6 IMPACTS OF THE REGIONAL WATER PLAN

The development of viable strategies to meet the demand for water is the primary focus of regional water planning. A part of this goal is the long-term protection of resources that contribute to water availability, and to the quality of life in the State. The purpose of this chapter is to describe how the 2021 update to the Region F Water Plan is consistent with the long-term protection of the State's water resources, agricultural resources, and natural resources. The requirement to evaluate the consistency of the regional water plan with protection of resources is found in 31 TAC Chapter 357.41, which states:

> "RWPGs shall describe how RWPs are consistent with the long-term protection of the state's water resources, agricultural resources, and natural resources as embodied in the guidance principles in §358.3(4) and (8) of this title (relating to Guidance Principles)."

Chapter 6 addresses this issue by providing general descriptions of how the plan is consistent with protection of water resources, agricultural resources, and natural resources. Additionally, the chapter will specifically address consistency of the 2021 Region F Water Plan with the State's water planning requirements. To demonstrate compliance with the State's requirements, a matrix has been developed and is included in Appendix A.

The regulations that describe the content and process for the development of regional water plans state that the plan include "a description of the major impacts of recommended water management strategies on key parameters of water quality identified by the regional water planning group pursuant to [31 TAC 357.34(d)(8)]."

This chapter presents an assessment of the water quality parameters that could be affected by the implementation of water management strategies (WMS) for Region F. Based on this assessment, the key water quality parameters for each type of WMS are identified. From this determination, the specific water management strategies selected for Region F were evaluated with respect to potential impacts to the key water quality parameters. In addition, this chapter discusses the potential impacts of moving water from rural areas to urban uses.

6.1 Potential Impacts of Water Management Strategies on Key Water Quality Parameters

The key water quality parameters to be evaluated are dependent on the recommended water management strategy. Table 6-1 summarizes the most pertinent water quality parameters for the types of strategies proposed in this plan.

The implementation of specific strategies can potentially impact both the physical and chemical characteristics of water resources in the region. The following is an assessment of the characteristics of each recommended WMS type that may affect water quality and an identification of the specific water quality parameters that could be affected based on those characteristics. Water management strategy types that were not recommended for Region F, and therefore are not evaluated in this section, include drought management and system operations.

Table 6-1
Key Water Quality Parameters by Water Management Strategy Type

Water Quality Parameter	Water Conservation	Reuse	Subordination	Voluntary Transfer	Conjunctive Use	New/ Expanded Supply Development	Desalination (Advanced Treatment)	Aquifer Storage and Recovery (ASR)	Brush Control	Precipitation Enhancement
Total dissolved solids (TDS)	+	+ / -		+ / -	+		-	+	+ / -	
Alkalinity	+				+			+		
Hardness	+				+			+		
Dissolved Oxygen (DO)	+	+ / -		+ / -	+			+	+ / -	
Nitrogen	+	+ / -		+ / -	+		-	+	+ / -	
Phosphorus	+	+ / -		+ / -	+			+	+ / -	
Radionuclides						-				
Metals [a]		+		-[a]		-[a]	-[a]			

a. Only for specific metals where there are significant discharges of the metal.
+ Positive Impact - Negative Impact

6.1.1 Water Conservation

The water conservation measure with the greatest potential for water savings to be implemented in Region F is improvements in the efficiency of water used for irrigated agriculture. These recommended strategies are not expected to affect water quality adversely. The results should be beneficial because the demand on surface and groundwater resources will be decreased. Mining conservation also represents the potential for significant reduction in water usage through recycling of flowback water from oil and gas operations in the region. Reducing mining's dependence on other water sources is expected to have a beneficial impact on the water quality of those sources. It also reduces the amount of waste injected underground or to a stream. Municipal conservation is expected to have similar beneficial impacts but on a smaller scale.

6.1.2 Reuse of Treated Wastewaters

In general, there are three possible water quality effects associated with the reuse of treated wastewaters:

- There can be a reduction in instream flow if treated wastewaters are not returned to the stream, which could affect TDS, nutrients, and DO concentrations of the receiving stream.
- Conversely, in some cases, reducing the volume of treated wastewater discharged to a stream could have a positive effect and improve levels of TDS, nutrients, DO, and possibly metals in the receiving stream.
- Reusing water multiple times and then discharging it can significantly increase the TDS concentration in the effluent and in the immediate vicinity of the discharge in the receiving stream. Total loading to the stream (i.e. the amount of dissolved material in the waste stream) should not change significantly.

These impacts will vary depending on the quality and quantity of treated wastewater that has historically been discharged to the stream and the existing quality and quantity of the receiving stream. For some entities in Region F, wastewater discharge is not discharged to a stream, but is land applied.

In Region F, there are four recommended direct non-potable reuse strategies including:

- Bangs (Direct Non-Potable)
- Menard (Direct Non-Potable)
- Mitchell County Steam-Electric Power (Direct Non-Potable)
- Pecos (Direct Non-Potable)

All of these non-potable strategies involve small volumes of water and are expected to have minimal to no impacts on key water quality parameters.

In addition to these projects, there is one direct potable reuse project recommended for Pecos City. Water from this project could potentially be used multiple times, increasing the TDS concentration in the effluent. The water that is discharged and not reused could impact the receiving stream in the immediate vicinity of the discharge. This would be evaluated as part of a discharge permit. Total loading to the stream however should not change significantly.

