4 IDENTIFICATION OF WATER NEEDS

Water needs are identified by finding the difference between currently available supplies developed for water users in Chapter 3 and projected demands developed in Chapter 2. Currently available supplies and demands can be defined in multiple ways yielding different levels of water needs. This chapter outlines First, Second, and Third Tier water needs analyses, as defined below, each utilizing different definitions of supplies and demands. The Texas Water Development Board (TWDB) specifies that the currently available supplies to a water user be defined as the most restrictive of current water rights, contracts, infrastructure capacity and available yields for surface water and historical use and/or modeled available groundwater (MAG) for groundwater, henceforth called "current" supplies.

Under the First Tier water needs analysis, current surface water supplies are analyzed using the Water Availability Model (WAM). Assumptions in the WAM, including the use of strict priority order, underestimate the surface water supplies for some sources in the Colorado River Basin in Region F. These WAM supplies are considered as the most restrictive constraint when developing the First Tier water needs. For groundwater users, the most restrictive constraint is commonly infrastructure limitation and/or the MAG values for a specific aquifer. These current supplies are then compared to the full demand scenario outlined in Chapter 2 to yield the First Tier needs analysis.

The Second Tier needs analysis identifies water needs after consideration of reduced demands due to implemented conservation and direct reuse strategies. In some cases, conservation reduces water needs for a particular water user group (WUG) and enables the conserved water to be applied to the needs of others.

The First and Second Tier analyses are required by TWDB. The Third Tier analysis is unique to Region F. This analysis considers surface water supplies, based on a modification to the Colorado River WAM, which subordinates water rights in the lower portion of the Colorado River Basin to those water rights in Region F. These available supplies with subordination are distributed to the water users and incorporated into the entity's total available supplies. This total supply (called "subordination supplies" for the discussion of the Third Tier water needs) is then compared to the demands after conservation and reuse to provide a more realistic assessment of potential water needs. The Third Tier analysis provides an estimate of the amount of additional water needs that may require the development of infrastructure strategies.

This comparison of current water supply to demands is made for the region, county, basin, major water provider, and water user group. If the projected demands for an entity exceed the current supplies, then a shortage is identified (represented by a negative number). For some users, the supplies may exceed the demands (represented by a positive number).

Attachment 4A shows the needs of each Major Water Provider (MWP) in Region F, categorized by water use type, e.g., irrigation, livestock, manufacturing, mining, municipal, steam electric power. Attachment 4B shows a summary of First, Second, and Third Tier needs analyses by each WUG in Region F. Both attachments are provided at the end of this chapter.

4.1 First Tier Water Needs Analysis

The current supply in Region F consists of groundwater, surface water, local supplies and wastewater reuse. There is a small amount of water that comes from outside the region (Regions E, G, and O). The TWDB requires the use of the TCEQ's Water Availability Models (WAM) for regional water planning.

Most of the surface water rights in Region F are in the Colorado River Basin. Chapter 3 discusses the use of the WAM models for water supply estimates and the impacts to the available supplies in the upper Colorado River Basin. Under a WAM analysis, water rights are fully allocated based on strict priority order and thus downstream senior water rights holders continuously make priority calls on major municipal water rights in Region F. Although this does not give an accurate assessment of water supplies based on the way the basin has historically been operated, TWDB requires the regional water planning groups to use the WAM to determine supplies. Therefore, by definition, several sources in Region F have no supply, even though in practice, their supply may be greater than indicated by the WAM.

A similar concern is associated with groundwater supplies. The TWDB requires the use of the MAG values as the cap to groundwater supplies in a county. In some situations, this cap has artificially limited the amount of groundwater that is distributed to existing water users for current supplies and may not be representative of the water that is developed and currently being used. As with the surface water supplies, these restrictions may result in artificially higher water needs.

