# 4

# Future population and water demand



# QUICK FACTS

Texas' population is projected to increase by more than 70 percent during the planning horizon, from 29.7 million in 2020 to nearly 51.5 million in 2070.

Over 60 percent of all the statewide population growth between 2020 and 2070 is projected to occur within Regions C, H, and L.

Statewide water demand is projected to increase by approximately 9 percent, from 17.7 million acre-feet per year in 2020 to 19.2 million acre-feet per year in 2070. This is a smaller magnitude increase as compared to the 2017 State Water Plan, primarily due to revised methodologies for the irrigation, manufacturing, and steam-electric power generation sectors of water use.

Irrigation is the largest water demand category in each planning decade through 2050, but municipal demand is projected to surpass irrigation demand by 2060.

Population and water demand projections by region, county, and water user group can be explored through the dashboard at www.twdb.texas.gov/waterplanning/data/dashboard/index.asp.

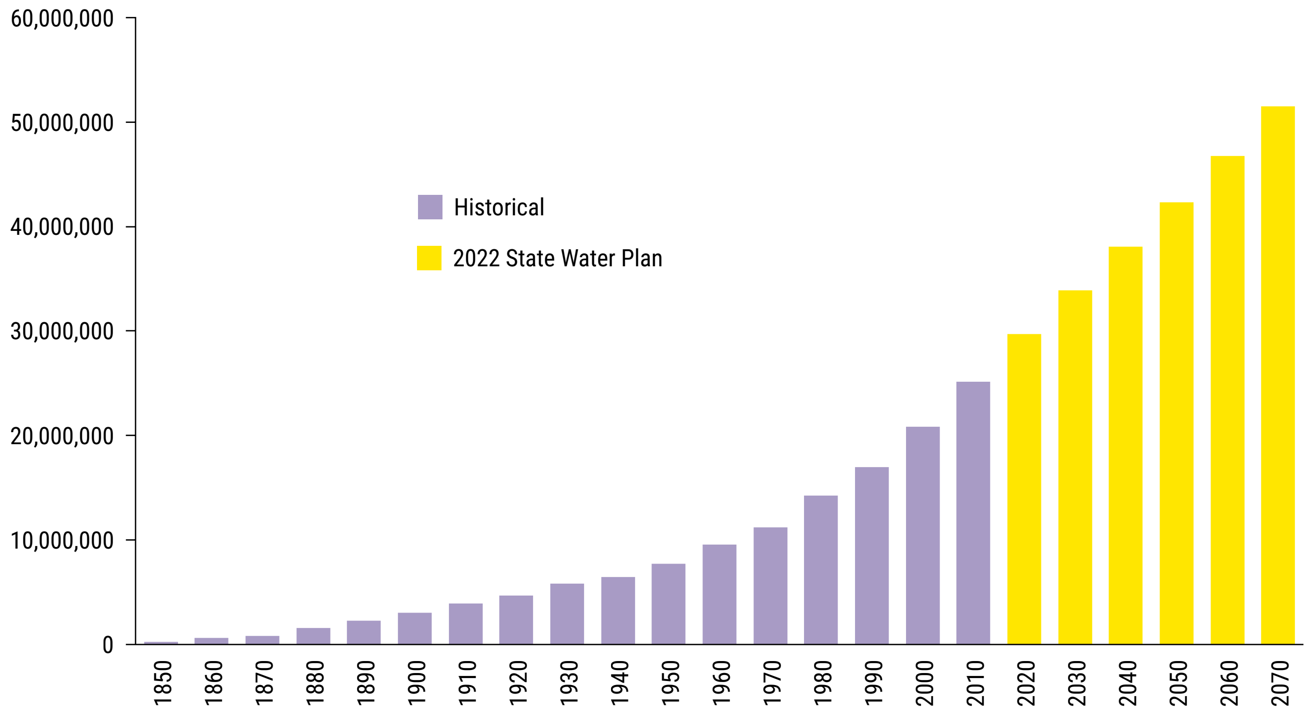
The first major milestone in the five-year regional water planning process is the development of population and water demand projections to determine how much water will be needed during a repeat of drought of record conditions over the 50-year planning horizon. Developing the most likely set of projections for a long-term plan is challenging and is accomplished through a collaborative process based on best available data and designed to develop consensus between state agencies, regional water planning groups, and local stakeholders.

The TWDB developed and distributed draft population and water demand projections using statewide, uniform methodologies for all 16 regional water planning groups. The Texas Commission on Environmental Quality, the Texas Department of Agriculture, the Texas Parks and Wildlife Department, representatives from the planning groups, and members of the public then helped determine the final projections by providing local data and information. This often involves determining the most likely locations where anticipated populations will reside geographically rather than adjusting the anticipated population growth within an entire planning region. The TWDB established water demand projections for municipal water users as well as five non-municipal water demand categories: irrigation, livestock, manufacturing, mining, and steam-electric power. This chapter delves into each of these categories, summarizing methodologies and analyzing the major trends and current outlook for water demands across the state.

## 4.1 Population projections

Texas has the second largest population in the United States and has gained more residents than any other state since 2000 (U.S. Census Bureau, 2011), as its booming economy and metropolitan areas continue to draw more people from across

*Figure 4-1. Historical and projected population growth in Texas (1850–2070)*




the country and around the world. Indeed, Texas has experienced robust population growth since it joined the United States, with growth outpacing the national average in each decade since the 1850s (Murdock and Cline, 2018). This trend is expected to continue, with Texas' population projected to increase by more than 70 percent during the planning horizon, from 29.7 million in 2020 to more than 51.5 million in 2070 (Figure 4-1).

