5B WATER CONSERVATION

Water conservation is a potentially feasible water savings strategy that can be used to preserve the supplies of existing water resources. For municipalities and manufacturers, advanced drought planning and conservation can be used to protect their water supplies and increase reliability during drought conditions. Some of the demand projections developed for SB1 Planning incorporate an expected level of conservation to be implemented over the planning period. For municipal use, the assumed reductions in per capita water use are the result of the implementation of the State Water-Efficiency Plumbing Act[1]. Among other things, the Plumbing Act specifies that only water-efficient fixtures can be sold in the State of Texas. Savings occur because all new construction must use water-efficient fixtures, and other fixtures will be replaced at a fairly steady rate. On a regional basis, the Plumbing Act results in about a ten percent reduction in municipal water use (20,323 acre-feet per year) by year 2070.

Water Conservation in Region F

- Water Conservation is an important part of the Region F Water Supply Portfolio
- Water Conservation is a Recommended Water Management Strategy for
  - Municipal Users
  - Irrigation Users
  - Mining Users
- Conservation is estimated to meet 11% of the water shortages in Region F in 2020 and 14% in 2070.
- More information can be found in Appendix B

Water conservation strategies must be considered for all water users with a need. In Region F, this includes municipal, manufacturing, agricultural, mining, and steam electric power water users. Conservation strategies to reduce industrial (manufacturing, mining, and steam electric power) water use are typically industry and process-specific and cannot be specified to meet county-wide needs. The region recommends that industrial water users be encouraged to develop and implement site-specific water conservation practices. Wastewater reuse is a more general strategy that can be utilized by various industries for process water, and this strategy will be considered where appropriate.

Based on factors developed by the TWDB, irrigation demands are estimated to remain constant over the planning period (2020 to 2070). Reductions in demands due to conservation were not quantified by the TWDB for manufacturing and livestock needs.

Steam electric demands in Region F are estimated to remain constant over the planning period. As an alternative to using water, Region F, in consultation with representatives of the power generators in the area, developed an analysis of alternative cooling technologies that use little or no water. Because these technologies reduce the amount of water needed for power generation, using these technologies can be considered a water conservation strategy and are discussed in this subchapter. Due to the cost of the conversion to this type of technology, this strategy is not considered economically feasible at this time but would be supported by the Region if a power generator chose to pursue the strategy.

Agricultural water shortages include shortages for livestock and irrigation. Most of the livestock demand in Region F is for free-range livestock. Region F encourages individual ranchers to adopt practices that prevent the waste of water for livestock. However, the savings from these practices will be small and

difficult to quantify. Therefore, livestock water conservation is not considered in this plan.

For municipal and irrigation users, additional conservation savings can potentially be achieved in the region through the implementation of conservation best management practices (BMPs), as discussed in Section 5B.1.1. These additional conservation measures were considered for all municipal and irrigation water user groups in Region F.

Although water conservation and drought management have proven to be effective strategies in Region F, the RWPG believes that water conservation should not be relied upon exclusively for meeting future needs. The region will need to develop additional surface water, groundwater, and alternative supplies to meet future needs. However, each entity that is considering development of a new water supply should monitor ongoing conservation activities to determine if conservation can delay or eliminate the need for a new water supply project.

The RWPG recognizes that it has no authority to implement, enforce or regulate water conservation and drought management practices. The water conservation practices described in this chapter and elsewhere in this plan are intended only as guidelines. Water conservation strategies determined and implemented by municipalities, water providers, industries or other water users supersede the recommendations in this plan and are considered to be consistent with this plan.