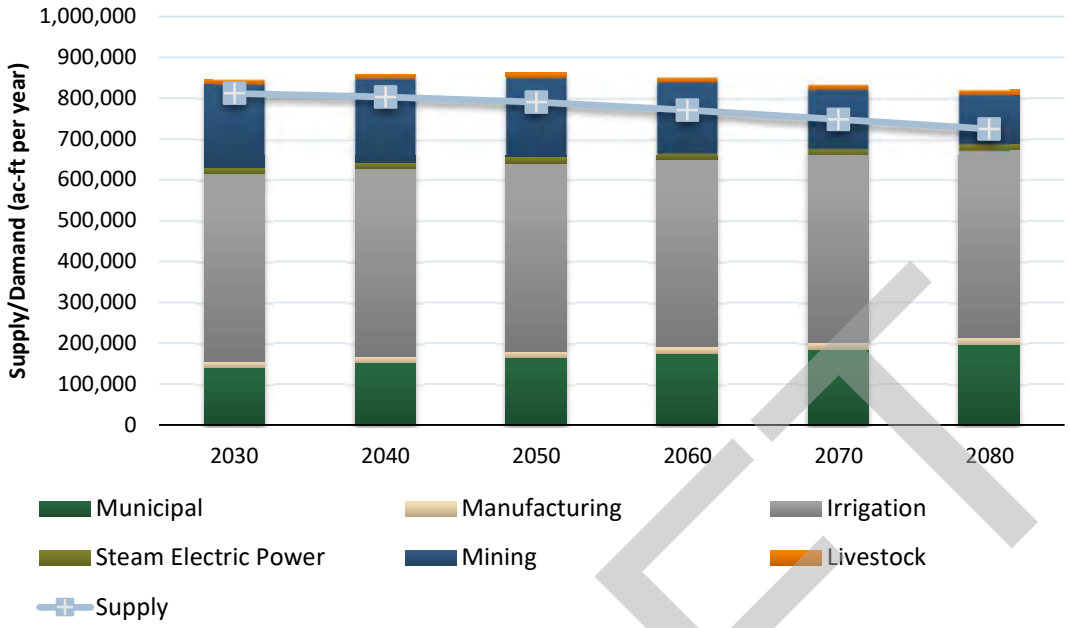
For the First Tier water needs, the current supplies as evaluated in Chapter 3 are compared to the projected demands from Chapter 2 in accordance with TWDB rules. Considering only the current, connected supplies for Region F, on a regional basis there is a projected regional shortage of over 49,000 acre-feet per year in 2030, increasing to a maximum shortage of over 98,000 acre-feet per year in 2080. This is shown in Table 4-1 and graphically in Figure 4-1.

On a county basis, there are twenty-six counties that have a shortage at some point over the planning period. These include Andrews, Borden, Brown, Coke, Coleman, Concho, Crane, Crockett, Ector, Howard, Irion, Kimble, Loving, Martin, Mason, McCulloch, Menard, Midland, Mitchell, Reeves, Runnels, Scurry, Sterling, Tom Green, Ward, and Winkler. Based on this analysis, there are significant irrigation, municipal, mining, and steam electric power shortages over the 50-year planning horizon. As previously discussed, some of these shortages are due to limited supply availability either in the surface water modeling (WAM Run 3) or limitations set up by the MAG.

Table 4-1
Comparison of Supplies and Demands for Region F
-Values are in acre-feet per year-

Region F (Acre-feet)	2030	2040	2050	2060	2070	2080
Connected Supply	825,457	816,922	805,224	786,163	763,816	741,157
Demand	859,746	873,452	876,796	866,685	849,659	837,055
Need	-49,763	-68,388	-79,182	-83,692	-87,195	-98,227

Figure 4-1
Region F Supplies and Demands (acre-feet per year)