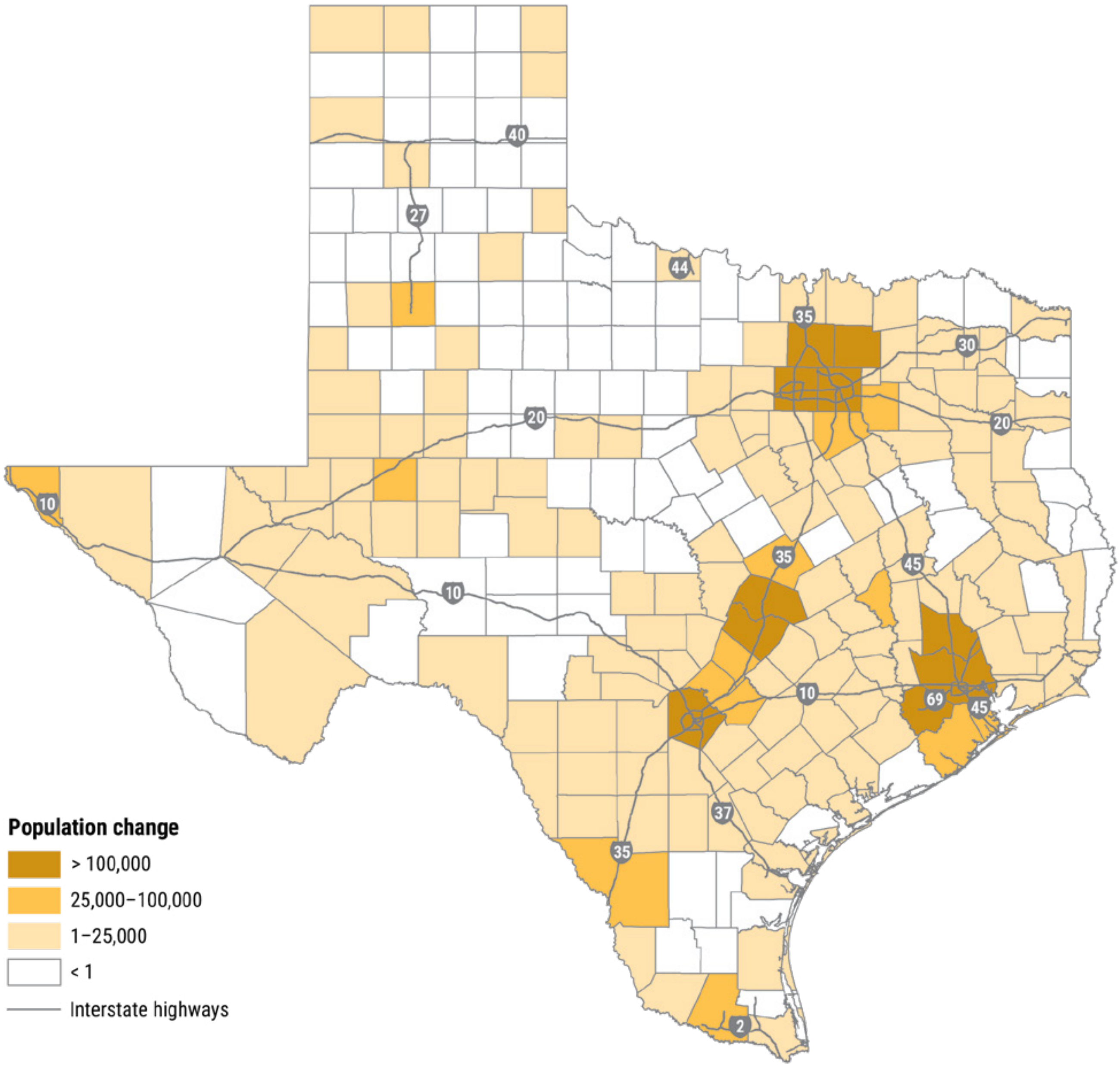
According to 2018 U.S. Census Bureau population estimates, Texas has four of the top 10 counties in the country with the largest annual numeric growth since 2010: Bexar, Dallas, Harris, and Tarrant. At the same time, Texas has 96 rural counties that experienced negative population growth between 2010 and 2018 (Figure 4-2).

While Texas is projected to remain one of the fastest growing states in the nation, not all regions will experience this growth equally (Table 4-1). Growth is projected to be concentrated around the state's major metropolitan areas, especially Austin, Dallas-Fort Worth, Houston, San Antonio, and the Rio Grande Valley. Regions C and H (which include the Dallas-Fort Worth metropolitan area and Houston, respectively) are projected to capture more than 50 percent of the state's growth over the next 50 years (Figure 4-3). Significant growth is not projected to occur in many rural areas of the state, reflecting the increasingly urban character of Texas and the nation. Even in West Texas, most population growth is projected to occur within regional urban hubs, such as Amarillo, Lubbock, Midland, and Odessa.

At a county level, 29 Texas counties are projected to double or more in population between 2020 and 2070 (Figure 4-4). These highest-growth counties are predominantly suburban areas surrounding the state's major metropolitan areas. On the other end of the spectrum, 22 predominantly rural counties around the state are projected to experience zero population growth across the planning horizon.

In addition to its highly variable climate, Texas' sustained population growth is a fundamental reason why the state has been at the forefront of long-range water supply planning since the

*Figure 4-2. Historical population change by county (2010–2018)*




1960s. Additional growth over the planning horizon will put increasing pressure on existing water supplies, as there will simply be many more Texans needing water, even alongside the significant advances in municipal conservation in recent years. This plan projects population growth from 2020 to 2070 for nearly 1,900 municipal water user groups across Texas' 254 counties. The next section provides detailed information on the methodology for determining population projections for this planning cycle.

### 4.1.1 Population projections methodology

Developing population projections involved two steps: first, projecting population at the county level and, then, projecting population at the municipal water user group level, including water utilities and rural areas. The state demographer at the Texas Demographic Center (Texas State Demographer, 2014) developed population projections for counties by using a standard demographic methodology known as a cohort-component model. This procedure uses separate

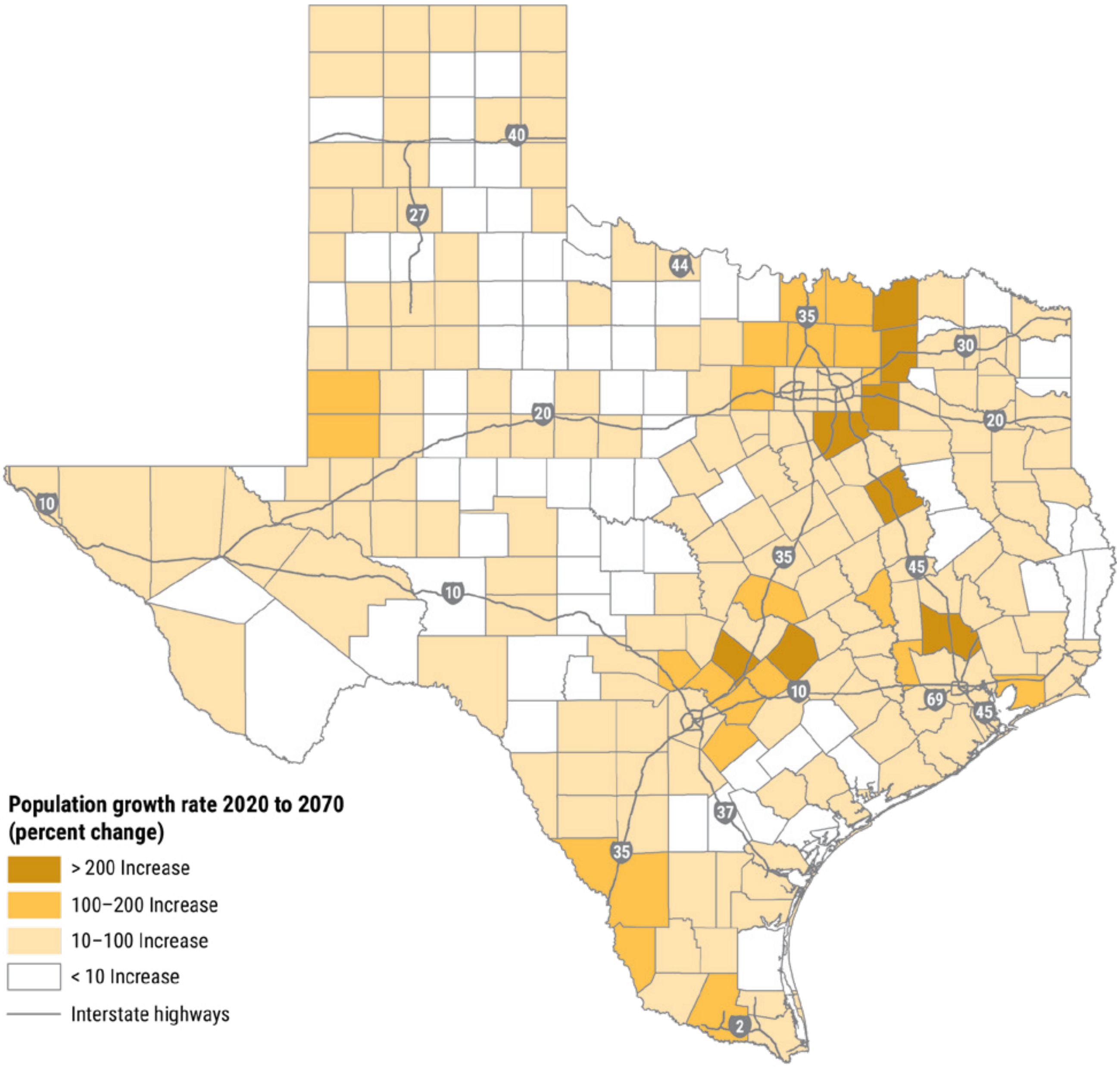
*Table 4-1. Projected population by region (2020–2070)*

