

AGENDA PACKET
June 20, 2019

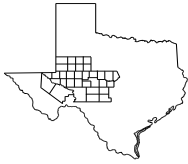
Agenda Memos for Planning Process

Agenda Item 5a. Review of Draft Chapter 1, Regional Overview

As Region F develops the 2021 Region F Water Plan, individual chapters will be presented to the RWPG for comment and input. This agenda item is to review a draft of Chapter 1, Regional Overview, for inclusion in the Region F Initially Prepared Plan (IPP). This chapter provides an overview of the region, including but not limited to: socio-economic conditions, current demand centers, descriptions of existing water supplies (including water quality and threats to these supplies), natural and agricultural resources, and major water providers.

Attachments:

1. Draft Chapter 1, *Regional Overview*



CHAPTER 1

Table of Contents

Chapter 1	Description of the Region	1-1
1.1	Introduction to Region F	1-1
1.1.1	Economic Activity in Region F.....	1-6
1.1.2	Water-Related Physical Features and Climate in Region F.....	1-12
1.2	Current Water Uses and Demand Centers in Region F	1-19
1.3	Current Sources of Water	1-25
1.3.1	Surface Water Sources	1-28
1.3.2	Groundwater Sources.....	1-31
1.3.3	Springs in Region F.....	1-37
1.4	Agricultural and Natural Resources in Region F	1-42
1.4.1	Endangered or Threatened Species.....	1-42
1.4.2	Agriculture and Prime Farmland	1-45
1.4.3	Mineral Resources	1-49
1.5	Water Providers in Region F	1-54
1.5.1	Major Water Providers	1-54
1.6	Existing Plans for Water Supply Development.....	1-55
1.6.1	Conservation Planning in Region F	1-57
1.6.2	Water Loss Audits.....	1-58
1.6.3	Assessment of Current Preparations for Drought in Region F	1-58
1.6.4	Other Water-Related Programs.....	1-59
1.7	Summary of Threats and Constraints to Water Supply in Region F	1-62
1.7.1	Threats to Water Supply.....	1-62
1.7.2	Constraints.....	1-69
1.8	Water-Related Threats to Agricultural and Natural Resources in Region F	1-70
1.8.1	Water Related Threats to Agriculture	1-70
1.8.2	Water Related Threats to Natural Resources.....	1-71
	List of References	1-72

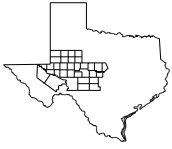
LIST OF TABLES

Table 1-1	Historical Population of Region F Counties ^a	1-3
Table 1-2	Region F Cities with a Year 2017 Population Greater than 10,000.....	1-4
Table 1-3	2017 County Payroll by Category (\$1000).....	1-7
Table 1-4	Major Water Supply Reservoirs in Region F ^{a,d}	1-13
Table 1-5	Historical Water Use by Category in Region F (Values in acre-feet).....	1-19
Table 1-6	Historical Total Water Use by County in Region F (Values in acre-feet).....	1-20
Table 1-7	Year 2016 Water Use by Category and County (Values in acre-feet).....	1-22
Table 1-8	Recreational Use of Reservoirs in Region F.....	1-24
Table 1-9	Historical Groundwater, Surface Water, and Reuse Water Use in Region F.....	1-25
Table 1-10	Surface Water Rights by County and Category.....	1-29
Table 1-11	Groundwater Pumping by County and Aquifer 2016 (Values in Acre-Feet).....	1-32
Table 1-12	Endangered and Threatened Species in Region F.....	1-43
Table 1-13	2017 U.S. Department of Agriculture County Census Data for Region F.....	1-46
Table 1-14	Summary of TWDB Water Loss Audits.....	1-57
Table 1-15	Summary of Identified Surface Water Quality Problems in Region F.....	1-64
Table 1-16	Percentage of Sampled Water Wells Exceeding Drinking Water Standards for Fluoride, Nitrate (as NO ₃) and Arsenic.....	1-66

LIST OF FIGURES

Figure 1-1	Area Map.....	1-2
Figure 1-2	Historical Population of Region F.....	1-4
Figure 1-3	Estimated Population Distribution by County (2017).....	1-5
Figure 1-4	Total County Payrolls (2017).....	1-10
Figure 1-5	Permian Basin in Region F.....	1-11
Figure 1-6	Surface Water Features in Region F.....	1-14
Figure 1-7	Mean Annual Precipitation.....	1-15
Figure 1-8	Mean Annual Temperature.....	1-16
Figure 1-9	Region F Major Aquifer Map.....	1-17
Figure 1-10	Region F Minor Aquifer Map.....	1-18
Figure 1-11	Historical Water Use by Category in Region F.....	1-19

Figure 1-12	Water Use by County (2016) in Region F	1-23
Figure 1-13	Historical Groundwater, Surface Water, and Reuse Water Use in Region F*	1-26
Figure 1-14	Groundwater, Surface Water, and Reuse Water Use in Region F in 2016	1-26
Figure 1-15	Supplies from Groundwater by County (2016)	1-27
Figure 1-16	Total Permitted Surface Water Diversion by County.....	1-30
Figure 1-17	GCD and GMA Areas in Region F.....	1-35
Figure 1-18	Reagan, Upton, and Midland County PGMA Boundary (Source: TCEQ).....	1-36
Figure 1-19	Springs in Region F	1-39
Figure 1-20	Prime Farmland Percentage of Total Area.....	1-48
Figure 1-21	Crude Oil and Total Gas Production in Region F	1-49
Figure 1-22	Crude Oil Production in Each County (2018)	1-51
Figure 1-23	Total Gas Production in Each County (2018)	1-52



Chapter 1 Description of the Region

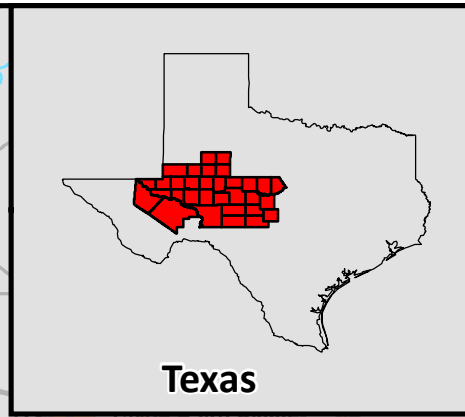
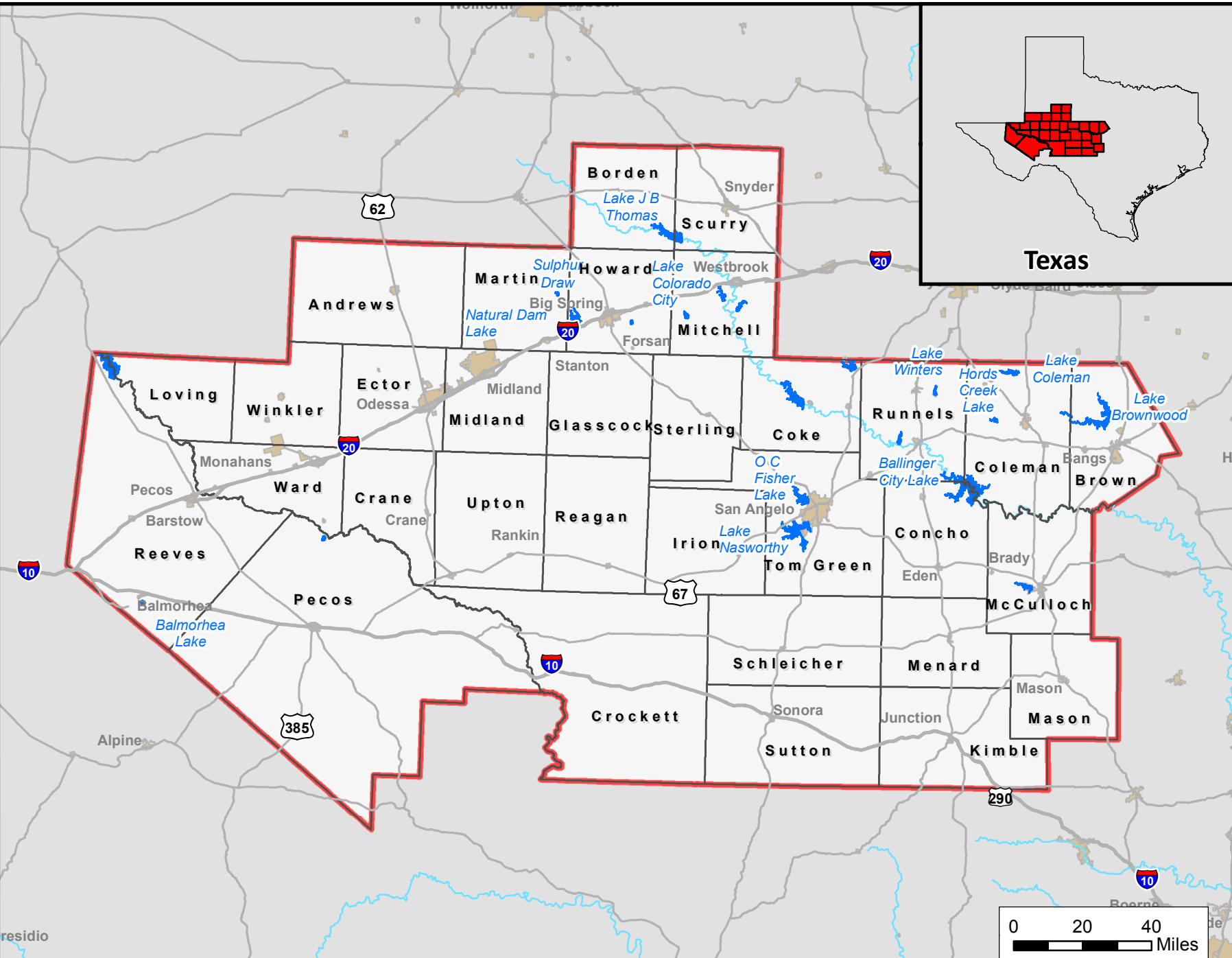
In 1997, the 75th Texas Legislature passed Senate Bill One (SB1), legislation designed to address Texas water issues. With the passage of SB1, the legislature put in place a grass-roots regional planning process to plan for the future water needs of all Texans. To implement this planning process, the Texas Water Development Board (TWDB) created 16 regional water planning areas 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 have been updated three times, in 2006, 2011, and 2016, and then consolidated into the state water plans, Water for Texas 2007, 2012, and 2017, respectively.