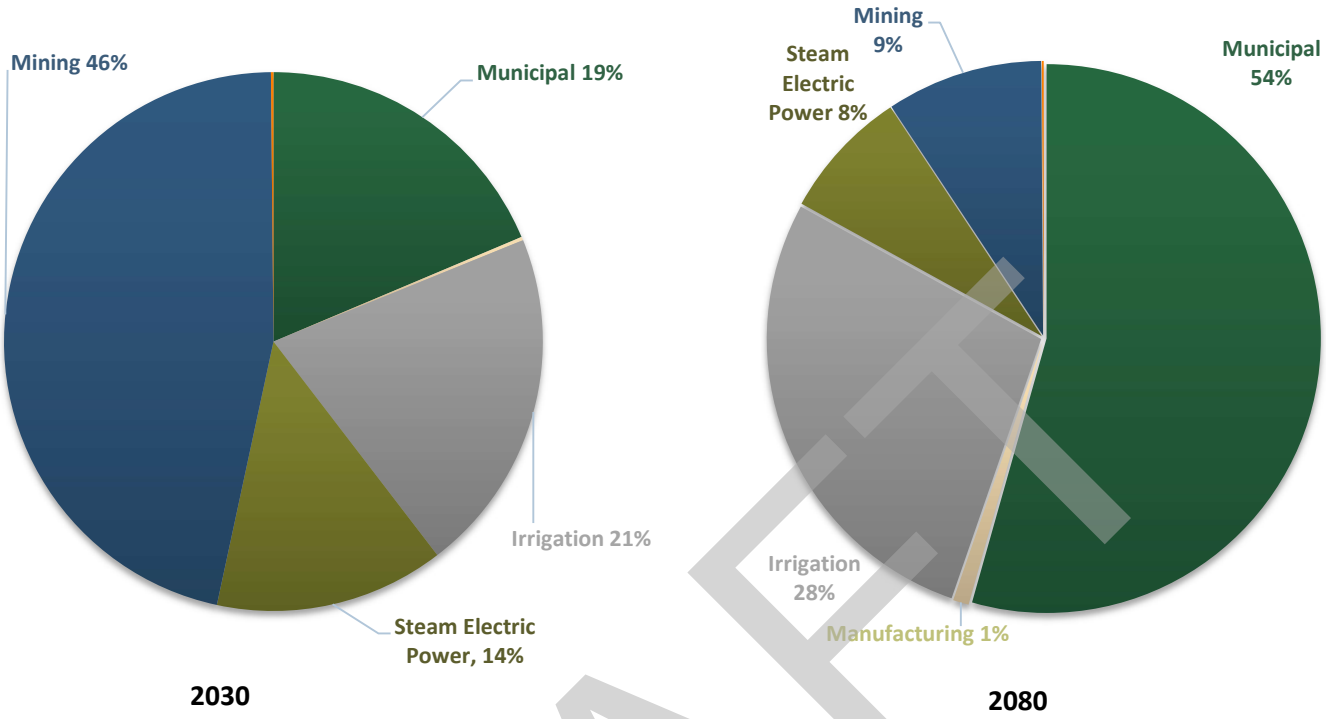
4.1.1 First Tier Water Needs for Water User Groups

A shortage occurs when current supplies are not sufficient to meet projected demands. In Region F there are 67 water user groups with identified shortages over the planning period. Of these, there are 38 municipal utilities and county-other water users spanning 26 counties that are projected to experience a water shortage by 2080.

Of the six use types, mining accounts for the largest percentage of the shortage in the short term. In 2030, mining represents 46 percent of the water needs. As mining demands decline over time, the percentage of water needs attributed to mining falls to nine percent in 2080. In the short term, irrigation and municipal users account for the next highest portions of needs in Region F. In 2030, irrigation users account for 20 percent of the region's water needs and municipal users account for nearly 19 percent. By 2080, municipal needs account for the highest portion of needs in Region F with 54 percent of needs

Figure 4-2 graphically illustrates the First Tier water needs in Region F by use type in 2030 and 2080. Table 4-2 and Table 4-3 quantitatively show the water needs by county and use type in 2030 and 2080, respectively.