5B.1 Municipal Conservation

Each public water supplier is required to update and submit a Water Conservation Plan (WCP) to the Texas Commission on Environmental Quality (TCEQ) every five years. Per Title 30, Part 1, Chapter 288, Subchapter A, Rule 288.2 of the Texas Administrative Code, some specific conservation strategies are required to be included as part of a water conservation plan. At a minimum each plan must include:

- Utility Profile that describes the entity, water use data, and water supply and wastewater system
- Record management system that is capable of recording water use by different types of users
- Quantified five-year and ten-year water savings goals
- Metering device with a 5 percent accuracy to measure the amount of water diverted from the source of supply
- A program for universal metering
- Measures to determine and control water loss
- A program of continuing public education and information regarding water conservation
- A non-promotional water rate structure
- A reservoir systems operation plan, if applicable
- Means of implementation and enforcement, as evidenced by: a document indicating the adoption of the WCP, and a description of the authority where the water supplier will implement and enforce the WCP
- Documentation of coordination with the regional water planning group

If a public water supplier serves over 5,000 people, they are additionally required to the have a conservation-oriented rate structure and a program of leak detection, repair, and water loss accounting for the water transmission, delivery, and distribution system.

Both the water conservation plans and water loss audit reports for water suppliers in Region F were reviewed to help identify appropriate municipal water conservation measures. The data from the water loss audit reports for Region F water providers are discussed in more detail in Chapter 1 of this plan.

Twenty-four water providers in Region F submitted water loss audits in 2017. Based on these reports, the percentage of real water loss for Region F is approximately 15 percent, which is slightly greater than the accepted range of water loss (less than or equal to 12 percent). This is likely due to the large service areas with low population densities characteristic of rural water supply corporations. For the water suppliers that fall under the water supply corporation category, there may be few cost effective options in reducing water loss.

5B.1.1 Identification of Potentially Feasible Conservation BMPs

To assess the appropriateness of additional conservation BMPs for Region F, 70 potential strategies were identified, and a screening level evaluation was conducted. Due to the differences in the water needs and available resources between the larger municipalities and smaller rural areas, the screening evaluation was performed both for entities with populations less than 20,000 people and entities with populations greater than 20,000.

The evaluation considered six criteria:

- Cost
- Potential Water Savings
- Time to Implement
- Public Acceptance
- Technical Feasibility
- Staff Resources

Each criterion was scored from 1 to 5, with 5 being the most favorable. Scores for all the criteria were then added to create a composite score. The strategies were then ranked and selected based on their composite score.

Selected Strategies for Entities under 20,000

Based on the screening level evaluation and requirements from the TCEQ, the following strategies were selected for consideration for entities in Region F with less than 20,000 people during every decade of the planning period:

- Education and Outreach
- Water Audits and Leak Repair
- Conservation – Oriented Rate Structure
- Water Waste Ordinance

Selected Strategies for Entities over 20,000

Based on the screening level evaluation and requirements from the TCEQ, the following strategies were selected for consideration for entities in Region F with more than 20,000 people during any decade of the planning period:

- Education and Outreach
- Water Audits and Leak Repair
- Conservation – Oriented Rate Structure
- Water Waste Ordinance
- Landscape Ordinance
- Time of Day Watering Limit

Each of the selected strategies above, was considered and evaluated for the appropriate water user groups (greater than or less than 20,000). Details of the strategy evaluation are included in Appendix C.

Municipal Water Conservation

Water conservation is a way life for many in drought prone Region F. Many municipalities have already benefited from the effects of municipal conservation and have a lower per capita water demand in the 2021 Region F Water Plan than previous Region F Water plans.

5B.1.2 Recommended Municipal Conservation Strategies

Published reports and previous studies were used to refine the description for the selected BMPs, including the potential water savings and costs. Water savings for some BMPs are difficult to estimate since there is little data for an extended time period. Also, most entities tend to implement a suite of strategies at the same time, which makes it difficult to estimate the individual water savings. These factors were considered in developing the assumptions defined below for each BMP. As more data becomes available through more rigorous water use tracking, the ability to estimate water conservation savings will improve.

