

1. DESCRIPTION OF REGION

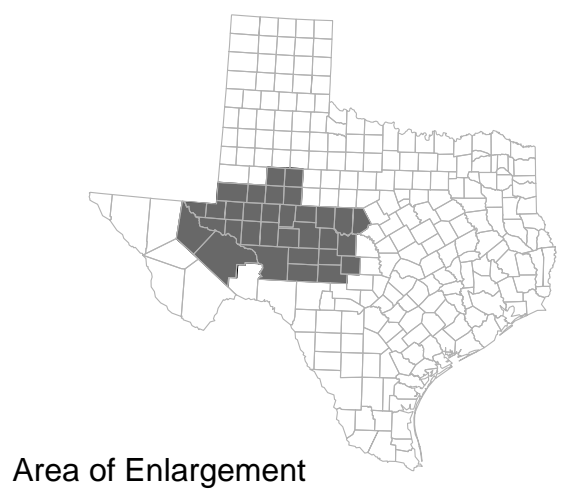
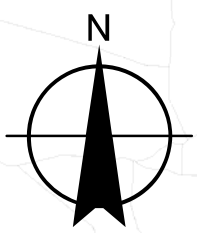
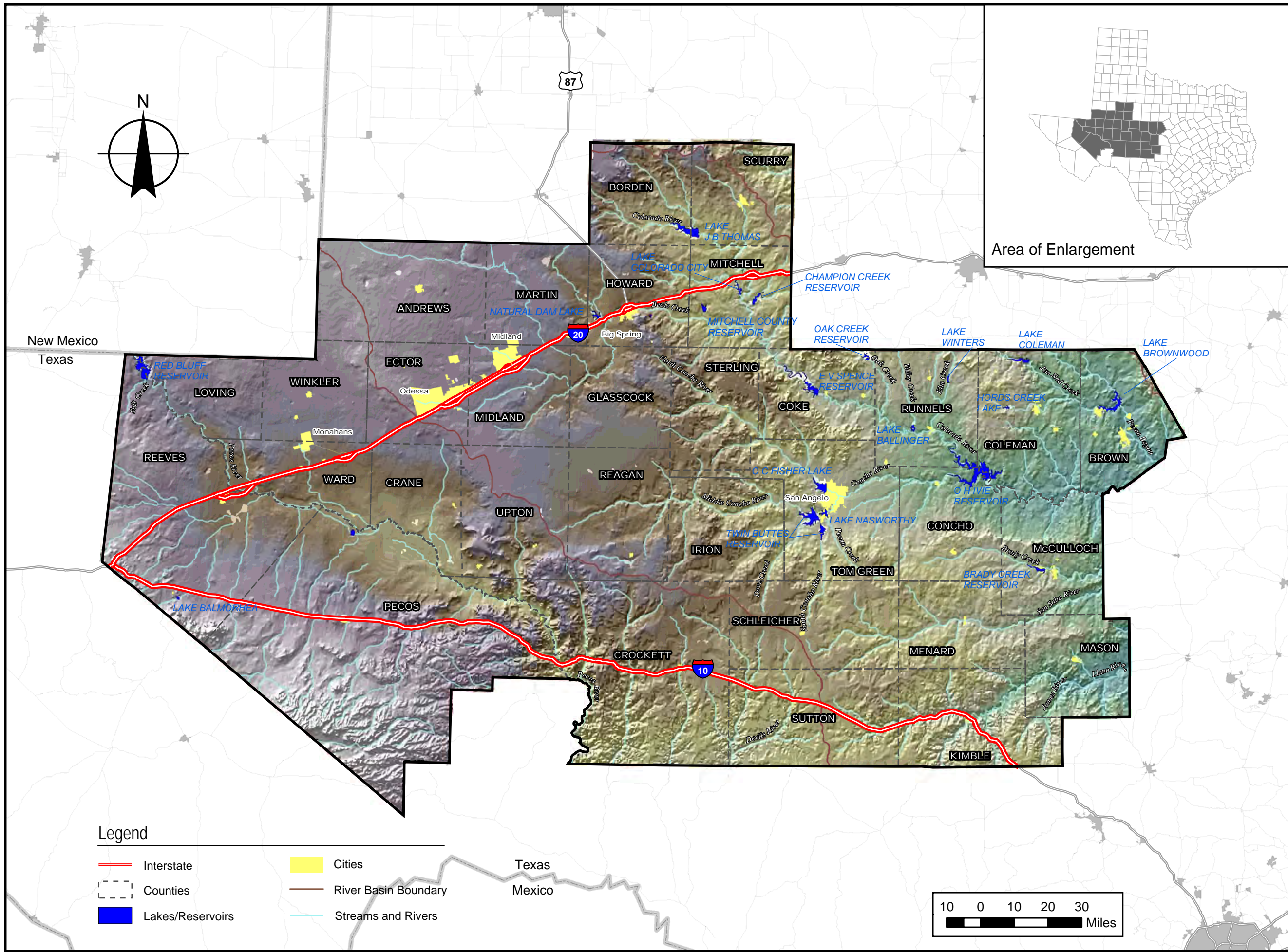
In 1997, the 75th Texas Legislature passed Senate Bill One (SB1), legislation designed to address Texas water issues. With the future passage of SB1, the legislature put in place a grass-roots regional planning process to plan for the future water needs of all Texans. To implement this planning process, the Texas Water Development Board (TWDB) created 16 regional water planning groups across the state and established regulations governing regional planning efforts. The first 16 Regional Water Plans developed as part of the SB1 planning process were submitted to the TWDB in 2001. The TWDB combined these regional plans into one statewide plan. SB1 calls for these plans to be updated every five years. Since 2001, the regional water plans were updated in 2006 and consolidated into the current state water plan, *Water for Texas 2007*.

The TWDB refers to the current round of regional planning as SB1, Third Round. This report is the update to the *2006 Region F Water Plan* and will become part of the basis for the next state water plan.

This chapter presents a description of Region F, one of the 16 regions created to implement SB1. Figure 1.1-1 is a map of Region F, which includes 32 counties in West Texas. The data presented in this regional water plan is a compilation of information from previous planning reports, on-going planning efforts and new data. A list of references is found at the end of this chapter, and a bibliography is included in Appendix 1A.

1.1 Introduction to Region F

Region F includes all of Borden, Scurry, Andrews, Martin, Howard, Mitchell, Loving, Winkler, Ector, Midland, Glasscock, Sterling, Coke, Runnels, Coleman, Brown, Reeves, Ward, Crane, Upton, Reagan, Irion, Tom Green, Concho, McCulloch, Pecos, Crockett, Schleicher, Menard, Sutton, Kimble and Mason Counties. Table 1.1-1 shows historical populations for these

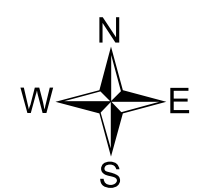


1.1-1
Figure

| | |
|-----------|------------------------|
| FN JOB NO | CMD07215 |
| FILE | RegionF_Hillshade2.mxd |
| DATE | April 2010 |
| SCALE | 1:1,750,000 |
| DESIGNED | BME |
| DRAFTED | BME |

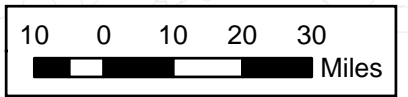
Region F

General Location Map



Legend

-  Interstate
-  Counties
-  Lakes/Reservoirs
-  Cities
-  River Basin Boundary
-  Streams and Rivers




Freese and Nichols
 4055 International Plaza Suite 200
 Fort Worth, Texas 76109-4895
 817-735-7300

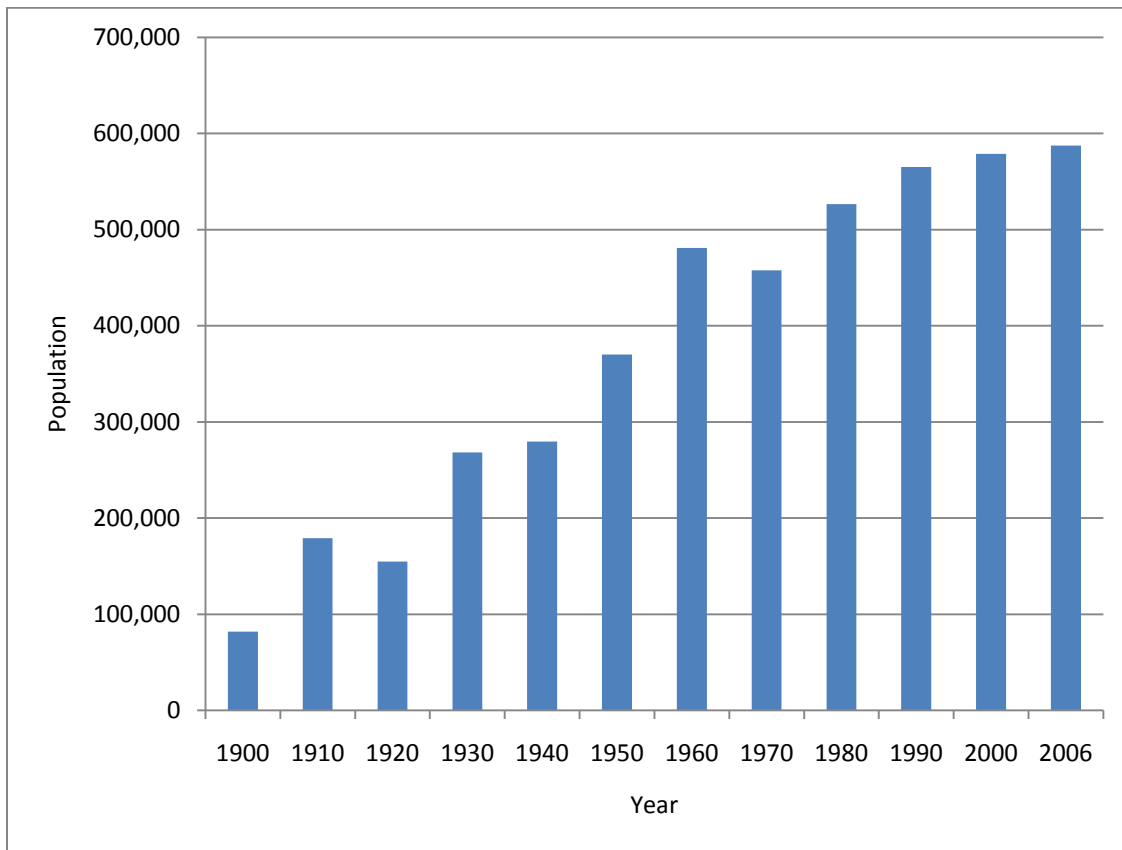
**Table 1.1-1
Historical Population of Region F Counties**