Figure 4-2
Region F First Tier Needs by Use Type in Year 2030 and 2080



Identified Needs for Municipal Users

Municipal users are shown to have significant water needs throughout the planning period. Thirty-nine municipal water user groups, not accounting for river basin splits, show a shortage at some point during the planning horizon. According to the WAM, the cities of Brady, Coleman, Junction, Mason, and Winters and their customers have no water supply. The cities of Andrews, Ballinger, Balmorhea, Big Spring, Bronte, Coahoma, Coleman, Colorado City, Eden, Junction, Kermit, Mason, Menard, Midland, Miles, Odessa, Pecos, Robert Lee, San Angelo, Snyder, Stanton, Sterling City, and Winters do not have sufficient water to meet current demands. Other municipal water suppliers that have a water need include Boden County Water System, Coleman County SUD, Concho Rural Water, Corix Utilities, Ector County UD, Goodfellow Airforce Base, Greater Gardendale WSC, Madera Valley WSC, Millers-Doole WSC, North Runnels WSC, U and F WSC, and County-Other users in Andrews, Coke, Coleman, Runnels, and Tom Green counties. The counties with the largest municipal needs are Andrews, Ector, Midland, and Tom Green counties. A significant portion of the needs in these counties are associated with large population centers of Odessa, Midland, and San Angelo.

Identified Needs for Manufacturing Users

There are four counties showing manufacturing needs over the planning period: Andrews, Coleman, Howard, and Kimble counties. Manufacturing needs in Coleman and Howard counties are associated with needs for the cities of Coleman and Big Spring, respectively, and will be met by strategies developed for these cities.

Identified Needs for Irrigation Users

Irrigation water shortages are identified for ten counties in Region F, including Andrews, Brown, Coleman, Ector, Irion, Kimble, Martin, Menard, Mitchell, and Tom Green counties.

Table 4-2
Water Needs by County and Use Type in Year 2030
-Values are in acre-feet per year-

County	Irrigation	Manufacturing	Mining	Municipal	Steam Electric Power	Livestock	Total
Andrews	(5,365)	(70)	(1,990)	(552)	0	(74)	(8,051)
Borden	0	0	(529)	0	0	0	(529)
Brown	(319)	0	0	(3)	0	0	(322)
Coke	0	0	0	(524)	0	0	(524)
Coleman	(361)	(1)	0	(794)	0	0	(1,156)
Concho	0	0	0	(450)	0	0	(450)
Crane	0	0	0	0	0	0	0
Crockett	0	0	(2,275)	0	0	0	(2,275)
Ector	0	0	0	0	(139)	0	(139)
Glasscock	0	0	0	0	0	0	0
Howard	0	0	(2,406)	0	(1)	0	(2,407)
Irion	(618)	0	(6,015)	0	0	0	(6,633)
Kimble	(1,258)	(35)	0	(523)	0	0	(1,816)
Loving	0	0	(6,725)	0	0	0	(6,725)
Martin	(437)	0	(144)	(51)	0	0	(632)
Mason	0	0	0	(148)	0	0	(148)
McCulloch	0	0	0	0	0	0	0
Menard	(394)	0	0	(44)	0	0	(438)
Midland	0	0	0	0	0	0	0
Mitchell	(1,555)	0	(44)	(264)	(6,725)	0	(8,588)
Pecos	0	0	0	0	0	0	0
Reagan	0	0	0	0	0	0	0
Reeves	0	0	0	(1,410)	0	0	(1,410)
Runnels	0	0	0	(912)	0	0	(912)
Schleicher	0	0	0	0	0	0	0
Scurry	0	0	0	0	0	0	0
Sterling	0	0	(1,607)	0	0	0	(1,607)
Sutton	0	0	0	0	0	0	0
Tom Green	0	0	0	(3,607)	0	0	(3,607)
Upton	0	0	0	0	0	0	0
Ward	0	0	(1,394)	0	0	0	(1,394)
Winkler	0	0	0	0	0	0	0
Total	**(10,307)**	**(106)**	**(23,129)**	**(9,282)**	**(6,865)**	**(74)**	**(49,763)**

Table 4-3
Water Needs by County and Use Type in Year 2080
-Values are in acre-feet per year-