The TWDB refers to the current round of regional planning as SB1, Fifth Round. This report is the update to the 2016 Region F Water Plan and will become part of the basis for the next state water plan.

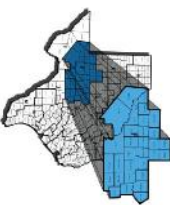
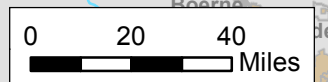
This chapter presents a description of Region F, one of the 16 regions created to implement SB1. Figure 1-1 is a map of Region F, which includes 32 counties in West Texas. The data presented in this regional water plan is a compilation of information from previous planning reports, on-going planning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

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 shows historical populations for these counties from 1900 through 2010 and estimated populations for 2017¹.



Texas



Region F

Regional Water Planning Area

Coordinate System: NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

Document Path: H:\WR_PLANNING\Chapter 1\Figure 1-1.mxd

FN JOB NO	SAN11472
FILE	Figure 1-1.mxd
DATE	MARCH, 2015
SCALE	1:2,534,400
DESIGNED	JLA
DRAWN	JLA

FIGURE 1-1

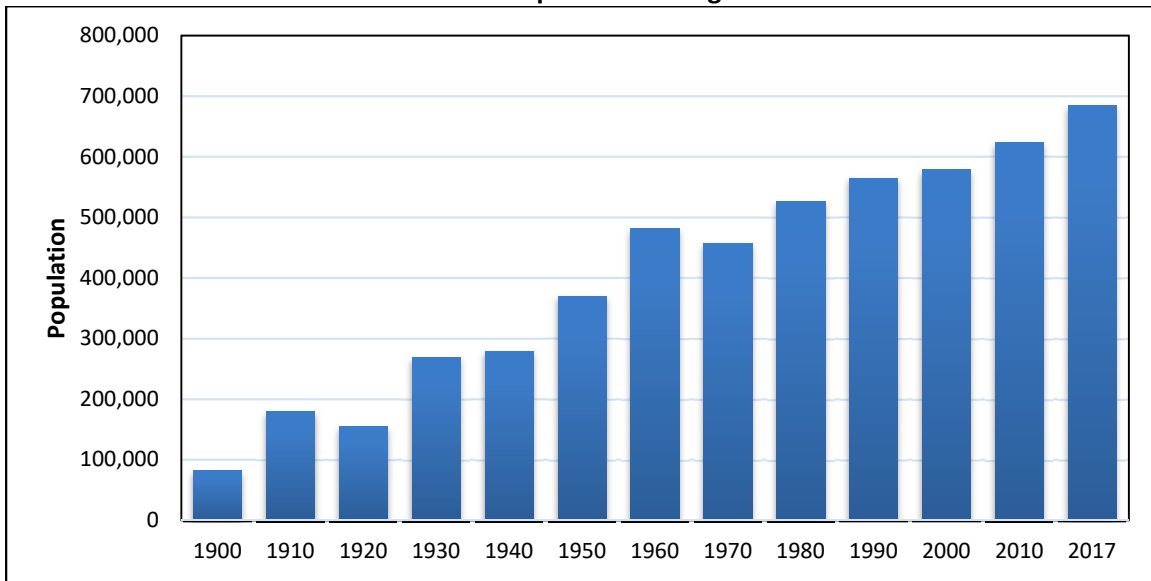
Table 1-1
Historical Population of Region F Counties^a

County	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010	2017
Andrews	87	975	350	736	1,277	5,002	13,450	10,372	13,323	14,338	13,004	14,786	17,631
Borden	776	1,386	965	1,505	1,396	1,106	1,076	888	859	799	729	641	670
Brown	16,019	22,935	21,682	26,382	25,924	28,607	24,728	25,877	33,057	34,371	37,674	38,106	37,870
Coke	3,430	6,412	4,557	5,253	4,590	4,045	3,589	3,087	3,196	3,424	3,864	3,320	3,303
Coleman	10,077	22,618	18,805	23,669	20,571	15,503	12,458	10,288	10,439	9,710	9,235	8,895	8,415
Concho	1,427	6,654	5,847	7,645	6,192	5,078	3,672	2,937	2,915	3,044	3,966	4,087	4,311
Crane	51	331	37	2,221	2,841	3,965	4,699	4,172	4,600	4,652	3,996	4,375	4,713
Crockett	1,591	1,296	1,500	2,590	2,809	3,981	4,209	3,885	4,608	4,078	4,099	3,719	3,555
Ector	381	1,178	760	3,958	15,051	42,102	90,995	91,805	115,374	118,934	121,123	137,130	157,173
Glasscock	286	1,143	555	1,263	1,193	1,089	1,118	1,155	1,304	1,447	1,406	1,226	1,360
Howard	2,528	8,881	6,962	22,888	20,990	26,722	40,139	37,796	33,142	32,343	33,627	35,012	36,198
Irion	848	1,283	1,610	2,049	1,963	1,590	1,183	1,070	1,386	1,629	1,771	1,599	1,511
Kimble	2,503	3,261	3,581	4,119	5,064	4,619	3,943	3,904	4,063	4,122	4,468	4,607	4,406
Loving	33	249	82	195	285	227	226	164	91	107	67	82	136
Martin	332	1,549	1,146	5,785	5,556	5,541	5,068	4,774	4,684	4,956	4,746	4,799	5,562
Mason	5,573	5,683	4,824	5,511	5,378	4,945	3,780	3,356	3,683	3,423	3,738	4,012	4,203
McCulloch	3,960	13,405	11,020	13,883	13,208	11,701	8,815	8,571	8,735	8,778	8,205	8,283	7,960
Menard	2,011	2,707	3,162	4,447	4,521	4,175	2,964	2,646	2,346	2,252	2,360	2,242	2,121
Midland	1,741	3,464	2,449	8,005	11,721	25,785	67,717	65,433	82,636	106,611	116,009	136,872	165,386
Mitchell	2,855	8,956	7,527	14,183	12,477	14,357	11,255	9,073	9,088	8,016	9,698	9,403	8,232
Pecos ^c	2,360	2,071	3,857	7,812	8,185	9,939	11,957	13,748	14,618	14,675	16,809	15,507	15,618
Reagan ^b		392	377	3,026	1,997	3,127	3,782	3,239	4,135	4,514	3,326	3,367	3,700
Reeves	1,847	4,392	4,457	6,407	8,006	11,745	17,644	16,526	15,801	15,852	13,137	13,783	15,295
Runnels	5,379	20,858	17,074	21,821	18,903	16,771	15,016	12,108	11,872	11,294	11,495	10,501	10,333
Schleicher	515	1,893	1,851	3,166	3,083	2,852	2,791	2,277	2,820	2,990	2,935	3,461	2,995
Scurry	4,158	10,924	9,003	12,188	11,545	22,779	20,369	15,760	18,192	18,634	16,361	16,921	17,004
Sterling	1,127	1,493	1,053	1,431	1,404	1,282	1,177	1,056	1,206	1,438	1,393	1,143	1,301
Sutton	1,727	1,569	1,598	2,807	3,977	3,746	3,738	3,175	5,130	4,135	4,077	4,128	3,798
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	110,224	117,689
Upton	48	501	253	5,968	4,297	5,307	6,239	4,697	4,619	4,447	3,404	3,355	3,661
Ward	1,451	2,389	2,615	4,599	9,575	13,346	14,917	13,019	13,976	13,115	10,909	10,658	11,423
Winkler	60	442	81	6,784	6,141	10,064	13,652	9,640	9,944	8,626	7,173	7,110	7,574
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	623,354	685,107
% Change		119%	-14%	73%	4%	32%	30%	-5%	15%	7%	2%	6%	10%

Notes: a. Historical and estimated population data are from the U.S. Census Bureau¹
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.

Figure 1-2 shows graphically the total population of the region. The population of Region F has increased from 81,985 in 1900 to 623,354 in 2010. Since the 2010 census, it is estimated that the population of Region F increased to 683,918 in the year 2017.

