

Texas Water Development Board



2016 Region M Water Plan Chapter 2: Water Demand Projections

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List of Abbreviations

| | |
|-------|---|
| BEG | Bureau of Economic Geology |
| GPCD | Gallons per Capita per Day |
| NAICS | North American Industry Classification System |
| RGWM | Rio Grande Water Master |
| RWP | Regional Water Plan |
| RWPG | Regional Water Planning Group |
| SWP | State Water Plan |
| SIC | Standard Industrial Classification |
| TRC | Texas Railroad Commission |
| TSDC | Texas State Data Center |
| TWDB | Texas Water Development Board |
| WMS | Water Management Strategy |
| WUG | Water User Group |

Chapter 2. Water Demand Projections

2.1 Introduction

In order to plan for future growth, the current water demands must be quantified and trends must be identified in the change in demands. Region M has experienced changes in both the quantity and type of demands as a result of population growth, changes in irrigated farmland and the type of crops that are grown in any given year, and changes in industrial water demand as a result of oil and gas mining operations, and other factors.

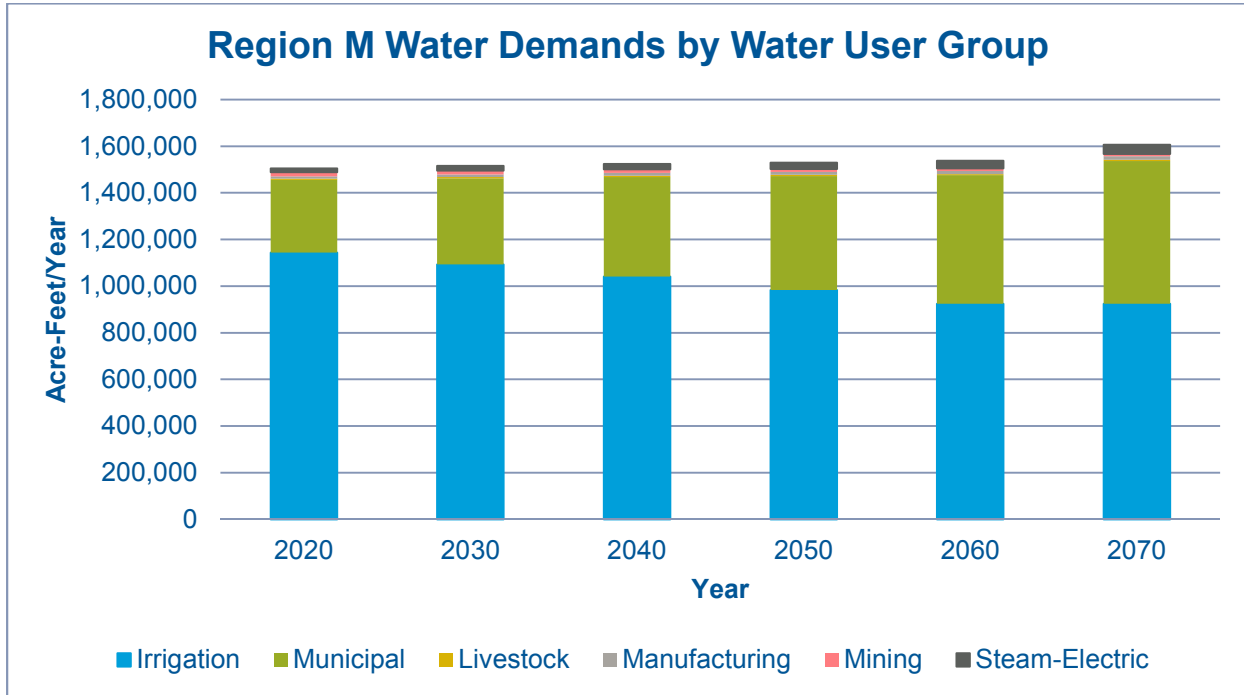


Figure 2-1 Aggregated Demands by Water User Group, Region M (Acre-feet/year)

The TWDB has collaborated with the RWPGs to develop demand projections for the region’s water users, shown in Figure 2-1 and Table 2-1. Population and municipal demands were estimated for cities and unincorporated areas for municipal water user group (WUG) projections. Other users were aggregated into geographical areas defined by county and river basin boundaries, such as Irrigation and Steam Electric Power Generation, to form the demand projections for all other WUGs. TWDB estimated demands based on historical data and recent studies for each category, establishing the *base year*. The base year was used with a *rate of change* to project decadal estimates over the 50-year planning horizon.

The TWDB draft demand projections were distributed to the RWPGs for review and were revised where necessary based on local information. The Region M Planning Group agreed with the TWDB estimates for population and municipal demand, manufacturing, steam-electric, and livestock demand. Revisions were requested and adopted for irrigation and mining demands based on recent studies and an alternative approach to estimating changes in irrigation demands.

Table 2-1 Regional Demand Projections by Water User Group (Acre-feet/year)

| Water User Group | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Municipal | 311,591 | 368,997 | 427,611 | 488,449 | 550,830 | 612,127 |
| Irrigation | 1,144,135 | 1,093,749 | 1,040,789 | 983,283 | 924,558 | 924,558 |
| Livestock | 4,986 | 4,986 | 4,986 | 4,986 | 4,986 | 4,986 |
| Manufacturing | 10,433 | 11,292 | 12,147 | 12,898 | 13,896 | 14,971 |
| Mining | 17,031 | 16,458 | 14,937 | 12,813 | 10,453 | 10,359 |
| Steam-Electric | 16,972 | 19,842 | 23,340 | 27,605 | 32,806 | 38,916 |
| Total | 1,505,148 | 1,515,324 | 1,523,810 | 1,530,034 | 1,537,529 | 1,605,917 |

2.2 Municipal Demands

2.2.1 Population Projections

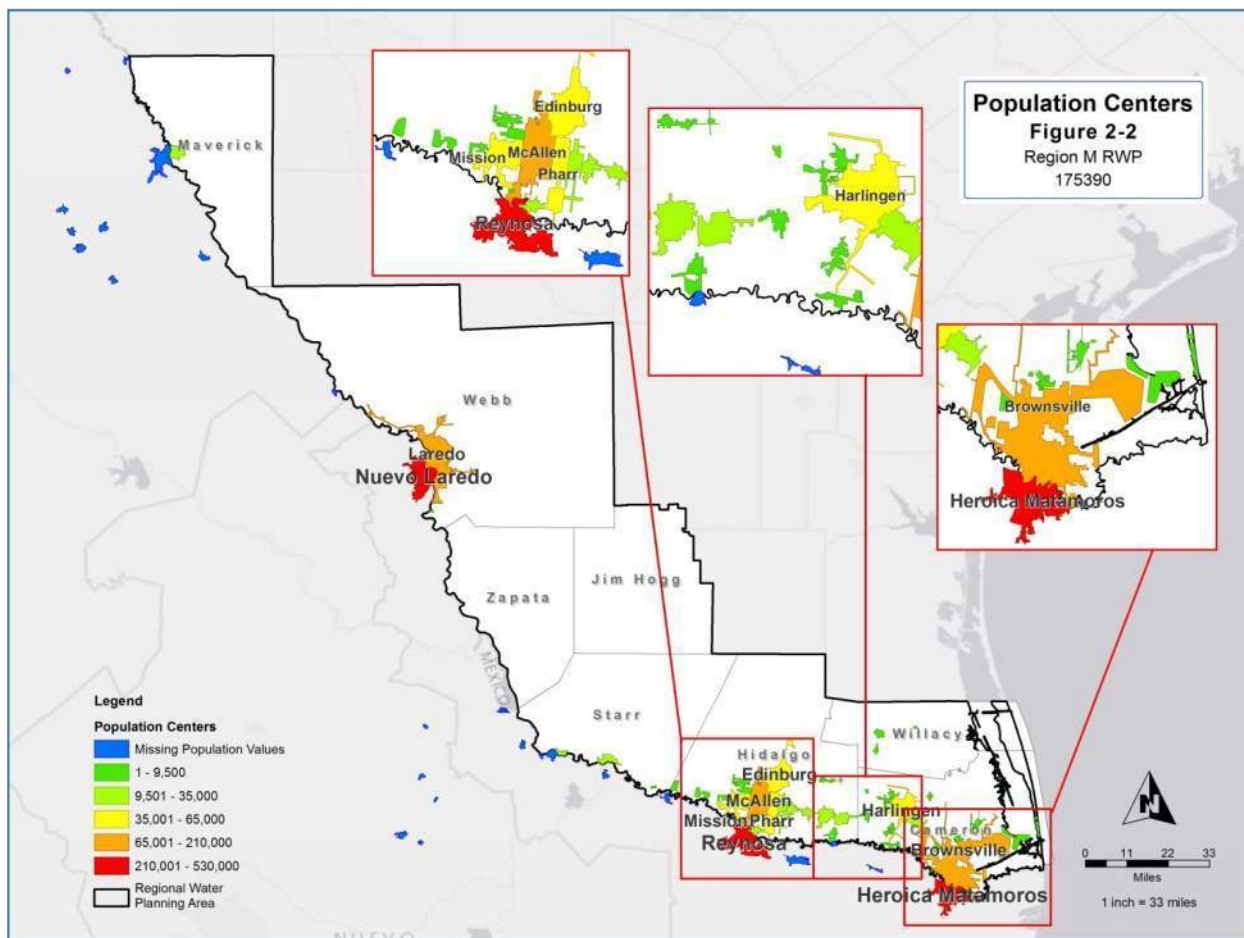


Figure 2-2 Population Projections for Region M by County

The population of Region M has been growing at about the same rate as the rest of the state of Texas. Figure 2-2 shows the major population centers within the Region. Table 2-2 shows the population growth by county over the planning horizon.