There is also one indirect potable reuse project recommended for San Angelo, the Concho River Project. The wastewater discharged into the Concho River will be highly treated to state permit requirements and is expected to have minimal impacts on key water quality parameters. Diversion of this water is not expected to significantly change stream flows (and thus water quality) since the water was previously diverted for agricultural use.

6.1.3 Subordination

The plan recommends the subordination of downstream senior water rights holders to major reservoirs in Region F. This reflects the current operation of the basin, so there are no expected changes in water quality associated with this strategy.

6.1.4 Voluntary Transfers

Voluntary redistribution in Region F involves the sales of water from a source to a water user group or wholesale water provider. None of the recommended strategies in Region F involve placing water from one source into another source. The amount of water proposed to be transferred should not significantly impact source reservoir or stream quantities beyond current commitments. Impacts to key water quality parameters are expected to be minimal.

In Region F, most of the surface water is fully utilized and there would not be significant changes to the quantities of surface water diversions and distribution to users within the region. Voluntary transfers are likely to have a neutral impact for surface water users. Drought will have a much greater impact on key water quality parameters.

Voluntary redistribution of groundwater sources will have minimal impacts on water quality parameters assuming there is no relative change in the amount of groundwater pumped. Impacts on key water quality parameters for large increases in groundwater pumpage to meet contractual sales are discussed in Section 6.2.6. Depending on the quality of the groundwater, municipal wastewater discharges could have a positive or negative impact to the water quality of the receiving stream.

Depending on the location and use of the water under voluntary redistribution, changes in locations of return flows (if applicable) could

impact flows in receiving streams. Such impacts would be site specific and could be positive or negative, depending on the changes.

Generally, these impacts are relative to the quantities of water that are diverted or redistributed. Small quantities are likely to have minimal to no impacts, while large quantities may have measured impacts. In Region F, no large surface water volume transfers are expected.

6.1.5 Conjunctive Use

Conjunctive use allows for surface water sources to be operated in conjunction with groundwater sources such that impacts to key water quality parameters can be minimized while still providing users with sufficient supplies from groundwater. Recommended strategies for CRMWD, San Angelo, and others in Region F involve conjunctive use of surface water and groundwater supplies. These users systems already employ conjunctive use and continued and expanded use of this strategy is expected to have minimal to no impacts.

6.1.6 New and/or Expanded Supply Development

Increased use of groundwater can decrease instream flows if the base flow is supported by spring flow. This is not expected to be a concern for the recommended water management strategies in Region F. Most new groundwater development is in areas that have no flowing surface water, such as Winkler County, or from relatively deep portions of aquifers that most likely do not have significant impact on surface flows, such as McCulloch County.

Increased use of groundwater has the potential to increase TDS concentrations in area streams if the groundwater sources have higher concentrations of TDS or hardness than local surface water and are discharged as treated effluent. This is not the case in most areas in Region F. Naturally occurring salt seeps and high TDS waters are common in Region F. The development of new supplies from brackish groundwater is discussed under desalination.

New development of groundwater from the Hickory aquifer could potentially introduce radionuclides to surface water if wastewaters are discharged to local streams. San Angelo has already developed treatment systems to remove radionuclides from the Hickory aquifer supplies so large-scale introduction to surface water is not expected. The net concentrations in the receiving streams are expected to be low and should not impact water use from the stream.

6.1.7 Desalination (Advanced Treatment)

Desalination of brackish groundwater is a not recommended strategy for any entities in the 2021 Region F Plan. However, with new technologies available, desalination has become a potentially viable option for the treatment of brackish and high nitrate source waters and may be considered as a recommended strategy in future plans. In terms of impacts on water quality, these systems produce a waste stream that may adversely impact waters if discharged to surface waters. Key water quality parameters that may be affected include TDS, nutrients, and metals.

6.1.8 Aquifer Storage and Recovery

Aquifer Storage and Recovery (ASR) is a strategy that treats surface water or brackish groundwater to drinking water standards and then pumps this water into an aquifer for storage. The water is later recovered from the aquifer for use. This allows for optimal sizing of treatment systems and reduces evaporative losses associated with reservoir storage, preserving water resources for future use. ASR, if used as part of a conjunctive use strategy, may allow a reservoir operator to minimize impacts to key water quality parameters while

still providing users with sufficient supplies from stored groundwater. ASR is expected to have minimal impacts on key water quality parameters of water in the aquifer because the treated water being pumped into the aquifer will be of equal or great quality than the supply already in the aquifer. There are no aquifer storage and recovery strategies recommended in the 2021 Region F Plan.

6.1.9 Brush Control

Brush control is a recommended strategy in Region F. Impacts to the water quality of area streams will depend upon the methods employed to control the brush. It is assumed that chemical spraying will not be used near water sources. Mechanical removal, prescribed burns and use of the salt cedar beetle are the preferred methods near water sources. With these assumptions, chemical contamination of water sources is very low. Increases in stream flow due to reduced evapotranspiration associated with the removed brush should improve water quality in watersheds where brush control is employed.

6.1.10 Precipitation Enhancement

Precipitation enhancement is a recommended strategy for irrigators in counties with an active weather modification program, such as the West Texas Weather Modification Association (WTWMA) or the Trans Pecos Weather Modification Program (TPWMA). These operations are already in progress, so there are no expected changes in water quality associated with this strategy.