**Figure 1-2
Historical Population of Region F**

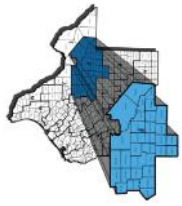
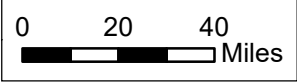
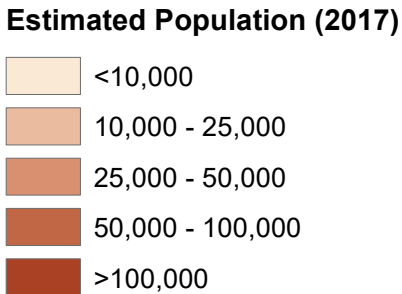
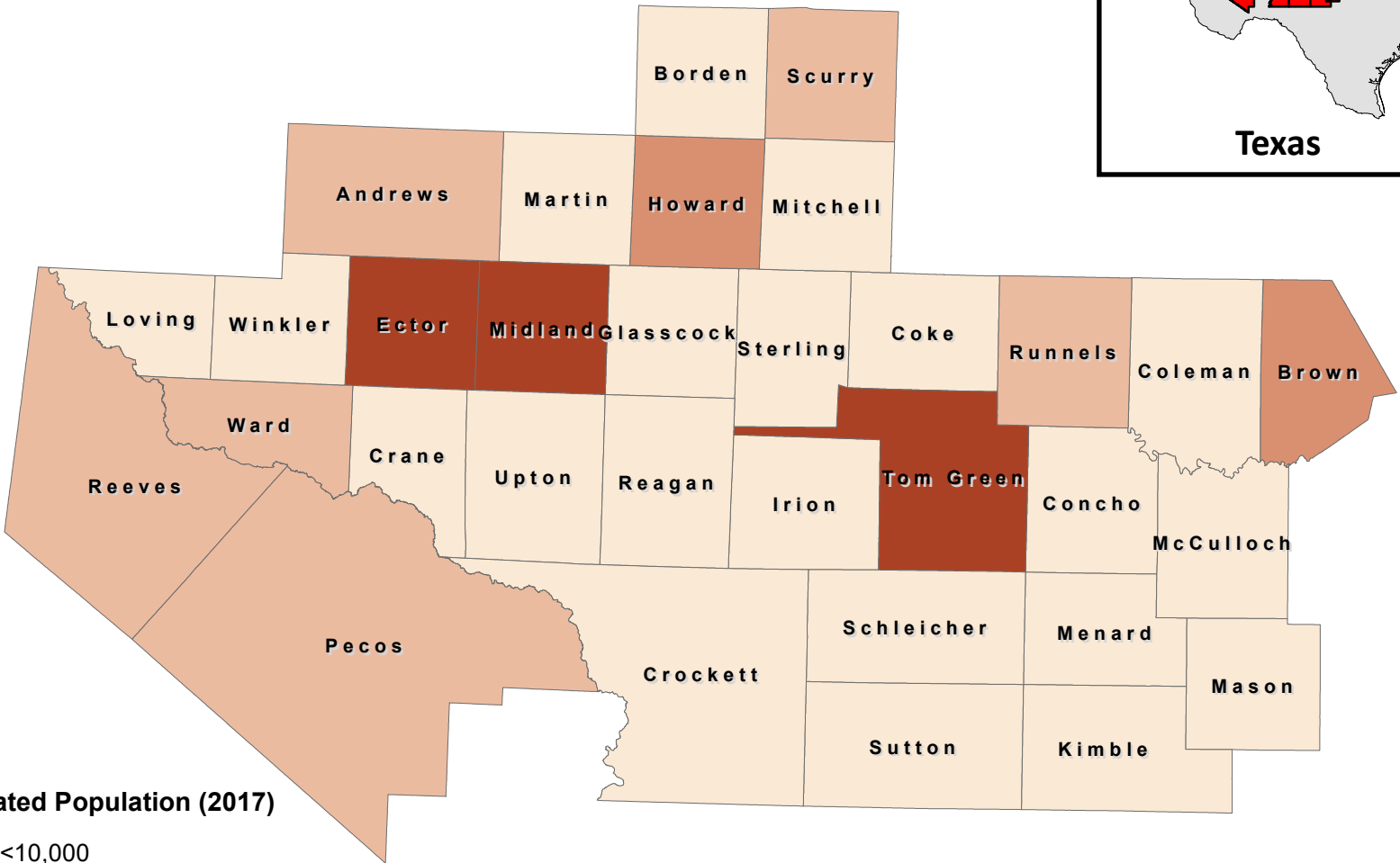
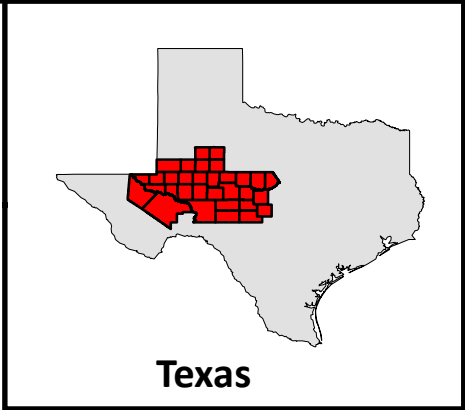


According to 2017 population estimates by the U.S. Census Bureau, Region F accounted for 2.5 percent of Texas’ total population. Figure 1-3 shows the distribution of population in Region F counties based on the census data. Ector, Midland, and Tom Green were the three most populous counties in Region F, accounting for 65 percent of the region’s population. Brown and Howard Counties were the next most populous counties with more than 35,000 people in each. Table 1-2 lists the seven cities in Region F with a 2017 population of more than 10,000, which encompass over 60 percent of the population in Region F.

**Table 1-2
Region F Cities with a Year 2017 Population Greater than 10,000**

City	Year 2017 Population
Midland	136,089
Odessa	116,861
San Angelo	100,119
Big Spring	27,905
Brownwood	18,831
Andrews	13,472
Snyder	11,320
Total	424,597

Data are from the 2017 US Census Bureau Estimates¹.



Region F

Estimated Population Distribution by County (2017)

FBI JOB NO	GMD17216
FILE	Figure 1-3.mxd
DATE	APRIL, 2019
SCALE	1:2,534,400
DESIGNED	JLA
DATE	JJS

1-3

FIGURE

1.1.1 Economic Activity in Region F

Region F includes the Midland, Odessa, and San Angelo Metropolitan Statistical Areas (MSAs). The largest employment sectors in both the Midland and Odessa MSAs are the oil and gas industry, retail trade, and healthcare services². Educational services, construction, and leisure and hospitality are also important employment sectors in these areas. In the San Angelo MSA the largest employment sectors are health services and retail trade, followed by educational services and leisure and hospitality.

Table 1-3 summarizes 2017 payroll data for Region F by county and economic sector³. Figure 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 75 percent of the payroll and 70 percent of the employment in the region. Other major centers of economic activity are located in Brown and Howard Counties. The largest private business sectors in Region F in terms of payroll in 2017 are natural resources and mining, trade, transportation, and utilities, and professional and business services, which together account for 54 percent of the region's total payroll.

Over the past decade, the oil and gas industry has been growing rapidly in the Permian Basin, particularly over the last decade (see Section 1.4.3). Since 2007, the payroll for mining and natural resources has more than doubled from \$2.0 billion to nearly \$4.5 billion in 2017 in Region F³. In 2017, Region F counties accounted for nearly 15% of the total state payroll for natural resources and mining. This increase in production has led to increased population for many cities within the region and subsequently, increased water use. The Permian Basin underlies most of Region F, as shown in Figure 1-5.

Table 1-3
2017 County Payroll by Category (\$1000)

Category	Andrews	Borden	Brown	Coke	Coleman	Concho	Crane	Crockett	Ector	Glasscock	Howard
Federal Government	728	31	6,956	494	1,480	598	244	225	10,916	273	68,034
State Government	1,567	315	41,237	608	1,171	781	475	1,655	82,367	0	27,087
Local Government	62,513	3,302	69,285	8,214	17,405	7,897	16,643	11,883	415,653	0	75,367
Private Industry, Total	376,534	3,545	465,699	14,019	45,703	19,929	47,626	47,733	3,481,114	18,135	453,729
Goods-Producing	212,224	1,286	215,066	3,559	8,872	2,424	24,907	21,846	1,646,308	12,941	198,156
Natural Resources and Mining	137,546	0	8,891	0	1,915	1,208	23,107	19,070	890,468	12,283	81,477
Construction	61,389	0	25,163	1,470	3,620	0	0	0	458,391	0	36,786
Manufacturing	13,289	0	181,012	0	3,337	0	0	0	297,449	0	79,892
Service Providing	164,310	2,259	250,633	10,460	36,831	17,506	22,719	25,887	1,834,806	5,194	255,573
Trade, Transportation, and Utilities	84,582	933	85,648	2,275	10,852	2,757	14,712	10,630	842,451	4,048	99,332
Information	5,098	0	5,606	0	0	0	0	0	21,396	0	4,726
Financial Activities	22,205	0	18,655	1,072	7,103	1,977	3,222	7,364	205,127	0	19,081
Professional and Business Services	26,144	998	20,439	5,523	1,795	0	1,852	1,675	228,501	0	22,201
Education and Health Services	5,411	0	93,147	554	11,208	4,386	1,900	0	251,741	0	75,277
Leisure and Hospitality	11,551	0	19,583	255	3,147	1,268	610	3,314	161,257	0	21,999
Other Services	9,044	239	7,205	0	1,124	261	0	2,289	123,357	0	12,755
Unclassified	274	0	349	0	0	0	0	0	976	7	202
Total Payroll	441,341	7,193	583,178	23,334	65,759	29,206	64,987	61,495	3,990,051	23,412	624,217
Total Employees	7,187	194	15,851	676	2,131	717	1,189	1,536	70,917	546	12,693