| County | 1900 | 1910 | 1920 | 1930 | 1940 | 1950 | 1960 | 1970 | 1980 | 1990 | 2000 | 2006 |
|------------------------|---------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Andrews | 87 | 975 | 350 | 736 | 1,277 | 5,002 | 13,450 | 10,372 | 13,323 | 14,338 | 13,004 | 13,154 |
| Borden | 776 | 1,386 | 965 | 1,505 | 1,396 | 1,106 | 1,076 | 888 | 859 | 799 | 729 | 710 |
| Brown | 16,019 | 22,935 | 21,682 | 26,382 | 25,924 | 28,607 | 24,728 | 25,877 | 33,057 | 34,371 | 37,674 | 38,617 |
| Coke | 3,430 | 6,412 | 4,557 | 5,253 | 4,590 | 4,045 | 3,589 | 3,087 | 3,196 | 3,424 | 3,864 | 3,897 |
| Coleman | 10,077 | 22,618 | 18,805 | 23,669 | 20,571 | 15,503 | 12,458 | 10,288 | 10,439 | 9,710 | 9,235 | 8,860 |
| Concho | 1,427 | 6,654 | 5,847 | 7,645 | 6,192 | 5,078 | 3,672 | 2,937 | 2,915 | 3,044 | 3,966 | 3,801 |
| Crane | 51 | 331 | 37 | 2,221 | 2,841 | 3,965 | 4,699 | 4,172 | 4,600 | 4,652 | 3,996 | 3,854 |
| Crockett | 1,591 | 1,296 | 1,500 | 2,590 | 2,809 | 3,981 | 4,209 | 3,885 | 4,608 | 4,078 | 4,099 | 3,986 |
| Ector | 381 | 1,178 | 760 | 3,958 | 15,051 | 42,102 | 90,995 | 91,805 | 115,374 | 118,934 | 121,123 | 127,212 |
| Glasscock | 286 | 1,143 | 555 | 1,263 | 1,193 | 1,089 | 1,118 | 1,155 | 1,304 | 1,447 | 1,406 | 1,241 |
| Howard | 2,528 | 8,881 | 6,962 | 22,888 | 20,990 | 26,722 | 40,139 | 37,796 | 33,142 | 32,343 | 33,627 | 32,918 |
| Irion | 848 | 1,283 | 1,610 | 2,049 | 1,963 | 1,590 | 1,183 | 1,070 | 1,386 | 1,629 | 1,771 | 1,748 |
| Kimble | 2,503 | 3,261 | 3,581 | 4,119 | 5,064 | 4,619 | 3,943 | 3,904 | 4,063 | 4,122 | 4,468 | 4,612 |
| Loving | 33 | 249 | 82 | 195 | 285 | 227 | 226 | 164 | 91 | 107 | 67 | 60 |
| Martin | 332 | 1,549 | 1,146 | 5,785 | 5,556 | 5,541 | 5,068 | 4,774 | 4,684 | 4,956 | 4,746 | 8,113 |
| Mason | 5,573 | 5,683 | 4,824 | 5,511 | 5,378 | 4,945 | 3,780 | 3,356 | 3,683 | 3,423 | 3,738 | 4,820 |
| McCulloch | 3,960 | 13,405 | 11,020 | 13,883 | 13,208 | 11,701 | 8,815 | 8,571 | 8,735 | 8,778 | 8,205 | 3,719 |
| Menard | 2,011 | 2,707 | 3,162 | 4,447 | 4,521 | 4,175 | 2,964 | 2,646 | 2,346 | 2,252 | 2,360 | 2,297 |
| Midland | 1,741 | 3,464 | 2,449 | 8,005 | 11,721 | 25,785 | 67,717 | 65,433 | 82,636 | 106,611 | 116,009 | 124,383 |
| Mitchell | 2,855 | 8,956 | 7,527 | 14,183 | 12,477 | 14,357 | 11,255 | 9,073 | 9,088 | 8,016 | 9,698 | 9,596 |
| Pecos ^c | 2,360 | 2,071 | 3,857 | 7,812 | 8,185 | 9,939 | 11,957 | 13,748 | 14,618 | 14,675 | 16,809 | 16,422 |
| Reagan ^b | | 392 | 377 | 3,026 | 1,997 | 3,127 | 3,782 | 3,239 | 4,135 | 4,514 | 3,326 | 3,041 |
| Reeves | 1,847 | 4,392 | 4,457 | 6,407 | 8,006 | 11,745 | 17,644 | 16,526 | 15,801 | 15,852 | 13,137 | 11,606 |
| Runnels | 5,379 | 20,858 | 17,074 | 21,821 | 18,903 | 16,771 | 15,016 | 12,108 | 11,872 | 11,294 | 11,495 | 11,020 |
| Schleicher | 515 | 1,893 | 1,851 | 3,166 | 3,083 | 2,852 | 2,791 | 2,277 | 2,820 | 2,990 | 2,935 | 2,911 |
| Scurry | 4,158 | 10,924 | 9,003 | 12,188 | 11,545 | 22,779 | 20,369 | 15,760 | 18,192 | 18,634 | 16,361 | 15,895 |
| Sterling | 1,127 | 1,493 | 1,053 | 1,431 | 1,404 | 1,282 | 1,177 | 1,056 | 1,206 | 1,438 | 1,393 | 1,223 |
| Sutton | 1,727 | 1,569 | 1,598 | 2,807 | 3,977 | 3,746 | 3,738 | 3,175 | 5,130 | 4,135 | 4,077 | 4,205 |
| Tom Green ^b | 6,804 | 17,882 | 15,210 | 36,033 | 39,302 | 58,929 | 64,630 | 71,047 | 84,784 | 98,458 | 104,010 | 103,123 |
| Upton | 48 | 501 | 253 | 5,968 | 4,297 | 5,307 | 6,239 | 4,697 | 4,619 | 4,447 | 3,404 | 3,169 |
| Ward | 1,451 | 2,389 | 2,615 | 4,599 | 9,575 | 13,346 | 14,917 | 13,019 | 13,976 | 13,115 | 10,909 | 10,369 |
| Winkler | 60 | 442 | 81 | 6,784 | 6,141 | 10,064 | 13,652 | 9,640 | 9,944 | 8,626 | 7,173 | 6,805 |
| Region F Total | 81,985 | 179,172 | 154,850 | 268,329 | 279,422 | 370,027 | 480,996 | 457,545 | 526,626 | 565,212 | 578,814 | 587,387 |
| % Change | | 119% | -14% | 73% | 4% | 32% | 30% | -5% | 15% | 7% | 2% | 1% |

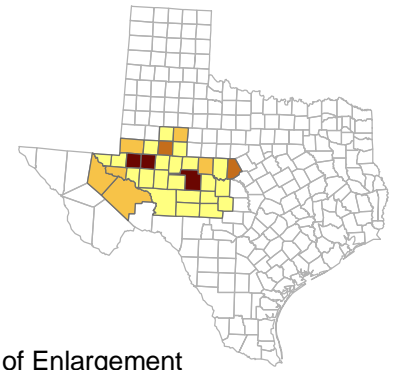
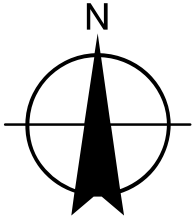
Notes: a. Population data are from the U.S. Bureau of Census
b. Reagan County was formed from part of Tom Green County in 1903
c. Terrell County was formed from part of Pecos County in 1905.

counties from 1900 through 2006.¹ Figure 1.1-2 shows graphically the total population of the region. The population of Region F has increased from 81,985 in 1900 to 587,387 in 2006. Since 1940, the region's population has increased at a compounded rate of 1.1 percent per year.

**Figure 1.1-2
Historical Population of Region F**

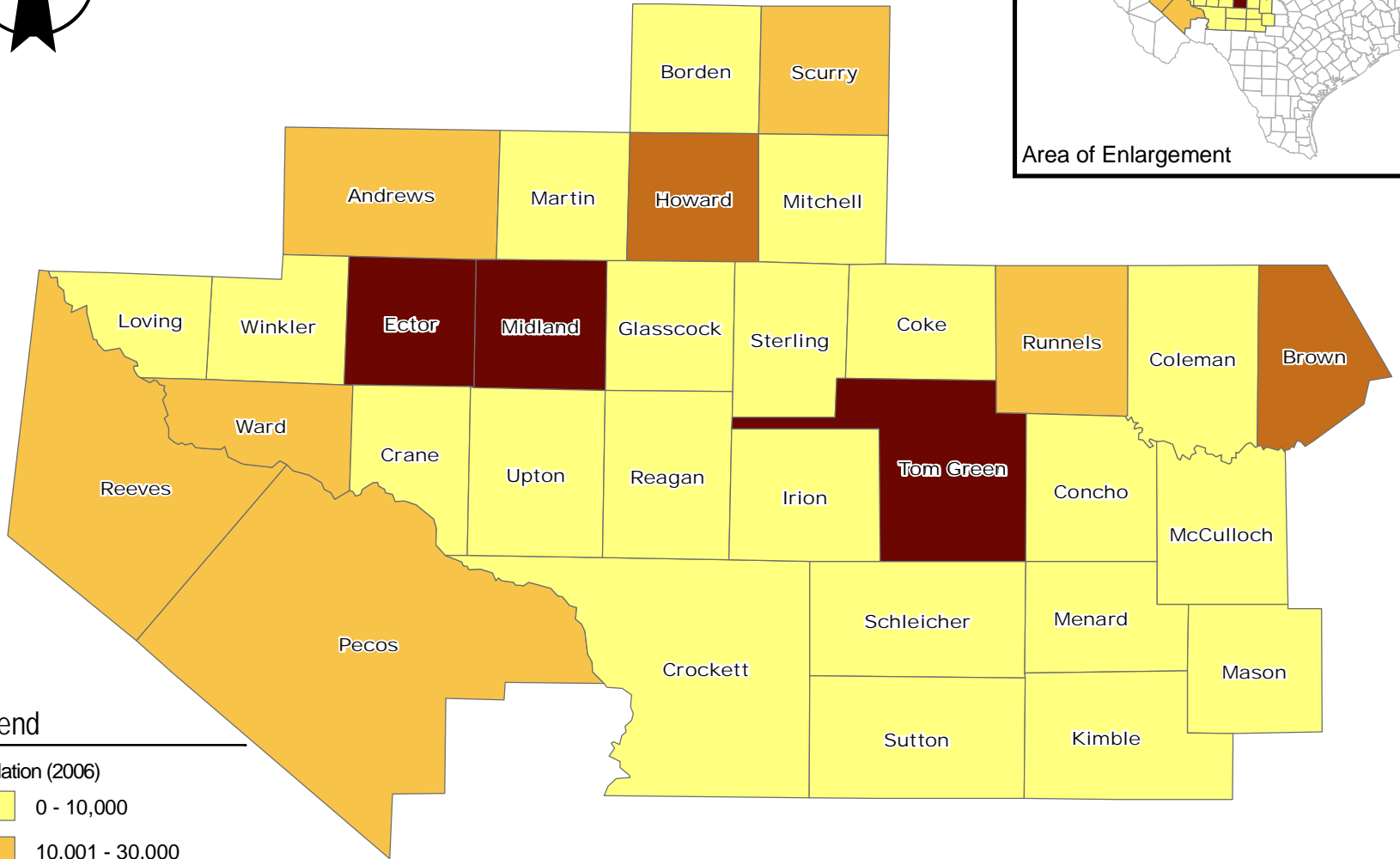


According to the 2000 census, Region F accounted for 3.0 percent of Texas' total population. Figure 1.1-3 shows the distribution of population in Region F counties based on the census data. Ector, Midland, and Tom Green were the three most populous counties in Region F, accounting for 59 percent of the region's population. Brown and Howard Counties were the next most populous counties with more than 30,000 people in each. Table 1.1-2 lists the six cities in Region F with a year 2006 population of more than 10,000. These cities included 57 percent of the population in Region F.

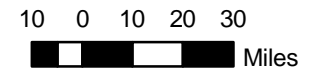
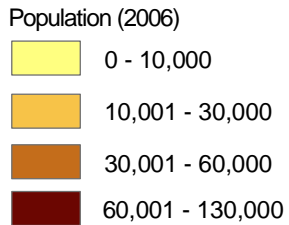


Area of Enlargement

Region F
Population Distribution by County
(2006)



Legend



FN:JOB:BN
 OMD:07215
 File: RegionF_Population.mxd
 DATE: January 4, 2010
 SCALE: 1:2,421,500
 DESIGNED: BME
 DRAFTED: BME

Table 1.1-2
Region F Cities with a Year 2006 Population Greater than 10,000

| City | Year 2006 Population |
|--------------|-------------------------|
| Midland | 100,193 |
| Odessa | 94,089 |
| San Angelo | 87,212 |
| Big Spring | 25,179 |
| Brownwood | 19,694 |
| Snyder | 10,493 |
| <i>Total</i> | <i>336,860</i> |

Data are from the State Data Center⁹.

1.1.1 Economic Activity in Region F

Region F includes the Midland, Odessa, and San Angelo Metropolitan Statistical Areas (MSAs). The largest employment sector in the Midland MSA is the service industry, followed by wholesale and retail trade and the oil and gas industry. In the Odessa and San Angelo MSAs the largest employment sectors are wholesale and retail trade, services, and manufacturing.² Table 1.1-3 summarizes 2007 payroll data for Region F by county and economic sector. (Data for certain payroll categories are only available on a state-wide basis and are not broken down by counties.)

Figure 1.1-4 shows the geographic distribution of total payroll in Region F. This figure shows that Ector, Midland and Tom Green Counties are the primary centers of economic activity in the region. These three counties account for 78 percent of the payroll and 71 percent of the employment in the region. Other major centers of economic activity are located in Brown and Howard Counties. The largest business sectors in Region F in terms of payroll in 2007 are healthcare and social assistance, mining and manufacturing, which together account for 43 percent of the region's total payroll.