Table 2-2 Population Growth Projections for Region M

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|--------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Cameron | 478,974 | 559,593 | 641,376 | 729,461 | 820,068 | 912,941 |
| Hidalgo | 981,890 | 1,219,225 | 1,457,502 | 1,696,257 | 1,935,015 | 2,167,137 |
| Jim Hogg | 5,853 | 6,356 | 6,790 | 7,274 | 7,694 | 8,082 |
| Maverick | 63,107 | 72,491 | 81,243 | 90,304 | 98,988 | 107,327 |
| Starr | 70,803 | 80,085 | 88,633 | 97,107 | 104,687 | 111,555 |
| Webb | 318,028 | 393,284 | 464,960 | 530,330 | 591,945 | 647,433 |
| Willacy | 25,264 | 28,479 | 31,559 | 34,840 | 38,012 | 41,121 |
| Zapata | 16,819 | 19,709 | 22,876 | 26,365 | 29,976 | 33,742 |
| Total | 1,960,738 | 2,379,222 | 2,794,939 | 3,211,938 | 3,626,385 | 4,029,338 |

The TWDB generated draft projections for population and municipal demand, which were adopted by the Planning group on August 16, 2013. County-level population projections are based on Texas State Data Center (TSDC) / Office of the State Demographer county-level population estimates. These projections are based on recent and projected demographic trends, including birth rates, survival rates, and net migration rates for population cohorts separated by age, gender, and race/ethnicity.

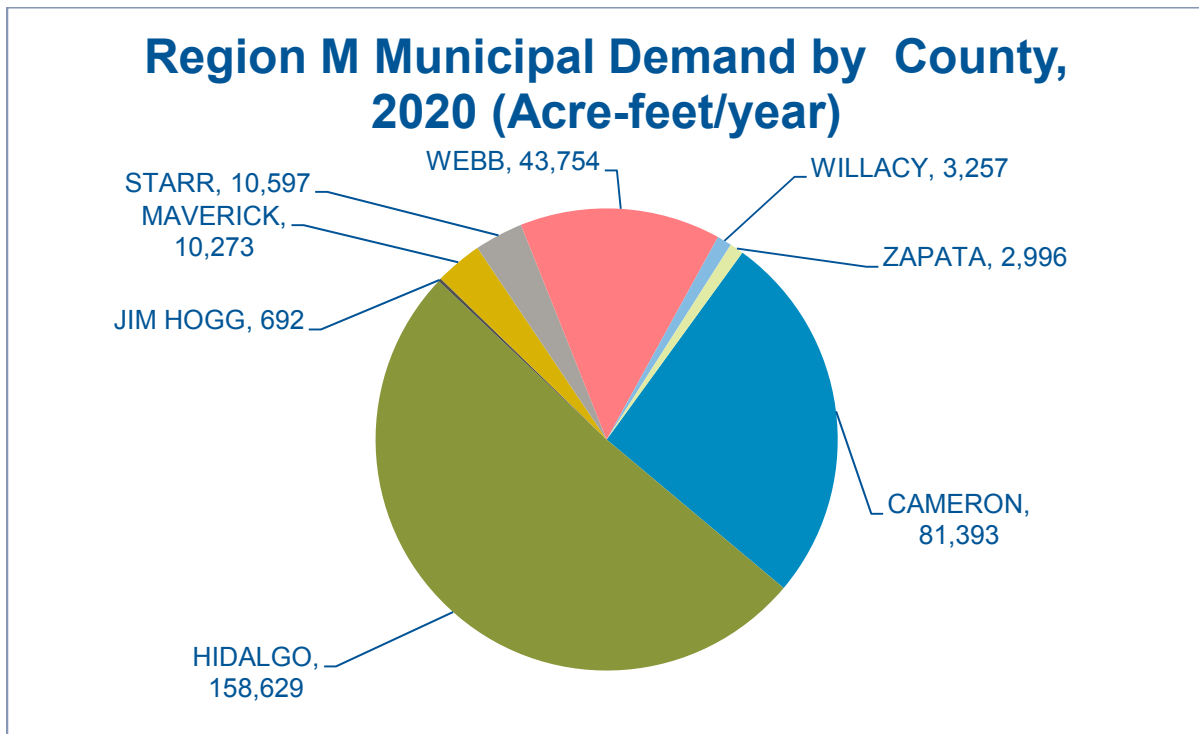


Figure 2-3 Municipal Demand Distribution among the Eight Counties of Region M (Acre-feet/year)

The TSDC developed county-level population projections from 2011 to 2050 under three migration scenarios:

1. No net migration (natural growth/decline only),

2. Continued net migration rates of 2000-2010 (“full migration scenario”), and
3. Half of the 2000-2010 migration rates (“half-migration scenario”).

TSDC’s projections extend to 2050, and the TWDB staff extended the projection to the extent of the planning horizon, through 2060 and 2070, by using the trend average annual growth rates of the 2011-2050 TSDC projections.

The county-level projections were then distributed to a municipal WUG-level.¹ Municipal WUGs in the regional planning process include:

- Cities with a 2010 population greater than 500;²
- Select Census Designated Places, such as military bases and in counties with no incorporated cities;
- Utilities (areas outside the places listed above) providing more than 280 acre-ft. of municipal water per year;
- Collections of utilities with a common water supplier or water supplies (collective reporting units); and
- Remaining rural, unincorporated population summarized as “County-Other.”

The projections for the individual WUGs were developed by allocating growth from the county projections to each of the cities, utilities, and rural areas within that county. A combination of factors influenced the allocation of growth, including that WUG’s share of historical growth or historical population, and instances where a WUG is expected to have a constant population, like a prison or military base.

Table 2-3 Historical and Projected Population, by Decade

| County/City | Census 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|-----------------------|----------------|---------|---------|---------|---------|---------|---------|
| Cameron County | | | | | | | |
| Brownsville | 175,023 | 211,200 | 251,288 | 291,955 | 335,755 | 380,809 | 426,990 |
| Combes | 2,895 | 3,414 | 3,989 | 4,571 | 5,199 | 5,845 | 6,507 |

¹ In some cases, the boundaries of qualifying water user groups may overlap. Examples and the method of population and water use allocation include: (1) City utility serving beyond city limits – The service area boundary of a city-owned water utility may extend beyond the city boundaries; in such cases the population and associated water use outside of the city limits are allocated not to the city but to the County-Other WUG. (2) Non-city utility serving city residents – a non-city water utility may provide water directly to residents of a city that qualifies as a WUG; in such cases the population and associated water use in the shared area are attributed to the city rather than the non-city utility in the regional water plan.

² The criterion for including only cities with populations greater than 500 has been used throughout the regional planning process, beginning with the 2001 regional water plans and the 2002 state water plan. Smaller cities are included in the aggregated County-Other water use, but are not separately delineated because many such small cities may not have a public water system or may not be the owner of the system. Regional planning groups do have the option of combining smaller water systems/cities into a collective water use group when the systems share a similar source or provider and are anticipated to coordinate in meeting their future water needs. In addition, regions may request the inclusion of cities or systems below the threshold criteria as distinct water user groups. This can be accommodated in the online planning database.

| County/City | Census | | | | | | |
|-----------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
| County-Other | 44,311 | 47,407 | 50,849 | 54,339 | 58,099 | 61,967 | 65,934 |
| East Rio Hondo WSC | 23,267 | 27,435 | 32,052 | 36,736 | 41,782 | 46,971 | 52,291 |
| El Jardin WSC | 12,805 | 15,099 | 17,640 | 20,218 | 22,995 | 25,851 | 28,779 |
| Harlingen | 64,849 | 76,464 | 89,334 | 102,390 | 116,452 | 130,916 | 145,742 |
| Indian Lake | 640 | 755 | 882 | 1,011 | 1,150 | 1,293 | 1,439 |
| La Feria | 7,302 | 8,610 | 10,059 | 11,530 | 13,113 | 14,742 | 16,411 |
| Laguna Vista | 3,117 | 3,676 | 4,294 | 4,922 | 5,598 | 6,293 | 7,006 |
| Los Fresnos | 5,542 | 6,535 | 7,635 | 8,751 | 9,952 | 11,189 | 12,456 |
| Los Indios | 1,083 | 1,277 | 1,492 | 1,710 | 1,945 | 2,187 | 2,434 |
| Military Highway WSC | 16,505 | 19,462 | 22,737 | 26,060 | 29,639 | 33,320 | 37,094 |
| North Alamo WSC | 408 | 482 | 563 | 645 | 733 | 824 | 917 |
| Olmito WSC | 3,361 | 3,963 | 4,630 | 5,307 | 6,036 | 6,786 | 7,554 |
| Palm Valley | 1,304 | 1,538 | 1,797 | 2,059 | 2,342 | 2,633 | 2,931 |
| Port Isabel | 5,006 | 5,903 | 6,897 | 7,904 | 8,990 | 10,107 | 11,251 |
| Primera | 4,070 | 4,799 | 5,607 | 6,427 | 7,309 | 8,217 | 9,147 |
| Rancho Viejo | 2,437 | 2,874 | 3,358 | 3,848 | 4,377 | 4,920 | 5,477 |
| Rio Hondo | 2,356 | 2,778 | 3,246 | 3,720 | 4,231 | 4,757 | 5,295 |
| San Benito | 24,250 | 28,594 | 33,406 | 38,289 | 43,547 | 48,956 | 54,500 |
| Santa Rosa | 2,873 | 3,388 | 3,958 | 4,537 | 5,160 | 5,800 | 6,457 |
| South Padre Island | 2,816 | 3,321 | 3,880 | 4,447 | 5,057 | 5,685 | 6,329 |
| <i>Cameron County Total</i> | <i>406,220</i> | <i>478,974</i> | <i>559,593</i> | <i>641,376</i> | <i>729,461</i> | <i>820,068</i> | <i>912,941</i> |
| Hidalgo County | | | | | | | |
| Agua SUD | 41,133 | 52,129 | 64,729 | 77,379 | 90,055 | 102,731 | 115,054 |
| Alamo | 18,353 | 23,259 | 28,881 | 34,525 | 40,181 | 45,837 | 51,335 |
| Alton | 12,341 | 15,640 | 19,420 | 23,215 | 27,019 | 30,822 | 34,519 |
| County-Other | 32,223 | 40,847 | 50,722 | 60,632 | 70,564 | 80,490 | 90,146 |
| Donna | 15,798 | 20,021 | 24,860 | 29,719 | 34,587 | 39,456 | 44,189 |
| Edcouch | 3,161 | 4,006 | 4,974 | 5,946 | 6,920 | 7,894 | 8,841 |
| Edinburg | 77,100 | 97,711 | 121,329 | 145,041 | 168,800 | 192,560 | 215,659 |
| Elsa | 5,660 | 7,173 | 8,906 | 10,647 | 12,391 | 14,136 | 15,831 |
| Hidalgo | 11,198 | 14,191 | 17,621 | 21,065 | 24,516 | 27,967 | 31,322 |
| Hidalgo County MUD | | | | | | | |
| #1 | 5,412 | 6,858 | 8,516 | 10,181 | 11,848 | 13,516 | 15,138 |
| La Joya | 3,985 | 5,050 | 6,271 | 7,496 | 8,724 | 9,952 | 11,146 |
| La Villa | 1,957 | 2,480 | 3,079 | 3,681 | 4,284 | 4,887 | 5,474 |
| McAllen | 129,877 | 164,597 | 204,382 | 244,325 | 284,348 | 324,372 | 363,284 |
| Mercedes | 15,570 | 19,732 | 24,501 | 29,290 | 34,088 | 38,886 | 43,551 |
| Military Highway WSC | 9,581 | 12,142 | 15,077 | 18,023 | 20,976 | 23,928 | 26,799 |
| Mission | 77,058 | 97,658 | 121,263 | 144,962 | 168,708 | 192,455 | 215,541 |
| North Alamo WSC | 116,890 | 148,138 | 183,945 | 219,894 | 255,915 | 291,937 | 326,957 |
| Palmhurst | 2,607 | 3,303 | 4,102 | 4,904 | 5,707 | 6,511 | 7,292 |
| Palmview | 5,460 | 6,919 | 8,592 | 10,271 | 11,953 | 13,636 | 15,272 |
| Penitas | 4,403 | 5,580 | 6,928 | 8,282 | 9,639 | 10,996 | 12,315 |
| Pharr | 70,400 | 89,220 | 110,785 | 132,437 | 154,131 | 175,826 | 196,918 |
| Progreso | 5,507 | 6,979 | 8,666 | 10,359 | 12,056 | 13,753 | 15,403 |
| San Juan | 33,856 | 42,906 | 53,277 | 63,690 | 74,123 | 84,556 | 94,699 |