| Region | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | Percent growth from 2020 |
|---|---|---|---|---|---|---|---|
| A | 418,000 | 460,000 | 503,000 | 546,000 | 591,000 | 637,000 | 52 |
| B | 206,000 | 214,000 | 219,000 | 223,000 | 226,000 | 229,000 | 11 |
| C | 7,638,000 | 8,858,000 | 10,150,000 | 11,533,000 | 13,052,000 | 14,685,000 | 92 |
| D | 831,000 | 908,000 | 989,000 | 1,089,000 | 1,212,000 | 1,370,000 | 65 |
| E | 954,000 | 1,086,000 | 1,208,000 | 1,329,000 | 1,444,000 | 1,551,000 | 63 |
| F | 716,000 | 798,000 | 859,000 | 919,000 | 978,000 | 1,040,000 | 45 |
| G | 2,371,000 | 2,721,000 | 3,097,000 | 3,495,000 | 3,918,000 | 4,351,000 | 84 |
| H | 7,325,000 | 8,208,000 | 9,025,000 | 9,868,000 | 10,766,000 | 11,743,000 | 60 |
| I | 1,152,000 | 1,234,000 | 1,310,000 | 1,389,000 | 1,470,000 | 1,554,000 | 35 |
| J | 141,000 | 154,000 | 163,000 | 171,000 | 178,000 | 185,000 | 31 |
| K | 1,763,000 | 2,095,000 | 2,417,000 | 2,697,000 | 2,971,000 | 3,290,000 | 87 |
| L | 3,013,000 | 3,491,000 | 3,937,000 | 4,357,000 | 4,795,000 | 5,219,000 | 73 |
| M | 1,961,000 | 2,379,000 | 2,795,000 | 3,212,000 | 3,626,000 | 4,029,000 | 105 |
| N | 615,000 | 662,000 | 693,000 | 715,000 | 731,000 | 745,000 | 21 |
| O | 540,000 | 594,000 | 646,000 | 698,000 | 751,000 | 802,000 | 49 |
| P | 50,000 | 52,000 | 53,000 | 54,000 | 55,000 | 56,000 | 12 |
| **Texas[a]** | **29,694,000** | **33,914,000** | **38,064,000** | **42,295,000** | **46,764,000** | **51,486,000** | **73** |

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

*Figure 4-3. Projected population growth by region (2020–2070)*

*Figure 4-4. Projected population growth (2020–2070)*




cohorts (combinations of age, gender, and racial-ethnic groups) and components of cohort change (birth, survival, and migration rates) to estimate future populations by county. These provided the TWDB with initial, 30-year projections by county. The TWDB then extrapolated the 30-year projections to the state water plan's 50-year planning horizon and distributed them beyond the county level to individual water user groups. Because there was no new decennial census data available for use during this planning cycle, population projections from the 2017 State Water Plan were carried forward and used as the starting point for the county-level draft projections for this 2022 State Water Plan.

Of the three components of cohort change, the migration rate, which calculates how many people move in and out of counties, is the most critical assumption. While birth and survival rates tend to closely follow historical trends, the state of the economy heavily influences migration rates, reflecting movement that results from economic opportunity. Other unforeseen events, such as

*Deploying a data buoy to measure evaporation rates at Lake Buchanan*

catastrophic weather, can also influence migration. Although the Coronavirus Disease 2019 (COVID-19) pandemic occurred late in this planning cycle, the TWDB reviewed available, related population data and determined that, as of this drafting, there is not likely a significant enough impact or sufficient data to make any meaningful changes to these long-term population or water demand projections. If there are any resulting population shifts or anticipated persistent shifts in water demands resulting from human or economic impacts from the pandemic, these will be reflected in the population projections developed for the next planning cycle.

During the previous cycle of regional water planning and development of the 2017 State Water Plan, the TWDB and the planning groups together evaluated three sets of projections to determine the most appropriate migration patterns to utilize in each region:

- Zero migration
- One-half of the migration rates from 2000 to 2010
- 2000–2010 migration rates

The one-half migration scenario was used for most counties, based on historical precedence and the state demographer's recommendations for long-range projections. Alternative migration scenarios other than one-half were used for 39 counties where 1) a comparison of the 2012 State Water Plan projections, the actual 2010 Census population, and the Texas Demographic Center's half-migration scenario 2020–2050 population projections indicated the half-migration scenario growth rates were under-projected, and 2) recent population estimates showed that a county has been continuing to grow at a much higher rate than that from 2000 to 2010.

### 4.1.2 Utility-based planning

Prior to this state water plan, regional and state water planning data were organized largely around political boundaries, such as city limits, rather than by water providers. One of the major process improvements of this planning cycle has been the transition to utility-based planning (away from political boundaries), which redefines municipal water user groups based on water utility service boundaries.

Utility-based planning delivers a more transparent and efficient planning process by planning directly for the entities in charge of providing water to Texans now and in the future. It also allows for better one-to-one continuity of data and responsibilities regarding water demand, water supply, implementation of water management strategies, and water project sponsors in the water plans. This provides a more direct, "cradle-to-grave" alignment of strategies and projects from the planning process to financing and implementation through the TWDB's state and federal financial assistance programs.

Additionally, at the request of the water planning community, the TWDB reduced the volumetric threshold required to designate individual water user groups from 280 acre-feet per year to 100 acre-feet per year, which increased the number of individual small utilities that are now explicitly planned for. As before, the remaining municipal and domestic water use that falls outside this threshold is aggregated for each county and planned for as a county-other water user group.

*Table 4-2. Projected water demand by water use category (acre-feet)*

| Category | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | Percent growth from 2020 |
|---|---|---|---|---|---|---|---|
| Irrigation | 9,448,000 | 9,383,000 | 8,703,000 | 8,154,000 | 7,737,000 | 7,594,000 | -20 |
| Livestock | 332,000 | 343,000 | 353,000 | 363,000 | 374,000 | 382,000 | 15 |
| Manufacturing | 1,339,000 | 1,531,000 | 1,531,000 | 1,531,000 | 1,531,000 | 1,531,000 | 14 |
| Mining | 407,000 | 409,000 | 365,000 | 323,000 | 287,000 | 281,000 | -31 |
| Municipal | 5,223,000 | 5,826,000 | 6,440,000 | 7,089,000 | 7,783,000 | 8,507,000 | 63 |
| Steam-electric | 931,000 | 935,000 | 935,000 | 935,000 | 935,000 | 935,000 | 0 |
| **Texas[a]** | **17,680,000** | **18,427,000** | **18,327,000** | **18,395,000** | **18,647,000** | **19,230,000** | **9** |

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

The TWDB prepared the final list of municipal water user groups for this planning cycle based on the new criteria using TWDB Water Use Survey data from 2010 to 2014. Utility population estimates for 2010 were developed based on utility boundaries and served as the baseline population estimate to be projected for the 2020–2070 horizon for this planning cycle.