6.2 Impacts of Moving Water from Rural and Agricultural Areas

The recommended water management strategies that involve taking water from primarily rural areas or water currently used for agricultural purposes for use in primarily urban areas include:

- CRMWD Ward County Well Field Expansion, Winkler County Well Field Development
- City of San Angelo McCulloch County Well Field Phase 2
- San Angelo Indirect Reuse
- Paul Davis Wellfield with Advanced Treatment

Of these three strategies, all entities already hold the rights to that water. Although all of the proposed well fields are located in rural areas, these strategies are not expected to have significant impact on those areas. The CRMWD well field is located in areas where very little groundwater is used for other purposes. The San Angelo well field may impact wells in rural communities that also depend on the Hickory aquifer. However, pumping and well spacing limits set by the Hickory Underground Water Conservation District should minimize the potential impacts.

San Angelo's treated wastewater effluent is currently used to supply the local irrigation district as a substitute for Twin Buttes water. Implementation of this reuse strategy will make this water unavailable to the irrigation district at certain times and may impact these users. When the City does not need the supply, it will still be available for irrigators, reducing the potential impacts somewhat. During drought times, irrigators may need to plant less water intensive crops, convert to dry land farming, find alternative sources of supply, or reduce the number of irrigated acres.

Smaller municipalities are also planning to develop additional groundwater. These entities are considered rural and therefore do not constitute any movement of water from rural and agricultural areas.

6.3 Socio-Economic Impacts of Not Meeting Water Needs

Region F will face substantial shortages in water supply over the planning period. The TWDB provided technical assistance to regional planning groups in the development of specific information on the socio-economic impacts of failing to meet projected water needs.

The TWDB's analysis calculated the impacts of a severe drought occurring in a single year at each decadal period in Region F. It was assumed that all of the projected shortage was attributed to drought. Under these assumptions, the TWDB's findings can be summarized as follows:

- With the projected shortages, the region's projected 2020 population would be reduced by 18,030, which is approximately 2.6%.
- Without any additional supplies, the projected water needs would reduce the region's projected 2020 employment by approximately 98,000 jobs (23 percent reduction). This declines to around 39,000 lost jobs by 2070. The mining sector accounts for 96 percent of these jobs losses in 2020 and 56 percent in 2070. Municipal and manufacturing sectors are the next biggest contributors, particularly in later decades.
- Without any additional supplies, the projected water needs would reduce the region's projected annual income by $19.6 billion, approximately 95 percent of which is within the mining industry. This represents nearly 40 percent of the region's current income. The loss in income reduces to approximately $6.4 billion in 2070, after the mining boom is projected to decline.

The full analysis performed by the TWDB is included in Appendix G.

6.4 Other Potential Impacts

The U.S. Army Corps of Engineers has published a list of the navigable portions of the rivers in Texas.[1] The Colorado River is considered navigable from the Bastrop-Fayette County line to Longhorn Dam in Travis County. The Rio Grande is considered navigable from the Zapata-Webb County line to the point of intersection of the Texas-New Mexico state line and Mexico. All of these areas are outside of the boundaries of Region F. Therefore, the Region F Plan does not have an impact on navigation.

The Region F Plan protects existing water contracts and option agreements by reserving the contracted amount included in those agreements where the amounts were known. In some cases, there were insufficient supplies to meet existing contracts. In those cases, water was reduced proportionately for each contract holder.

A special water resource is a major water supply source that is committed to provide water outside the region. TWDB has designated two special water resources in Region F: 1) Oak Creek Reservoir, which supplies water to Sweetwater in Brazos G, and 2) Ivie Reservoir, which supplies water to Abilene in Brazos G.

6.5 Consistency with the Protection of Water Resources

The water resources in Region F include three river basins providing surface water, and 14 aquifers providing groundwater. Most of Region F is located in the upper portion of the Colorado River Basin and in the Pecos portion of the Rio Grande River Basin. A small portion of the region is located in the Brazos River Basin. Figure 6-1 shows the major streams in Region F, including the Colorado River, Concho River, Pecan Bayou, San Saba River, Llano River, and Pecos River.