Education and Outreach

Local officials would offer water conservation education to schools, civic associations, include information in water bills, provide pamphlets and other materials as appropriate. It was assumed that the education outreach programs would be needed throughout the planning period to maintain the water savings. It was assumed that education and outreach would save 5,000 gallons per household per year with a 30 percent adoption rate, i.e., assume that 30 percent of the customers respond to this measure by reducing water use. Per person costs were based on data obtained from municipalities and water providers. The costs for entities with populations less than 20,000 are greater on a per person basis than for the larger cities. In this case, education and outreach were assumed to cost $2.75 per person per year with a maximum cost of $15,000 for entities with populations less than 20,000. In contrast, education and outreach were assumed to cost $1.80 per person per year for entities with populations greater than 20,000.

Water Audits and Leak Repairs

Local officials would perform a water audit system wide and create a program of leak detection and repair, including infrastructure replacement as necessary. As part of the this type of program, some entities may choose to install Advanced Metering Infrastructure. It was assumed that 20 percent of an entity's losses could be recovered through a water audit and leak repair program, and that the leak detection and repair program would be an ongoing activity to maintain the level of water loss reductions. This strategy was considered for all cities with greater than or equal to 15 percent losses and WSCs with losses greater than or equal to 25 percent. If no water loss data was available for a WUG, this strategy was not considered. Costs were estimated at $10 per person per year. If an entity's population was less than 20,000 people, then an estimated base cost of $5,000 was added to the total cost.

Rate Structure

Local officials would implement an increasing block rate structure where the unit cost of water increases as consumption increases. Increasing block rate structures discourages the inefficient use or waste of water. Many cities already have a non-promotional rate structure. This strategy assumes that the entity adopts a higher level of a non-promotional rate structure. It is assumed that increasing block rates would save 6,000 gallons per household per year and that 10 percent of the households would respond to this measure by reducing water use. Since it is likely that the entity would conduct the rate structure modifications themselves, this BMP has no additional costs to the water provider.

Water Waste Ordinance

Local officials would implement an ordinance prohibiting water waste such as watering of sidewalks and driveways or runoff into public streets. A water waste ordinance saves about 3,000 gallons per household per year. It is assumed that 50 percent of the households in entities with over 20,000 people and 30 percent

of the households in entities with less than 20,000 people would respond to this measure by not wasting water. Costs for this strategy would be those costs associated with enforcement. In this case, the costs associated with enforcement was estimated to be $10,000 in entities with over 20,000 people and $2,500 in entities with less than 20,000 people.

Landscape Ordinance (Population over 20,000)
Local officials would implement an ordinance that would promote residential plantings that conserve water for all new construction. This strategy is assumed to be implemented by 2030 and would only apply to new construction for both residential and commercial properties. This BMP would save 1,000 gallons per increased number of households per year. Costs for this strategy would be those costs associated with enforcement, which were estimated to be $10,000.

Time of Day Watering Limit (Population over 20,000)
Local officials would implement an ordinance prohibiting outdoor watering during the hottest part of the day when most of that water is lost (wasted) through evaporation. Many ordinances limit outdoor watering to between 6 p.m. and 10 a.m. on a year-round basis. It is assumed that time of day watering limits save 1,000 gallons/household/year and 75 percent of the population would realize these savings. (The other 25 percent is either not irrigating or already abide by this practice.) Costs for this strategy would be those costs associated with enforcement, which were estimated to be $10,000.

5B.1.3 Municipal Conservation Summary

It is estimated that the municipal conservation strategy outlined in this plan will save, on a regional basis, over 2,500 acre-feet in 2020 and over 3,900 acre-feet in 2070. The unit costs vary considerably between water user groups depending on the population size, and implementation of a water audit and leak repair program for entities with high water losses. Generally, conservation programs are funded through a city's annual operating budget and are not capitalized. However, in some cases, an entity may choose to capitalize a portion or all of their program. These kinds of costs are difficult to estimate for each individual entity due to the wide variety of factors at play. For this plan, it is assumed that only water audits and leak repairs are capitalized. It was assumed that the repairs would be financed over 20 years in 2020, 2040, and 2060. However, all capital expenditures for conservation are considered consistent with Region F Plan. The savings and costs associated with water audits and leak repairs are shown separately in Table 5B-3.

