540	55,300	27,920
K	Mining	620	4,360	5,010	5,730	6,510	7,380
L	Irrigation	115,470	107,350	97,960	91,280	84,820	79,610
L	Mining	11,140	10,840	9,220	5,880	2,530	1,120
M	Irrigation	500,140	453,910	408,410	359,810	311,970	294,480
M	Manufacturing	70	390	1,110	1,280	1,280	1,280
M	Mining	3,580	3,720	4,460	4,500	4,650	5,150
N	Irrigation	0	0	0	0	0	970
N	Mining	1,660	2,060	1,900	0	0	0
O	Irrigation	1,613,510	1,719,030	1,846,000	1,900,780	1,913,900	2,025,050
O	Manufacturing	5,220	4,970	4,460	4,940	6,770	7,320
O	Steam-electric	7,750	6,620	3,190	4,190	5,470	11,790
O	Mining	9,920	11,710	11,290	10,310	8,630	7,340
O	Livestock	12,130	14,510	12,890	16,270	18,790	17,630
Texas		**2,923,990**	**2,932,280**	**2,901,560**	**2,894,320**	**2,861,930**	**3,054,650**

Figure 7.4 - Statewide annual water supply needs that are unmet by the plan (acre-feet)



associated with an unmet need may actually shift geographically to a less water-scarce location, for example, when a power provider decides to shift the location of future power production.

7.8 Comparison to the 2012 State Water Plan

This water plan estimates 4.8 million acre-feet of annual statewide water needs in 2020, which is similar to the total from the 2012 State Water Plan. However, aggregation of data at the state level masks geographic and categorical changes in water needs that may be more significant at the local level. Many factors can affect water needs, making it difficult to draw broad conclusions. Notable changes to the identified water needs from the 2012 State Water Plan are summarized below:

- Statewide unmet needs are approximately 28 percent higher in 2020 and 17 percent higher

Ranch land during drought conditions in Gillespie County, Texas

Texas' population is expected to increase more than 70 percent between 2020 and 2070, from 29.5 million to 51 million

in 2060 than the 2012 plan. There was a small unmet municipal need of approximately 2,200 acre-feet per year in 2010 in the previous plan; however, unmet municipal needs in this plan range from approximately 28,000 acre-feet per year to 69,000 from 2020 to 2060. Changes to unmet needs are due to a variety of interrelated factors that vary geographically, including lower than anticipated water supplies due to more severe drought conditions, changes in demands, and changes in the process of how groundwater availability is determined.

- Statewide, annual municipal water needs in 2020 are approximately 400,000 acre-feet less than those from the previous plan, primarily due to lower water demand projections. Municipal needs in Regions A, B, and D are significantly higher in 2020 and 2060. In general, this is due to a increase in demands and a reduced amount of water supplies.
- Needs for manufacturing in 2020 doubled, largely due to the recognition of additional infrastruture limitations. Mining needs increased by approxmiately two-thirds from the 2012 plan's estimates. This is partly due to the increased water demand projections associated with hydraulic fracturing activities.
- Estimated direct economic impacts of not meeting water needs are higher than the previous plan. This is due to many factors, including inflation and changes in the economy such as increased economic activity associated with hydraulic fracturing activities (included in the mining water use category).