Figure 6-1
Major Surface Water Features in Region F

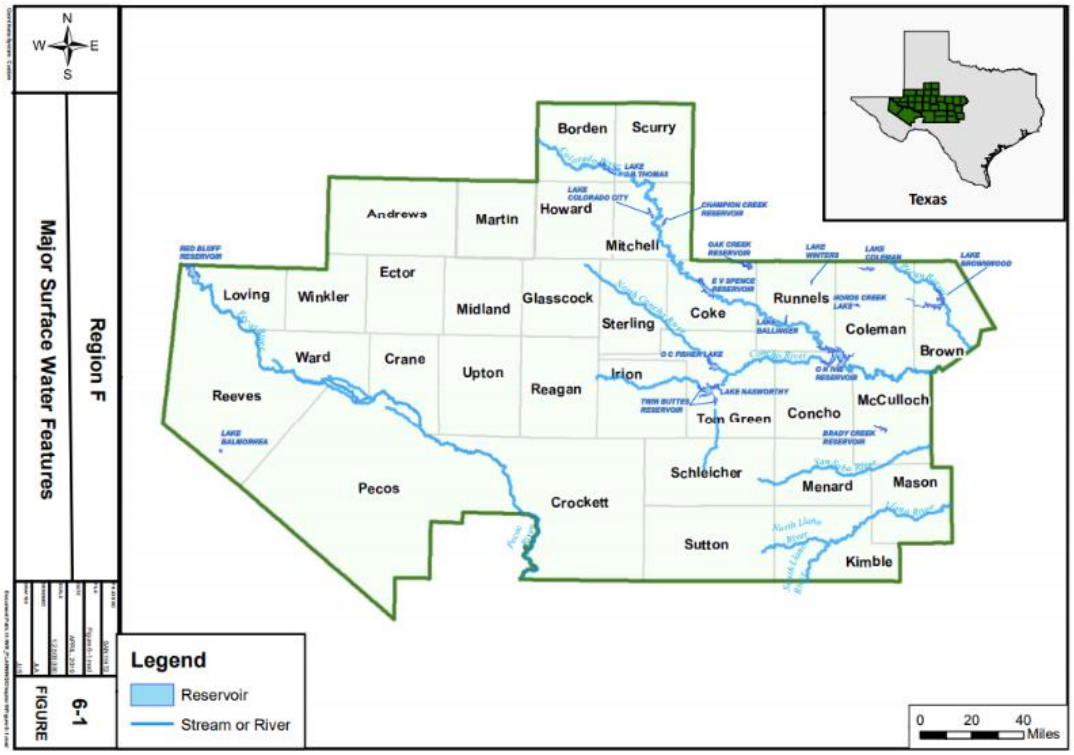


Figure 6-2
Springs in Region F

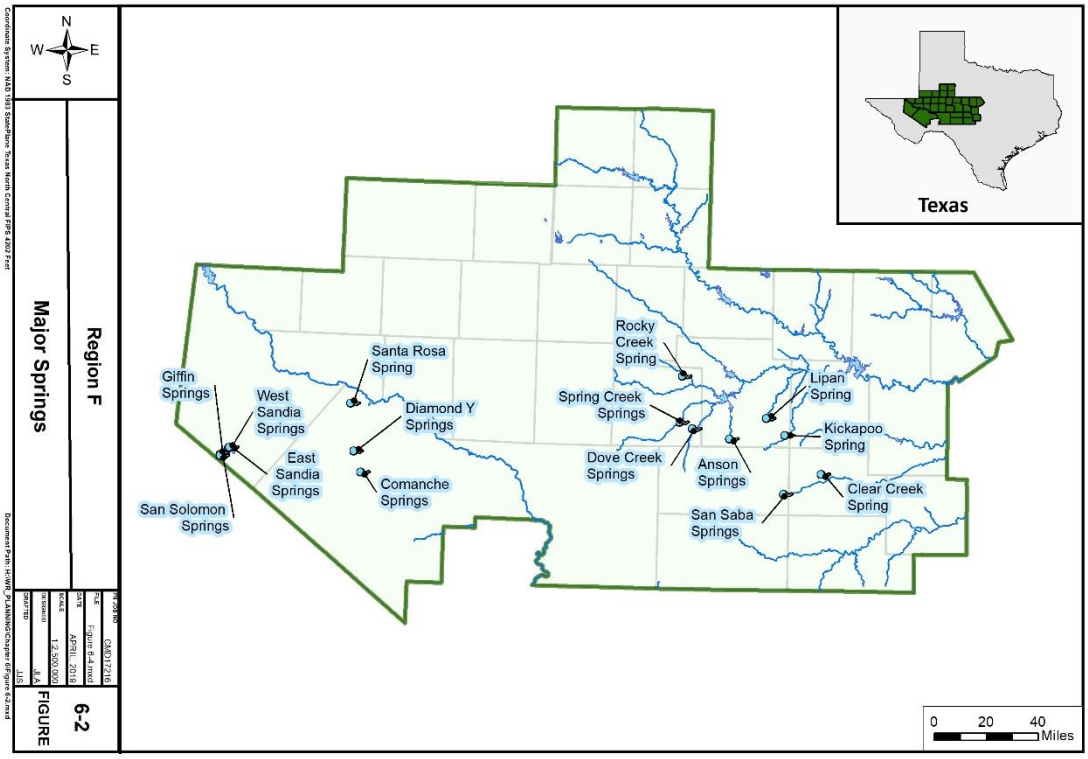


Figure 6-3
Major Aquifers in Region F

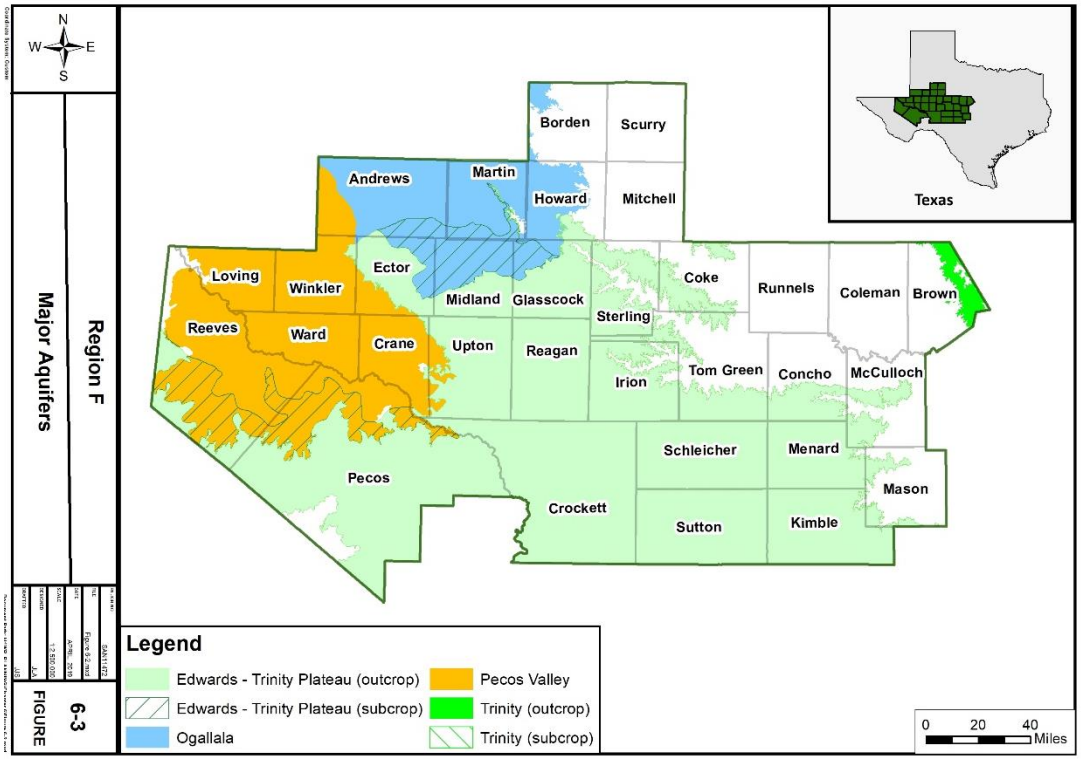
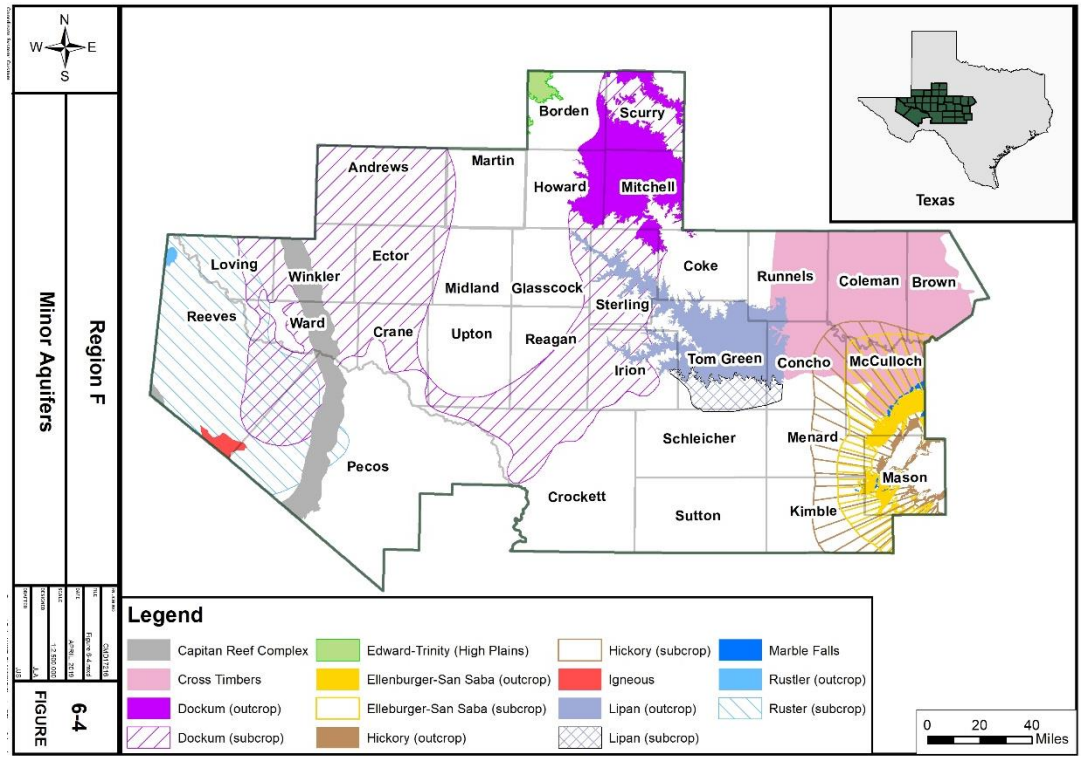


Figure 6-4
Minor Aquifers in Region F



The source of most of the region's surface water supply is the upper Colorado River Basin and the Pecos portion of the Rio Grande Basin, which supply municipal, industrial, mining and irrigation needs in the region. Major reservoirs in Region F include Red Bluff Reservoir, Lake J.B. Thomas, E.V. Spence Reservoir, O.C. Fisher Lake, Twin Buttes Reservoir, O.H. Ivie Reservoir, and Lake Brownwood.

Springs are an important water resource in Region F. They supplement surface water sources and provide water for aquatic and riparian habitat. Region F identified 16 major springs, which are shown on Figure 6-2. Lake Balmorhea, Twin Buttes Reservoir, Concho River and San Saba River are just some of the important water supply sources in Region F that rely on spring-fed streamflow.

Figure 6-3 shows the major aquifers in Region F, and Figure 6-4 shows the minor aquifers. There are a total of 14 aquifers that supply water to the 32 counties in Region F. Major aquifers include the Edwards-Trinity Plateau, Ogallala, Pecos Valley, and a small portion of the Trinity. Minor aquifers include the Dockum, Hickory, Lipan, Ellenburger-San Saba, Marble Falls, Rustler, Cross Timbers, Igneous and the Capitan Reef Complex. The Edwards-Trinity High Plains is used only on a limited basis. More detailed information on water resources in Region F is presented in Chapters 1 and 3.