The combined net impact of transitioning to utility-based planning and lowering the threshold for designating unique water user groups was an increase of 258 additional water user groups with their own designated planning data to support a combined associated population of over 1 million people in 2020. Regions G, H, and I had the greatest increase in unique water user groups, and almost half the regions saw a net shift of approximately 90,000 or more people included in unique groups.

## 4.2 Water demand projections

The TWDB projects water demand across the 50-year planning horizon for municipal and all non-municipal sectors of the Texas economy to determine how much water the state will need during a single year repeat of drought of record conditions. The five non-municipal categories are irrigation, livestock, manufacturing, mining, and steam-electric power. Water demand projections exclude demands associated with purely saline supplies, much of which are associated with industrial uses located along the coast.

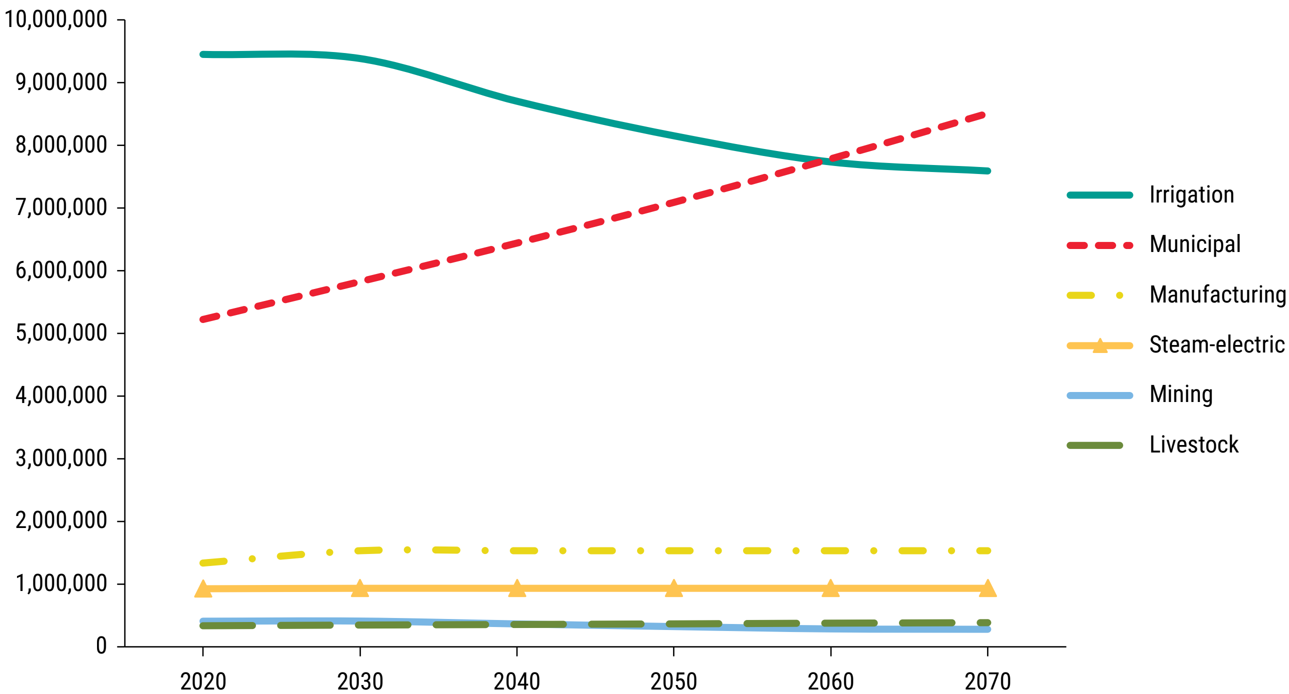
Across the planning horizon, the TWDB projects total demand across all water use categories to increase by 9 percent, from 17.7 million acre-feet in 2020 to 19.2 million acre-feet in 2070.

While irrigation is the largest water demand category in each planning decade through 2050, it is projected to gradually decrease by 20 percent over the planning horizon (Table 4-2, Figure 4-5). Municipal demand is projected to steadily increase in each planning decade due to Texas' projected population growth and eventually surpass irrigation demand by 2060. Livestock water demand is projected to increase roughly 15 percent across the planning horizon, while manufacturing and steam-electric power demands are projected to remain constant from 2030 to 2070. Water demand for mining, which includes oil and gas operations, is projected to increase through 2030 then decrease by roughly 30 percent in later planning decades, although the sector is a relatively small water user overall compared to irrigation and municipal water use categories.

### 4.2.1 Projected water demand by region

As with population projections, total water demand projections vary significantly by regional water planning area (Table 4-3, Figure 4-6). Water demand in Region C is projected to increase by 67 percent over the planning period, by far the