| County/City | Census 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|------------------------------|------------------------|----------------|------------------|------------------|------------------|------------------|------------------|
| Sharyland WSC | 35,567 | 45,075 | 55,970 | 66,908 | 77,869 | 88,829 | 99,485 |
| Sullivan City | 4,002 | 5,071 | 6,297 | 7,528 | 8,761 | 9,995 | 11,194 |
| Weslaco | 35,670 | 45,205 | 56,132 | 67,102 | 78,094 | 89,087 | 99,773 |
| <i>Hidalgo County Total</i> | <i>774,769</i> | <i>981,890</i> | <i>1,219,225</i> | <i>1,457,502</i> | <i>1,696,257</i> | <i>1,935,015</i> | <i>2,167,137</i> |
| Jim Hogg County | | | | | | | |
| County-Other | 742 | 819 | 889 | 950 | 1,018 | 1,077 | 1,131 |
| Hebbronville | 4,558 | 5,034 | 5,467 | 5,840 | 6,256 | 6,617 | 6,951 |
| <i>Jim Hogg County Total</i> | <i>5,300</i> | <i>5,853</i> | <i>6,356</i> | <i>6,790</i> | <i>7,274</i> | <i>7,694</i> | <i>8,082</i> |
| Maverick County | | | | | | | |
| County-Other | 28,010 | 31,983 | 36,197 | 40,127 | 44,196 | 48,095 | 51,839 |
| Eagle Pass | 26,248 | 31,124 | 36,294 | 41,116 | 46,108 | 50,893 | 55,488 |
| <i>Maverick County Total</i> | <i>54,258</i> | <i>63,107</i> | <i>72,491</i> | <i>81,243</i> | <i>90,304</i> | <i>98,988</i> | <i>107,327</i> |
| Starr County | | | | | | | |
| Agua SUD | 254 | 295 | 334 | 370 | 405 | 437 | 465 |
| County-Other | 24,657 | 28,631 | 32,385 | 35,841 | 39,269 | 42,334 | 45,113 |
| Escobares | 1,188 | 1,380 | 1,561 | 1,728 | 1,893 | 2,040 | 2,174 |
| La Grulla | 1,622 | 1,884 | 2,131 | 2,359 | 2,584 | 2,786 | 2,968 |
| Rio Grande City | 13,834 | 16,066 | 18,172 | 20,112 | 22,035 | 23,755 | 25,313 |
| Rio WSC | 3,298 | 3,831 | 4,333 | 4,795 | 5,253 | 5,663 | 6,035 |
| Roma | 9,765 | 11,341 | 12,827 | 14,196 | 15,554 | 16,768 | 17,868 |
| Union WSC | 6,350 | 7,375 | 8,342 | 9,232 | 10,114 | 10,904 | 11,619 |
| <i>Starr County Total</i> | <i>60,968</i> | <i>70,803</i> | <i>80,085</i> | <i>88,633</i> | <i>97,107</i> | <i>104,687</i> | <i>111,555</i> |
| Webb County | | | | | | | |
| County-Other | 6,146 | 7,810 | 9,658 | 11,418 | 13,023 | 14,536 | 15,899 |
| El Cenizo | 3,273 | 4,158 | 5,142 | 6,079 | 6,934 | 7,740 | 8,465 |
| Laredo | 236,091 | 299,969 | 370,952 | 438,558 | 500,216 | 558,332 | 610,669 |
| Rio Bravo | 4,794 | 6,091 | 7,532 | 8,905 | 10,157 | 11,337 | 12,400 |
| <i>Webb County Total</i> | <i>250,304</i> | <i>318,028</i> | <i>393,284</i> | <i>464,960</i> | <i>530,330</i> | <i>591,945</i> | <i>647,433</i> |
| Willacy County | | | | | | | |
| County-Other | 468 | 530 | 600 | 666 | 735 | 800 | 867 |
| East Rio Hondo WSC | 31 | 36 | 40 | 45 | 49 | 54 | 58 |
| Lyford | 2,611 | 2,981 | 3,360 | 3,723 | 4,110 | 4,485 | 4,851 |
| North Alamo WSC | 5,333 | 6,088 | 6,862 | 7,604 | 8,395 | 9,159 | 9,908 |
| Raymondville | 11,284 | 12,880 | 14,519 | 16,089 | 17,762 | 19,379 | 20,964 |
| San Perlita | 573 | 655 | 738 | 817 | 902 | 985 | 1,065 |
| Sebastian MUD | 1,834 | 2,094 | 2,360 | 2,615 | 2,887 | 3,150 | 3,408 |
| <i>Willacy County Total</i> | <i>22,134</i> | <i>25,264</i> | <i>28,479</i> | <i>31,559</i> | <i>34,840</i> | <i>38,012</i> | <i>41,121</i> |
| Zapata County | | | | | | | |
| County-Other | 2,321 | 2,785 | 3,262 | 3,787 | 4,366 | 4,962 | 5,587 |
| San Ygnacio MUD | 835 | 1,002 | 1,174 | 1,363 | 1,571 | 1,786 | 2,010 |

| County/City | Census 2010 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|----------------------------|------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Zapata County | | | | | | | |
| Waterworks | 10,862 | 13,032 | 15,273 | 17,726 | 20,428 | 23,228 | 26,145 |
| <i>Zapata County Total</i> | <i>14,018</i> | <i>16,819</i> | <i>19,709</i> | <i>22,876</i> | <i>26,365</i> | <i>29,976</i> | <i>33,742</i> |

2.2.2 **Municipal Water Demands**

Municipal water demand projections were developed from the population projections and a per-person water use volume (gallons per capita per day, GPCD). The base year uses 2011 GPCD values for each city, water utility, and rural area (County-Other), considered an initial ‘dry year’ water use estimate. Over the planning horizon, a reduction is applied to the GPCD based on expected replacement rates for adoption of water-efficient fixtures and appliances, so that the projected GPCD gradually decreases from the 2011 volume. For each municipal WUG, the projected GPCD is multiplied by the projected population for each future decade to develop municipal water demand projections. The 2011 GPCD for each WUG is calculated by:

- Calculating the net water use of each water system surveyed annually by the TWDB (total intake volume minus sales to large industrial facilities and to other public water suppliers),
- Allocating all or portions of the system net use and applicable estimates of non-system municipal water use (private groundwater) to the planning WUGs (city boundaries or water utility service areas), and
- Converting annual use to daily use, and city-wide to per-capita, using the 2011 population.

When calculating the base (2011) or projected GPCD values, TWDB staff applied a minimum of 60 GPCD.³ For city WUGs, the 2011 population estimates from the U.S. Census Bureau were used.⁴ For all non-city WUGS, the population reported in the annual water use survey was used, with an alternative calculation based on the reported number of connections if necessary.

The efficiency gains that are applied to GPCD are based on new construction and gradual replacement of fixtures and appliances in existing homes. The fixtures that were included in this estimate are: toilets, showerheads, dishwashers, and clothes washers. Total water savings are based on the phased implementation of federal efficiency requirements for each of these kinds of fixtures/appliances, and assumptions about the rate at which new homes are constructed and old

³ 60 GPCD minimum was based on the “Standard New Homes Retrofitted...” estimate of 39 GPCD for indoor use (Analysis of water Use in New Single Family Homes, Prepared by William B. DeOreo of Aquacraft Water Engineering & Management for the Salt Lake City Corporation and the USEPA, 2011) and an estimate that indoor use accounts for 69% of total household use (The Grass is Always Greener... Outdoor Residential Water Use in Texas, Sam Marie Hermitte and Robert Mace, TWDB Technical Note 12-01, 2012). The total of 56.5 GPCD is rounded up to account for additional local government and commercial water use.