The Edwards-Trinity Plateau, Pecos Valley, and Ogallala aquifers are the largest sources of groundwater in Region F, providing 36, 20, and 13 percent of the total groundwater pumped in 2016, respectively. The Lipan and Dockum aquifers each provided 5 percent of the 2016 totals. All remaining aquifers within the region contributed 21 percent combined.

The protections of water resources were considered through the supply allocation process and the development of water management strategies. For surface water, the distribution of supplies does not exceed the safe yield of the reservoir under subordination. This provides some water in the lakes through the drought of record and provides some protections from future droughts. For groundwater, the desired future conditions, as adopted by the GMAs, were honored for both currently developed supplies and potential future strategies. By not exceeding the modeled available groundwater, long-term effects on groundwater and surface water interrelationships were minimized since these complex relationships are considered by the respective GMA when selecting the DFCs.

To be consistent with the long-term protection of water resources, the plan must recommend strategies that minimize threats to the region's sources of water over the planning period. The water management strategies identified in Chapter 5 were evaluated for threats to water resources. The recommended strategies represent a comprehensive plan for meeting the needs of the region while effectively minimizing threats to water resources. Descriptions of the major strategy types and the ways in which they minimize threats to water resources are outlined in the following sections.

6.5.1 Water Conservation

Strategies for water conservation have been recommended that will reduce the demand for water, thereby reducing the impact on the region's groundwater and surface water sources. Water conservation practices are expected to save over 31,000 acre-feet of water annually by 2020, reducing demands on both groundwater and surface water resources. By 2070, the recommended conservation strategies savings (excluding wastewater reuse) total nearly 66,000 acre-feet per year. These savings are in addition to the water savings assumed in the demands.

6.5.2 Wastewater Reuse

Strategies involving wastewater reuse will provide high quality treated wastewater effluent for municipal and mining water needs in the region. These strategies will decrease the future demands on surface and groundwater sources and will not have a major impact on water resources. However, at times, San Angelo's reuse project may impact agricultural users that currently rely on the treated effluent for irrigation. In this case, these users may actually increase their demand on other local surface and groundwater sources.

6.5.3 Subordination of Downstream Water Rights

The Colorado WAM makes many assumptions that are contrary to the way the Colorado Basin has historically operated, showing that most surface water sources in the region have no supply. In conjunction with the Lower Colorado Region (Region K), a subordination strategy was developed that protects the supply of Region F water rights and the water resources in Region F. This strategy is described in Subchapter 5C.

6.5.4 Voluntary Transfers

Under this strategy, surface and ground water rights holders with surplus water supplies will provide water to areas with current or projected needs. This strategy is for proposed customers of wholesale water providers and expanded sales to entities with a projected future need. As proposed, this strategy will only use water that is available on a sustainable basis and will not significantly impact water resources.

6.5.5 Conjunctive Use

Conjunctive use supports the management of surface water and groundwater sources to provide water necessary for beneficial use while protecting the individual water resource during periods of drought.

6.5.6 New or Expanded Use of Groundwater

This strategy is recommended for entities with limited alternative sources and sufficient groundwater supplies to meet needs. Recommended strategies for groundwater supplies do not exceed the MAG values that were determined to meet the desired future conditions of the groundwater source. Large transfers of groundwater may have potential impacts to local surface water and springs. Such impacts were considered during the evaluation of the strategies. Where possible, strategies were selected that minimized impacts to surface water.

While the Region F water plan does not recommend strategies that exceed the MAG, several water providers are planning to develop strategies that would ultimately exceed the MAGs. These strategies are currently permitted or located in counties without GCDs. Based on technical review of the potential impacts of these strategies, water resources would not be significantly impacted. The need for water and the protections for public health and safety is paramount in this plan.

6.5.7 Desalination

No entities in Region F have desalination as a recommended strategy. However, there are significant sources of brackish groundwater in Region F that desalination could make accessible as treatment technologies improve and costs decline. In the future, desalination may represent an important additional source of water that could be used to augment existing freshwater sources

6.5.8 Aquifer Storage and Recovery (ASR)

No entities in Region F are pursuing Aquifer Storage and Recovery (ASR) as a recommended strategy; however, it is considered as an alternative strategy for Pecos City. ASR represents is a one potential solution to limit

high evaporative losses from reservoirs during drought. However, it is highly dependent upon locating an area with suitable geology. ASR may also make brackish groundwater desalination more viable by reducing the need for peak time treatment capacity. ASR strategy is not expected to threaten water resources of the State, but rather to preserve surface water resources for future use and allow increased use of brackish groundwater in a more economical manner.

6.5.9 Brush Control

This strategy will support the surface water supplies in the region by reducing losses associated with evapotranspiration of invasive brush species.

6.5.10 Precipitation Enhancement

This strategy will support the water supplies in the region by increasing streamflows and reducing irrigation demands due to increased rainfall.

6.6 Consistency with Protection of Agricultural Resources

Agriculture is an important economic and cultural cornerstone in Region F. Given the relatively low rainfall rates, irrigation is a critical component for agriculture in the region. The RWPG is recommending improved irrigation efficiency as a strategy to maximize the efficient use of available water supplies and protect current and future agricultural resources in the region. These efficiency increases will reduce the projected deficit in heavily irrigated counties and preserve water supplies for future use in counties with no identified shortage. In some cases, development of additional supplies for irrigated agriculture is not economically feasible. In these cases, the irrigation need is shown as unmet in this plan. However, it is likely that the demands will decrease in response to this economic reality during dry years. Irrigated agriculture is likely to rebound during wet years when supplies are more abundant and economical. A summary of all unmet irrigation needs is shown in the table below.