*Figure 4-5. Projected annual water demand by water use category (acre-feet)**



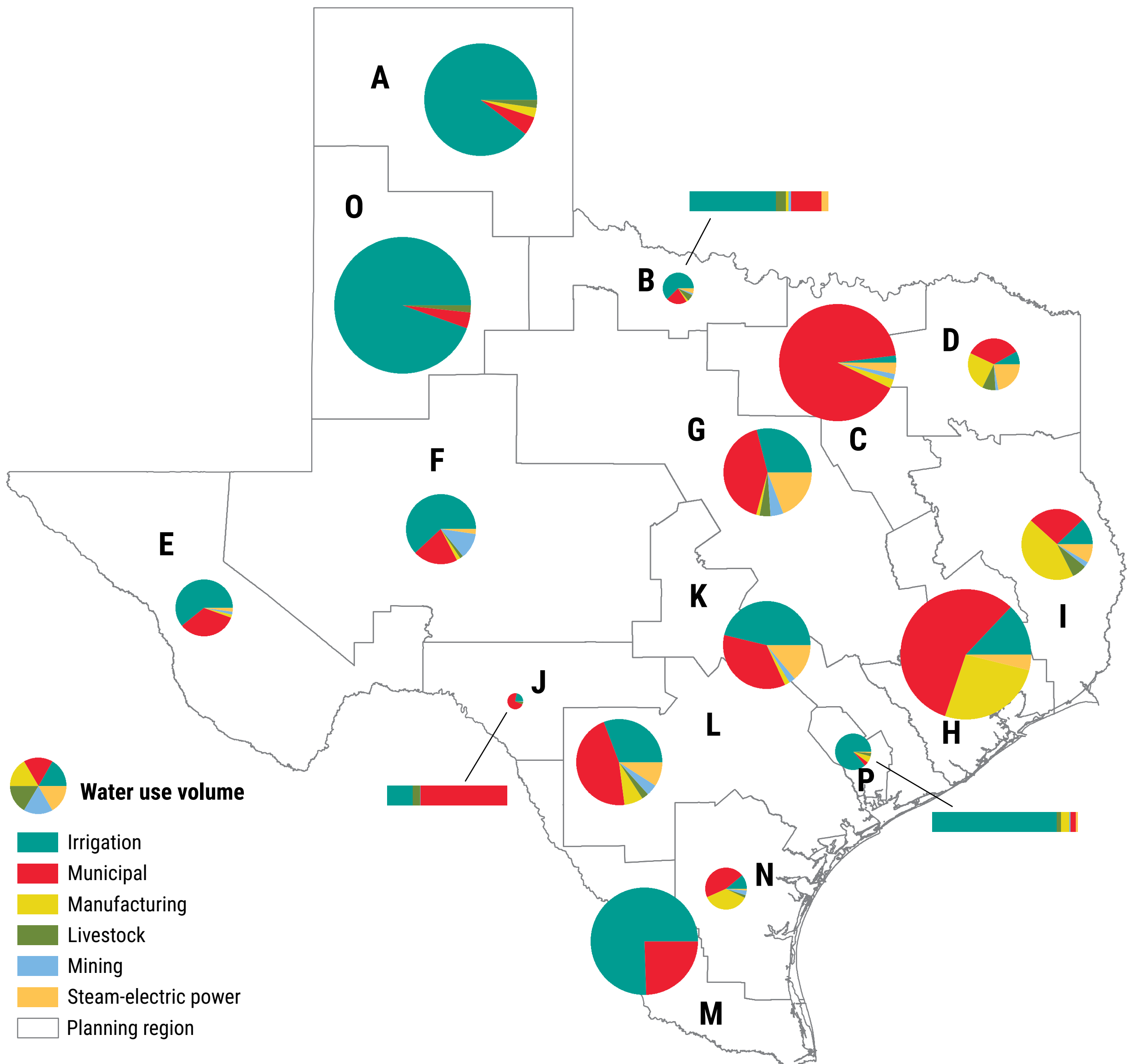

** Water use categories are presented in the order listed in the legend.*

*Table 4-3. Projected annual water demand by region (acre-feet)*

| Region | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | Percent growth from 2020 |
|---|---|---|---|---|---|---|---|
| A | 2,131,000 | 2,138,000 | 1,995,000 | 1,789,000 | 1,586,000 | 1,598,000 | -25 |
| B | 156,000 | 156,000 | 155,000 | 154,000 | 154,000 | 155,000 | -1 |
| C | 1,734,000 | 1,937,000 | 2,152,000 | 2,391,000 | 2,641,000 | 2,899,000 | 67 |
| D | 401,000 | 415,000 | 425,000 | 438,000 | 456,000 | 479,000 | 19 |
| E | 480,000 | 498,000 | 513,000 | 528,000 | 544,000 | 560,000 | 17 |
| F | 765,000 | 780,000 | 770,000 | 755,000 | 745,000 | 744,000 | -3 |
| G | 1,121,000 | 1,178,000 | 1,220,000 | 1,279,000 | 1,350,000 | 1,422,000 | 27 |
| H | 2,337,000 | 2,561,000 | 2,675,000 | 2,796,000 | 2,931,000 | 3,077,000 | 32 |
| I | 738,000 | 793,000 | 799,000 | 811,000 | 826,000 | 840,000 | 14 |
| J | 37,000 | 39,000 | 40,000 | 41,000 | 42,000 | 43,000 | 16 |
| K | 1,117,000 | 1,163,000 | 1,204,000 | 1,237,000 | 1,265,000 | 1,308,000 | 17 |
| L | 1,051,000 | 1,115,000 | 1,164,000 | 1,211,000 | 1,264,000 | 1,320,000 | 26 |
| M | 1,784,000 | 1,797,000 | 1,809,000 | 1,822,000 | 1,837,000 | 1,853,000 | 4 |
| N | 253,000 | 270,000 | 273,000 | 273,000 | 275,000 | 276,000 | 9 |
| O | 3,368,000 | 3,382,000 | 2,928,000 | 2,663,000 | 2,527,000 | 2,453,000 | -27 |
| P | 206,000 | 206,000 | 205,000 | 205,000 | 204,000 | 204,000 | -1 |
| **Texas[a]** | **17,679,000** | **18,428,000** | **18,327,000** | **18,393,000** | **18,647,000** | **19,231,000** | **9** |

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

*Figure 4-6. Projected annual water demand by region and category in 2040**




** Relative size of pie charts is based on volume of water use.*

most of any planning area, largely driven by the increase in municipal water demands due to projected population growth in the area. Significant water demand increases are also projected for Regions G, H, and L, where water demand is projected to increase by more than 25 percent between 2020 and 2070, also largely driven by projected population growth.

Regions A and O in the Texas Panhandle are the only planning areas projected to show significant declines in total water demand due to anticipated long-term groundwater drawdowns associated with irrigated agriculture between 2020 and 2070.

### 4.2.2 Water demand methodology

In a process similar to establishing the population projections, the TWDB produced draft water demand projections for municipal water use and each of the five non-municipal water use categories. The Texas Commission on Environmental Quality, the Texas Department of Agriculture, and

*Texas' population is projected to increase from 29.7 million in 2020 to nearly 51.5 million in 2070*

the Texas Parks and Wildlife Department reviewed the draft projections, which were then sent to the planning groups for their review and comments. The TWDB worked extensively with each planning group and local entities through an iterative, data-intensive review process and ultimately approved more than 350 requested changes to projections for specific water user groups. These revision requests were intended to reflect the best available data and most likely projections and were reviewed by the four agencies before the TWDB ultimately adopted them. The methodology for developing water demand projections for each of the six water use categories is summarized in the sections below.

### 4.2.3 Irrigation water demand

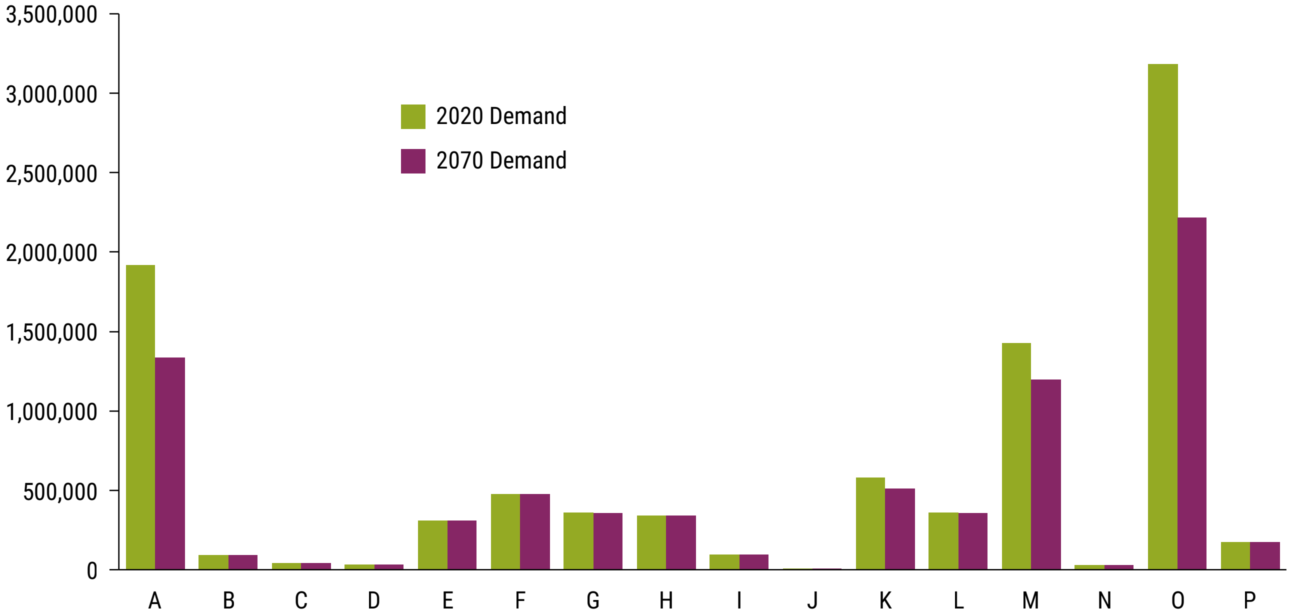
Irrigation water demand includes water used for irrigated field crops, vineyards, orchards, and self-supplied golf courses. The baseline methodology for irrigation water demand projections was to average the most recent five years (2010–2014) of water use estimates and then hold this value constant between 2020 and 2070. However, in certain counties, the total groundwater availability over the planning period was projected to be less than the groundwater portion of the baseline water demand projections. Where this occurs, the demand projections decline in later decades roughly commensurate with the groundwater availability but at a delayed rate to recognize the fact that water demands will likely remain higher than water availability even as they both predictably decline. This projection methodology was supported by a study (CDM Smith, 2016) funded by the TWDB. The goal of the study was to find the best projection method for this sector that the TWDB can update regularly and which transparently and more directly considers foreseeable declines in water availability than previous methods. The planning groups reviewed and provided input on drafts of both this new methodology and the resulting projections. This approach to groundwater-constrained areas was utilized in 36 counties.