Estimates of municipal conservation savings for Region F water users are shown in Table 5B-1. This table shows the amount of water savings that are estimated through conservation water management strategies, which is above the amount assumed to be achieved through the Plumbing Act. Table 5B-2 shows the estimated costs for municipal conservation.

Although water conservation is part of the culture of the region, the challenge for future water conservation activities in Region F will be the development of water conservation programs that are cost-effective, meet state mandates, and result in permanent real reductions in water use. Development of water conservation programs will be a particular challenge for smaller communities, which lack the financial and technical resources needed to develop and implement the programs. Any water conservation activities should consider the potential adverse impacts of lost revenues from water sales and the ability of communities to find alternative sources for those revenues. State financial and technical assistance will be required to meet state mandates for these communities.

Table 5B-1
Estimated Savings from Municipal Conservation (acre-feet per year)

Water User Group	2020	2030	2040	2050	2060	2070
AIRLINE MOBILE HOME PARK	7	7	8	9	10	10
ANDREWS	45	55	96	111	129	150
ANDREWS COUNTY-OTHER	14	15	17	18	20	21
BALLINGER	12	12	12	12	12	12
BANGS	8	8	8	8	8	8
BALMORHEA	2	2	2	2	2	2
BARSTOW	1	1	1	1	1	1
BIG LAKE	10	12	12	13	13	14
BIG SPRING	131	138	140	139	139	139
BRADY	18	18	19	19	19	19
BRONTE	3	3	3	3	3	3
BROOKESMITH SUD	25	25	25	25	25	25
BROWNWOOD	61	91	91	91	91	91
COAHOMA	8	8	8	8	8	8
COLEMAN	15	15	15	15	15	15
COLEMAN COUNTY-OTHER	1	1	1	1	1	1
COLEMAN COUNTY SUD	10	10	10	10	10	10
COLORADO CITY	16	18	18	18	18	19
CONCHO RURAL WSC	20	21	22	23	24	24
CONCHO COUNTY-OTHER	3	3	3	3	3	3
CROCKETT COUNTY WCID	12	13	13	13	13	13
CRANE	11	12	13	13	14	14
DADS SLC	1	1	1	1	1	1
EARLY	9	9	9	9	9	9
ECTOR COUNTY UD	60	84	94	125	137	149
EDEN	4	4	4	4	4	4
EL DORADO	6	6	6	6	6	6
FORT STOCKTON	36	39	42	44	46	48
GOODFELLOW AFB	8	9	9	10	10	11
GRANDFALLS	1	1	1	1	2	2
GREATER GARDENDALE WSC	12	13	15	17	19	20
GREENWOOD WATER	3	3	4	4	4	5
IRAAN	4	4	5	5	5	5
JUNCTION	8	8	8	8	8	8
KERMIT	18	18	19	19	19	19
LORAINE	2	2	2	2	2	2
MADERA VALLEY WSC	5	5	5	6	6	6
MASON	7	7	7	7	7	7
MCCAMEY	7	7	8	8	8	8
MENARD	5	5	5	5	5	5
MERTZON	3	3	3	3	3	3
MIDLAND	631	755	816	882	944	1,012
MILES	3	3	3	3	3	3
MITCHELL COUNTY UTILITY	5	5	5	5	5	6
MILLERSVIEW-DOOLE WSC	13	14	14	14	14	15
MONAHANS	23	24	25	26	27	27
NORTH RUNNELS WSC	5	5	5	5	5	5
ODESSA	568	680	752	829	905	990
PECOS	29	31	33	34	35	35
PECOS WCID	9	10	11	11	12	12