⁴ Historically the July 1st population estimates from the TSDC have been used in GPCD calculation, however because the TSDC did not release their 2011 population estimates by January 2013, TWDB staff used the available Census Bureau Estimates.

fixtures are replaced.⁵ This is considered passive conservation and measures beyond those described above are included in the discussion of Advanced Water Conservation as a Water Management Strategy (WMS) in later chapters. Passive conservation savings are shown for each WUG in Table 2-4.

Table 2-4 Passive Efficiency Savings Projections for Municipal WUGs by County (Acre-feet/year)

| County | Entity Name | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---------|-----------------------|----------|----------|----------|----------|----------|----------|
| Cameron | Brownsville | 2,233.26 | 3,687.38 | 4,993.77 | 6,130.33 | 7,063.85 | 7,963.54 |
| Cameron | Combes | 38.05 | 62.60 | 84.69 | 103.31 | 117.92 | 131.93 |
| Cameron | County-Other, Cameron | 482.70 | 729.07 | 941.01 | 1,095.93 | 1,190.42 | 1,271.79 |
| Cameron | East Rio Hondo WSC | 236.63 | 374.11 | 491.74 | 596.26 | 684.51 | 767.31 |
| Cameron | El Jardin WSC | 139.70 | 223.48 | 296.68 | 360.61 | 413.22 | 462.60 |
| Cameron | Harlingen | 843.66 | 1,382.93 | 1,868.33 | 2,278.84 | 2,601.48 | 2,910.78 |
| Cameron | Indian Lake | 5.92 | 6.92 | 7.93 | 9.02 | 10.14 | 11.28 |
| Cameron | La Feria | 89.79 | 145.80 | 195.67 | 238.25 | 272.30 | 304.78 |
| Cameron | Laguna Vista | 31.79 | 50.55 | 66.71 | 80.95 | 92.91 | 104.14 |
| Cameron | Los Fresnos | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Cameron | Los Indios | 15.03 | 24.80 | 33.67 | 41.09 | 46.86 | 52.40 |
| Cameron | Military Highway WSC | 189.45 | 303.84 | 402.25 | 487.04 | 557.23 | 623.68 |
| Cameron | North Alamo WSC | 4.47 | 6.99 | 9.06 | 10.87 | 12.44 | 13.93 |
| Cameron | Olmito WSC | 44.97 | 73.54 | 99.33 | 121.16 | 138.27 | 154.59 |
| Cameron | Palm Valley | 18.42 | 30.52 | 41.54 | 50.74 | 57.84 | 64.68 |
| Cameron | Port Isabel | 69.03 | 114.03 | 154.85 | 189.02 | 215.56 | 241.09 |
| Cameron | Primera | 46.50 | 75.24 | 100.57 | 122.40 | 140.09 | 156.76 |
| Cameron | Rancho Viejo | 25.43 | 39.91 | 52.33 | 63.39 | 72.75 | 81.53 |
| Cameron | Rio Hondo | 29.87 | 48.94 | 62.50 | 71.09 | 79.93 | 88.97 |
| Cameron | San Benito | 333.43 | 550.07 | 747.13 | 912.17 | 1,040.27 | 1,162.96 |
| Cameron | Santa Rosa | 39.85 | 65.79 | 89.39 | 109.13 | 124.41 | 139.09 |
| Cameron | South Padre Island | 35.19 | 57.28 | 76.96 | 93.75 | 107.11 | 119.88 |
| Hidalgo | Agua SUD | 482.90 | 805.54 | 1,089.51 | 1,339.61 | 1,554.64 | 1,751.44 |
| Hidalgo | Alamo | 234.74 | 394.36 | 536.78 | 660.27 | 765.03 | 861.39 |
| Hidalgo | Alton | 119.48 | 196.00 | 260.82 | 319.90 | 372.87 | 420.69 |
| Hidalgo | County-Other, Hidalgo | 584.74 | 800.54 | 986.15 | 1,171.40 | 1,356.92 | 1,527.78 |
| Hidalgo | Donna | 238.39 | 411.02 | 568.59 | 702.01 | 811.00 | 912.25 |
| Hidalgo | Edcouch | 50.75 | 88.14 | 122.62 | 151.54 | 174.90 | 196.68 |
| Hidalgo | Edinburg | 897.49 | 1,497.68 | 2,024.34 | 2,488.30 | 2,888.15 | 3,253.94 |
| Hidalgo | Elsa | 89.51 | 155.23 | 215.63 | 266.49 | 307.66 | 345.97 |
| Hidalgo | Hidalgo | 128.76 | 213.76 | 288.11 | 353.98 | 411.01 | 463.12 |
| Hidalgo | Hidalgo County MUD #1 | 60.69 | 100.45 | 135.03 | 165.76 | 192.58 | 217.05 |

⁵ For details regarding the way efficiency improvements were calculated, see Regional Water Planning Documentation, Projection Methodology for Draft Population and Municipal Demands, TWDB.

| County | Entity Name | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|----------|--------------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Hidalgo | La Joya | 55.72 | 95.25 | 130.98 | 161.53 | 186.84 | 210.25 |
| Hidalgo | La Villa | 26.00 | 44.53 | 61.23 | 75.53 | 87.42 | 98.41 |
| Hidalgo | McAllen | 1,834.50 | 3,147.89 | 4,335.08 | 5,350.98 | 6,187.74 | 6,962.58 |
| Hidalgo | Mercedes | 231.19 | 398.50 | 551.52 | 680.81 | 786.66 | 884.93 |
| Hidalgo | Military Highway WSC | 118.19 | 201.47 | 278.19 | 344.69 | 400.16 | 450.58 |
| Hidalgo | Mission | 901.38 | 1,511.81 | 2,049.22 | 2,519.06 | 2,923.22 | 3,293.20 |
| Hidalgo | North Alamo WSC | 1,373.95 | 2,285.04 | 3,088.76 | 3,795.40 | 4,408.11 | 4,966.20 |
| Hidalgo | Palmhurst | 26.82 | 41.58 | 53.89 | 65.46 | 76.36 | 86.17 |
| Hidalgo | Palmview | 63.47 | 104.71 | 140.71 | 172.72 | 200.55 | 225.98 |
| Hidalgo | Penitas | 41.50 | 68.29 | 90.91 | 111.53 | 130.07 | 146.77 |
| Hidalgo | Pharr | 870.47 | 1,469.29 | 2,001.22 | 2,463.70 | 2,855.78 | 3,216.01 |
| Hidalgo | Progreso | 68.32 | 113.28 | 152.94 | 187.71 | 217.68 | 245.17 |
| Hidalgo | San Juan | 433.03 | 728.67 | 992.37 | 1,221.35 | 1,415.04 | 1,593.27 |
| Hidalgo | Sharyland WSC | 507.43 | 873.96 | 1,206.64 | 1,489.79 | 1,722.37 | 1,937.90 |
| Hidalgo | Sullivan City | 59.07 | 100.94 | 139.05 | 171.44 | 198.17 | 222.94 |
| Hidalgo | Weslaco | 482.06 | 823.67 | 1,131.22 | 1,394.38 | 1,613.61 | 1,816.10 |
| Jim Hogg | County-Other, Jim Hogg | 9.21 | 14.22 | 18.42 | 21.50 | 23.10 | 24.34 |
| Jim Hogg | Hebbronville | 57.01 | 88.37 | 114.61 | 133.78 | 143.64 | 151.36 |
| Maverick | County-Other, Maverick | 317.06 | 493.45 | 640.96 | 758.43 | 840.43 | 909.91 |
| Maverick | Eagle Pass | 342.01 | 558.19 | 743.80 | 894.54 | 1,002.19 | 1,097.65 |
| Starr | Agua SUD | 2.73 | 4.16 | 5.21 | 6.02 | 6.61 | 7.08 |
| Starr | County-Other, Starr | 337.38 | 542.69 | 719.84 | 847.63 | 926.59 | 990.95 |
| Starr | Escobares | 18.22 | 28.22 | 32.01 | 35.77 | 39.17 | 41.91 |
| Starr | La Grulla | 19.69 | 31.17 | 40.85 | 48.19 | 52.80 | 56.48 |
| Starr | Rio Grande City | 175.10 | 277.44 | 364.06 | 429.72 | 470.45 | 503.29 |
| Starr | Rio WSC | 33.47 | 51.01 | 65.10 | 76.32 | 83.99 | 89.91 |
| Starr | Roma | 129.70 | 205.75 | 270.64 | 319.53 | 349.54 | 373.88 |
| Starr | Union WSC | 65.51 | 99.52 | 126.78 | 148.52 | 163.42 | 174.92 |
| Webb | County-Other, Webb | 103.41 | 179.37 | 232.52 | 269.43 | 304.48 | 334.28 |
| Webb | El Cenizo | 43.55 | 72.17 | 96.76 | 116.51 | 131.96 | 144.98 |
| Webb | Laredo | 3,158.48 | 5,343.58 | 7,241.00 | 8,746.50 | 9,900.27 | 10,876.19 |
| Webb | Rio Bravo | 70.89 | 120.14 | 163.39 | 197.51 | 223.25 | 245.15 |
| Willacy | County-Other, Willacy | 3.73 | 5.04 | 5.90 | 6.79 | 7.64 | 8.36 |
| Willacy | East Rio Hondo WSC | 0.31 | 0.47 | 0.60 | 0.70 | 0.79 | 0.85 |
| Willacy | Lyford | 30.25 | 47.80 | 62.80 | 74.81 | 83.04 | 90.20 |
| Willacy | North Alamo WSC | 56.46 | 85.24 | 106.81 | 124.50 | 138.30 | 150.49 |
| Willacy | Raymondville | 137.93 | 218.90 | 288.89 | 344.20 | 381.61 | 414.70 |
| Willacy | San Perlita | 7.97 | 12.89 | 16.79 | 18.88 | 20.94 | 22.73 |
| Willacy | Sebastian MUD | 22.52 | 34.37 | 38.08 | 42.04 | 45.87 | 49.63 |
| Zapata | County-Other, Zapata | 39.62 | 52.36 | 62.65 | 73.90 | 85.43 | 96.75 |
| Zapata | San Ygnacio MUD | 11.58 | 19.06 | 26.12 | 32.26 | 37.21 | 42.08 |
| Zapata | Zapata County Waterworks | 139.70 | 227.02 | 308.56 | 380.30 | 439.46 | 497.28 |
| | | 20,267.18 | 33,537.99 | 45,240.77 | 55,138.97 | 63,186.23 | 70,529.83 |

The Regional average GPCD for 2020 is 141.8, and in 2070 is 135.6, which is a 4% reduction in per-capita daily demand over 50 years. The base year GPCD and projected demands for all Region M municipal WUGs is shown in Table 2-5.