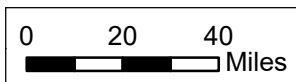
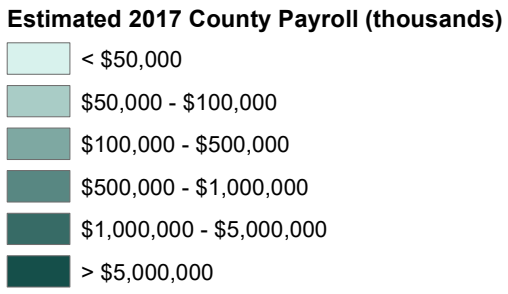
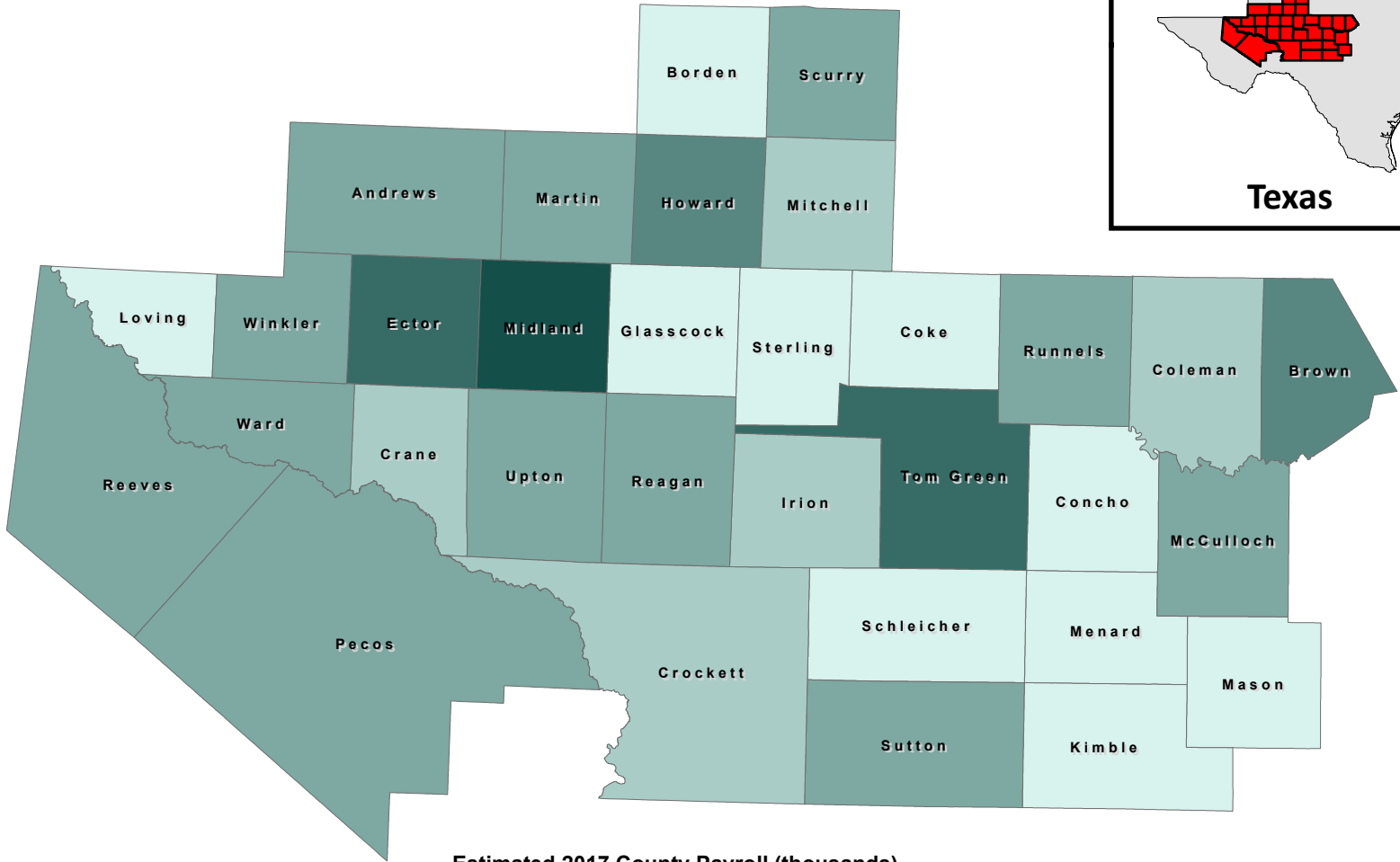
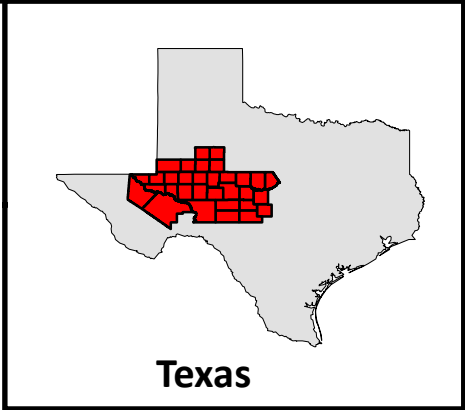
Table 1-3 (cont.) 2017 County Payroll by Category (\$1000)

Category	Irion	Kimble	Loving	Martin	Mason	McCulloch	Menard	Midland	Mitchell	Pecos	Reagan
Federal Government	101	633	0	816	719	1,164	240	39,681	919	3,716	530
State Government	261	3,146	0	655	1,026	2,126	616	32,612	17,431	23,951	609
Local Government	3,830	6,699	0	23,320	8,232	17,061	5,440	392,007	24,622	54,449	16,892
Private Industry, Total	50,708	28,745	0	79,091	25,326	99,502	4,538	5,814,323	42,213	170,817	90,232
Goods-Producing	42,534	6,765	0	35,940	8,429	38,918	1,141	3,135,739	20,197	69,458	41,605
Natural Resources and Mining	40,035	1,071	1,487	0	5,336	28,718	576	2,625,271	16,648	50,133	38,139
Construction	0	3,354	0	23,256	2,322	2,695	0	305,992	0	13,899	3,466
Manufacturing	0	2,340	0	0	770	7,504	0	204,476	0	5,427	0
Service Providing	8,174	21,980	1,328	43,151	16,897	60,584	3,397	2,678,584	22,016	101,358	48,628
Trade, Transportation, and Utilities	5,795	7,972	0	29,945	6,107	34,784	1,903	1,024,227	11,284	57,872	44,098
Information	0	0	0	0	0	804	0	54,527	347	782	0
Financial Activities	0	2,194	0	2,360	3,657	4,496	676	275,627	2,338	10,747	957
Professional and Business Services	371	1,012	0	1,949	2,195	2,034	96	692,947	1,391	9,871	499
Education and Health Services	511	4,733	0	3,722	1,835	12,848	0	309,505	4,263	7,438	0
Leisure and Hospitality	0	4,933	0	1,297	2,007	4,030	462	194,901	1,861	11,971	2,033
Other Services	166	1,043	0	1,737	753	1,489	163	123,958	532	2,616	995
Unclassified	0	0	0	0	0	100	6	2,892	0	62	0
Total Payroll	54,900	39,223	3,852	103,882	35,303	119,853	10,834	6,278,624	85,185	252,932	108,262
Total Employees	789	1,293	85	1,987	1,109	2,886	398	89,895	2,093	5,559	1,913

Table 1-3 (cont.) 2017 County Payroll by Category (\$1000)

Category	Reeves	Runnels	Schleicher	Scurry	Sterling	Sutton	Tom Green	Upton	Ward	Winkler	Region F Total
Federal Government	4,353	1,843	588	1,607	250	234	67,817	288	719	482	216,679
State Government	2,978	1,923	173	15,019	674	1,853	109,973	544	2,101	529	375,463
Local Government	66,081	25,837	7,675	54,755	4,627	14,545	197,584	20,300	32,036	23,215	1,687,367
Private Industry, Total	195,495	70,505	23,478	274,817	18,699	101,539	1,547,089	82,322	226,498	137,480	14,057,183
Goods-Producing	106,721	30,514	13,500	134,663	11,487	47,865	367,559	53,253	135,948	91,348	6,741,172
Natural Resources and Mining	39,841	6,888	0	115,792	10,429	35,877	80,493	48,143	108,247	55,966	4,485,054
Construction	43,737	4,258	9,205	9,312	1,058	6,444	103,342	5,110	18,965	34,668	1,177,904
Manufacturing	23,143	19,368	0	9,559	0	5,545	183,724	0	8,736	713	1,046,284
Service Providing	88,774	39,990	9,978	140,154	7,211	53,674	1,179,530	29,069	90,550	46,132	7,317,339
Trade, Transportation, and Utilities	51,012	20,900	5,170	75,013	4,638	44,044	339,096	19,499	55,029	27,620	3,024,231
Information	1,239	0	0	1,761	0	0	34,554	0	1,705	0	132,547
Financial Activities	11,950	3,781	1,036	10,568	1,473	2,514	133,267	1,536	11,883	4,856	771,721
Professional and Business Services	6,363	4,493	908	30,114	262	2,714	140,586	573	10,936	8,517	1,226,957
Education and Health Services	2,895	7,985	2,406	6,649	0	1,406	392,933	394	2,356	515	1,206,021
Leisure and Hospitality	13,342	1,931	0	7,339	0	2,156	97,361	274	6,864	1,963	577,709
Other Services	1,737	892	219	8,622	0	631	41,054	0	1,777	2,491	347,147
Unclassified	236	8	17	88	0	0	680	0	0	0	5,897
Total Payroll	268,908	100,107	31,914	346,197	24,249	118,171	1,922,464	103,454	261,353	161,706	16,345,548
Total Employees	5,463	2,870	764	6,694	537	1,850	47,212	1,535	4,579	2,732	295,880