**Table 1.1-3
2007 County Payroll by Category (\$1000)**

| Category | Andrews | Borden | Brown | Coke | Coleman | Concho | Crane | Crockett |
|------------------------------------------------------|----------------|---------------|----------------|--------------|----------------|---------------|---------------|-----------------|
| Forestry, Fishing, Hunting, and Agricultural Support | (N) | (N) | (D) | (D) | (D) | (N) | (N) | (D) |
| Mining | 51,169 | (N) | (D) | 729 | 696 | (D) | 26,616 | 6,960 |
| Utilities | (D) | (N) | 3,392 | (D) | (D) | (D) | (N) | D |
| Construction | 14,972 | (N) | 20,825 | 586 | (D) | 160 | 1,873 | 3,345 |
| Manufacturing | (D) | (N) | 124,654 | (D) | 2,023 | (D) | (D) | (D) |
| Wholesale Trade | 7,259 | (N) | 11,718 | (D) | 1,765 | 256 | 847 | 957 |
| Retail Trade | 7,850 | (D) | 43,541 | 1,263 | 4,155 | 1,180 | 2,528 | 4,300 |
| Transportation and Warehousing | 7,790 | (N) | 6,361 | (D) | 778 | (N) | 4,405 | 992 |
| Information | 920 | (N) | 8,155 | (D) | 1,036 | (D) | (N) | (D) |
| Finance and Insurance | 7,046 | (N) | 14,005 | 906 | 3,333 | (D) | 345 | (D) |
| Real Estate, Rental, and Leasing | 5,425 | (N) | 2,641 | (N) | 423 | (D) | (N) | (D) |
| Professional, Scientific and Technical Services | 2,371 | (D) | 4,871 | 150 | 708 | (D) | (D) | 348 |
| Management of Companies and Enterprises | (N) | (N) | 3,139 | (N) | (D) | (N) | (N) | (D) |
| Admin, Support, Waste Mgmt, Remediation Services | (D) | (N) | 5,328 | (D) | (D) | (D) | (D) | (D) |
| Educational Services | (D) | (D) | (D) | (N) | (D) | (N) | (D) | (N) |
| Health Care & Social Assistance | (D) | (N) | 74,221 | (N) | 9,065 | 2,654 | 4,564 | 524 |
| Arts, Entertainment, & Recreation | (D) | (N) | 1,203 | (D) | (D) | (D) | (D) | 104 |
| Accommodation & Food Services | 3,273 | (N) | 13,871 | 275 | 1,377 | 865 | 211 | 1,908 |
| Other Services | 10,953 | (N) | 11,880 | 382 | 1,118 | (D) | (D) | 402 |
| <i>Total Payroll</i> | <i>119,028</i> | <i>(D)</i> | <i>349,805</i> | <i>4,291</i> | <i>26,477</i> | <i>5,115</i> | <i>41,389</i> | <i>19,840</i> |
| <i>Total Employees</i> | <i>4,081</i> | <i>(N)</i> | <i>13,287</i> | <i>413</i> | <i>1,607</i> | <i>674</i> | <i>1,002</i> | <i>928</i> |

Table 1.1-3 (cont.) 2007 County Payroll by Category (\$1000)

| Category | Ector | Glasscock | Howard | Irion | Kimble | Loving | Martin | Mason |
|------------------------------------------------------|------------------|------------------|----------------|--------------|---------------|---------------|---------------|---------------|
| Forestry, Fishing, Hunting, and Agricultural Support | (D) | 880 | (D) | (D) | (N) | (N) | (D) | (D) |
| Mining | 256,212 | (D) | 38,893 | 939 | (D) | (N) | 5,333 | (D) |
| Utilities | 10,915 | (N) | 4,871 | (N) | (D) | (N) | (N) | (D) |
| Construction | 275,054 | (D) | 17,578 | 1,325 | 3,683 | (N) | (D) | 1,291 |
| Manufacturing | 217,893 | (D) | 46,569 | (N) | 7,116 | (N) | (N) | (D) |
| Wholesale Trade | 264,324 | (D) | 10,650 | (D) | D | (N) | (D) | (D) |
| Retail Trade | 175,007 | (D) | 29,034 | (D) | 4,613 | (N) | 2,833 | 2,285 |
| Transportation and Warehousing | 72,211 | (N) | 1,677 | (D) | (D) | (N) | (D) | 594 |
| Information | (D) | (N) | 3,560 | (D) | 213 | (N) | (D) | (D) |
| Finance and Insurance | 50,297 | (D) | 12,905 | (D) | (D) | (N) | 779 | 3,169 |
| Real Estate, Rental, and Leasing | 69,772 | (N) | 3,396 | (N) | 122 | (N) | (N) | (D) |
| Professional, Scientific and Technical Services | 91,438 | (D) | 10,741 | 174 | 369 | (N) | (D) | 860 |
| Management of Companies and Enterprises | 23,241 | (N) | (D) | (D) | (D) | (N) | (N) | (N) |
| Admin, Support, Waste Mgmt, Remediation Services | 62,906 | (N) | (D) | (D) | (D) | (N) | 94 | 112 |
| Educational Services | 3,032 | (D) | (D) | (N) | (D) | (N) | D | (N) |
| Health Care & Social Assistance | 255,162 | (N) | 92,601 | (D) | (D) | (N) | 4,651 | 2,925 |
| Arts, Entertainment, & Recreation | 5,886 | (N) | 782 | (D) | 65 | (N) | (D) | (D) |
| Accommodation & Food Services | 59,907 | (N) | 10,315 | (D) | 2,197 | (D) | (D) | 1,423 |
| Other Services | 75,584 | (D) | 8,469 | (D) | 835 | (N) | 809 | 643 |
| <i>Total Payroll</i> | <i>1,968,841</i> | <i>880</i> | <i>292,041</i> | <i>2,438</i> | <i>19,213</i> | <i>(D)</i> | <i>14,499</i> | <i>13,302</i> |
| <i>Total Employees</i> | <i>50,942</i> | <i>118</i> | <i>9,705</i> | <i>398</i> | <i>1,177</i> | <i>(N)</i> | <i>931</i> | <i>844</i> |

Table 1.1-3 (cont.) 2007 County Payroll by Category (\$1000)

| Category | McCulloch | Menard | Midland | Mitchell | Pecos | Reagan | Reeves | Runnels |
|------------------------------------------------------|---------------|--------------|------------------|---------------|---------------|---------------|---------------|---------------|
| Forestry, Fishing, Hunting, and Agricultural Support | (D) | (N) | (D) | 463 | (D) | (N) | (D) | (D) |
| Mining | (D) | (N) | 756,637 | 2,820 | 13,538 | 19,767 | 12,207 | 3,600 |
| Utilities | (D) | (D) | 33,544 | (D) | 1,334 | (D) | 2,227 | (D) |
| Construction | 2,006 | 521 | 167,541 | 553 | 5,255 | 3,537 | (D) | 2,074 |
| Manufacturing | (D) | D | 90,954 | D | (D) | (N) | 365 | 22,714 |
| Wholesale Trade | 689 | D | 193,750 | 305 | (D) | 1,353 | 554 | 2,099 |
| Retail Trade | 8,854 | 807 | 185,485 | 4,890 | 13,073 | 1,713 | 10,282 | 11,797 |
| Transportation and Warehousing | 1,690 | (N) | 71,963 | 3,815 | 8,635 | (D) | 2,004 | 1,815 |
| Information | (D) | (D) | 47,567 | 409 | D | (D) | 1,015 | 371 |
| Finance and Insurance | 2,952 | (D) | 94,009 | 1,454 | 3,743 | 314 | (D) | 3,399 |
| Real Estate, Rental, and Leasing | (D) | (D) | 70,482 | (D) | 624 | (D) | 262 | (D) |
| Professional, Scientific and Technical Services | 2,395 | (D) | 181,036 | 699 | 3,538 | 98 | 635 | (D) |
| Management of Companies and Enterprises | (D) | (D) | 119,566 | (N) | (N) | (N) | (D) | (D) |
| Admin, Support, Waste Mgmt, Remediation Services | 573 | (D) | 72,422 | (D) | (D) | (N) | (D) | 498 |
| Educational Services | (D) | (N) | 15,620 | (N) | (N) | (N) | (N) | (D) |
| Health Care & Social Assistance | 7,786 | (D) | 231,068 | (D) | 13,687 | (D) | (D) | 8,024 |
| Arts, Entertainment, & Recreation | (D) | (D) | 18,265 | (N) | 239 | (D) | (D) | 70 |
| Accommodation & Food Services | 1,441 | 365 | 74,466 | 938 | 6,203 | 435 | 3,421 | 1,587 |
| Other Services | 1,403 | 117 | 80,968 | 889 | 3,587 | 1,054 | 854 | 2,046 |
| <i>Total Payroll</i> | <i>29,789</i> | <i>1,810</i> | <i>2,505,343</i> | <i>17,235</i> | <i>73,456</i> | <i>28,271</i> | <i>33,826</i> | <i>60,094</i> |
| <i>Total Employees</i> | <i>2,126</i> | <i>247</i> | <i>62,373</i> | <i>1,227</i> | <i>3,102</i> | <i>810</i> | <i>1,909</i> | <i>2,509</i> |

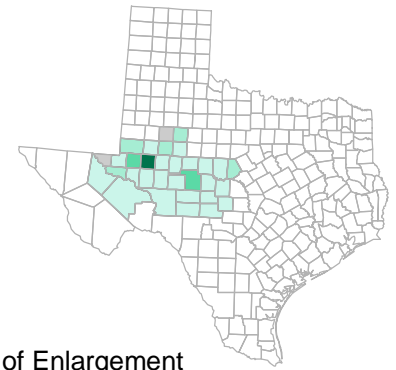
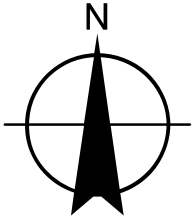
Table 1.1-3 (cont.) 2007 County Payroll by Category (\$1000)

| Category | Schleicher | Scurry | Sterling | Sutton | Tom Green | Upton | Ward | Winkler |
|------------------------------------------------------|---------------|----------------|--------------|---------------|------------------|---------------|----------------|---------------|
| Forestry, Fishing, Hunting, and Agricultural Support | (D) | (D) | (N) | (N) | 1,530 | (N) | (N) | (N) |
| Mining | 6,472 | 43,367 | 3,492 | 12,339 | 24,756 | 16,825 | 58,909 | 25,769 |
| Utilities | (D) | (D) | (D) | (D) | 10,978 | (D) | 10,057 | (D) |
| Construction | (D) | 21,199 | (D) | 11,804 | 68,523 | (D) | 6,300 | 10,101 |
| Manufacturing | (D) | 7,562 | (N) | (D) | 120,060 | (D) | (D) | (D) |
| Wholesale Trade | 985 | 8,810 | (D) | 6,251 | 43,959 | 1,394 | 4,726 | (D) |
| Retail Trade | 917 | 14,668 | 297 | 3,090 | 134,488 | 1,329 | 5,873 | 3,476 |
| Transportation and Warehousing | (D) | 14,126 | (D) | 6,508 | 18,558 | 2,645 | 5,867 | 4,363 |
| Information | (D) | (D) | (N) | (D) | 80,093 | (D) | (D) | (D) |
| Finance and Insurance | 663 | 6,228 | (D) | 2,710 | 49,833 | (D) | 3,210 | 1,374 |
| Real Estate, Rental, and Leasing | (N) | 5,120 | (N) | 1,496 | 15,654 | (D) | 4,198 | (D) |
| Professional, Scientific and Technical Services | 127 | 4,717 | (D) | 596 | 53,239 | 134 | 1,268 | 292 |
| Management of Companies and Enterprises | (N) | (D) | (N) | (N) | 13,396 | (N) | (D) | (N) |
| Admin, Support, Waste Mgmt, Remediation Services | (D) | (D) | (N) | (D) | 54,058 | (D) | (D) | (D) |
| Educational Services | (N) | (N) | (N) | (N) | 3,222 | (D) | (N) | (N) |
| Health Care & Social Assistance | 2,154 | 13,841 | 91 | (D) | 259,683 | 3,965 | 7,070 | 3,565 |
| Arts, Entertainment, & Recreation | (D) | 418 | (N) | (D) | 6,957 | (D) | (D) | (D) |
| Accommodation & Food Services | 135 | 5,762 | (D) | 2,753 | 52,735 | 549 | 1,968 | 946 |
| Other Services | 308 | 7,123 | 112 | 862 | 37,410 | 91 | 2,798 | 3,896 |
| <i>Total Payroll</i> | <i>11,761</i> | <i>152,941</i> | <i>3,992</i> | <i>48,409</i> | <i>1,049,132</i> | <i>26,932</i> | <i>112,244</i> | <i>53,782</i> |
| <i>Total Employees</i> | <i>593</i> | <i>5,049</i> | <i>163</i> | <i>1,426</i> | <i>37,196</i> | <i>892</i> | <i>3,617</i> | <i>1,533</i> |