County	Irrigation	Manufacturing	Mining	Municipal	Steam Electric Power	Livestock	Total
Andrews	(8,982)	(279)	0	(7,417)	0	(108)	(16,786)
Borden	0	0	0	(134)	0	0	(134)
Brown	(319)	0	0	(3)	0	0	(322)
Coke	0	0	0	(826)	0	0	(826)
Coleman	(361)	(1)	0	(325)	0	0	(687)
Concho	0	0	0	(463)	0	0	(463)
Crane	0	0	(191)	0	0	0	(191)
Crockett	0	0	0	0	0	0	0
Ector	(188)	0	0	(15,772)	(461)	0	(16,421)
Glasscock	0	0	0	0	0	0	0
Howard	0	(587)	0	(2,644)	(337)	0	(3,568)
Irion	(618)	0	(130)	0	0	0	(748)
Kimble	(1,258)	(35)	0	(511)	0	0	(1,804)
Loving	0	0	(6,723)	0	0	0	(6,723)
Martin	(4,881)	0	(259)	(504)	0	0	(5,644)
Mason	0	0	0	(237)	0	0	(237)
McCulloch	0	0	0	(21)	0	0	(21)
Menard	(394)	0	0	0	0	0	(394)
Midland	0	0	0	(8,861)	0	0	(8,861)
Mitchell	(1,406)	0	(13)	(302)	(6,725)	0	(8,446)
Pecos	0	0	0	0	0	0	0
Reagan	0	0	0	0	0	0	0
Reeves	0	0	0	(3,535)	0	0	(3,535)
Runnels	0	0	0	(1,077)	0	0	(1,077)
Schleicher	0	0	0	0	0	0	0
Scurry	0	0	0	(718)	0	0	(718)
Sterling	0	0	0	(669)	0	0	(669)
Sutton	0	0	0	0	0	0	0
Tom Green	(8,785)	0	0	(9,177)	0	0	(17,962)
Upton	0	0	0	0	0	0	0
Ward	0	0	(1,706)	0	0	0	(1,706)
Winkler	0	0	0	(284)	0	0	(284)
Total	**(27,192)**	**(902)**	**(9,022)**	**(53,480)**	**(7,523)**	**(108)**	**(98,227)**

Identified Needs for Livestock Users

Livestock needs have been identified for one county within Region F: Andrews County. Needs in Andrews County are due to limited MAG.

Identified Needs for Mining Users

Recent significant growth in demand for mining water, particularly for oil and gas exploration, has created mining shortages throughout Region F, especially in early decades of the planning horizon. There are ten counties showing mining water shortages over the next fifty years: Andrews, Borden, Crockett, Howard, Irion, Loving, Martin, Mitchell, Sterling, and Ward.

Identified Needs for Steam Electric Power Users

Ector, Howard, and Mitchell counties all show a shortage for steam electric power (SEP) water use. The SEP shortages in Ector County are associated with MAG limitations in Andrews and Gaines (Region O) Counties (one of their sources of supply). The SEP shortage in Mitchell County is attributed to there being no firm yield under WAM Run 3 for Champion Lake, as well as the development of new facilities projected to be brought online by FGE Power. The SEP needs in Howard County are associated with needs of the City of Big Spring and will be met through strategies developed for the Colorado River Municipal Water District (CRMWD), who provides water supplies for Big Spring.

Identified Needs for Major Water Providers

Table 4-4 is a summary of the needs for the five Major Water Providers (MWPs) in Region F. All MWPs have a water shortage at some point over the next fifty years, with the exception of BCWID. Needs for CRMWD, San Angelo, and Odessa are partially the result of using the Colorado WAM for water availability. A summary of the supply, demand, and needs comparison for each designated major provider is included in Attachment 4A.