Notes: Data are from U.S. Bureau of Labor Statistics 2017 Census of Employment and Wages data³



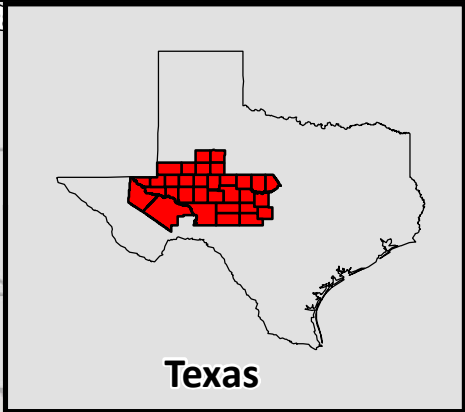
Region F

Estimated Payroll Distribution by County (2017)

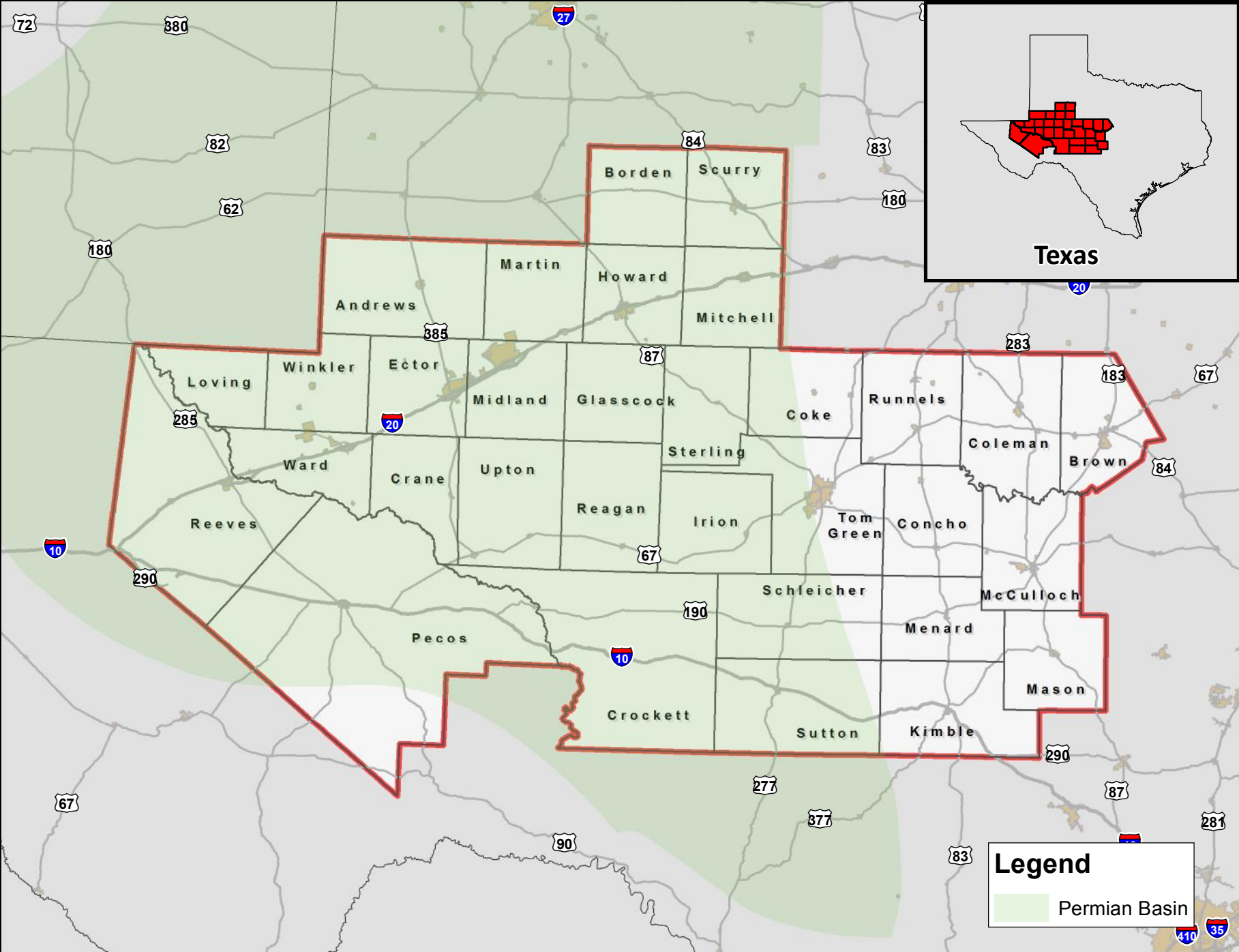
FN JOB NO: OMD17216
 FILE: Figure 1-4.mxd
 DATE: APRIL, 2019
 SCALE: 1:2,534,400
 DESIGNED: JLA
 DRAFTED: JLA

1-4

FIGURE

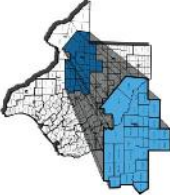


Texas



Legend

Permian Basin



Region F
Permian Basin

FN JOB NO	SAN11472
FILE	Figure 1-5.mxd
DATE	MARCH, 2015
SCALE	1:2,534,400
DESIGNED	JLA
DRAWN	JLA

FIGURE 1-5

Coordinate System: NAD 1983 StatePlane Texas North Central FIPS 4202 Feet

Document Path: H:\WR_PLANNING\Chapter 1\Figure 1-5.mxd

1.1.2 Water-Related Physical Features and Climate in Region F

Most of Region F is in the upper portion of the Colorado River Basin and in the Pecos River portion of the Rio Grande River Basin. A small part of the region is in the Brazos Basin. Figure 1-6 shows the surface water features in the Region F, which include the Colorado River, Concho River, Pecan Bayou, San Saba River, Llano River, and Pecos River.

Table 1-4 lists the 17 major water supply reservoirs in Region F. 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.

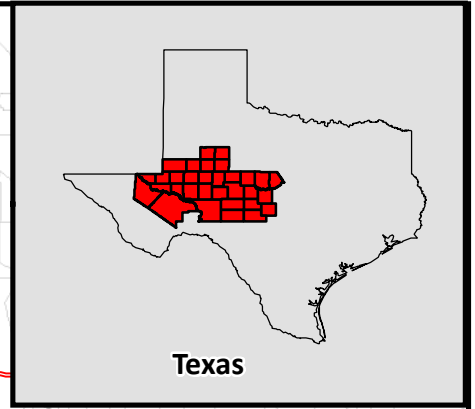
Figure 1-7 shows the average annual precipitation throughout Region F⁴. Average precipitation ranges from slightly more than 11 inches per year in Reeves County to approximately 30 inches per year in Brown County. Precipitation generally increases from the western to the eastern portions of the region. Some of the highest evaporation rates in the state are in Region F, which often exceed rainfall throughout the region. Figure 1-8 illustrates the mean annual temperatures throughout Region F⁴. The mean annual temperatures for the entire region varied from a mean minimum temperature of 46.0 °F in Pecos County to a mean maximum temperature of 81.6 °F in Reeves County. The patterns of rainfall, runoff, evaporation, and temperature result in more abundant water supplies in the eastern portion of Region F.

Figure 1-9 shows the major aquifers in Region F, and Figure 1-10 shows the minor aquifers. There are 14 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 the Capitan Reef Complex, Cross Timbers, Dockum, Ellenberger-San Saba, Hickory, Igneous, Lipan, Marble Falls, and the Rustler. 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.