Overall irrigation demand is projected to decline as a result of more efficient irrigation systems, reduced groundwater supplies, the economic difficulty of pumping water from increasingly greater depths, and the transfer of water rights from agricultural to municipal uses, in addition to limited available groundwater. In total, irrigation accounts for 53 percent of Texas' water demand in 2020, declining to 39 percent of demand by 2070. Regions A, M, and O account for over 60 percent of statewide irrigation water demand in 2070 (Figure 4-7).

### 4.2.4 Livestock water demand

Livestock water demand includes water used in the production of various types of livestock, including cattle (beef and dairy), poultry, hogs, horses, sheep, and goats. The 2020 water demand projections for each county were based on the average of the most recent five years (2010–2014) of water use estimates. Water use estimates were calculated by applying a water use coefficient for each livestock category to county-level inventory estimates from the Texas Agricultural Statistics Service. The rate of change for projections in each planning area was carried forward from the 2017 State Water Plan and

*Figure 4-7. Projected annual irrigation water demand by region in 2020 and 2070 (acre-feet)*




applied to the new baseline estimate. Livestock accounts for roughly 2 percent of Texas' total water demand across the planning horizon. Livestock water demand occurs throughout Texas but is highest in Regions A, G, I, and O, due in part to the concentration of confined animal feeding operations in these areas.

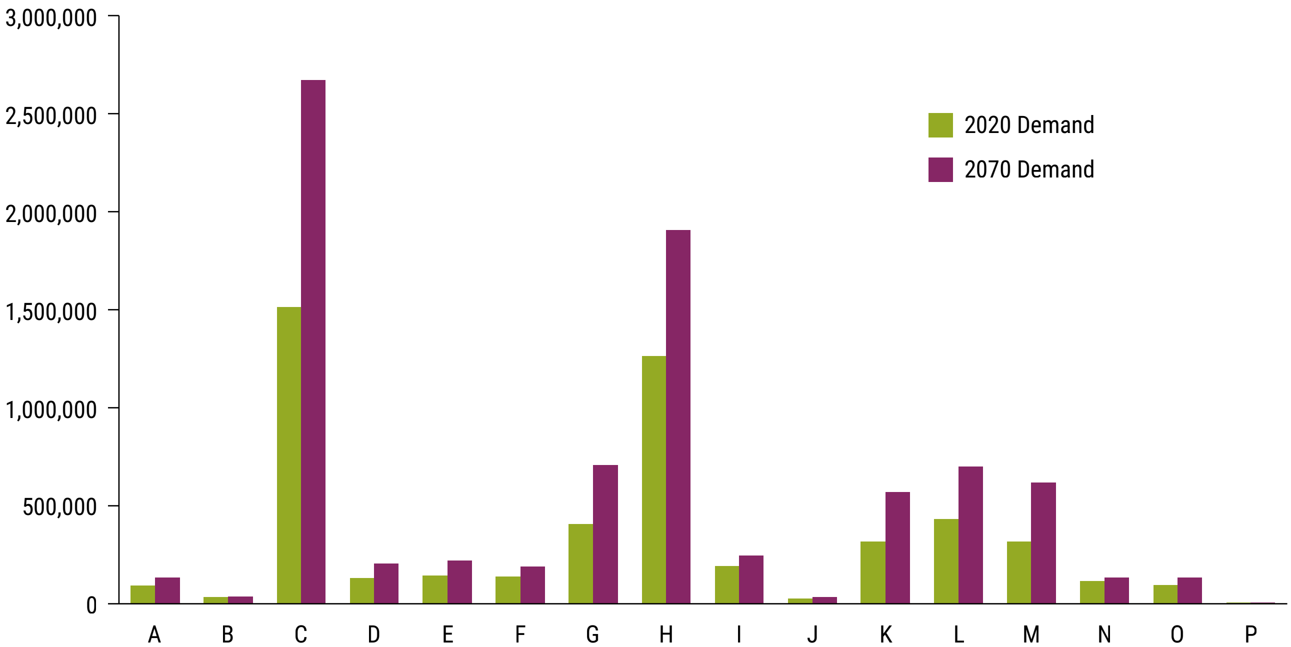
## 4.2.5 Municipal water demand

Municipal water demand includes water used by a variety of consumers in Texas communities, ranging from single and multi-family residences to nonresidential establishments (commercial, institutional, and light industrial). Residential, nonresidential, and even many commercial consumers use water for similar purposes, such as drinking, cooking, sanitation, cooling, and landscape watering. Water-intensive industrial customers, such as large manufacturing plants, steam-electric power generation facilities, and mining operations, are not included in municipal water demand, despite their presence within municipalities. Instead they are included in their associated non-municipal demand categories.

To project total annual municipal water demand, the TWDB multiplied the populations for each municipal water user group by the associated projected per capita water use (also referred to as gallons per capita daily or GPCD) during a historical dry year. The per capita water use was based on annual Water Use Survey data for each water user group. Per capita water use values exclude sales to other retail water utilities and large manufacturing, mining, or steam-electric power generating customers that are captured elsewhere to avoid double counting. For most municipal water user groups, the 2011 per capita dry-year water use was used in estimating demand because of the severity of the 2011 drought. Based on local circumstances, some water user groups used per capita use during drought conditions in a year other than 2011 when that was more representative of dry-year conditions. Counterintuitively, the dry-year water use usually reflects the highest per capita water use.

In all regions, the municipal water demand projections incorporated certain anticipated future water savings from the installation of more efficient toilets, shower heads, dishwashers, and clothes washers that are already required by state and federal laws determining water use efficiency in fixtures and appliances. These savings are projected to be 297,000 acre-feet per year in 2020, increasing to 889,000 acre-feet per year in 2070.

*Figure 4-8. Projected annual municipal demand by region in 2020 and 2070 (acre-feet)*




Water savings due to existing legal requirements are embedded in the municipal water demand projections because they can be expected to occur and should require no additional action on the part of cities and water utilities.

Planning groups estimated and incorporated additional future water savings from municipal conservation programs as recommended water management strategies in the regional plans to be implemented by water providers (see Chapter 7). These strategy volumes represent voluntary water conservation savings that would not otherwise occur if not for additional, proactive actions and investments by water providers and customers.