Table 2-5 GPCD and Projected Municipal Demands by City/County (Acre-feet/year)

| County/City | Base Dry- Year GPCD | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|-----------------------------|------------------------------------|---------------|---------------|----------------|----------------|----------------|----------------|
| Cameron County | | | | | | | |
| Brownsville | 162 | 36,092 | 41,913 | 47,986 | 54,797 | 62,040 | 69,520 |
| Combes | 94 | 322 | 358 | 397 | 445 | 498 | 554 |
| County-Other | 155 | 7,749 | 8,100 | 8,494 | 8,992 | 9,569 | 10,176 |
| East Rio Hondo WSC | 132 | 3,820 | 4,366 | 4,941 | 5,582 | 6,261 | 6,965 |
| El Jardin WSC | 109 | 1,704 | 1,931 | 2,172 | 2,447 | 2,744 | 3,052 |
| Harlingen | 168 | 13,546 | 15,429 | 17,400 | 19,636 | 22,035 | 24,516 |
| Indian Lake | 67 | 51 | 60 | 68 | 78 | 87 | 97 |
| La Feria | 126 | 1,126 | 1,274 | 1,432 | 1,613 | 1,809 | 2,012 |
| Laguna Vista | 599 | 2,435 | 2,831 | 3,236 | 3,676 | 4,130 | 4,597 |
| Los Fresnos | 60 | 440 | 514 | 589 | 669 | 752 | 838 |
| Los Indios | 111 | 144 | 161 | 179 | 201 | 226 | 251 |
| Military Highway WSC | 144 | 2,950 | 3,364 | 3,802 | 4,294 | 4,818 | 5,360 |
| North Alamo WSC | 153 | 79 | 90 | 102 | 115 | 129 | 144 |
| Olmito WSC | 175 | 732 | 835 | 941 | 1,063 | 1,192 | 1,327 |
| Palm Valley | 176 | 285 | 324 | 365 | 411 | 462 | 514 |
| Port Isabel | 211 | 1,327 | 1,517 | 1,714 | 1,936 | 2,174 | 2,419 |
| Primera | 87 | 422 | 472 | 526 | 590 | 661 | 735 |
| Rancho Viejo | 267 | 835 | 965 | 1,099 | 1,246 | 1,399 | 1,557 |
| Rio Hondo | 75 | 204 | 224 | 251 | 285 | 320 | 356 |
| San Benito | 123 | 3,607 | 4,053 | 4,529 | 5,088 | 5,705 | 6,346 |
| Santa Rosa | 88 | 295 | 325 | 358 | 400 | 448 | 498 |
| South Padre Island | 877 | 3,228 | 3,755 | 4,292 | 4,875 | 5,478 | 6,098 |
| <i>Cameron County Total</i> | -- | <i>81,393</i> | <i>92,861</i> | <i>104,873</i> | <i>118,439</i> | <i>132,937</i> | <i>147,932</i> |
| Hidalgo County | | | | | | | |
| Agua SUD | 104 | 5,590 | 6,736 | 7,925 | 9,152 | 10,414 | 11,652 |
| Alamo | 133 | 3,231 | 3,909 | 4,607 | 5,326 | 6,064 | 6,787 |
| Alton | 125 | 2,071 | 2,524 | 2,990 | 3,464 | 3,943 | 4,413 |
| County-Other | 121 | 4,952 | 6,075 | 7,232 | 8,393 | 9,553 | 10,691 |
| Donna | 127 | 2,610 | 3,126 | 3,660 | 4,219 | 4,802 | 5,375 |
| Edcouch | 91 | 358 | 419 | 484 | 554 | 630 | 705 |
| Edinburg | 128 | 13,113 | 15,899 | 18,772 | 21,714 | 24,721 | 27,667 |
| Elsa | 112 | 811 | 963 | 1,121 | 1,289 | 1,466 | 1,641 |
| Hidalgo | 125 | 1,859 | 2,254 | 2,662 | 3,079 | 3,505 | 3,923 |
| Hidalgo County MUD #1 | 82 | 570 | 682 | 801 | 923 | 1,049 | 1,174 |
| La Joya | 125 | 652 | 783 | 919 | 1,060 | 1,207 | 1,351 |
| La Villa | 108 | 275 | 328 | 385 | 443 | 504 | 564 |
| McAllen | 220 | 38,728 | 47,219 | 55,875 | 64,722 | 73,748 | 82,563 |

| County/City | Base Dry- Year GPCD | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|------------------------------|------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Mercedes | 111 | 2,223 | 2,648 | 3,091 | 3,558 | 4,049 | 4,531 |
| Military Highway WSC | 144 | 1,841 | 2,231 | 2,629 | 3,039 | 3,460 | 3,873 |
| Mission | 193 | 20,212 | 24,704 | 29,290 | 33,954 | 38,684 | 43,305 |
| North Alamo WSC | 153 | 24,015 | 29,240 | 34,598 | 40,064 | 45,625 | 51,069 |
| Palmhurst | 259 | 932 | 1,149 | 1,369 | 1,591 | 1,813 | 2,030 |
| Palmview | 104 | 743 | 897 | 1,056 | 1,220 | 1,388 | 1,554 |
| Penitas | 103 | 603 | 732 | 865 | 1,001 | 1,139 | 1,275 |
| Pharr | 108 | 9,923 | 11,933 | 14,021 | 16,183 | 18,415 | 20,607 |
| Progreso | 101 | 722 | 868 | 1,020 | 1,177 | 1,339 | 1,498 |
| San Juan | 137 | 6,152 | 7,448 | 8,782 | 10,154 | 11,561 | 12,940 |
| Sharyland WSC | 169 | 8,026 | 9,722 | 11,460 | 13,252 | 15,094 | 16,896 |
| Sullivan City | 106 | 544 | 647 | 755 | 869 | 989 | 1,107 |
| Weslaco | 165 | 7,873 | 9,551 | 11,271 | 13,040 | 14,852 | 16,625 |
| <i>Hidalgo County Total</i> | -- | <i>158,629</i> | <i>192,687</i> | <i>227,640</i> | <i>263,440</i> | <i>300,014</i> | <i>335,816</i> |
| Jim Hogg County | | | | | | | |
| County-Other | 118 | 100 | 104 | 108 | 114 | 120 | 126 |
| Hebbronville | 115 | 592 | 616 | 638 | 673 | 709 | 745 |
| <i>Jim Hogg County Total</i> | -- | <i>692</i> | <i>720</i> | <i>746</i> | <i>787</i> | <i>829</i> | <i>871</i> |
| Maverick County | | | | | | | |
| County-Other | 128 | 4,269 | 4,697 | 5,113 | 5,579 | 6,056 | 6,523 |
| Eagle Pass | 182 | 6,004 | 6,841 | 7,639 | 8,506 | 9,374 | 10,215 |
| <i>Maverick County Total</i> | -- | <i>10,273</i> | <i>11,538</i> | <i>12,752</i> | <i>14,085</i> | <i>15,430</i> | <i>16,738</i> |
| Starr County | | | | | | | |
| Agua SUD | 104 | 32 | 35 | 38 | 42 | 45 | 48 |
| County-Other | 124 | 3,640 | 3,956 | 4,259 | 4,607 | 4,954 | 5,276 |
| Escobares | 121 | 169 | 184 | 203 | 221 | 238 | 253 |
| La Grulla | 169 | 337 | 373 | 406 | 441 | 475 | 506 |
| Rio Grande City | 223 | 3,839 | 4,262 | 4,660 | 5,075 | 5,464 | 5,820 |
| Rio WSC | 100 | 396 | 435 | 473 | 513 | 551 | 587 |
| Roma | 117 | 1,357 | 1,476 | 1,590 | 1,719 | 1,849 | 1,968 |
| Union WSC | 108 | 827 | 910 | 991 | 1,076 | 1,156 | 1,231 |
| <i>Starr County Total</i> | -- | <i>10,597</i> | <i>11,631</i> | <i>12,620</i> | <i>13,694</i> | <i>14,732</i> | <i>15,689</i> |
| Webb County | | | | | | | |
| County-Other | 116 | 912 | 1,076 | 1,252 | 1,423 | 1,585 | 1,732 |
| El Cenizo | 93 | 390 | 464 | 537 | 606 | 675 | 737 |
| Laredo | 134 | 41,867 | 50,337 | 58,587 | 66,336 | 73,905 | 80,785 |
| Rio Bravo | 96 | 585 | 690 | 795 | 895 | 996 | 1,089 |
| <i>Webb County Total</i> | -- | <i>43,754</i> | <i>52,567</i> | <i>61,171</i> | <i>69,260</i> | <i>77,161</i> | <i>84,343</i> |
| Willacy County | | | | | | | |
| County-Other | 118 | 67 | 75 | 83 | 91 | 99 | 107 |

| County/City | Base Dry- Year GPCD | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|-----------------------------|---------------------------|-------|-------|-------|-------|-------|-------|
| East Rio Hondo WSC | 132 | 6 | 6 | 7 | 7 | 8 | 8 |
| Lyford | 96 | 291 | 314 | 338 | 368 | 400 | 432 |
| North Alamo WSC | 153 | 987 | 1,091 | 1,197 | 1,315 | 1,432 | 1,548 |
| Raymondville | 115 | 1,522 | 1,652 | 1,784 | 1,944 | 2,115 | 2,286 |
| San Perlita | 330 | 235 | 260 | 286 | 315 | 344 | 371 |
| Sebastian MUD | 73 | 149 | 159 | 176 | 195 | 212 | 230 |
| <i>Willacy County Total</i> | -- | 3,257 | 3,557 | 3,871 | 4,235 | 4,610 | 4,982 |
| Zapata County | | | | | | | |
| County-Other | 138 | 391 | 452 | 523 | 601 | 682 | 767 |
| San Ygnacio MUD | 179 | 190 | 217 | 248 | 283 | 321 | 361 |
| Zapata County Waterworks | 175 | 2,415 | 2,767 | 3,167 | 3,625 | 4,114 | 4,628 |
| <i>Zapata County Total</i> | -- | 2,996 | 3,436 | 3,938 | 4,509 | 5,117 | 5,756 |