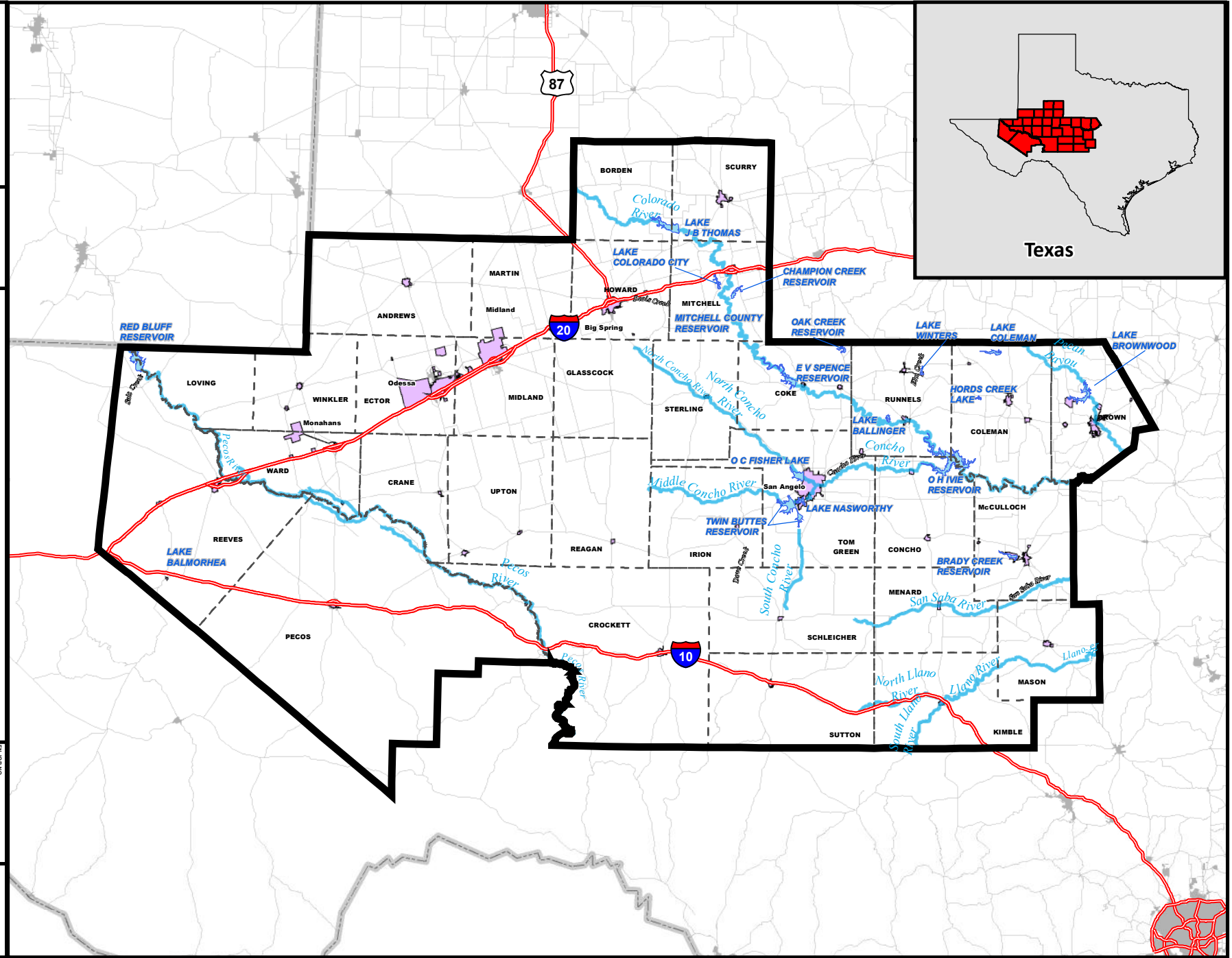
**Table 1-4
Major Water Supply Reservoirs in Region F^{a,d}**

Reservoir Name	Basin	Stream	County(ies)	Water Right Number(s)	Priority Date	Permitted Conservation Storage (Ac-Ft)	Permitted Diversion (Ac-Ft/Yr)	Year 2016 Use (Acre-Feet)	Owner	Water Rights Holder(s)
Lake J B Thomas	Colorado	Colorado River	Borden, Scurry	CA-1002	08/05/1946	204,000	30,000	11,167	CRMWD	CRMWD
Lake Colorado City	Colorado	Morgan Creek	Mitchell	CA-1009	11/22/1948	29,934	5,500	2,837	Luminant Generation	Luminant Generation
Champion Creek Reservoir	Colorado	Champion Creek	Mitchell	CA-1009	04/08/1957	40,170	6,750		Luminant Generation	Luminant Generation
Oak Creek Reservoir	Colorado	Oak Creek	Coke	CA-1031	04/27/1949	30,000	10,000	835	City of Sweetwater	City of Sweetwater
Lake Coleman	Colorado	Jim Ned Creek	Coleman	CA-1702	08/25/1958	40,000	9,000	546	City of Coleman	City of Coleman
E V Spence Reservoir	Colorado	Colorado River	Coke	CA-1008	08/17/1964	488,760	43,000	9,904	CRMWD	CRMWD
Mitchell County Reservoir	Colorado	Off-Channel	Mitchell		2/14/1990	27,266				
Lake Winters	Colorado	Elm Creek	Runnels	CA-1095	12/18/1944	8,374	1,755	No data	City of Winters	City of Winters
Lake Brownwood	Colorado	Pecan Bayou	Brown	CA-2454	09/29/1925	114,000	29,712	8,522	Brown Co. WID	Brown Co. WID
Hords Creek Lake	Colorado	Hords Creek	Coleman	CA-1705	03/23/1946	7,959	2,240	496	COE	City of Coleman
Lake Ballinger	Colorado	Valley Creek	Runnels	CA-1072	10/04/1946	6,850	1,000	260	City of Ballinger	City of Ballinger
O. H. Ivie Reservoir	Colorado	Colorado River	Coleman, Concho & Runnels	A-3866 P-3676	02/21/1978	554,340	113,000	32,534	CRMWD	CRMWD
O. C. Fisher Lake	Colorado	N. Concho River	Tom Green	CA-1190	05/27/1949	80,400	80,400	No data	COE	Upper Colorado River Authority
Twin Buttes Reservoir	Colorado	S. Concho River	Tom Green	CA-1318	05/06/1959	170,000	29,000	No data	U.S. Bureau of Reclamation	City of San Angelo
Lake Nasworthy	Colorado	S. Concho River	Tom Green	CA-1319	03/11/1929	12,500	25,000	No data	City of San Angelo	City of San Angelo
Brady Creek Reservoir	Colorado	Brady Creek	McCulloch	CA-1849	09/02/1959	30,000	3,500	1	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	48,147	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	8,266	Reeves Co WID #1	Reeves Co WID #1
<i>Total</i>						2,158,136	723,757	123,515		

- a. A major reservoir has more than 5,000 acre-feet of storage.
 - b. Total diversions under CA 1002 and CA 1008 limited to 73,000 acre-feet per year. CA 1008 allows up to 50,000 acre-feet per year of diversion. For purposes of this table, the limitation is placed on CA 1008.
 - c. Permitted storage is reported for water conservation storage. UCRA has permission to use water from the sediment pool.
 - d. Data are from TCEQ active water rights list⁵, TCEQ water rights permits⁶, and TCEQ historical water use by water right⁷. Year 2016 use is consumptive.
- CA: Certificate of Adjudication; A: Application; P Permit; COE: Corps of Engineers; NA – Data Not Available



Texas



Coordinate System: Custom

Surface Water Features Reservoirs

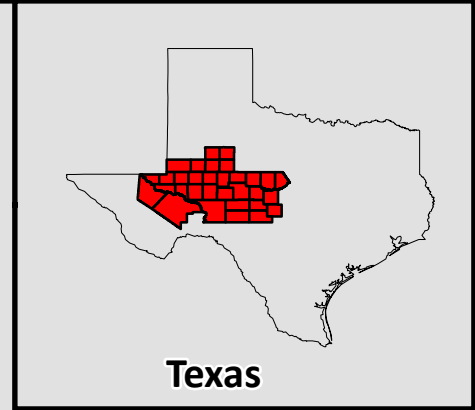
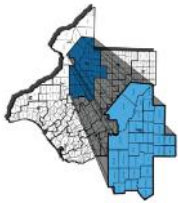
Region F

PROJECT NO.	SANT1477
FILE	Figure 1-3.mxd
DATE	MARCH, 2015
SCALE	1:2,534,400
DRAWN BY	J.A.
CHECKED BY	J.A.