Notes: Data are from U.S. Census Bureau 2007 economic data³

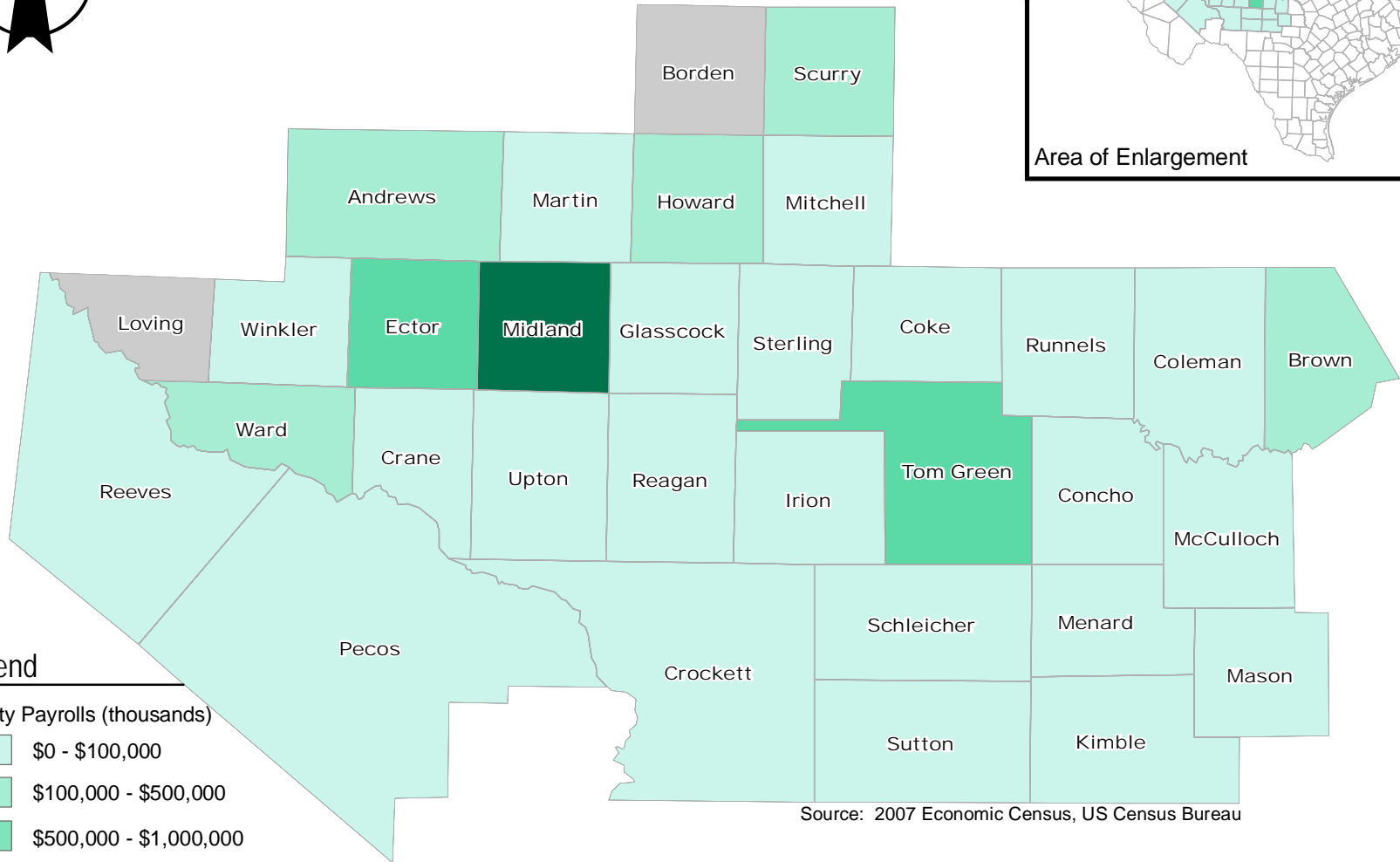
D = Data withheld to avoid disclosing data for individual companies

N = Data not available



Area of Enlargement

Region F
Total County Payrolls
(2007)

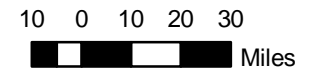


Legend

County Payrolls (thousands)

- \$0 - \$100,000
- \$100,000 - \$500,000
- \$500,000 - \$1,000,000
- \$1,000,000 - \$2,000,000
- > \$2,000,001
- Not available

Source: 2007 Economic Census, US Census Bureau



FN JOB NO: GMD07215
 FILE: RegionFPayroll.mxd
 DATE: January 4, 2010
 SCALE: 1:2,446,400
 DESIGNED: BME
 DATED: BME

1.1.2 Water-Related Physical Features in Region F

Most of Region F is in the upper portion of the Colorado Basin and in the Pecos portion of the Rio Grande Basin. A small part of the region is in the Brazos Basin. Figure 1.1-1 shows the major streams in Region F, which include the Colorado River, Concho River, Pecan Bayou, San Saba River, Llano River and Pecos River.

Figure 1.1-5 shows the average annual precipitation in Texas. In Region F, precipitation increases from slightly more than 11 inches per year in western Reeves County to approximately 30 inches per year in Brown County. Figure 1.1-6 shows average annual runoff, which follows a similar pattern of increasing from the west to the east.⁴ Figure 1.1-7 shows gross reservoir evaporation in Texas, which generally increases from northeast to southwest.⁵ (Gross reservoir evaporation is the amount lost to evaporation from the surface of a reservoir.) Some of the highest evaporation rates in the state are in Region F, exceeding rainfall throughout the region. The patterns of rainfall, runoff, and evaporation result in more abundant water supplies in the eastern portion of Region F.

Figure 1.1-8 shows the variations in annual streamflow for seven U.S. Geological Survey (USGS) streamflow gages in Region F.⁶ The five gages on tributaries have watersheds with limited development and show the natural variation in streamflows in this region. The Colorado gage near Winchell is the most downstream gage on the main stem of the Colorado River in Region F. Flows at the Pecos River gage near Girvin are largely controlled by releases from Red Bluff Reservoir. Figure 1.1-9 shows seasonal patterns of median streamflows for the same seven gages.

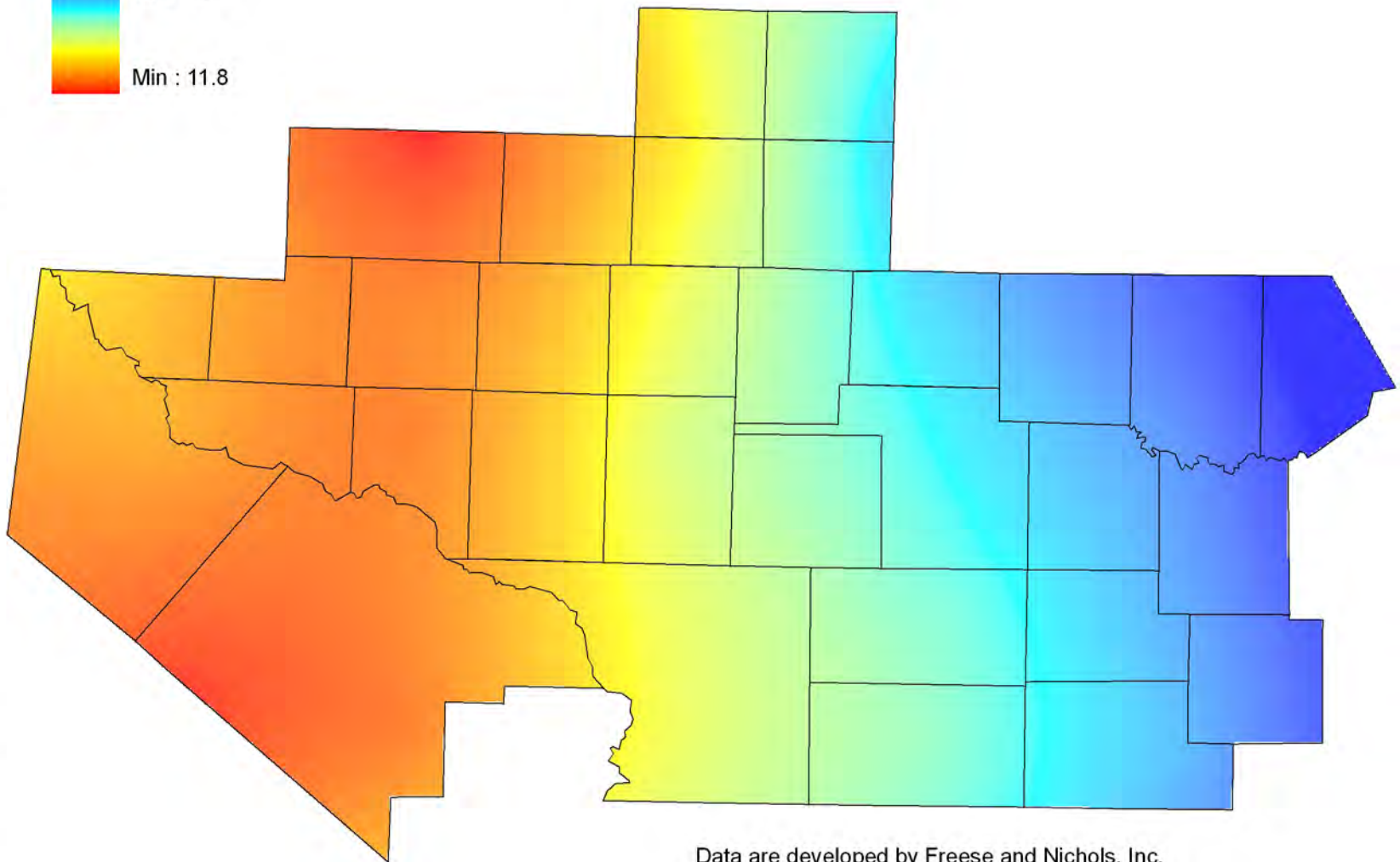
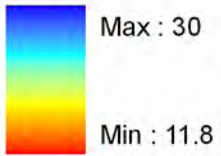
Table 1.1-4 lists the 17 major water supply reservoirs in Region F, all of which are shown in Figure 1.1-1. These reservoirs provide most of the region's surface water supply. Reservoirs are necessary to provide a reliable surface water supply in this part of the state because of the wide variations in natural streamflow. Reservoir storage serves to capture high flows when they are available and save them for use during times of normal or low flow.