Water User Group	2020	2030	2040	2050	2060	2070
PECOS COUNTY FRESH WATER	2	2	3	3	3	3
RANKIN	3	3	3	3	3	3
RICHLAND SUD	3	3	3	3	3	3
ROBERT LEE	3	3	3	3	3	3
RUNNELS COUNTY-OTHER	2	2	2	2	2	2
SAN ANGELO	459	532	558	592	629	668
SNYDER	41	47	51	55	59	93
SANTA ANNA	3	4	4	4	4	4
SCURRY COUNTY-OTHER	20	22	24	26	28	30
SONORA	9	9	9	10	10	10
SOUTHWEST SANDHILLS WSC	20	22	24	26	28	30
STANTON	8	9	10	10	11	11
STERLING CITY	3	3	3	3	3	3
TOM GREEN COUNTY FWSD 3	3	4	4	4	5	5
WICKETT	2	2	2	2	2	2
WINK	3	4	4	4	4	5
WINTERS	8	9	9	9	9	9
ZEPHYR WSC	13	13	13	13	13	13
TOTAL	**2,523**	**2,936**	**3,177**	**3,420**	**3,648**	**3,922**

Table 5B-2
Estimated Costs for Municipal Conservation

	2020	2030	2040	2050	2060	2070
Region F Annual Cost	$1,528,000	$1,764,000	$1,870,000	$1,964,000	$2,055,000	$2,161,000
Annual Cost per acre-foot	$606	$600	$589	$574	$563	$551
Annual Cost per 1,000 gal	$1.86	$1.84	$1.81	$1.76	$1.73	$1.69

Table 5B-3
Estimated Savings and Costs from Water Audits and Leak Repairs

Water User Group	Capital Cost			Savings (acre-feet/year)					
	2020	2040	2060	2020	2030	2040	2050	2060	2070
BROOKESMITH SUD	$1,737,000	$1,756,500	$1,756,500	81	81	79	78	78	78
COLEMAN	$1,074,800	$1,085,600	$1,085,600	59	58	57	57	57	57
MILLERSVIEW-DOOLE WSC	$965,800	$991,000	$1,009,100	65	66	65	66	67	68
SONORA	$679,900	$707,400	$720,800	106	112	114	116	117	118
ZEPHYR WSC	$944,700	$954,800	$954,800	19	19	18	18	18	18
TOTAL	**$5,402,200**	**$5,495,300**	**$5,526,800**	**330**	**336**	**333**	**335**	**337**	**339**

5B.2 Irrigation Water Conservation

The agricultural water needs in Region F include livestock and irrigated agriculture. New water supply strategies to meet these needs are limited. For irrigated agriculture, the primary strategies identified to address irrigation shortages are demand reduction strategies (conservation). The agricultural water conservation practices considered include:

- Changes in irrigation equipment
- Crop type changes and crop variety changes
- Conversion from irrigated to dry land farming
- Water loss reduction in irrigation canals

In addition to these practices, the region encourages research into development of drought-tolerant crops, implementation of a region-wide evapotranspiration and soil moisture monitoring network, and, where applicable, water-saving improvements to water transmission systems.

Depending on the method employed to achieve irrigation conservation, the composition of crops grown, sources of water, and method of delivery, will impact the potential savings and costs of this strategy. Since Region F does not have data on county-specific irrigation equipment employed by crop type, a general approach to irrigation conservation savings was taken. For planning purposes, a 5 percent increase in irrigation efficiency was assumed in decades 2020, 2030, and 2040. This efficiency could be achieved through implementation of one or more of the identified practices. The efficiency level was held constant for decades 2050, 2060, and 2070. A maximum efficiency level of 85 percent was assumed. For planning purposes, it was assumed that on average, irrigation conservation would have a capital cost of $760 per acre-foot saved. This is based on the Water Conservation Implementation Task Force Water Conservation Best Management Practices cost per acre for irrigation equipment changes indexed to December 2018 dollars. These costs are based on expenditures for changes in irrigation equipment.