Table 6-2
Unmet Irrigation Needs in Region F

Water User Group	2020	2030	2040	2050	2060	2070
Andrews	(681)	(3,652)	(5,261)	(6,353)	(7,276)	(8,098)
Brown	(1,302)	(1,062)	(1,061)	(1,063)	(1,060)	(1,061)
Irion	(252)	(200)	(147)	(147)	(147)	(147)
Kimble	(970)	(837)	(784)	(784)	(784)	(784)
Mitchell	(1,328)	(1,602)	(1,507)	(1,389)	(1,310)	(1,226)
Scurry	(6,153)	(5,799)	(5,582)	(5,579)	(5,577)	(5,580)
Total	**(10,686)**	**(13,152)**	**(14,342)**	**(15,315)**	**(16,154)**	**(16,896)**

In addition to irrigated agriculture, dry land agriculture and the ranching industry are important economically and culturally to the region. All livestock demands in the region are met through local surface water (stock ponds) or groundwater supplies, with the exception of livestock Andrews County, which is shown to have an unmet need of 10 to 60 acre-feet per year due to MAG limitations. However, local ranchers will develop additional local surface or groundwater supplies as needed to meet any water demands, and it is anticipated that this will not impact the livestock industry in this area.

All agricultural enterprises depend on the survival of small rural communities and their assurance of a reliable, affordable water supply. These communities increase the local area's tax base and provide government services, health

services, fire protection, education facilities, and businesses where agriculture obtains fuels, crop processing and storage, banking, and general products and supplies. If small rural communities do not have an affordable water supply to sustain themselves and provide for economic stability, agriculture will suffer an increase in the cost of doing business and the loss of services that contribute to its overall well-being and safety. The Governor's Office, the Texas Department of Agriculture, and U.S. Department of Agriculture are working to enhance the validity and sustainability of Texas agriculture and small rural communities.

6.7 Consistency with Protection of Natural Resources

Region F contains many natural resources that must be considered in water planning. Natural resources include threatened or endangered species; local, state, and federal parks and public land; and energy/mineral reserves. The Region F Water Plan is consistent with the long-term protection of these resources. Following is a brief discussion of consistency of the plan with protection of natural resources.

6.7.1 Threatened/Endangered Species

A list of threatened or endangered species potentially present within Region F is contained in Table 1-12, in Chapter 1. Included are sixteen species of birds, two crustaceans, twelve fishes, one mammal, nine reptiles, eleven mollusks, and four flowering plants that are considered threatened or endangered on a state or federal level in Texas. None of the recommended water management strategies in this plan inherently impact the listed species. However, some strategies may require site-specific studies to verify that threatened or endangered species will not be impacted.

6.7.2 Parks and Public Lands

Seven state parks (Lake Brownwood, Big Spring, Lake Colorado City, Monahans Sandhills, San Angelo, Balmorhea and South Llano River) and one state wildlife management area (Mason Mountain) are located in Region F. The state parks and wildlife management area are not expected to be impacted by the recommended strategies. The subordination strategy simply continues the current operations in the basin and will not change lake or stream operations. There are no new recommended surface water strategies to impact streamflows.

In addition to the state parks, there are several city parks, recreational facilities, and public lands located throughout the region. None of the recommended water management strategies evaluated for the Region F Water Plan are expected to adversely impact these facilities or public land. The development of adequate water supplies would be beneficial for these facilities.

6.7.3 Energy Reserves

Thousands of producing oil and gas wells are located within Region F, representing an important economic base for the region. The RWPG is recommending recycling of flowback water from oil and gas operations (otherwise referred to in the plan as "mining conservation") as a strategy for all mining entities in the region, as it has the potential to significantly reduce water usage. Mining conservation, as well as all other recommended water management strategies for mining are expected to positively impact oil or gas production in the region. Some counties in Region F still show an unmet mining need, especially in counties with limited availability under the MAG, since water used for the protection of public health and safety is considered paramount in this plan. Advances in technology to reuse fracking water may help to close this gap. Furthermore, water used for the oil and gas industry is exempt from

GCD regulation, and in actuality, operators may exceed the MAG availability. The mining industry is not expected to be adversely impacted by this plan. Table 6-3 summarizes the unmet mining needs.

Table 6-3
Unmet Mining Needs in Region F

Water User Group	2020	2030	2040	2050	2060	2070
Andrews	(909)	(868)	(66)	0	0	0
Irion	(1,444)	(1,440)	(225)	0	0	0
Loving	(3,381)	(3,381)	(2,543)	(1,427)	(699)	(762)
Scurry	(222)	(363)	(385)	(290)	(196)	(132)
Total	**(5,956)**	**(6,052)**	**(3,219)**	**(1,717)**	**(895)**	**(894)**

6.7.4 Power Generation

Four counties in Region F are projected to have a steam electric power water demand over the next fifty years, including Ector, Howard, Mitchell, and Ward Counties. Steam electric power users in Mitchell and Ward Counties are identified to have an unmet need. Table 6-4 summarizes the unmet steam electric power needs in the 2021 Region F Plan.