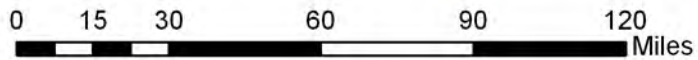
Mean Annual Precipitation

Region F

Mean annual precipitation (in/yr)



Data are developed by Freese and Nichols, Inc. from TWDB quadrangle precipitation data.



| | |
|-----------|-------------------|
| EN JOB NO | CMD01311 |
| FILE | 1-5 RegF_Prec.mxd |
| DATE | JULY 2005 |
| SCALE | 1:2,400,000 |
| DESIGNED | HEO |
| DRAFTED | HEO |

1.1-5

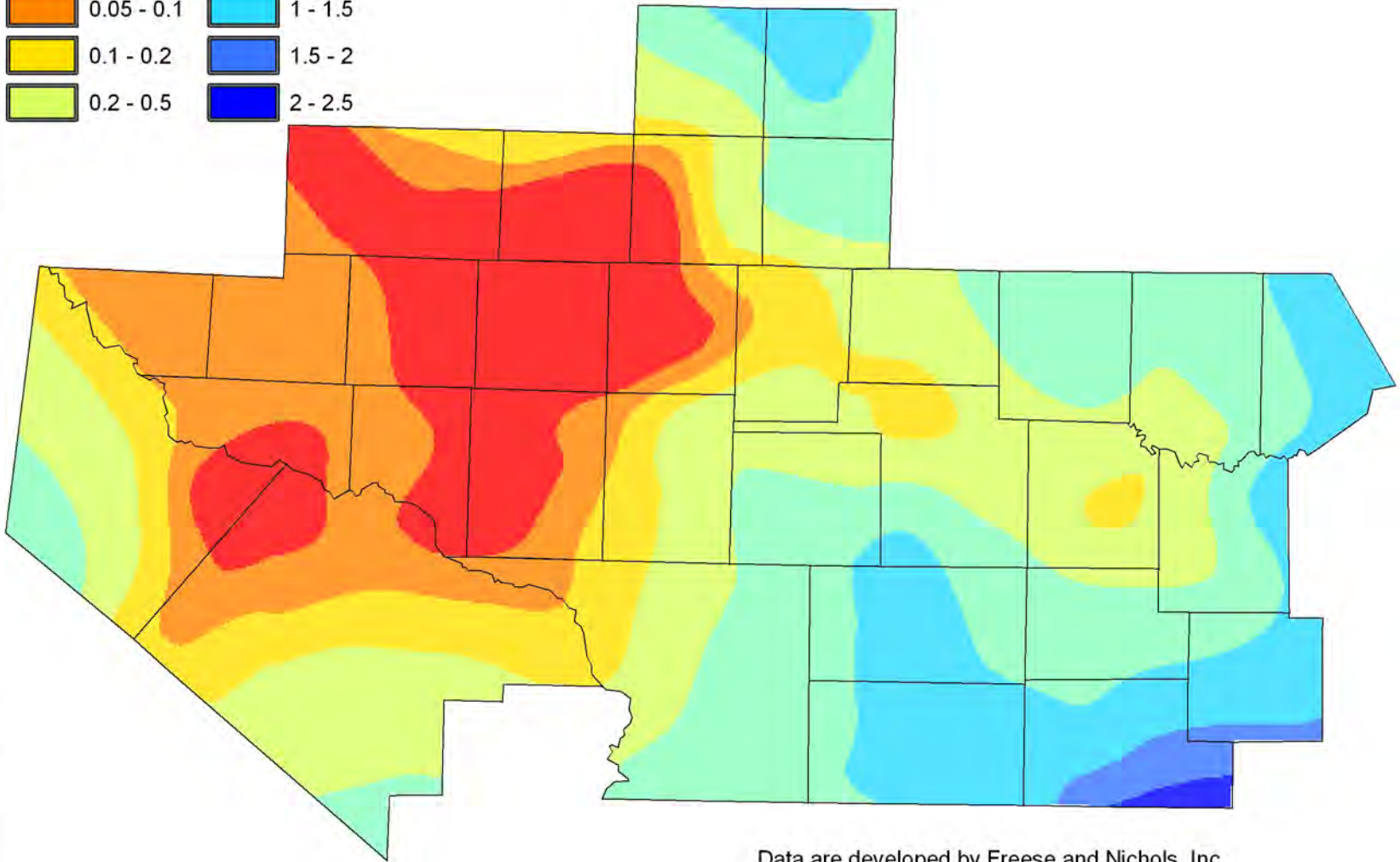
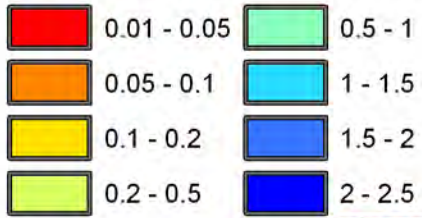
FIGURE



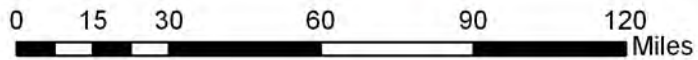
Mean Annual Runoff

Region F

Mean Annual Runoff (in/yr)



Data are developed by Freese and Nichols, Inc. from USGS stream gage data.



| | |
|------------|---------------------|
| EN JOB NO. | CMD01311 |
| FILE | 1-6 RegF Runoff.mxd |
| DATE | JULY 2005 |
| SCALE | 1:2,400,000 |
| DESIGNED | HEO |
| DRAFTED | HEO |

1.1-6

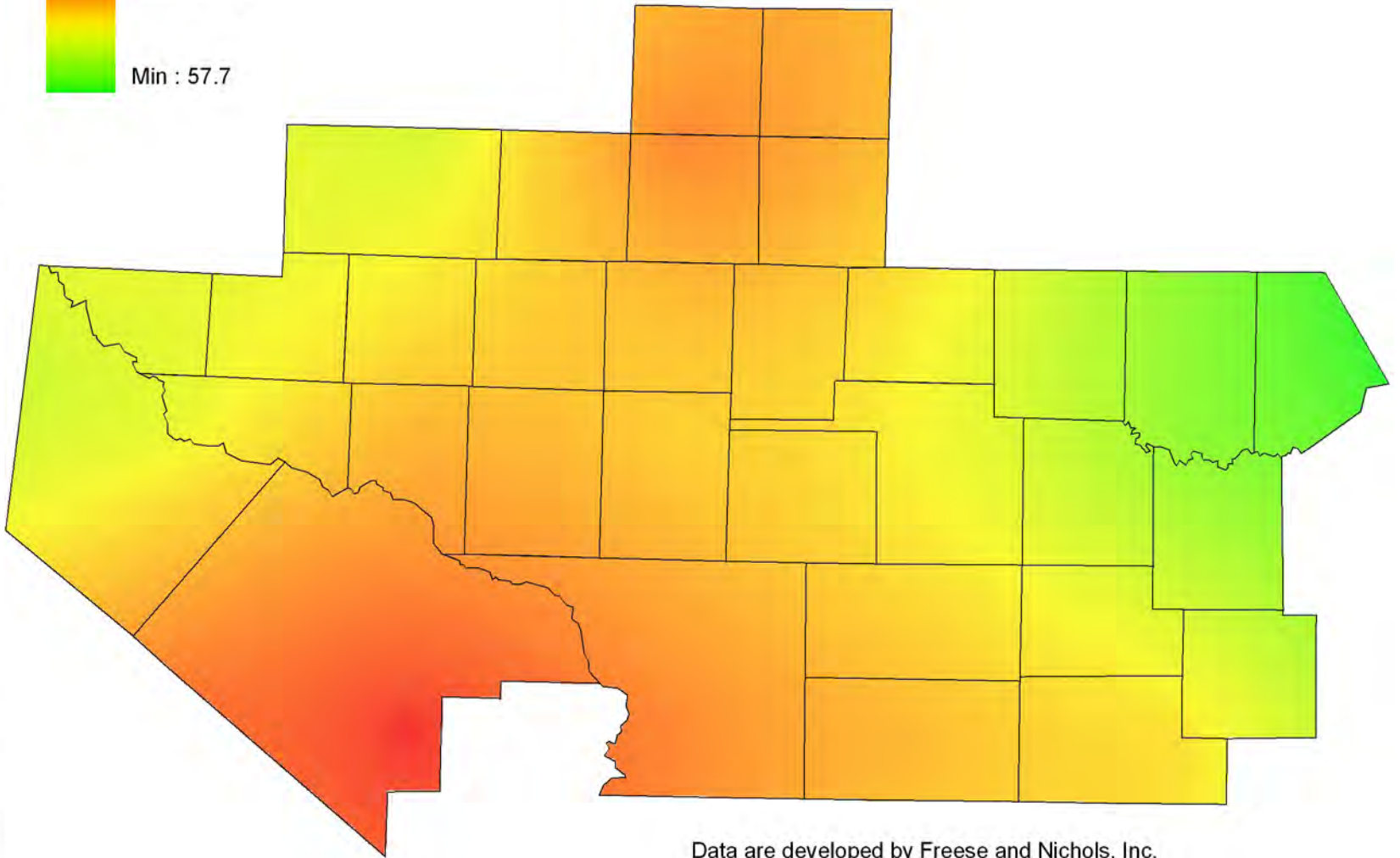
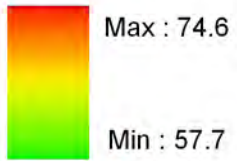
FIGURE



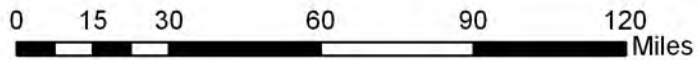
Gross Reservoir Evaporation

Region F

Gross Reservoir Evaporation (in/yr)



Data are developed by Freese and Nichols, Inc. from TWDB quadrangle evaporation data.



| | |
|-----------|------------------|
| EN JOB NO | CMD01311 |
| FILE | 1-7 RegF_Eva.mxd |
| DATE | JULY, 2005 |
| SCALE | 1:2,400,000 |
| DESIGNED | HEO |
| DRAFTED | HEO |

1-1-7

FIGURE

**Table 1.1-4
Major Water Supply Reservoirs in Region F^a**

| Reservoir Name | Basin | Stream | County(ies) | Water Right Number(s) | Priority Date | Permitted Conservation Storage (Acre-Feet) | Permitted Diversion (Acre-Feet per Year) | Year 2006 Use (Acre-Feet per Year) | Owner | Water Rights Holder(s) |
|--------------------------|------------|--------------------|-----------------------------|-----------------------|---------------|--------------------------------------------|------------------------------------------|------------------------------------|----------------------------------------|----------------------------------------|
| Lake J B Thomas | Colorado | Colorado River | Borden and Scurry | CA-1002 | 08/05/1946 | 204,000 | 30,000 ^c | 15,398 | CRMWD | CRMWD |
| Lake Colorado City | Colorado | Morgan Creek | Mitchell | CA-1009 | 11/22/1948 | 29,934 | 5,500 | 38 ^b | TXU | TXU |
| Champion Creek Reservoir | Colorado | Champion Creek | Mitchell | CA-1009 | 04/08/1957 | 40,170 | 6,750 | | TXU | TXU |
| Oak Creek Reservoir | Colorado | Oak Creek | Coke | CA-1031 | 04/27/1949 | 30,000 | 10,000 | 95 | City of Sweetwater | City of Sweetwater |
| Lake Coleman | Colorado | Jim Ned Creek | Coleman | CA-1702 | 08/25/1958 | 40,000 | 9,000 | 1,513 | City of Coleman | City of Coleman |
| E V Spence Reservoir | Colorado | Colorado River | Coke | CA-1008 | 08/17/1964 | 488,760 | 50,000 ^c | 14,048 | CRMWD | CRMWD |
| Lake Winters | Colorado | Elm Creek | Runnels | CA-1095 | 12/18/1944 | 8,347 | 1,755 | 0 | City of Winters | City of Winters |
| Lake Brownwood | Colorado | Pecan Bayou | Brown | CA-2454 | 09/29/1925 | 114,000 | 29,712 | 13,678 | Brown Co. WID | Brown Co. WID |
| Hords Creek Lake | Colorado | Hords Creek | Coleman | CA-1705 | 03/23/1946 | 7,959 | 2,240 | 262 | COE | City of Coleman |
| Lake Ballinger | Colorado | Valley Creek | Runnels | CA-1072 | 10/04/1946 | 6,850 | 1,000 | 197 | City of Ballinger | City of Ballinger |
| O. H. Ivie Reservoir | Colorado | Colorado River | Coleman, Concho and Runnels | A-3866 P-3676 | 02/21/1978 | 554,340 | 113,000 | 42,954 | CRMWD | CRMWD |
| O. C. Fisher Lake | Colorado | North Concho River | Tom Green | CA-1190 | 05/27/1949 | 80,400 | 80,400 | NA | COE | Upper Colorado River Authority |
| Twin Buttes Reservoir | Colorado | South Concho River | Tom Green | CA-1318 | 05/06/1959 | 170,000 | 29,000 | NA | U.S. Bureau of Reclamation | City of San Angelo |
| Lake Nasworthy | Colorado | South Concho River | Tom Green | CA-1319 | 03/11/1929 | 12,500 | 25,000 | NA | City of San Angelo | City of San Angelo |
| Brady Creek Reservoir | Colorado | Brady Creek | McCulloch | CA-1849 | 09/02/1959 | 30,000 | 3,500 | 0 | City of Brady | City of Brady |
| Red Bluff Reservoir | Rio Grande | Pecos River | Loving and Reeves | CA-5438 | 01/01/1980 | 300,000 | 292,500 | 9,194 | Red Bluff Water Power Control District | Red Bluff Water Power Control District |
| Lake Balmorhea | Rio Grande | Toyah Creek | Reeves | A-0060 P-0057 | 10/05/1914 | 13,583 | 41,400 | 14,863 | Reeves Co WID #1 | Reeves Co WID #1 |
| <i>Total</i> | | | | | | <i>2,130,843</i> | <i>730,757</i> | <i>112,241</i> | | |

a Data are from TCEQ active water rights list, TCEQ water rights permits,⁷ and TCEQ historical water use by water right.⁸ Year 2006 use is consumptive.

b Use is total consumptive use from both Champion Creek Reservoir and Lake Colorado City.

c Total consumptive use for CA 1002 and CA 1008 limited to 73,000 ac-ft per year.