Based on these assumptions, the irrigation conservation strategy is estimated to save around 23,000 acre-feet of supply in 2020 and 60,000 acre-feet in 2070. The projected savings by county are presented in Table 5B-4. The region-wide capital and annual costs are shown in Table 5B-5.

Table 5B-4
Irrigation Conservation Savings (acre-feet per year)

County Name	2020	2030	2040	2050	2060	2070
ANDREWS	1,018	2,037	2,037	2,037	2,037	2,037
BORDEN	147	295	295	295	295	295
BROWN	406	650	650	650	650	650
COKE	34	69	83	83	83	83
COLEMAN	23	47	47	47	47	47
CONCHO	245	490	539	539	539	539
CRANE	0	0	0	0	0	0
CROCKETT	7	14	20	20	20	20
ECTOR	38	76	113	113	113	113
GLASSCOCK	2,050	2,050	2,050	2,050	2,050	2,050
HOWARD	344	688	757	757	757	757
IRION	53	105	158	158	158	158
KIMBLE	133	266	319	319	319	319

County Name	2020	2030	2040	2050	2060	2070
LOVING	0	0	0	0	0	0
MARTIN	1,825	3,649	5,474	5,474	5,474	5,474
MASON	248	497	745	745	745	745
MCCULLOCH	116	232	349	349	349	349
MENARD	183	366	549	549	549	549
MIDLAND	905	1,811	2,716	2,716	2,716	2,716
MITCHELL	256	256	256	256	256	256
PECOS	7,167	14,335	21,502	21,502	21,502	21,502
REAGAN	1,102	2,203	3,305	3,305	3,305	3,305
REEVES	2,947	5,894	8,841	8,841	8,841	8,841
RUNNELS	155	311	373	373	373	373
SCHLEICHER	91	109	109	109	109	109
SCURRY	378	756	983	983	983	983
STERLING	45	90	135	135	135	135
SUTTON	56	112	168	168	168	168
TOM GREEN	2,125	4,249	5,099	5,099	5,099	5,099
UPTON	520	1,040	1,560	1,560	1,560	1,560
WARD	158	316	474	474	474	474
WINKLER	175	351	526	526	526	526
Total	**22,950**	**43,364**	**60,232**	**60,232**	**60,232**	**60,232**

Table 5B-5
Irrigation Conservation Costs

	2020	2030	2040	2050	2060	2070
Region F Capital Cost	$17,442,684	$15,511,646	$12,819,946	$0	$0	$0
Annual Cost per acre-foot	$20.89	$20.89	$12.93	$5.85	$0.00	$0.00
Annual Cost per 1,000 gal	$0.06	$0.06	$0.04	$0.02	$0.00	$0.00

Irrigation conservation is a strategy that proactively causes a decrease in future water needs by increasing the efficiency of current irrigation practices throughout the region. The adoption of irrigation conservation will help preserve the existing water resources for continued agriculture use and provide for other demands. However, without technical and financial assistance it is unlikely that aggressive irrigation conservation programs will be implemented. Also, increased efficiencies may lead to higher water application rates to increase crop yields, which negates the estimated water savings.

Region F recognizes that it has no authority to implement, enforce, or regulate irrigation conservation practices. These water conservation practices are intended to be guidelines. Water conservation strategies determined and implemented by the individual water user group supersede the recommendations in this plan and are considered to meet regulatory requirements for consistency with this plan. Furthermore, all capital expenditures for conservation are considered to be consistent with the Region F plan.

5B.3 Mining Water Conservation

Most of the mining water use in Region F is used in oil and gas production, and the majority of the increase in projected future use is associated with the current Permian Basin activities. In accordance with §27.0511 of the Texas Water Code, Region F encourages the use of alternatives to fresh water for oil and gas production whenever it is economically and technically feasible to do so. Furthermore, Region F recognizes the regulatory authority of the Railroad Commission and the TCEQ to determine alternatives to fresh water use in the permitting process.