2.2.3 Wholesale Water Providers

There are 51 Wholesale Water Providers (WWPs) or WUG-Sellers in Region M. These include Irrigation Districts, which sell raw water to irrigation and municipal users, as well as water supply corporations (WSCs), cities with customers outside of their service area, and regional water suppliers like Southmost Regional Water Authority. All of the contract demands between WWPs or WUG Sellers and WUGs are given in Appendix B.

2.3 Irrigation Demands

2.3.1 Base Year Demand

Irrigation use within Region M is largely dependent on available supply from the Amistad-Falcon reservoir system; however, it is important that regional planning irrigation estimates make a distinction between irrigation water use and irrigation water demand. Since the RWP process permits only a single demand scenario and is intended to represent a drought year, irrigation demand is best developed assuming a dry year in which regional irrigation water needs are met, rather than limiting demand to the availability of surface water supplies.

In most actual drought years, some farmers can respond to anticipated limited water supplies by selecting crops that require less water or no ‘applied’ water (dry land farming) which are often lower in value. Similarly, citrus and pecan trees can tolerate minimal water for a limited time period, but their true demand is greater than the minimum water required to survive. In order to address the long-term needs of the farmers in Region M, demands are based on the “worst-case” scenario, where there is minimal rainfall. A detailed discussion of irrigation conservation measures is included in Chapter 5.

Various methodologies have been proposed for the estimation of irrigation demand. The 2011 RWP used the portion of agricultural water rights associated with each county to estimate the base year agricultural demand. The rate of change used in the 2011 RWP projected a rapid

decrease between 2020 and 2030, and a constant demand from 2030 through the remainder of the planning horizon.

The initial data proposed by the TWDB for this round of planning established a base year calculated using an average of 2005 to 2009 estimated water use, where that historical water use varied based on supply availability and climate conditions from year to year.

The Region M RWPG formed a sub-committee to research alternative methods for estimating non-population related demand within the TWDB standards. An alternate methodology was developed by the RWPG and approved by TWDB staff. Instead of using the base proposed by TWDB, the base year is established utilizing the same data set but aggregating the maximum year for each county and assembling a new representative demand year. This revised approach results in an increase of the 2011 base year estimate from 998,000 acre-ft. to 1,100,000 acre-ft., which is over 12%. A summary of the TWDB base year estimates, the average use, and the 5-year maximum use are shown in Table 2-6.

Table 2-6 Summary of TWDB Irrigation Base-Year Demand Estimates (Acre-feet/year)

| County | 2005 | 2006 | 2007 | 2008 | 2009 | 5-Year Average | 5-Year Maximum |
|--------------|----------------|----------------|----------------|------------------|------------------|----------------|------------------|
| Cameron | 298,503 | 308,571 | 322,976 | 314,353 | 314,597 | 311,800 | 322,976 |
| Hidalgo | 513,348 | 530,395 | 519,770 | 610,576 | 616,600 | 558,138 | 616,600 |
| Jim Hogg | 500 | 500 | 417 | 563 | 0 | 396 | 563 |
| Maverick | 53,720 | 69,592 | 33,325 | 30,194 | 40,000 | 45,366 | 69,592 |
| Starr | 7,358 | 9,756 | 14,060 | 17,387 | 17,504 | 13,213 | 17,504 |
| Webb | 7,250 | 9,544 | 6,610 | 3,738 | 4,750 | 6,378 | 9,544 |
| Willacy | 57,532 | 57,000 | 57,457 | 59,300 | 59,700 | 58,198 | 59,700 |
| Zapata | 3,414 | 4,033 | 4,349 | 2,780 | 6,300 | 4,175 | 6,300 |
| Total | 941,625 | 989,391 | 958,964 | 1,038,891 | 1,059,451 | 997,664 | 1,102,779 |

2.3.2 Rate of Change

In addition to revising the methods for estimating the base year demand, the Region M stakeholders had concerns about the methods used for estimating the rate of change. Specifically, the approach TWDB used to estimate irrigation demands is based on the 2001 Regional Water Plan, and does not reflect the data and trends of the last 15 years.

Faculty at Texas AgriLife Research recommended that, for this planning cycle, a “relatively quick and updated rate of change” be developed that considers the relationship between municipal and irrigation demands. Given that both agriculture and municipal users rely primarily on the Rio Grande for water, it follows that as municipal demands increase, the agricultural demands will decrease as land area that was farmed is developed and municipal demand pressures will lead to some irrigation water rights being converted to municipal water rights. In response, Black & Veatch created a simple model that irrigation demands decline over the planning horizon at the same rate that municipal demands increase. “This *is* better than using the 15-year old rate of change that has been used in previous plans that assumes no change over

several decades” (Lacewell et. al, 2012). Municipal demands from the 2011 RWP were used because updated municipal demands were not yet available at the time.⁶ The model was applied to all counties in the region except Webb County, which was omitted due to the comparatively large growth in municipal demand projected in the 2011 RWP (more than 90,000 acre-ft./year) versus a relatively small irrigation base year of 7,250 acre-ft./year.

Table 2-7 provides a detailed by county summary of the adopted revisions. Figure 2-4 compares the 2011 RWP and current irrigation projections.

Table 2-7 Irrigation Demand Projections by County (Acre-feet/year)

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|-----------------|------------------|------------------|------------------|----------------|----------------|----------------|
| Cameron | 355,962 | 339,470 | 322,622 | 305,522 | 288,601 | 288,601 |
| Hidalgo | 639,676 | 609,754 | 577,457 | 540,797 | 502,563 | 502,563 |
| Jim Hogg | 439 | 413 | 398 | 414 | 451 | 451 |
| Maverick | 52,993 | 51,886 | 50,903 | 49,951 | 49,076 | 49,076 |
| Starr | 13,483 | 11,085 | 8,646 | 6,192 | 3,714 | 3,714 |
| Webb | 7,612 | 7,612 | 7,612 | 7,612 | 7,612 | 7,612 |
| Willacy | 69,253 | 69,074 | 68,936 | 68,814 | 68,741 | 68,741 |
| Zapata | 4,717 | 4,455 | 4,215 | 3,981 | 3,800 | 3,800 |
| Total | 1,144,135 | 1,093,749 | 1,040,789 | 983,283 | 924,558 | 924,558 |

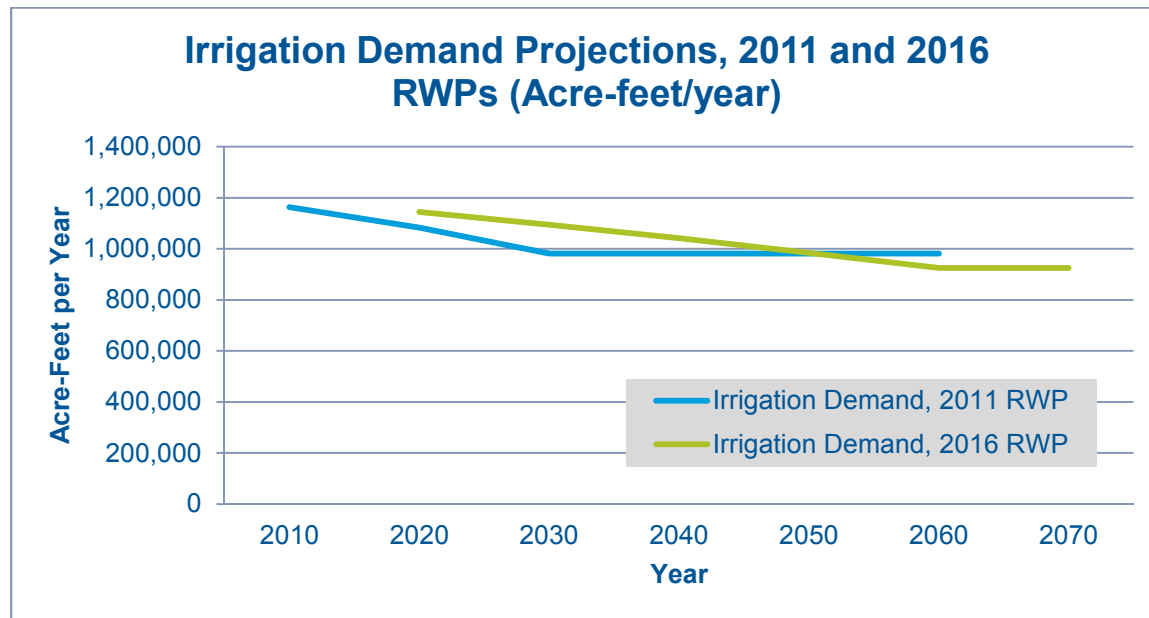


Figure 2-4 Irrigation Projections from Region M 2011 RWP and 2016 RWP (Acre-feet/year)

⁶ The 2012 SWP municipal demand data only extends to 2060, so the 2060 values were used for 2070.