CA Certificate of Adjudication

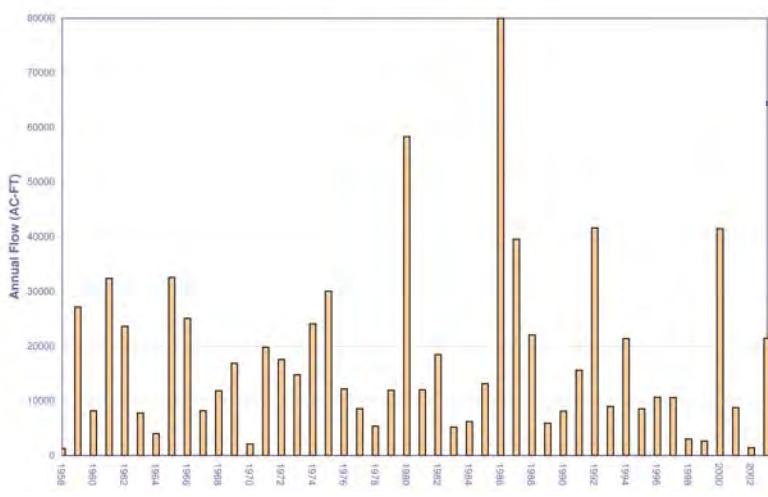
A Application

P Permit

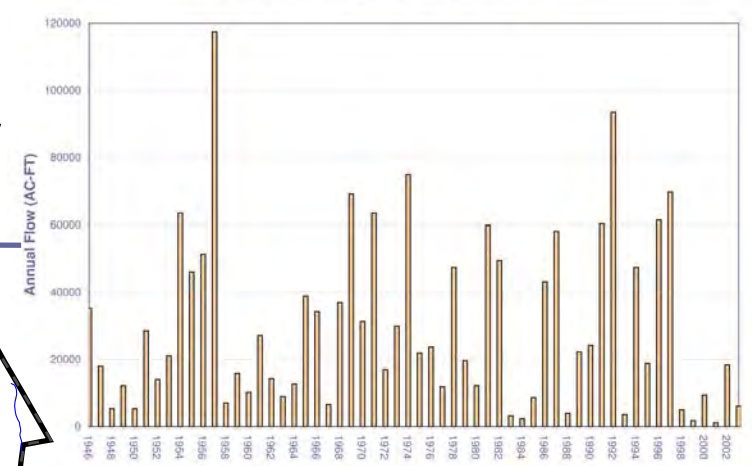
COE Corps of Engineers

NA – Data Not Available

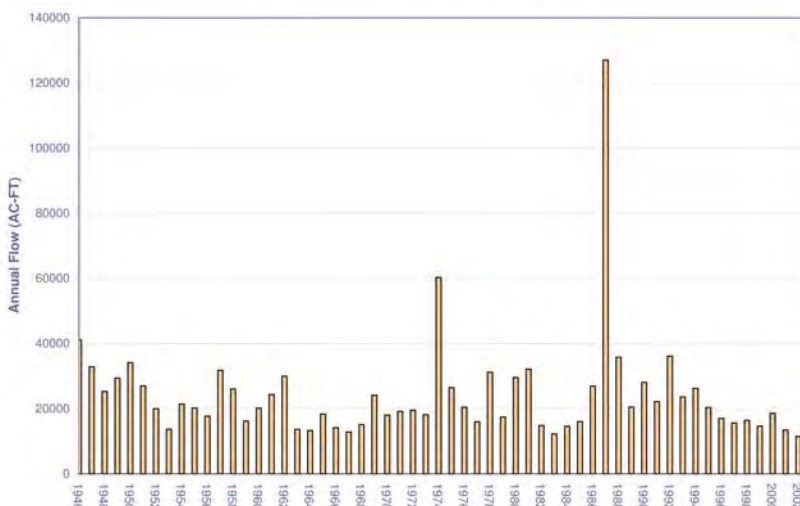
Flow at Beals Creek near Westbrook, Texas 1958 - 2003 *



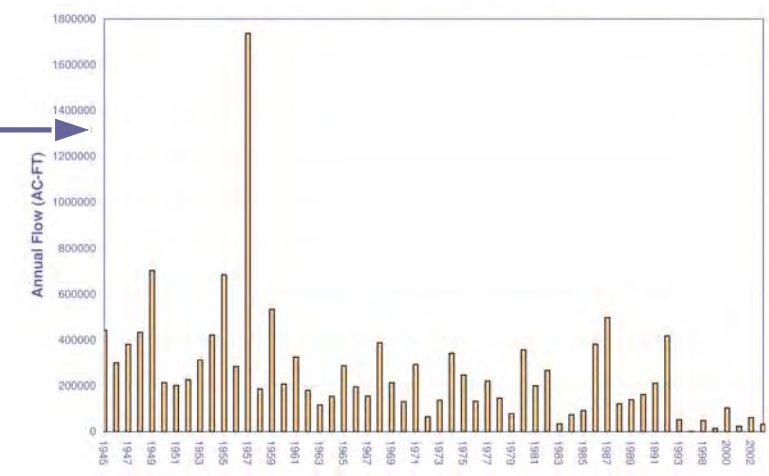
Flow at Elm Creek at Balinger, Texas 1946 - 2003



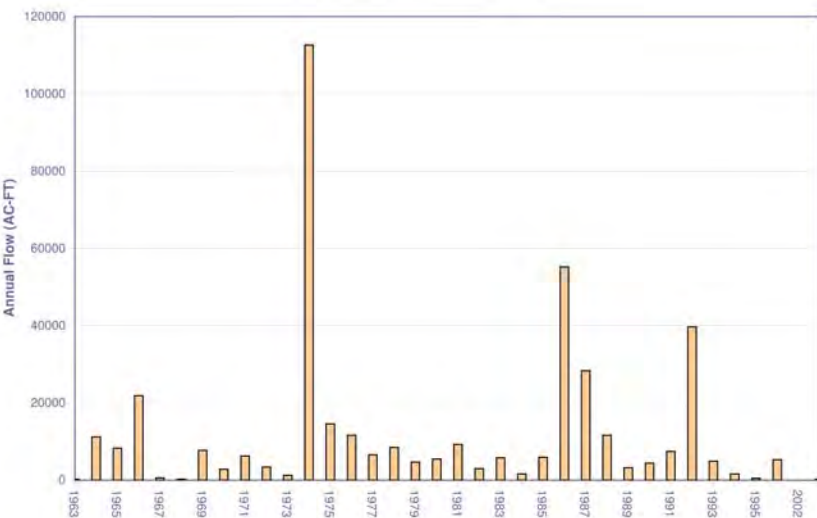
Flow at Pecos River near Girvin, Texas 1946 - 2003



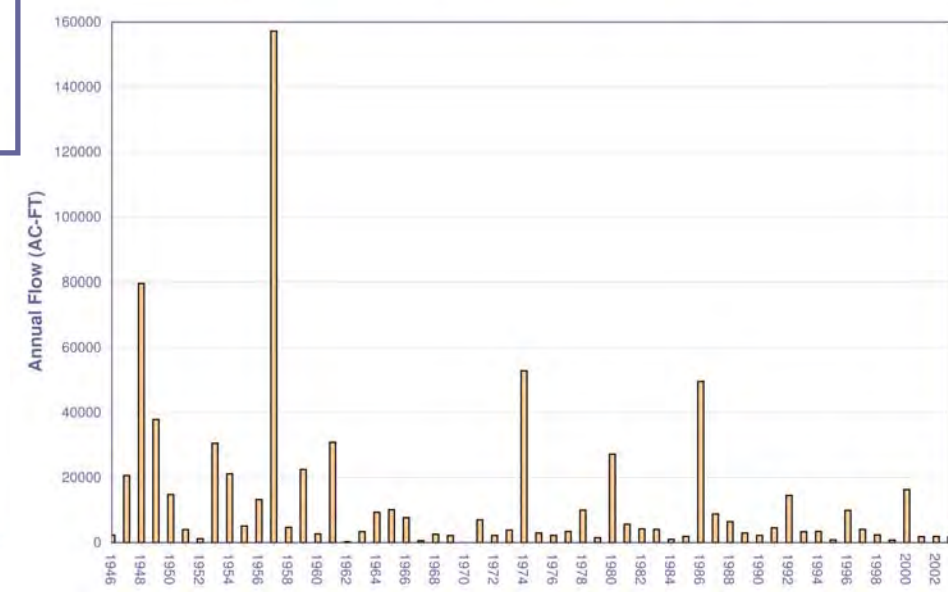
Flow at Colorado River near Winchell, Texas 1945 - 2003



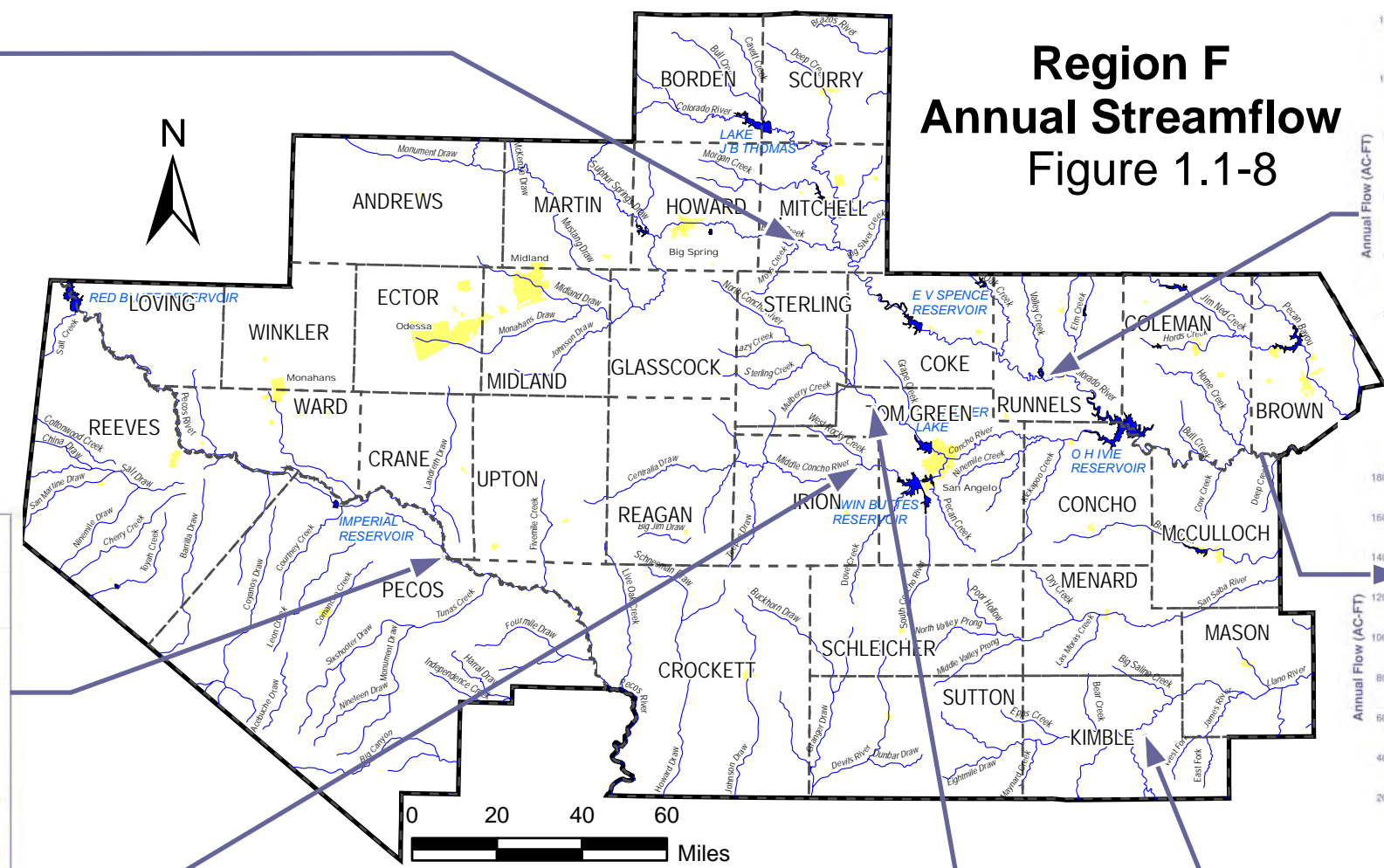
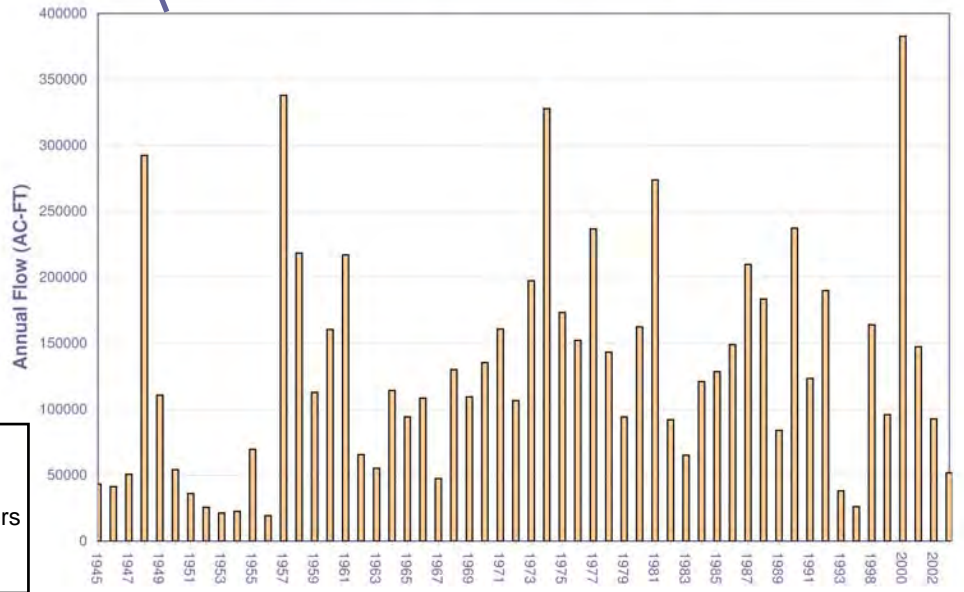
Flow at Middle Concho River 1963 - 2003