Mining Water Conservation

- Region F highly supports and encourages the use of alternatives to fresh water supply for mining operations.
- This strategy involves the reuse/recycling of mining flowback water to reduce the demand for fresh water supplies.
- Several oil and gas companies already employ this strategy and many are expanding and actively pursuing additional ways to further reuse/recycling flowback water.

Due to the limited water resources in the Permian Basin, oil and gas companies have been actively pursuing recycling and reuse of the make-up water. These activities are a form of conservation, which is a demand management strategy that decreases future fresh water needs by treating and reusing water used in mining operations. Mining conservation and recycling is possible for both oil and gas mining as well as sand and gravel mining. Mining recycling and conservation was considered for all mining operations in Region F.

The amount of water than can be reused/recycled is dependent on the amount of water that flows back to the surface during and after the completion of the hydraulic fracturing or oil field flooding. For planning purposes, it is assumed that 20 percent of water used for mining purposes would be available through flow back and can be reused/recycled. The flow back water is of low quality and requires treatment or must be blended with fresh water. Some of the flow back water will be lost during the treatment process.

On a regional basis, the amount of water saved through mining recycling and conservation is around 5,500 acre-feet in 2020 and nearly 1,500 acre-feet in 2070 when demands will have decreased significantly. Estimated savings by county are shown in Table 5B-6. The actual quantity of water available from this strategy will vary. Since this strategy is largely dependent on each individual operator and on economic factors specific to each mining operation, it is difficult to estimate the actual quantity of water that could be made available through this strategy.

The costs associated with this strategy vary based on the amount of flow back, the geographic location of the flow back, the amount of treatment required, and transportation distances required. For the purposes of this plan, a $20,000 per acre-foot capital investment for the maximum amount of water saved over the planning period was assumed. This investment was amortized over 20 years. However, individual operators may plan to invest the capital with no debt service and would likely implement capital improvements at the level needed for each decade. The costs in Table 5B-7 assume a single capital investment beginning in 2020. A 20 cent per barrel ($1,550 per acre-foot) annual savings from not having to dispose of the brine was assumed for the decades with capital cost. If an operator continued to employ this strategy in the later decades, they may realize a net savings over treating and

disposing of the brine. However, for planning purposes, the annual cost was assumed to be $0 after the capital investment is paid off.

As competition for water grows, and water resources become more scarce, individual mining operators may find it more attractive to implement a reuse/recycling strategy. Reusing/recycling flow back water may also reduce brine disposal costs for the operator to help offset the cost of treatment and transportation. Ultimately, the decision to implement this strategy will be based on the economics of each individual well field. If brackish water is readily available and not in demand by other users, it may be more attractive to use brackish supplies. For planning purposes, it is assumed that the mining industry will adopt this strategy at the following rates:

- If there is a mining water shortage, mining conservation will be adopted 50 percent of the time
- If there is no mining shortage, mining conservation will be adopted 30 percent of the time
- If there is a surplus of mining water, mining conservation will be adopted 10 percent of the time

This assumption is incorporated into the water savings and costs shown in the previous tables. This strategy is recommended for all counties with a mining demand.

Table 5B-6
Mining Conservation (Recycling) Supplies (acre-feet per year)

Mining Conservation (Recycling) Supplies						
County	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Andrews	277	260	222	176	135	104
Borden	29	39	33	21	10	5
Brown	66	66	67	67	66	66
Coke	20	20	18	16	14	12
Coleman	5	4	4	4	3	3
Concho	20	20	18	15	13	12
Crane	26	35	36	29	22	17
Crockett	315	315	43	24	7	3
Ector	28	30	27	22	18	15
Glasscock	248	248	189	134	88	63
Howard	143	143	101	59	25	13
Irion	322	322	231	28	14	7
Kimble	1	1	1	1	1	1
Loving	525	525	462	378	301	238
Martin	302	302	227	49	27	14
Mason	43	40	30	24	19	16
McCulloch	375	351	279	236	203	176
Menard	46	45	40	35	30	26
Midland	445	445	344	231	46	32
Mitchell	25	31	27	21	16	12
Pecos	539	539	539	434	67	52
Reagan	445	445	323	62	24	8
Reeves	882	882	847	693	546	434
Runnels	11	11	10	9	8	7
Schleicher	26	31	24	16	10	6
Scurry	20	32	34	25	17	12
Sterling	33	40	34	22	11	6
Sutton	19	30	32	24	16	11