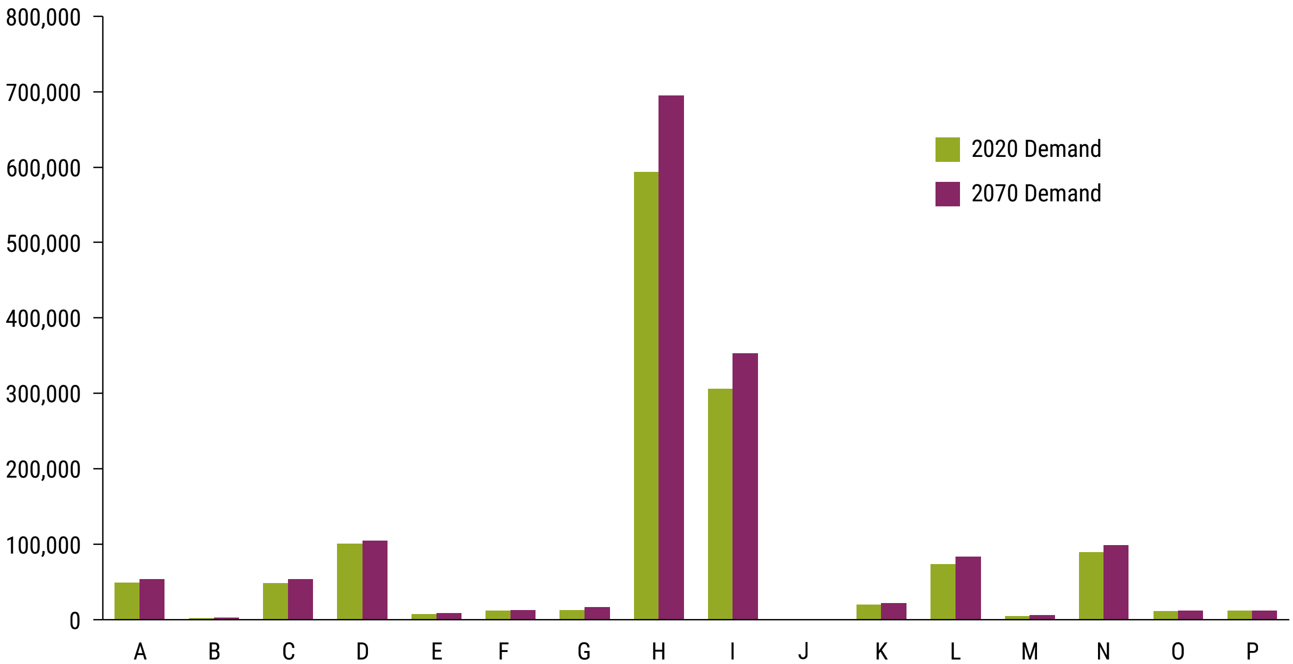
Regions C, G, H, K, L, and M account for over 80 percent of statewide municipal demand in 2070 (Figure 4-8).

### 4.2.6 Manufacturing water demand

Manufacturing water demand consists of the water necessary for large facilities, including those that process chemicals, oil and gas, food, paper, and other materials. The 2020 water demand projections for each county were based on the highest county-aggregated manufacturing water use in the most recent five years of survey data between 2010 and 2014. Then the most recent 10-year projections for employment growth from the Texas Workforce Commission were used as a proxy for projected growth in each manufacturing sector between 2020 and 2030. In cases where employment was projected to decrease for a specific sector, the water demand projections were held constant for that sector. After 2030, the manufacturing water demand was held constant through 2070.

This projection methodology was supported by a study (CDM Smith, 2016) funded by the TWDB. The goal of the study was to find the best projection method for this sector that the TWDB can update regularly. It was also partially influenced by the fact that, historically, the TWDB has seen the manufacturing sector continue to become more efficient in its water use while increasing its economic output. This resulted in the most significant relative change (reduction) in water demand projections and intentionally reflects the encouraging fact that declining water use can

*Figure 4-9. Projected annual manufacturing demand by region in 2020 and 2070 (acre-feet)*




be experienced even in the midst of increasing economic production (Hoffman, 2016).

Overall, manufacturing accounts for approximately 8 percent of Texas' water demand across the planning horizon. The majority of Texas manufacturing occurs along the Gulf Coast, with Regions H and I accounting for nearly 70 percent of all manufacturing demand in 2070 (Figure 4-9). Regional water plans for Regions C and H noted concern that the assumption of no growth in manufacturing water demand after 2030 does not reflect ongoing manufacturing growth in the regions. The Region C plan stated that several water suppliers have included a management supply factor to help mitigate this concern. The Region H plan stated that it is unlikely that reductions in water use per production unit will offset all growth in manufacturing in the region and acknowledged the need for continuing evaluation of this topic in future planning cycles to consider the potential for mitigating influence from changes in regional industry categories, water use characteristics, and implementation of water-efficient technologies.

### 4.2.7 Mining water demand

Mining water demand consists of water used in exploring, developing, and extracting oil, gas, coal, aggregates, and other minerals. Initial draft mining water demand projections were carried forward from the 2017 State Water Plan and were based upon two TWDB-contracted studies with the University of Texas at Austin's Bureau of Economic Geology (BEG, 2011, 2012). The TWDB estimated and projected historical mining water use across the planning horizon using data collected from trade organizations, government agencies, and other industry representatives. Mining demand is projected to increase through 2030 and then decline in later planning decades based on the oil and gas industry outlook. More than half of all mining water demand in Texas is projected to occur in Regions F, G, and L in 2030. Region F requested to increase mining demands due to recent increases in non-conventional oil and gas activities in the Permian Basin, which is predominately located in that region. Across the planning horizon, mining accounts for roughly 2 percent of total water demand statewide.

*Municipal water demand is projected to increase in each planning decade*

### **4.2.8** Steam-electric power water demand

Steam-electric water demand consists of water used for the purpose of generating power. A generation facility typically diverts surface water, uses it for cooling purposes, and then returns a large portion to a body of water. Landfill gas, wood waste biomass, and battery power plants, as well as any power generating facilities using renewable energy sources, were not included in the water demand projections. Water demand projections for 2020 were based on the highest county-aggregated historical steam-electric power water use in the most recent five years of survey data (2010–2014). The anticipated water use for future power generation facilities listed in state and federal reports was added to the demand projections from the anticipated operation date through 2070, while projected water demands from facilities scheduled for retirement were subtracted. Subsequent demand projections after 2020 were held constant throughout the planning period to reflect increasing trends in using renewable energy and more water-efficient technology.