Table 4-4
Comparison of Supplies and Demands for Major Water Providers
-Values in Acre-Feet per Year-

Major Water Provider	Category	2030	2040	2050	2060	2070	2080
BCWID #1	Supply	15,550	15,420	15,290	15,160	15,030	14,900
	Demand	14,291	14,322	14,316	14,330	14,351	14,375
	Surplus (Need)	1,259	1,098	974	830	679	525
CRMWD	Supply	71,260	68,693	66,072	61,744	59,167	56,605
	Demand	68,769	73,045	78,200	80,445	82,692	84,956
	Surplus (Need)	2,491	(4,352)	(12,128)	(18,701)	(23,525)	(28,351)
City of Midland	Supply	48,518	47,040	45,261	43,873	42,908	42,032
	Demand	34,386	36,472	38,865	41,877	45,332	49,306
	Surplus (Need)	14,132	10,568	6,396	1,996	(2,424)	(7,274)
City of Odessa[a]	Supply	39,556	41,465	41,907	40,265	39,592	38,810
	Demand	39,556	49,138	55,832	58,567	61,320	64,094
	Surplus (Need)	0	(7,673)	(13,925)	(18,302)	(21,728)	(25,284)
City of San Angelo[b]	Supply	15,218	17,285	17,153	17,021	16,888	16,756
	Demand	18,958	20,280	21,506	22,713	24,030	25,467
	Surplus (Need)	(3,740)	(2,995)	(4,353)	(5,692)	(7,142)	(8,711)

a. Includes demands for potential future customers
b. Does not include irrigation demands, only treated water demands

4.1.2 Summary of First Tier Water Needs

The total demands in Region F exceed the total current supply by over 49,000 acre-feet beginning in 2030. The regional need grows to over 98,000 acre-feet by 2080. Most of these needs are associated with either mining, municipal, or irrigation demands. Manufacturing, steam electric power, and livestock needs collectively account for only about less than 15 percent of the needs in Region F in 2030 and less than ten percent in 2080. First Tier water needs are largely attributed to assumptions made in the WAM model and limitations by the MAG in certain counties. Other shortages are due to limitations of

infrastructure and/or growth. The First Tier needs report provided by the TWDB is provided in Appendix J and is summarized by WUG in Attachment 4B. Further review of the region's options and strategies to meet shortages is explored in more detail in Chapter 5 and the impacts of these strategies on water quality are discussed in Chapter 6. Second Tier Water Needs Analysis.

The Second Tier water needs analysis compares current supplies with demands after reductions from conservation and direct reuse. Conservation and direct reuse are both considered water management strategies and are discussed further in Chapter 5B. The Second Tier needs report provided by TWDB is provided in Appendix I and is part of the summary provided in Attachment 4B.

4.2 Summary of Second Tier Water Needs

Under the Second Tier water needs analysis, municipal water needs were reduced through conservation, water audit and leak repair savings, and direct reuse supplies. Conservation was considered for all municipal and irrigation water users. Water audits and leak repairs was considered for all municipal users with reported water loss above certain thresholds. Recycling of water was considered for all mining water user groups. More detail on each of these strategies can be found in Chapter 5B and Appendix C. The plan assumes that a significant reduction in water needs could potentially be achieved through conservation. The realization of these water use reductions is contingent upon the implementation of conservation strategies by individual water users and producers. The plan also includes direct reuse supplies for Pecos City (to be confirmed with Pecos City).

4.3 Third Tier Water Needs Analysis

The TCEQ WAM does not give an accurate assessment of water supplies based on the way the basin has historically been operated, so Region F has developed a water management strategy called "subordination." Subordination assumes that downstream senior water rights do not make priority calls on Region F water rights in the upper Colorado River Basin, which provides a more realistic assessment of surface water supplies in the upper Colorado River Basin. A full description of the subordination strategy is included in Chapter 5C and Appendix C.

The Third Tier water needs analysis compares the subordination supplies (total current supplies with the subordinated surface water supplies) and the demands after conservation and reuse. The results of the Third Tier water needs analysis is what was used to determine a water user group or major water provider's need for additional water management strategies.