Table 6-4
Unmet Steam Electric Power Needs in Region F

Water User Group	2020	2030	2040	2050	2060	2070
Mitchell	(8,656)	(8,670)	(8,684)	(8,698)	(8,712)	(8,726)
Ward	(2,352)	(2,352)	(2,352)	(2,352)	(2,352)	(2,352)
Total	**(11,008)**	**(11,022)**	**(11,036)**	**(11,050)**	**(11,064)**	**(11,078)**

Unmet steam electric power needs in Mitchell County are associated with two proposed FGE Texas Power facilities. These facilities do not currently exist, and development is dependent upon market conditions and other economic factors. If these power plants are developed in Mitchell County, steam electric power is projected have a large shortage, even after considering recommended strategies, such as reuse sales from Colorado City and subordination. Options to meet this shortage are restricted due to limited groundwater availability in Mitchell County. However, some of the water needs associated with these facilities may not come to fruition if FGE does not move forward with construction.

Ward County steam electric power demands are associated with the Luminant Permian Basin Power Plant, which uses groundwater from the Pecos Valley Aquifer. The demands shown in this plan (~2,500 acre-feet per year) are based on water usage from 2010, when the power plant utilized steam technology. However, over the past decade, the steam units at this plant have been retired and switched to combustion-based generation, which significantly reduced water needs. Since this replacement, the highest annual water usage from this plant was 123 acre-feet in 2012, and water demands are not expected to increase. Therefore, the unmet needs shown for steam electric power in Ward County are artificial and can be met with current groundwater supplies.

6.8 Consistency with Protection of Public Health and Safety

Consistent with the guiding principles for regional water planning, the Region F Water Plan protects the public health and safety of current and future residents in the region.

The City of Andrews, Andrews-County Other, and Colorado City have limited supplies to serve future municipal water needs without exceeding the MAG. This plan is unable to show the full supply amount expected from future groundwater development strategies for these entities because of this limitation. As a result, the City of Andrews, Andrews County-Other, and Colorado City show an unmet municipal need in this plan. However, these users are planning to pursue the development of additional groundwater above the MAG to in order protect the public health and safety of their residents. Andrews and Andrews County-Other are able to do this because there is no GCD limit on groundwater production within Andrews County. However, Colorado City will have to coordinate with the GCD in Mitchell County (Lone Wolf GCD) to determine potential groundwater development above the MAG.

Conservation was considered and recommended as a strategy to help reduce the unmet needs and protect the human health and safety of the residents of Andrews, Andrews County-Other, and Colorado City. Drought management was also considered for both entities but was not considered feasible for meeting long-term growth in demands. Instead it is intended and encouraged to be used as means to reduce water usage during drought emergencies through the implementation of the entity's Drought Contingency Plan. Table 6-4 below summarizes all municipal unmet needs in Region F.

Table 6-5
Municipal Unmet Needs

Water User Group	2020	2030	2040	2050	2060	2070
Andrews	(147)	(361)	(619)	(1,186)	(1,850)	(2,650)
County-Other, Andrews	(16)	(43)	(74)	(134)	(192)	(254)
Colorado City	0	(115)	(126)	(137)	(150)	(164)
Total	**(163)**	**(586)**	**(895)**	**(1,573)**	**(2,343)**	**(3,250)**

6.9 Consistency with Economic Development

Consistent with the guiding principles for regional water planning, the Region F Water Plan provides for the further economic development of the region through water supply development for manufacturing and industrial use as well as increasing municipal demands associated with economic growth. The only unmet manufacturing need in Region F is in Andrews County. Similar to other entities in Andrews County, limited groundwater supplies under the MAG inhibit showing groundwater development as a recommended strategy, thus causing this unmet need. However, manufacturing users in Andrews County can pursue groundwater development of additional supplies above the MAG to meet all future water needs since production is not limited by a GCD. Table 6-5 shows the manufacturing unmet need in Region F.

Table 6-6
Manufacturing Unmet Needs

Water User Group	2020	2030	2040	2050	2060	2070
Andrews	(31)	(59)	(87)	(134)	(174)	(209)
Total	**(31)**	**(59)**	**(87)**	**(134)**	**(174)**	**(209)**

6.10 Consistency with State Water Planning Guidelines

To be considered consistent with long-term protection of the State's water, agricultural, and natural resources, the Region F Water Plan must be determined to be in compliance with the following regulations:

- 31 TAC Chapter 357.35
- 31 TAC Chapter 357.40
- 31 TAC Chapter 357.41
- 31 TAC Chapter 358.3

The information, data, evaluation, and recommendations included in the 2021 Region F Water Plan collectively comply with these regulations. To assist with demonstrating compliance, Region F has developed a matrix addressing the specific recommendations contained in the above referenced regulations.

The matrix is a checklist highlighting each pertinent paragraph of the regulations. The content of the Region F Water Plan has been evaluated against this matrix. Appendix A contains a completed matrix.

6.11 Summary of the Protections of the State's Resources

The RWPG balanced meeting water shortages with good stewardship of water, agricultural, and natural resources within the region. During the strategy selection process, long-term protection of the State's resources were considered through assessment of environmental impacts, impacts to agricultural and rural areas and impacts to natural resources. These evaluations are documented in Appendices C and E.

In this plan, existing in-basin or region surface water and groundwater supplies were utilized as feasible before recommendations for new water supply projects. Wastewater reuse is also an active water source to meet long-term needs in Region F. The plan assumes that this resource will be fully utilized to meet the growing demands in the region. The proposed conservation measures for municipalities, irrigators, and mining operators will continue to protect and conserve the State's resources for future water use.

LIST OF REFERENCES

[1] U.S. Army Corps of Engineers. *Fort Worth District: Navigable Waters of the United States in the Fort Worth, Albuquerque, and Tulsa Districts within the State of Texas*, December 20, 2011.