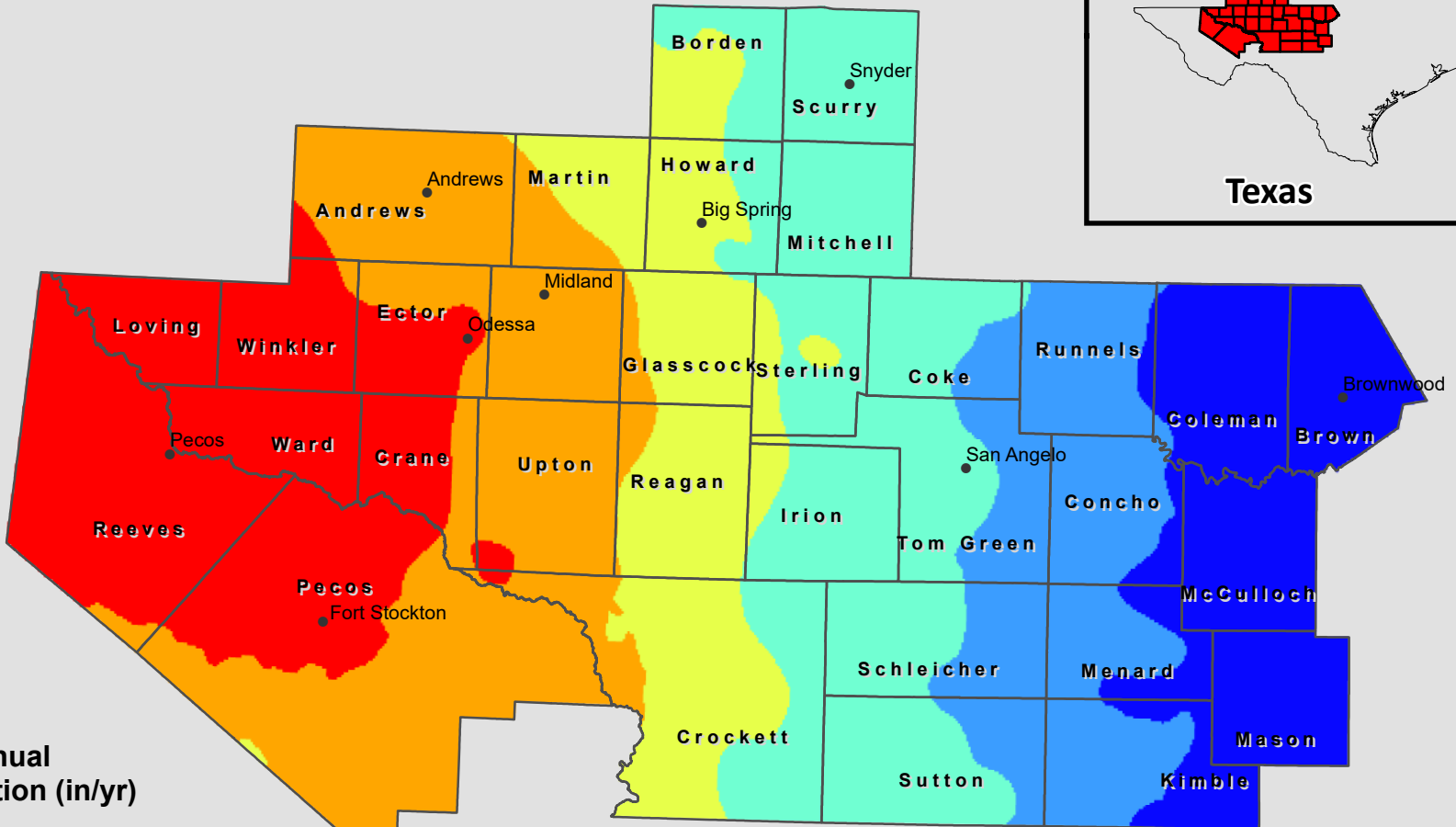
1-6

FIGURE

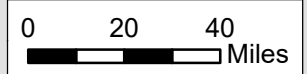
Document Path: H:\MFG_P\ANNING\Chapter 1\Figure 1-6.mxd



Texas



Mean Annual Precipitation (in/yr)



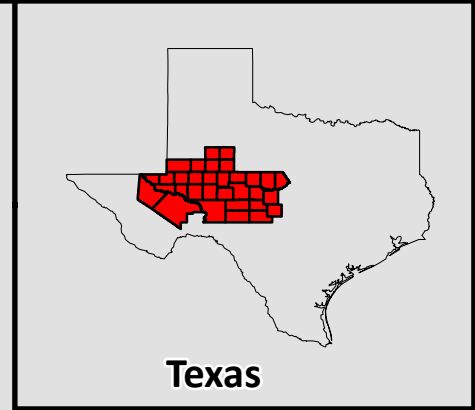
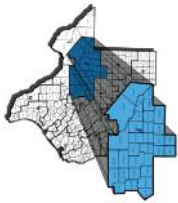
Mean Annual Precipitation (in/yr)
from 1981 - 2010

Region F

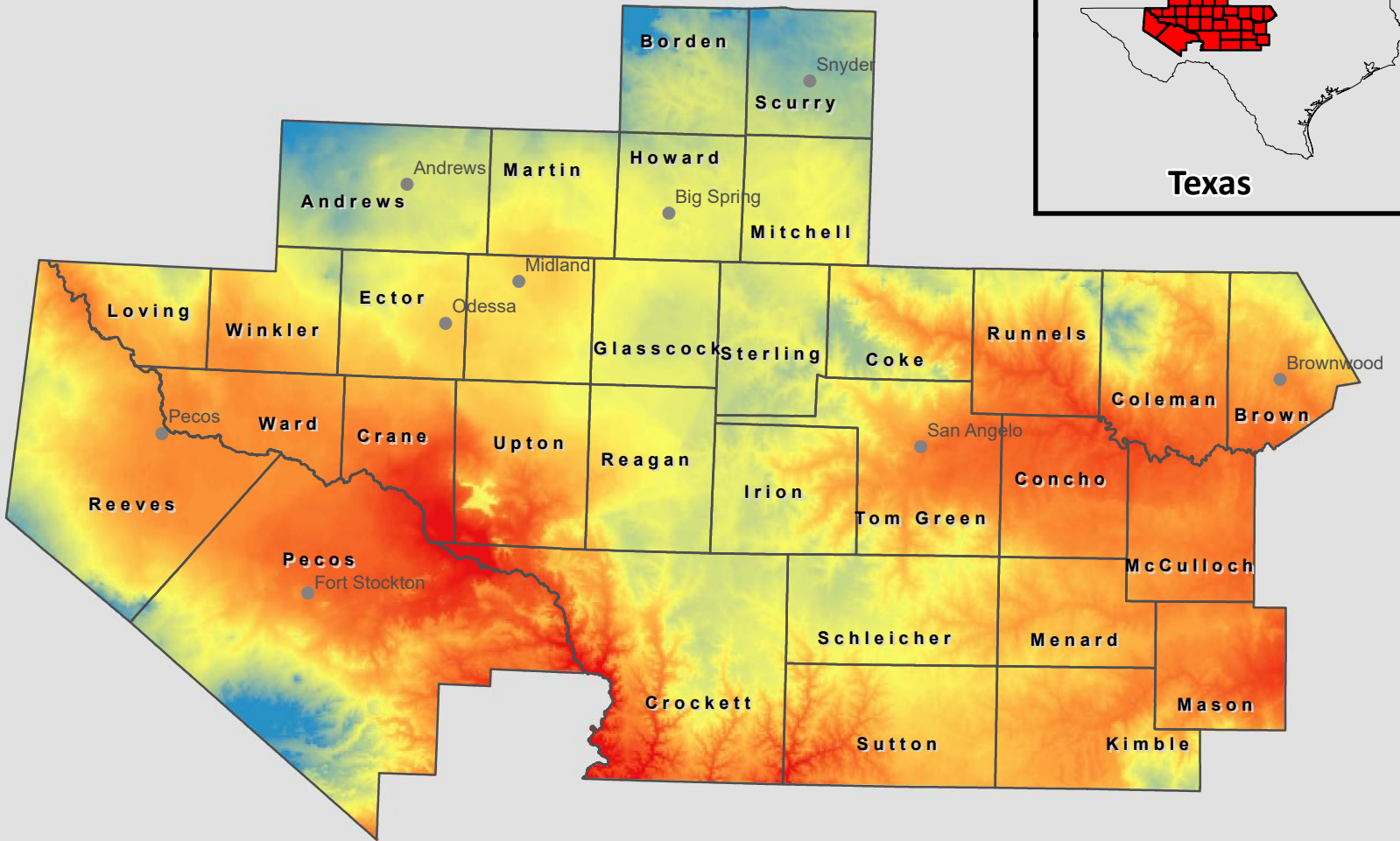
FILE	Figure 1-7.mxd
DATE	APRIL, 2019
SCALE	1:2,534,400
DESIGNED	JLA
DRAFTED	JJS

1-7

FIGURE

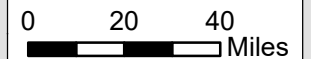
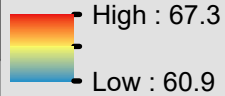