Flow at North Concho River near Carlsbad, Texas 1946 - 2003



Flow at Llano River near Junction, Texas 1945 - 2003



Region F Annual Streamflow Figure 1.1-8

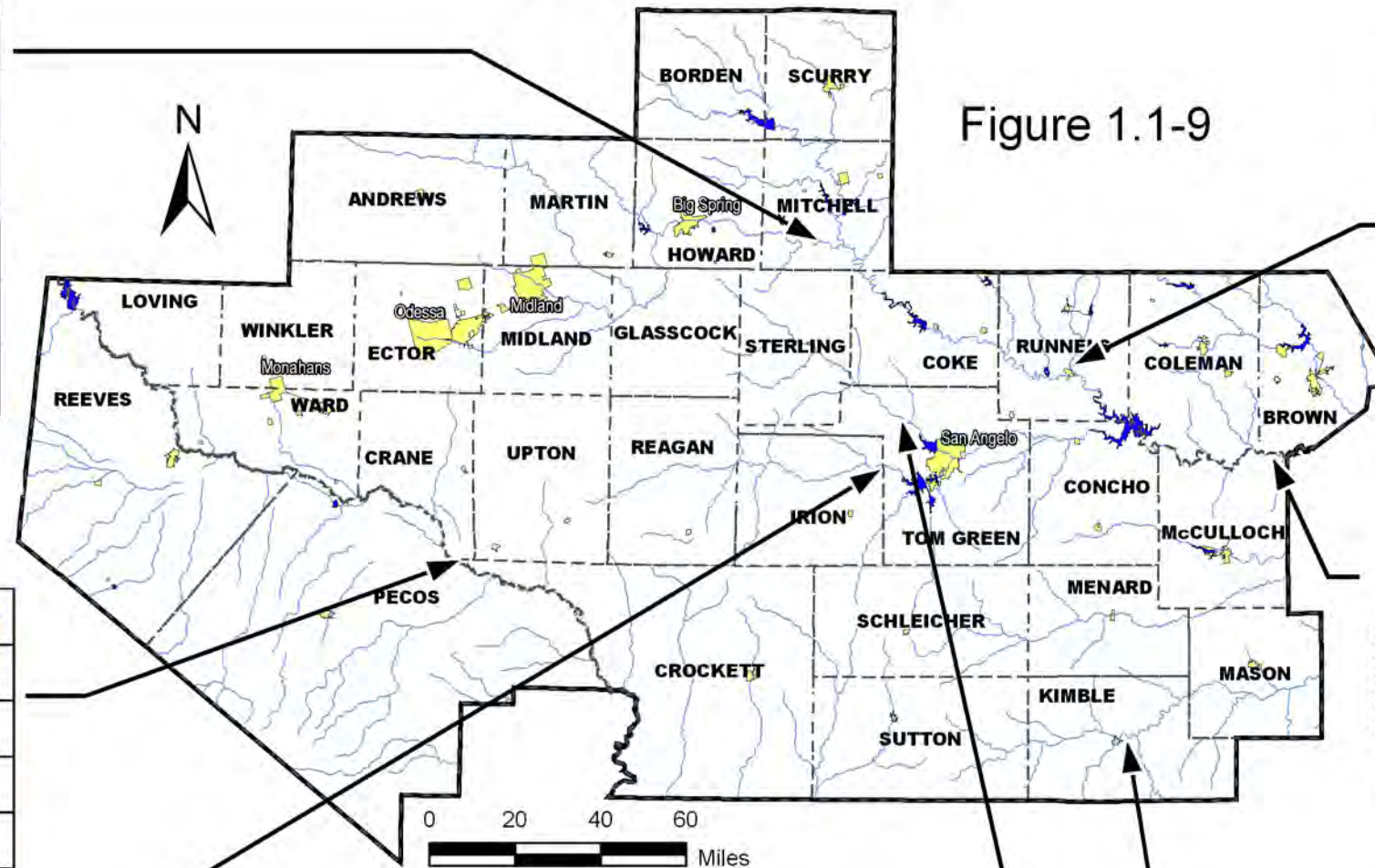
Legend

- Streams/Rivers
- Counties

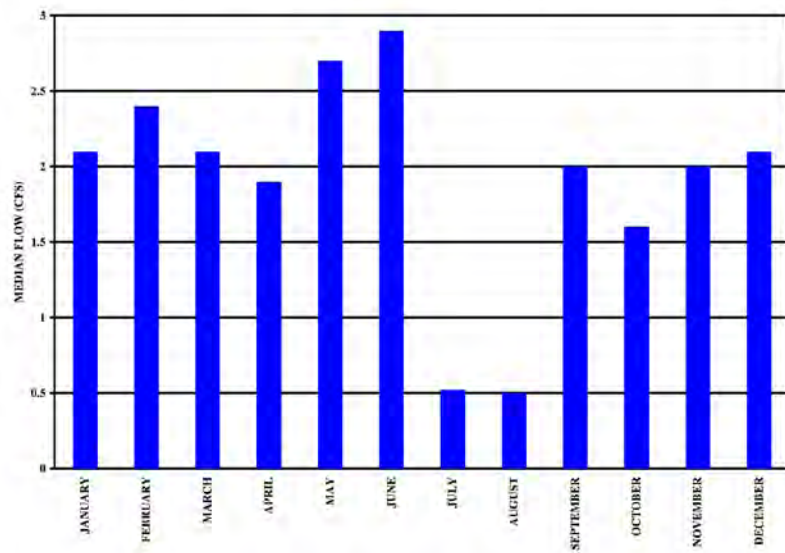
* Natural Dam Lake, which is above the Beals Creek gage, spilled intermittently during 1986 and 1987. Natural Dam has subsequently been improved so that spills from the lake will not reoccur.

Region F Median Streamflow

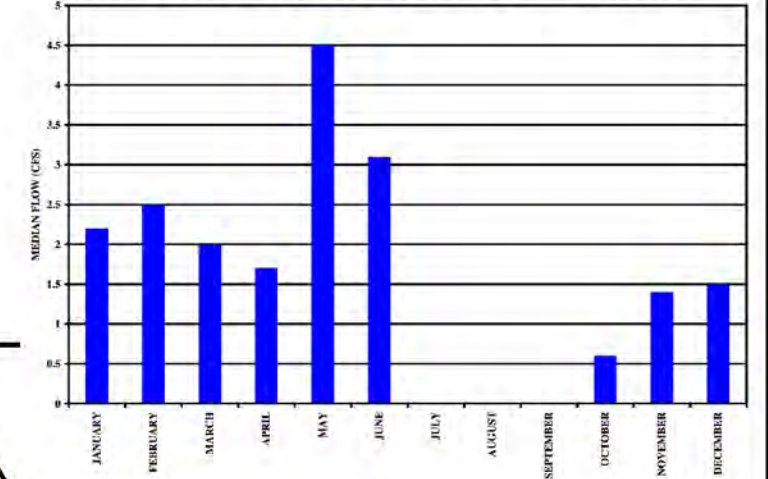
Figure 1.1-9



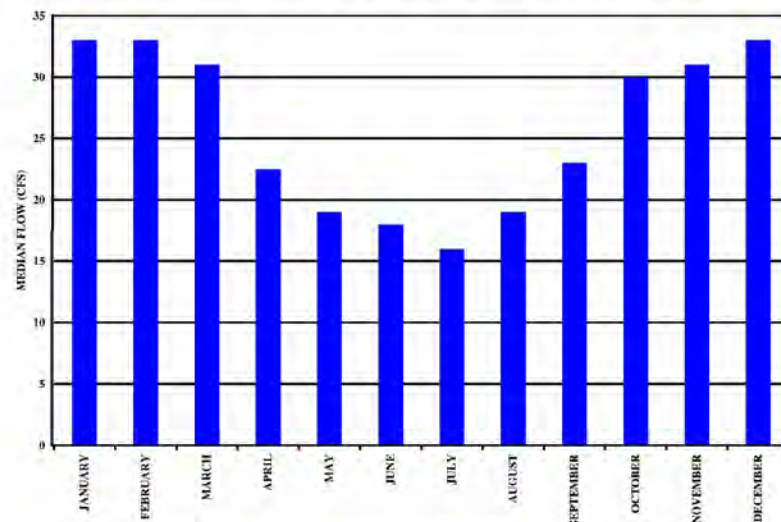
Seasonal Median Flow at Beals Creek near Westbrook, Texas *



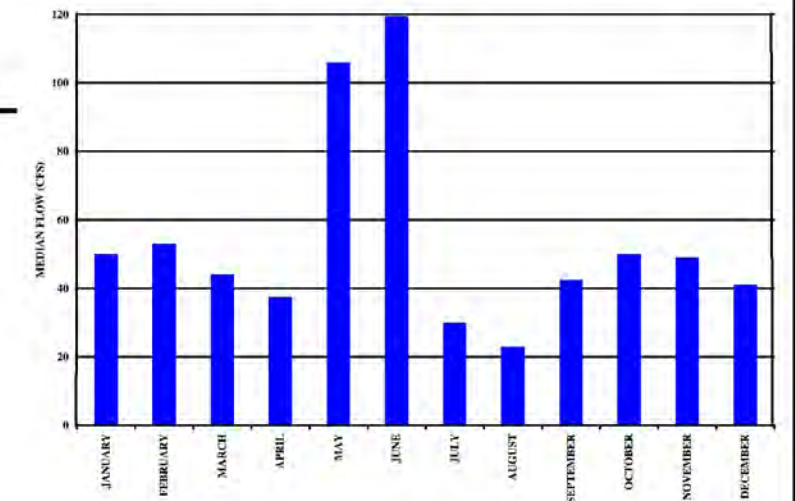
Seasonal Median Flow at Elm Creek at Ballinger, Texas