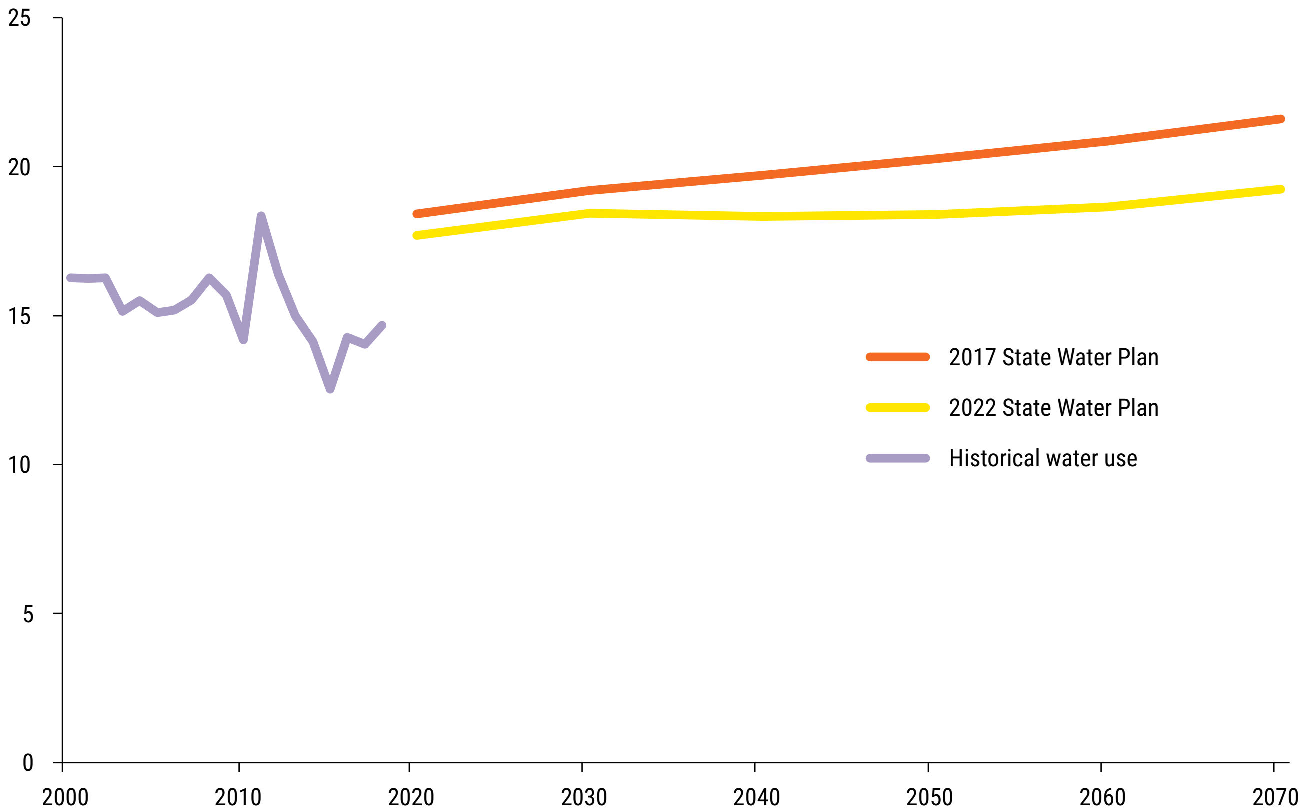
Based on data reported to the U.S. Energy Information Administration (EIA, 2018), more than 60 percent of all capacity of proposed electricity generators in Texas will come from renewable sources, mainly wind and solar, which use far less water than conventional fossil fuel sources to generate power. This projection methodology was based on a study (CDM Smith, 2016) funded by the TWDB. The study's goal was to find the best projection method for this sector that the TWDB can update regularly and that better reflects overall, historic patterns of water demand in this sector.

Steam-electric power accounts for roughly 5 percent of Texas' total water demand across the planning horizon. Regions G and K (occupying the Brazos and Lower Colorado basins) account for over 40 percent of statewide steam-electric power water demand. Regional water plans for Regions C and H noted concern that the assumption of no growth in steam-electric water demand after 2020 does not reflect ongoing growth in the electric demands in the regions. The Region C plan stated that several water suppliers have included a management supply factor to help mitigate this concern. The Region H plan acknowledged the need for continuing evaluation of this topic in future planning cycles to consider the potential for mitigating influence from changes in regional power generation water use characteristics, power generation facility types, and implementation of less water-intensive technologies.

## **4.3** Comparison to the 2017 State Water Plan

Overall, population projections in the new plan increased by less than 1 percent within each planning decade largely due to adjustments requested by five planning groups and based on more recent population estimates from the U.S. Census Bureau. The most significant changes occurred in Region C, which expects more than 330,000 additional residents by 2070 than were included in the previous plan. These are rather small changes in the big picture: where the 2017 plan projected 51 million Texans by 2070, the new plan projects that there will be 51.5 million.

***Figure 4-10. Comparison of water demand projections between 2017 and 2022 state water plans (millions of acre-feet)***




*Note: Historical water use and projected demand can be further explored through the TWDB's state water plan comparison tool, www.twdb.texas.gov/waterplanning/data/dashboard/index.asp*

Total water demand projections across all six categories decreased considerably this planning cycle, primarily due to methodological revisions grounded in reported historical use. Statewide, this plan projects water demand to be about 727,000 acre-feet per year lower in 2020 (a 4 percent decrease) and more than 2.3 million acre-feet per year lower by 2070 (an 11 percent decrease) (Figure 4-10). This can be attributed mainly to significant declines in long-range projections for manufacturing and steam-electric power water demand due to revisions to TWDB methodologies in these categories. Substantial decreases in irrigation demand projections in some regions were mostly offset by increases in other regions. Mirroring the small increases to population projections, total municipal water demand increased in the new plan by less than 1 percent in each planning decade.

## 4.4 Uncertainty of population and water demands

The population and water demand projections used to develop the regional and state water plans are re-evaluated each five-year planning cycle because they are products of many complex and dynamic real-world forces and data-driven calculations. The baseline for population projections is adjusted every other planning cycle when new decadal data from the U.S. Census Bureau is released. In each planning cycle, the TWDB relies on input from the planning groups to adjust draft projections based on local data and information from a diverse range of stakeholders, including the U.S. Census Bureau and the state demographer. Many of the underlying factors that influence water use are difficult to accurately predict, especially at the micro level and over the long term, resulting in the inherent uncertainty of water demand projections. The uncertainty of these types of projections tends to decline as you increase their geographic extent by aggregating more entities, whereas uncertainty increases as you focus more locally on smaller numbers. In other words, there is a high level of confidence in the approximate total number of Texans to expect by 2070 even if the individual zip codes are unpredictable.

For example, a wide range of factors can influence the long-range outlook for municipal and non-municipal water demand through 2070. Population growth and distribution depend on economic and social factors including individual preferences. Municipal water demand depends on population growth and distribution and how much water residents are using. Per capita water use depends on individual preferences, culture and habits, the weather, local conservation ordinances, and the adoption of more water-efficient appliances.

Irrigation and livestock demands are strongly influenced by the economy and the weather. Historically, irrigation has been the category of greatest water use in Texas. Irrigation demand is contingent upon many variables such as the number of acres of each crop, the water needs of each crop type, and the weather. Economic factors also contribute to irrigation demand, including prices of agricultural commodities and agricultural production inputs like fuel and fertilizer. Complex government policies such as farm subsidies and disaster assistance can also be influential. The TWDB is currently working toward developing remote sensing expertise and capabilities through collaborative efforts with the OpenET project team to assist in better refining irrigation water use estimates and projected demands for future state water plans.

Manufacturing, mining, and steam-electric power demands are influenced by numerous economic factors such as price levels of their inputs and outputs, the resources needed for production, technology, and markets, as well as government regulation. Because most industrial processes are energy intensive, the prices of energy sources such as gasoline, natural gas, coal, and renewable sources are also of particular importance.

Rather than attempting to predict this complex array of future economic conditions and government policies and trying to translate those often contradictory factors into water demand projections, the TWDB grounds its projections in the reported data of its historic annual water use estimates and strives to adhere to relatively straightforward, highly credible, and fully transparent projection methodologies that can be revisited each five-year cycle. This allows each state water plan to be adaptive to changes and incorporate the most recent and best available information.

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