Texas

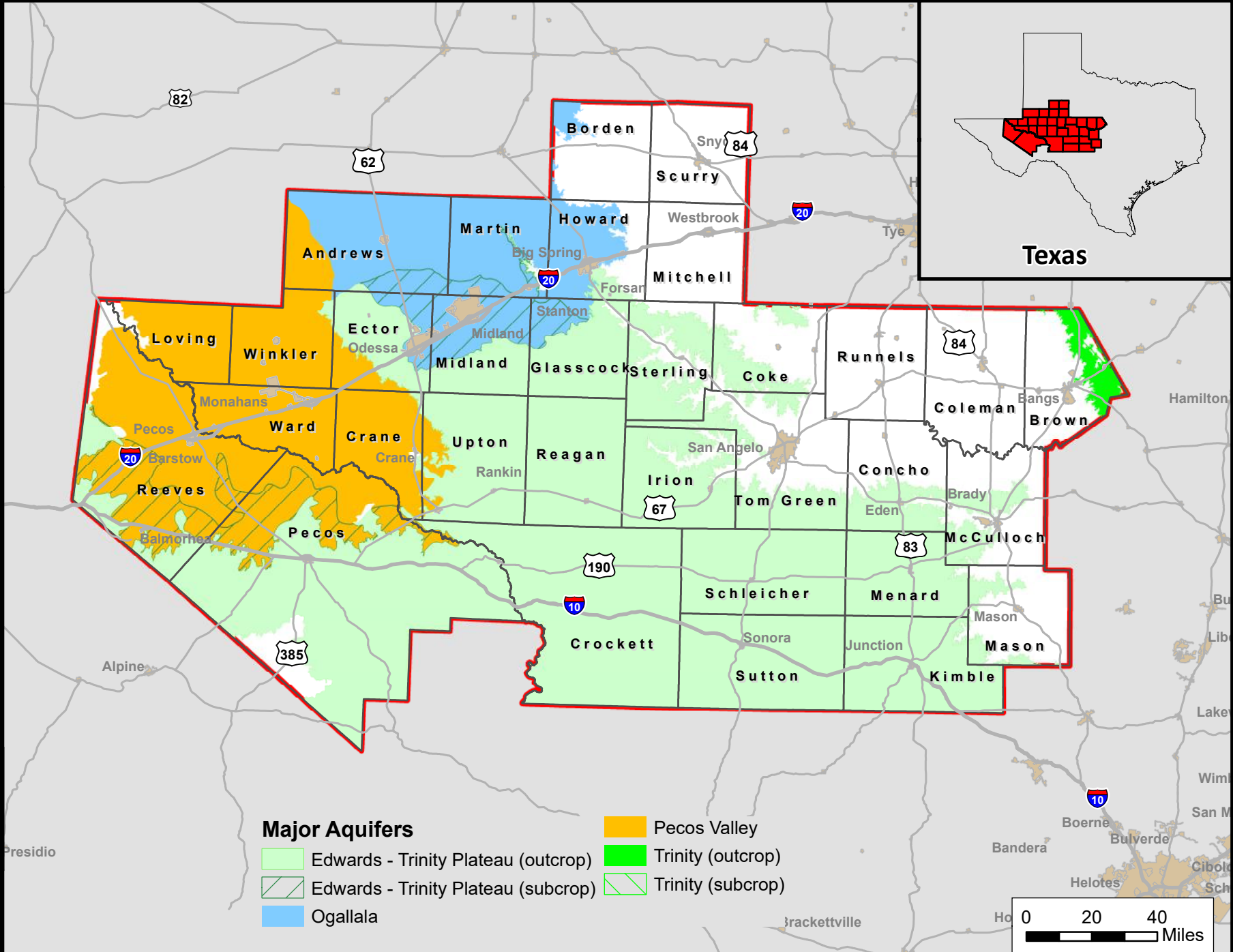
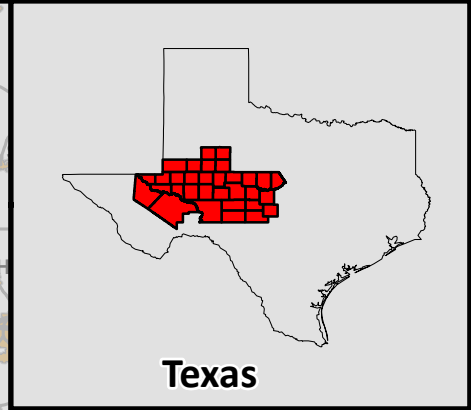


Region F
Mean Annual Temperature (°F)
from 1981 - 2010

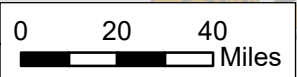
Mean Annual Temperature (°F)



FN JOB NO	GMD17216
FILE	Figure 1-8.mxd
DATE	APRIL 2019
SCALE	1:2,534,400
DESIGNED	JLA
DRAFTED	JJS



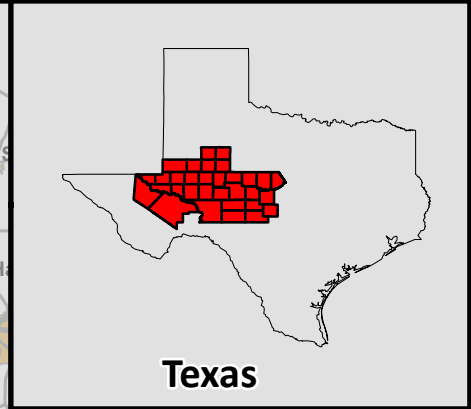
- Major Aquifers**
- Edwards - Trinity Plateau (outcrop)
 - Trinity (outcrop)
 - Edwards - Trinity Plateau (subcrop)
 - Trinity (subcrop)
 - Ogallala
 - Pecos Valley



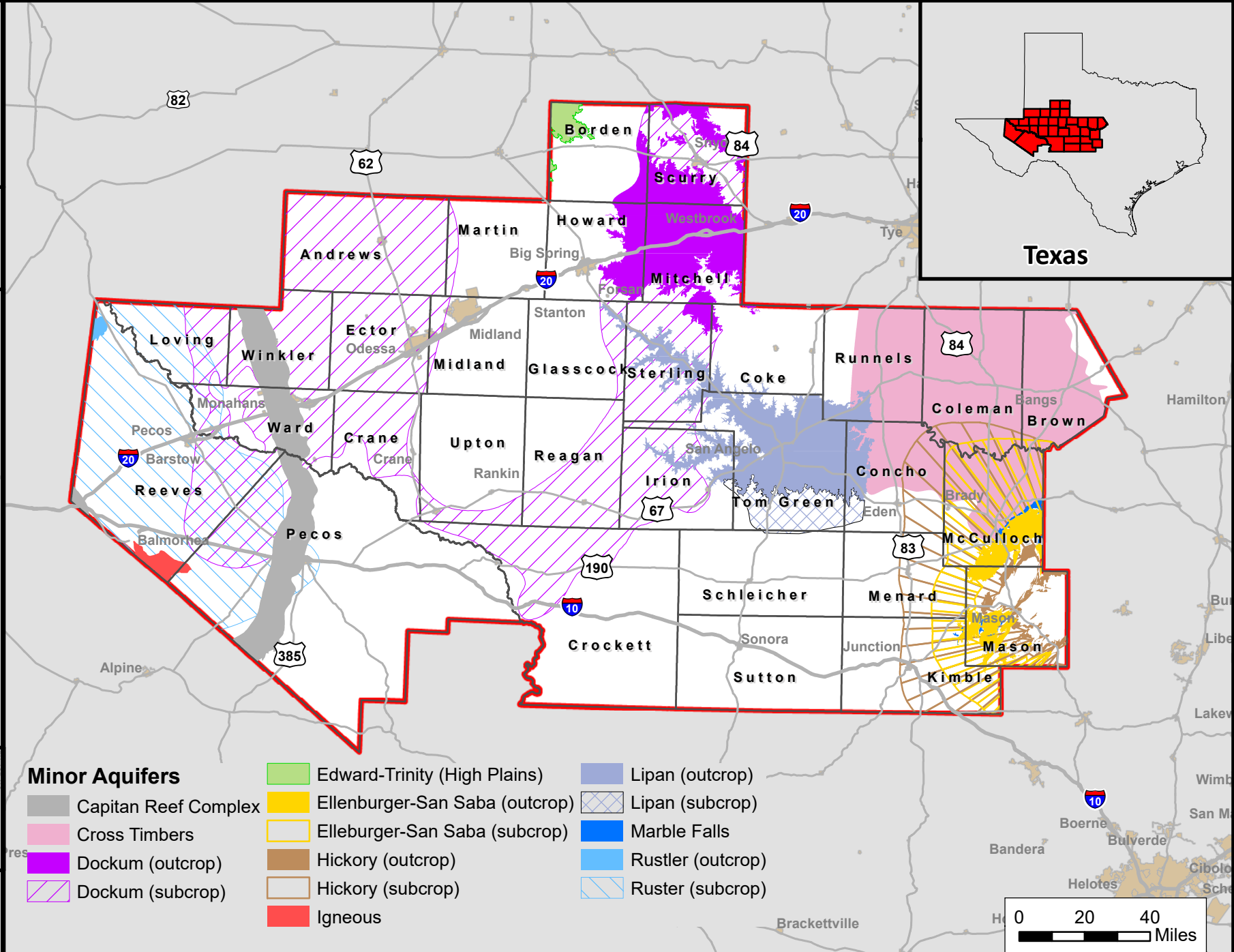
Region F
Major Aquifers

FIG. JOB NO.	OMD17216
FILE	Figure 1-9.mxd
DATE	APRIL, 2019
SCALE	1:2,534,400
DESIGNED	JLA
DRAFTED	JLA

FIGURE 1-9

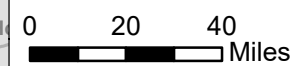


Texas



Minor Aquifers

- Capitan Reef Complex
- Cross Timbers
- Dockum (outcrop)
- Dockum (subcrop)
- Edward-Trinity (High Plains)
- Ellenburger-San Saba (outcrop)
- Ellenburger-San Saba (subcrop)
- Hickory (outcrop)
- Hickory (subcrop)
- Igneous
- Lipan (outcrop)
- Lipan (subcrop)
- Marble Falls
- Rustler (outcrop)
- Ruster (subcrop)



Minor Aquifers

Region F

FIGURE

1-10

FILE	SAN11472
DATE	APRIL 2019
SCALE	1:2,534,400
DESIGNED	JLA
DRAWN	JLA