2.3.3 Recommendation for Future Study

The Region M Planning Group recommended that a special study be conducted in the near future to better understand historical, existing and future irrigation water demands within the planning area. Such a study would consider the impacts of urbanization and potential water rights transfers. It should also include passive irrigation conservation measures that are expected to occur as either a regulatory or legislative requirement. It is recommended that the resulting updated projections not include active irrigation conservation measures (such as canal lining or crop portfolio optimization), as these are considered to be specific water management strategies by TWDB and are addressed as part of the water management strategy evaluation task. This approach would be consistent with the municipal conservation model, with measures divided into passive and active, or ‘advanced’ measures.

2.4 Manufacturing Demands

TWDB projects that manufacturing will make up less than 2% of the overall non-population related water demands and less than 30% of overall industrial water demands in Region M throughout the planning horizon. The primary manufacturing water users are related to the agriculture industry and the fishing industry, including shrimp farming, and sugar and vegetable processing. Manufacturing projections show an increase in water demand from 10,400 acre-ft./year in decade 2020 to 15,000 acre-ft./year in decade 2070. The majority of the increase in demand occurs in Cameron and Hidalgo counties and represents a 25% higher projection than the adopted 2011 RWP manufacturing projections. The region-wide manufacturing projections are shown in Table 2-8 by county for the planning horizon.

Table 2-8 Manufacturing Demand Projections by County (Acre-feet/year)

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|--------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Cameron | 4,708 | 5,111 | 5,510 | 5,856 | 6,324 | 6,829 |
| Hidalgo | 5,461 | 5,909 | 6,357 | 6,756 | 7,276 | 7,836 |
| Jim Hogg | 0 | 0 | 0 | 0 | 0 | 0 |
| Maverick | 93 | 98 | 103 | 107 | 114 | 121 |
| Starr | 14 | 15 | 16 | 17 | 18 | 19 |
| Webb | 21 | 23 | 25 | 26 | 28 | 30 |
| Willacy | 136 | 136 | 136 | 136 | 136 | 136 |
| Zapata | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 10,433 | 11,292 | 12,147 | 12,898 | 13,896 | 14,971 |

2.4.1 Base Year

Manufacturing water demand projections utilized 2004-2008 data from TWDB’s Annual Water Use Survey. In counties where reported employment from the companies returning surveys was low compared to manufacturing employment data reported by the Bureau of Economic Analysis, surveyed water use was adjusted to account for non-responses.

2.4.2 Rate of Change

The rate of change for manufacturing projections from the 2011 RWP was applied to the updated 2016 RWP base year estimate. The 2011 RWP manufacturing rate of change utilized the rate of

change initially developed for the 1997 SWP, which followed increasing population trends. Because of the relatively small portion of the overall demands that manufacturing represents, and no major shifts are expected in the region, the TWDB projections were adopted by the RWPG.

2.5 Mining Demands

Mining water usage in Region M is dominated by hydraulic fracturing, with some aggregate operations in Hidalgo, Starr, and Webb Counties. One of the major hurdles in evaluating mining water usage is the lack of consistent reporting, especially for groundwater usage. In Region M, the use of surface water from the Rio Grande allowed the Region M Planning Group to further inform water demand projections for mining.

In 2011 the Bureau of Economic Geology (BEG) issued a report, “Current and Projected Water Use in the Texas Mining and Oil and Gas Industry” (June 2011, the 2011 report) and a subsequent update to the report, “Oil and Gas Water Use Report: Update to the 2011 Mining Water Use Report” (September 2012, the 2012 update) to better reflect some of the fast-moving changes to water use due to the growth of hydraulic fracturing across the state.⁷ This initial report addressed traditional mining water usage and the update used new information to better estimate hydraulic fracturing water use.

The TWDB staff and Black & Veatch considered the data provided by the BEG, and additionally referenced the Texas Railroad Commission, and FracFocus, a Hydraulic Fracturing well and chemical disclosure registry, to develop estimates for both Base Year and Rate of Change. County-by-county determinations were made for the most appropriate base year demand and how that demand splits between groundwater and surface water.

2.5.1 Base Year

Statewide, a major shift from gas to oil production significantly changed the spatial distribution of production in a relatively short time. Within Region M, accelerated development of the Eagle Ford Shale reflected this trend. Adoption of operating practices that allowed for more water recycling and use of brackish water also changed patterns of water consumption and usage at the same time that overall water usage was increasing. Thus, another major objective of the 2012 update was to further differentiate between total water use and consumptive use for mining operations.

Water usage was estimated for the upstream segment of the oil and gas industry, that is, water used to extract the commodity until it leaves the wellhead. For the aggregate industry, estimates included washing but no further processing, for coal mostly pit dewatering and aquifer depressurization, or mining as defined in the SIC/NAICS codes. Therefore cement factories, in spite of large quarries, are grouped with manufacturing and not mining.

Reuse or recycling is taken into account in water-use values, as well as opportunity usages like stormwater collection for aggregate mining. Usage numbers mostly represent consumption. The

⁷ Bureau of Economic Geology, Oil and Gas Water Use in Texas: 2011 Mining Water Use Report...and Update to the 2011 Mining Water Use Report. Bureau of Economic Geology, Scott W. Tinker, Director, Jackson School of Geosciences, The University of Texas at Austin, Austin, Texas 78713-8924

division of water between surface and groundwater sources is not well documented. Some facilities provided this information directly, but no consistent information is available due to the reporting exemption for the oil and gas industry. The BEG estimated that approximately 56% of water used in mining statewide was groundwater, and regional estimates varied from 7% in Zapata County to 86% in Maverick County.

The BEG report estimated water usage for the oil and gas, coal, aggregate, and other mineral sectors for a base year and projected through 2060. The data were linearly interpolated through 2070 by TWDB staff. The base year for the 2011 BEG report is 2008; the base year for the 2012 update is 2011. Water usage from the different sectors was calculated variously (only the oil and gas sector was considered in the 2012 report). In general, the data used was compiled from reports submitted to the state for permitting (e.g. information about wells submitted to Railroad Commission of Texas, RRC), surveys distributed by TWDB, and communication with operators and industry trade groups.

For the oil and gas sector, estimates of water use for water-flooding and drilling operations were developed through consultation with operators.⁸ There is not a single directly reported source for this information. As noted, one major objective of the 2012 update was to better differentiate between total water usage, which is the volume of water needed for operations regardless of source, and water consumption or “new” water usage, i.e. the portion of demand not met by recycled or reused water. Estimates from operators regarding water sources and current and anticipated future levels of recycling were used to further quantify demand met from various sources for current and projected water use.

Oil and gas sector water usage was projected in the 2012 update using a resource-based approach. Estimates of quantity of developable resources, quantity of operations needed for extraction, and amount of water used by these operations were developed for each major production region. Concentration of future operations was distributed spatially by characteristics of each major play. Temporal distribution was accomplished by modeling production with a hyperbolic decline curve, once again parameterized by data specific to each play.

No comprehensive data set exists for aggregate mining. Surveys were distributed to operators, but despite collaboration with industry trade groups response rates were low. Some data from similar historical water-use surveys distributed by TWDB were available. Records of aggregate production coupled with water-use coefficients from previous studies were also utilized in the attempt to quantify aggregate industry water use. The product of aggregate mining is used locally, so population projections were used to predict future production and water use for this sector as well.

⁸ Information from a database compiled by a private vendor (IHS) provided the basis for calculating water used for well development by hydraulic fracturing. Data explicitly reporting water use was available from this source. While a report must be submitted for each well receiving a permit, the completeness and quality of these data varies. Across the state, the percentage of wells determined to be reporting full and consistent information ranged from about 93% in the Barnett Shale to about 32% in the Cotton Valley formation. The Eagle Ford Shale had full and consistent reporting for 47% of permitted wells.

Table 2-9 Base Year Mining Demand by Resource (Acre-feet/year)

| BEG Base-Year Data | Coal & Lignite | Crushed Stone | Sand & Gravel | Oil & Gas |
|--------------------|----------------|---------------|---------------|-----------|
| Cameron | 0 | 0 | 0 | 27 |
| Hidalgo | 0 | 898 | 603 | 46 |
| Jim Hogg | 0 | 0 | 0 | 33 |
| Maverick | 0 | 0 | 0 | 174 |
| Starr | 0 | 180 | 5 | 35 |
| Webb | 0 | 100 | 0 | 4,599 |
| Willacy | 0 | 0 | 0 | 17 |
| Zapata | 0 | 0 | 0 | 30 |

2.5.2 Rate of Change

Limited data was available for groundwater usage, because of the reporting exemption afforded oil and gas industries. Surface water records were available for all Rio Grande water from the TCEQ Rio Grande Watermaster (RGWM). Because all water rights are classified according to their intended use, diversions associated with mining water rights were recorded and compared with the portion of mining usage attributed to surface water by the BEG. This surface water data was not used in the development of the BEG data, and revisions were made for some counties based on these records.

Each county used one of three different projection methodologies, based on evidence of existing traditional mining users and hydraulic fracturing operations. The majority of counties retained the BEG mining projections, based on the information discussed below for each portion of the mining sector.

In order to project future demands from current usage, the general approach was stated to be: 1) Assume general trends will continue. 2) Apply correction factors, such as an estimate of increased recycling in the oil and gas sector. 3) Distribute anticipated trends spatially and temporally. For all counties, the BEG estimated rate of change was used.

For Cameron and Hidalgo counties, where there is evidence of little to no hydraulic fracturing and a significant reliance on surface water, the Rio Grande Watermaster (RGWM) mining diversion data was used to scale the BEG projections.