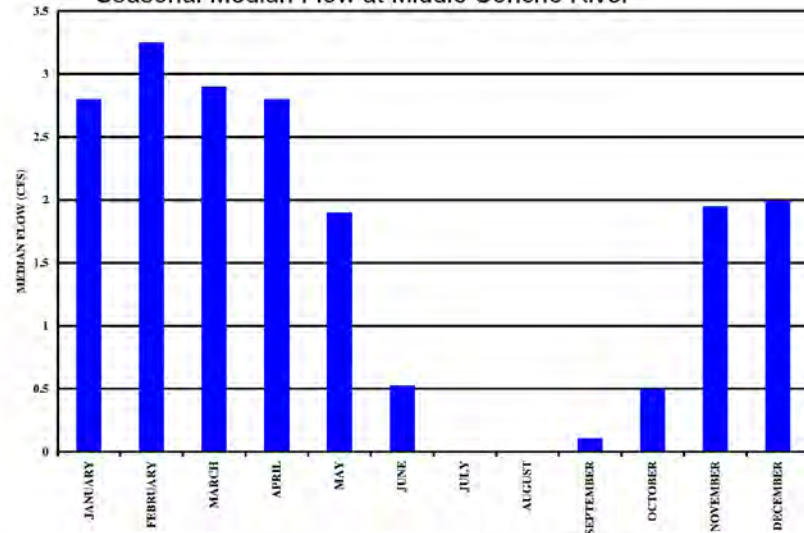
Seasonal Median Flow at Pecos River near Girvin, Texas



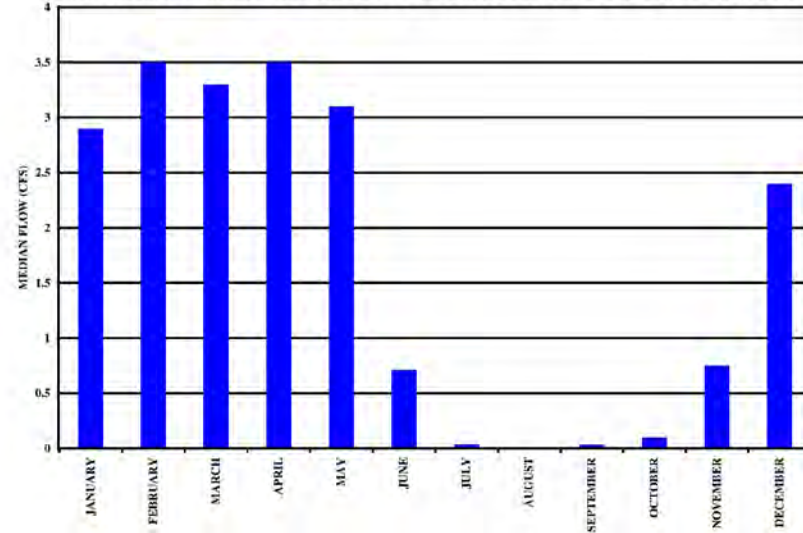
Seasonal Median Flow at Colorado River near Winchell, Texas



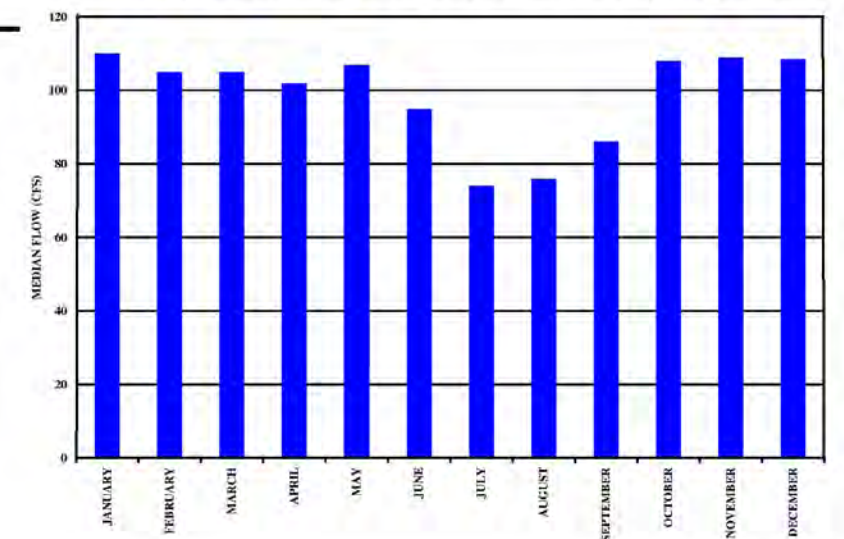
Seasonal Median Flow at Middle Concho River



Seasonal Median Flow at North Concho River near Carlsbad, Texas



Seasonal Median Flow at Llano River near Junction, Texas



Legend

- Streams/Rivers
- Counties

* Natural Dam Lake, which is above the Beals Creek gage, spilled intermittantly during 1986 and 1987. Natural Dam has subsequently been improved so that spills from the lake will not reoccur.

Figure 1.2-1 shows major aquifers in Region F, and Figure 1.2-2 shows the minor aquifers. There are 11 aquifers that supply water to the 32 counties of Region F. The major aquifers are the Edwards-Trinity Plateau, Ogallala, Pecos Valley and a small portion of the Trinity. The minor aquifers are Dockum, Hickory, Lipan, Ellenberger-San Saba, Marble Falls, Rustler and the Capitan Reef Complex. A small portion of the Edwards-Trinity High Plains extends into Region F but is not a major source of water. More information on these aquifers may be found in Chapter 3.

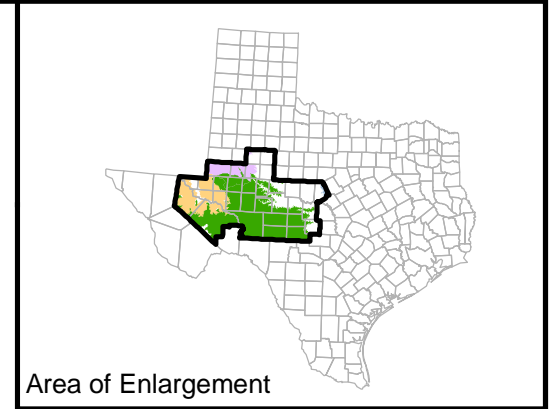
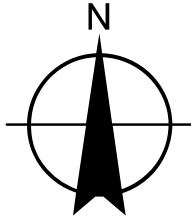
1.2 Current Water Uses and Demand Centers in Region F

Table 1.2-1 shows the total water use by county in Region F from 1997 through 2006. (Year 2006 data are the most recent available.)⁹ Table 1.2-2 shows water use for the same period by TWDB use category and Figure 1.2-3 is a graph of the same data. Water use in Region F decreased somewhat between 1997 and 2003 and has increased in recent years. Most of these trends in water use are associated with irrigation. This may be attributed in part to changes by the TWDB in the reporting of irrigated agriculture water use after year 2000. Some of these changes include reporting of delivery losses associated with surface water irrigation systems, source of data for irrigated acreages (previous reporting was based on surveys by the Natural Resources Conservation Service and Texas Agricultural Statistics Service, while recent data is provided by the Farm Service Agency and local districts), and types of crops included for water use estimates. In addition to these factors, irrigated agriculture is subject to water use fluctuations due to availability of surface water, economic factors and government programs.

Table 1.2-3 shows water use by category and county in 2006, and Figure 1.2-4 shows the distribution of water use by county in the region. About 70 percent of the current water use in Region F is for irrigated agriculture. Municipal supply is the second largest category, followed by mining, steam electric power generation, livestock watering, and manufacturing.

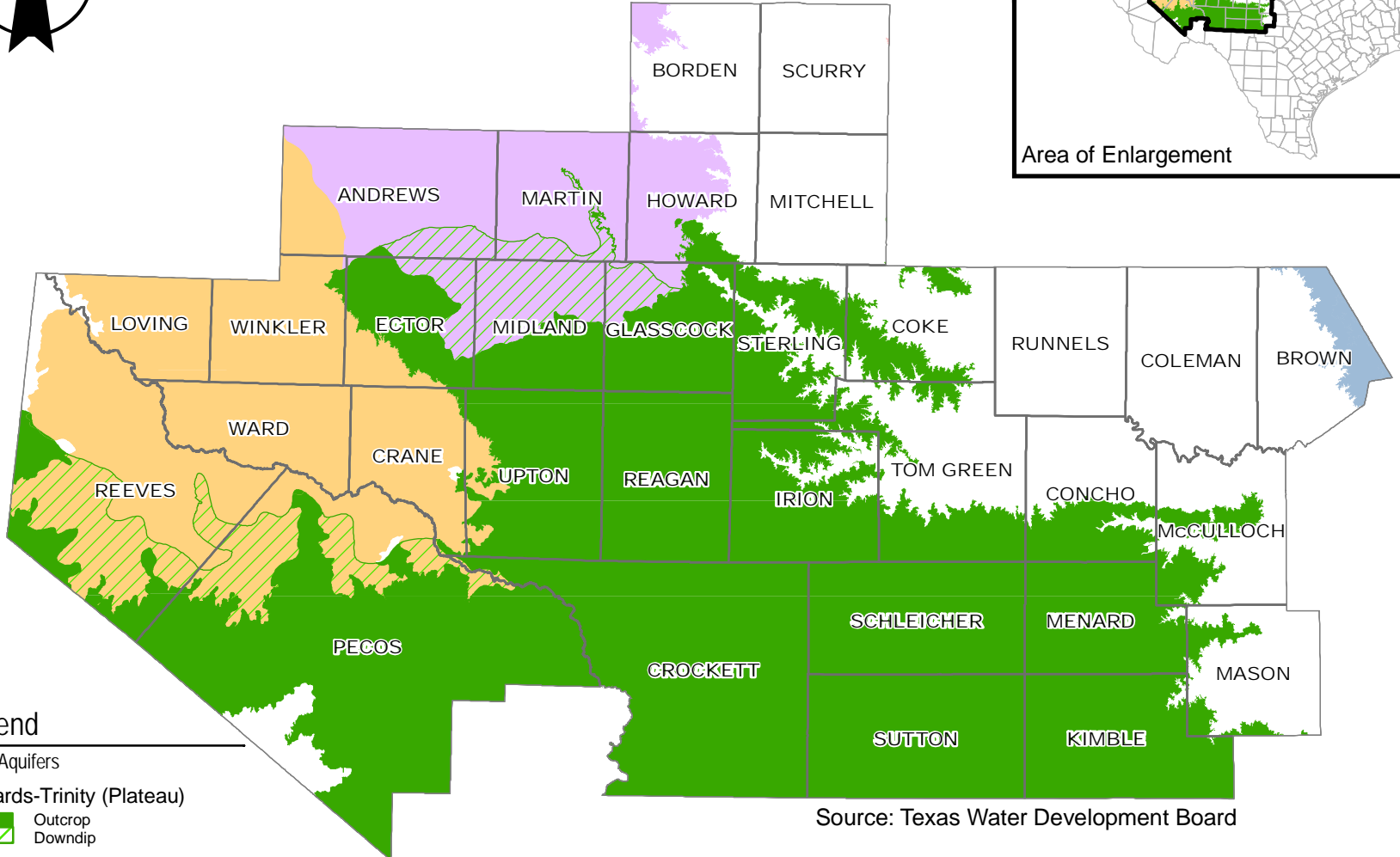
The data in Table 1.2-3 and Figure 1.2-4 lead to the following observations about year 2006 water use in Region F:

- The areas with the highest water use are Reeves, Pecos, Tom Green, Midland and Glasscock Counties, accounting for over half of the total water used in the region.



Area of Enlargement

Major Aquifer Map
Region F

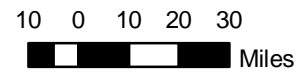


Legend

Major Aquifers

- Edwards-Trinity (Plateau)
 - Outcrop
 - Downdip
- Pecos Valley
- Ogallala
- Trinity

Source: Texas Water Development Board



FILE: RegionF_MajAquifers.mxd
 DATE: January 4, 2010
 SCALE: 1:2,420,500
 DESIGNED: BME
 DRAWN: BME