4.3.1 Summary of Third Tier Water Needs

Implementation of the subordination strategy eliminates many of the needs shown in the First and Second Tier needs analyses. Twenty-two water user groups (WUGs) show no needs after conservation and subordination: Ballinger, Big Spring, Brady, Coahoma, Coleman, Coleman County SUD, Ector County Utility District, Greater Gardendale WSC, Menard, Odessa, Snyder, Coleman County-Other, Runnels County-Other, Tom Green County-Other, manufacturing in Coleman, Ector and Howard counties, irrigation in Coleman, Ector, Menard counties and steam electric power in Howard County. However, there are thirteen municipal WUGs that do not have sufficient supplies even after the subordination strategy: Bronte, Coke County Other, Eden, Goodfellow Air Force Base, Junction, Midland, Miles, Millersview-Doole WSC, North Runnels WSC, Robert Lee, San Angelo, Stanton, and Winters. There are four non-municipal WUGs for whom subordination does not meet their needs: manufacturing in Howard and Kimble counties and steam electric power in Howard and Mitchell counties. WUGs that do not utilize any surface water sources are not impacted by subordination and continue to show needs

throughout the planning period. Figure 4-3 and Table 4-5 compare the First, Second and Third Tier water needs in Region F throughout the planning cycle. The needs are approximately 30 to 50 percent lower after conservation, direct reuse, and subordination (Third Tier needs) than they are under strict WAM analysis (First Tier needs). Attachment 4B shows the summary of each water user group and major water provider's demands, current supplies, conservation supplies, subordination supplies and Third Tier water needs.

Figure 4-3
Comparison of First, Second, and Third Tier Water Needs in Region F

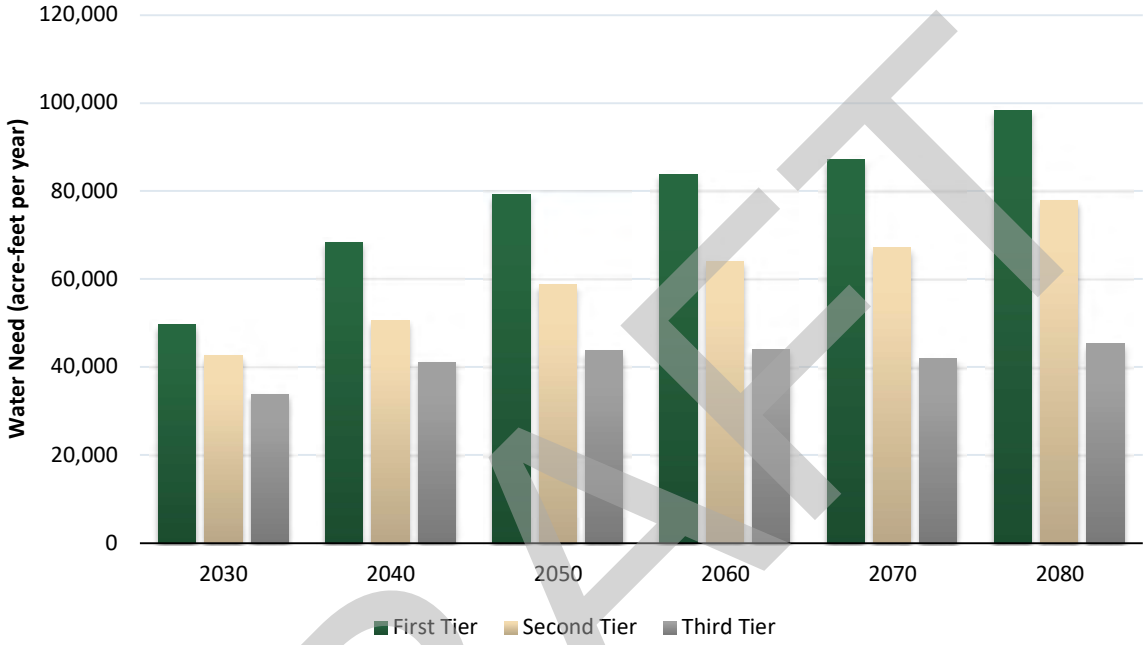


Table 4-5
Comparison of First, Second, and Third Tier Needs in Region F

Tier	2030	2040	2050	2060	2070	2080
First Tier	49,763	68,388	79,182	83,692	87,195	98,227
Second Tier	42,662	50,586	58,735	64,095	67,133	77,994
Third Tier	33,870	41,122	43,714	44,056	41,909	45,299