Table 2-10 Sources of Data for Cameron and Hidalgo County Mining Water Projections

| Dataset | Cameron | Hidalgo |
|---|--------------|----------------|
| 2011 Oil & Gas Water Use (BEG 2012) | 27 acre-ft. | 46 acre-ft. |
| 2011 Water Use, All Other Sectors (BEG 2012) | 0 acre-ft. | 1,501 acre-ft. |
| 2011 Well Count, FracFocus Registry | 0 wells | 3 wells |
| 2011 Oil & Gas Wells, Texas Railroad Commission (TRC) | 4 wells | 47 wells |
| Operational Drilling Rigs in County (May 22, 2013 Baker Hughes Rig Count) | 0 rigs | 2 rigs |
| 2012 Mining Water Charged from Rio Grande, RGWM | 351 acre-ft. | 3,998 acre-ft. |

Although the BEG report estimated the split between ground and surface water for the base year data, the RGWM records showed a much higher use of surface water for mining. Therefore the RGWM surface water records were used in the place of the BEG surface water estimate, and the

groundwater estimate from BEG increased proportionally. The BEG rate of change, based on estimates of future productivity, was applied to the revised base year.

Table 2-11 Cameron and Hidalgo County Mining Water Use Revisions (Acre-feet/year)

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|-------------------|-------|-------|-------|-------|-------|-------|
| Cameron, BEG 2012 | 65 | 68 | 47 | 31 | 15 | 7 |
| Cameron, Adopted | 264 | 277 | 191 | 126 | 61 | 28 |
| Hidalgo, BEG 2012 | 2,445 | 3,203 | 3,888 | 4,592 | 5,385 | 6,339 |
| Hidalgo, Adopted | 2,844 | 3,620 | 4,198 | 4,819 | 5,532 | 6,434 |

Two other counties, Webb and Zapata, showed some surface water usage in the RGWM data that did not agree with the BEG estimates. Webb County, in the southern Eagle Ford Shale development area, was one of the top ten counties in the state by volume of water used for hydraulic fracturing in 2011. Actual water use in Webb County in 2011 was estimated to be more than double the amount initially projected for that year from the 2008 base-year data in the 2011 report, and was further increased based on the TCEQ Rio Grande Watermaster’s records.

The FracFocus Registry lists 164 wells reported with a total water use of 3,170 acre-ft., an average of 19.3 acre-ft. per well. Applying that per-well volume to the 221 wells permitted through TRC produces a 2011 water use of 4,265 acre-ft., which is similar to the BEG estimate of 4,719 acre-ft.

Comparing these estimates to the surface water diversion records shows a much larger than expected reliance on surface water, as opposed to the general assumption that hydraulic fracturing relied primarily on groundwater. Zapata County, on the other hand, shows a small volume of water used in oil and gas, but significantly more surface water than was estimated in the BEG report.

Table 2-12 Sources of Data for Webb and Zapata County Mining Water Projections

| Dataset | Webb | Zapata |
|---|----------------|----------------|
| 2011 Oil & Gas Water Use (BEG 2012) | 4,599 acre-ft. | 30 acre-ft. |
| 2011 Water Use, All Other Sectors (BEG 2012) | 0 acre-ft. | 1,501 acre-ft. |
| 2011 Well Count, FracFocus Registry | 164 wells | 3 wells |
| 2011 Oil & Gas Wells, Texas Railroad Commission (TRC) | 220 wells | 23 wells |
| Operational Drilling Rigs in County (May 22, 2013 Baker Hughes Rig Count) | 1 rig | 0 rigs |
| 2011 Mining Water Charged from Rio Grande, RGWM | 7,280 acre-ft. | 846 acre-ft. |
| 2012 Mining Water Charged from Rio Grande, RGWM | 6,728 acre-ft. | 763 acre-ft. |

The projections for Webb and Zapata Counties were revised to reflect the initial groundwater usage estimates from the BEG report and the 2011 RGWM records as a base year for surface water usage.

Table 2-13 Webb and Zapata County Mining Water Use Revisions (Acre-feet/year)

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|----------------|-------|-------|-------|-------|------|------|
| Webb, BEG 2012 | 3,862 | 3,008 | 2,257 | 1,537 | 690 | 502 |

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|------------------|--------|-------|-------|-------|-------|-------|
| Webb, Adopted | 10,331 | 8,047 | 6,038 | 4,112 | 1,846 | 1,343 |
| Zapata, BEG 2012 | 85 | 89 | 66 | 49 | 31 | 20 |
| Zapata, Adopted | 911 | 956 | 707 | 525 | 332 | 214 |

Jim Hogg, Maverick, Starr, and Willacy Counties mining use estimates are all directly based on the 2012 BEG report.

Table 2-14 Mining Water Demand Projections (Acre-feet/year)

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|--------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Cameron | 264 | 277 | 191 | 126 | 61 | 28 |
| Hidalgo | 2,844 | 3,620 | 4,198 | 4,819 | 5,532 | 6,434 |
| Jim Hogg | 93 | 97 | 72 | 53 | 34 | 22 |
| Maverick | 1,988 | 2,737 | 2,933 | 2,302 | 1,674 | 1,217 |
| Starr | 571 | 697 | 775 | 858 | 961 | 1,091 |
| Webb | 10,331 | 8,047 | 6,038 | 4,112 | 1,846 | 1,343 |
| Willacy | 49 | 51 | 38 | 28 | 18 | 12 |
| Zapata | 911 | 954 | 707 | 525 | 332 | 214 |
| Total | 17,051 | 16,480 | 14,952 | 12,823 | 10,458 | 10,361 |

2.6 Steam –Electric Power Generation Demand Projections

Steam-electric power generation water demand is projected to grow from less than 2% to over 4% of the overall non-population related water demands in Region M throughout the planning horizon. Similarly, the projections show an increase from 48% to over 62% of the overall industrial water demand. The steam-electric water demands show a significant temporal increase from approximately 17,000 acre-ft./year in 2020 to nearly 39,000 acre-ft./year in 2070. The region-wide steam-electric power generation water demand projections are shown in Table 2-15 by county for the planning horizon.

Table 2-15 Steam Electric Power Generation Demands by County (Acre-feet/year)

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Cameron | 1,523 | 1,780 | 2,094 | 2,477 | 2,944 | 3,428 |
| Hidalgo | 14,151 | 16,545 | 19,462 | 23,018 | 27,354 | 32,507 |
| Jim Hogg | 0 | 0 | 0 | 0 | 0 | 0 |
| Maverick | 0 | 0 | 0 | 0 | 0 | 0 |
| Starr | 0 | 0 | 0 | 0 | 0 | 0 |
| Webb | 1,298 | 1,517 | 1,784 | 2,110 | 2,508 | 2,981 |
| Willacy | 0 | 0 | 0 | 0 | 0 | 0 |
| Zapata | 0 | 0 | 0 | 0 | 0 | 0 |
| Total: | 16,972 | 19,842 | 23,340 | 27,605 | 32,806 | 38,916 |

2.6.1 Base Year

The 2011 RWP adopted the same water demand projections for steam-electric generation as was presented in the 2006 Regional Water Plan. The 2008 TWDB report *Water Demand Projections for Power Generation in Texas* by Tinker et al. estimated the base year from actual water consumption and electricity generation data for 2006, which was a lower estimate than previous reports. During the 2011 planning cycle Region M stakeholders elected to continue use of the more conservative base year estimates from the 2003 report. That base year was developed from the 2003 TWDB report *Water Power Generation Water Use in Texas* by Sledge et al. which estimated the base year demand using plant electricity generation data from the year 2000.

The 2016 RWP was estimated by gathering reported power generation, by fuel type, and applying a water use factor for the generating units for each existing plant. Cameron, Hidalgo and Webb counties are the only areas with demands associated with power generation..

2.6.2 Rate of Change

Similar to the base year, the 2011 Regional Water Plan Region M utilized the projected water demands presented in the 2003 TWDB report (Sledge et al, 2003) versus the 2008 TWDB report (Tinker et al, 2008). This same rate of change is again being carried forward for the 2016 RWP.

2.6.3 Recommendation

It is recommended that further review of existing generation facilities and their water usage be undertaken. Additionally, the total demand, rather than consumptive demand, should be considered, with all treated return flows shown as a water reuse strategy.

2.7 Livestock Demands

Livestock is expected to make up less than 1% of the overall non-population related water demands in Region M throughout the planning horizon. The livestock water demand projections show a constant demand of 4,986 acre-ft./year for decade 2020 through decade 2070. This represents 14% less demand for each planning decade than was predicted in the approved 2011 RWP livestock projections for Region M. The region-wide livestock projections are shown in Table 2-16 by county for the planning horizon.

Table 2-16 Livestock Demand Projections (Acre-feet/year)

| County | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Cameron | 334 | 334 | 334 | 334 | 334 | 334 |
| Hidalgo | 830 | 830 | 830 | 830 | 830 | 830 |
| Jim Hogg | 436 | 436 | 436 | 436 | 436 | 436 |
| Maverick | 499 | 499 | 499 | 499 | 499 | 499 |
| Starr | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 | 1,018 |
| Webb | 1,129 | 1,129 | 1,129 | 1,129 | 1,129 | 1,129 |
| Willacy | 261 | 261 | 261 | 261 | 261 | 261 |
| Zapata | 479 | 479 | 479 | 479 | 479 | 479 |
| Total | 4,986 | 4,986 | 4,986 | 4,986 | 4,986 | 4,986 |

2.7.1 Base Year Demand

Livestock water demand projections utilized an average of TWDB's 2005 to 2009 livestock water use estimates as the base year. Water use estimates for 2005 to 2009 were calculated by applying a water use coefficient for each livestock category to county level inventory estimates from Texas Agricultural Statistics Service. Livestock categories considered include breeding cattle, dairy cattle, feed cattle, hogs, pigs, sheep, goats, hens, broilers and horses.

2.7.2 Rate of Change

The rate of change for projections from the 2011 RWP was then applied to the updated base year. During the last RWP cycle many counties, including all of those within Region M, chose to hold the base constant throughout the planning horizon.