Mining Conservation (Recycling) Supplies						
County	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Tom Green	44	45	47	47	48	49
Upton	101	101	80	53	32	22
Ward	80	80	71	55	38	25
Winkler	33	49	42	32	22	16
Total	**5,494**	**5,527**	**4,482**	**3,042**	**1,897**	**1,483**

Table 5B-7
Mining Conservation (Recycling) Costs

Costs	2020	2030	2040	2050	2060	2070
Region F Total Capital Cost	$111,660,000	$0	$0	$0	$0	$0
Region F Annual Cost (ac-ft/yr)	$827,934	$776,784	$0	$0	$0	$0
Annual Cost per acre-foot	$151	$141	$0	$0	$0	$0
Annual Cost per 1,000 gal	$0.46	$0.43	$0.00	$0.00	$0.00	$0.00

5B.4 Steam Electric Power Conservation

Steam Electric Power is a bit of a misnomer. 'Steam Electric Power' is the official name given by the TWDB for water demands associated with large power generation plants that sell to the open market and use water for cooling, not just facilities that use steam technology. Thus, throughout the Region F Water plan, 'Steam Electric Power' is used to refer to the broader water needs of multiple types of power generation.

By 2070 the region will have water needs for steam electric power generation of nearly 12,000 acre-feet after subordination. However, some these needs may not be realized due to changes in technology at the power generation facility that have already reduced water demands or projected new facilities that may not come online.

The projections for steam electric power water use in Region F are based on the highest county-aggregated historical power water use from 2010-2014. The anticipated water use of future facilities listed in state and federal reports is then added to the demand projections from the anticipated operation date to 2070. Subsequent demand projections after 2020 are held constant throughout the planning period. In Region F there are water demands for power generation in four counties: Ector, Howard, Mitchell, and Ward.

The use of alternative cooling technologies (ACT) that generate the same amount of electricity, but use less water is a form of water conservation. One example of an ACT implemented in power generation facilities is air cooling. This type of technology can be very costly to implement, and the adoption of ACT is largely a business decision on the part of the power industry. At this time, no facilities in Region F are currently considering adoption of this technology and it not considered economically feasible. However, the Region F planning group supports all types of water conservation and would support any power generation facility that chooses to implement a technology change that reduces water needs.

5B.5 Water Conservation Plans

The TCEQ defines water conservation as "a strategy or combination of strategies for reducing the volume of water withdrawn from a water supply source, for reducing the loss or waste of water, for maintaining or improving the efficiency in the use of water, for increasing the recycling and reuse of water, and for preventing the pollution of water."

In §11.1271 of the Texas Water Code, the State of Texas requires water conservation plans for all municipal and industrial/mining water users with surface water rights of 1,000 acre-feet per year or more and irrigation water users with surface water rights of 10,000 acre-feet per year or more. Water conservation plans are also required for all water users applying for a state water right and may also be required for entities seeking state funding for water supply projects. Recent legislation passed in 2003 requires all conservation plans to specify quantifiable five-year and ten-year conservation goals. While achieving these goals is not mandatory, the goals must be identified. In 2007, §13.146 of the Texas Water Code was amended requiring retail public suppliers with more than 3,300 connections to submit a water conservation plan to the TWDB. In addition, any entity that is applying for a new water right or an amendment to an existing water right is required to prepare and implement a water conservation plan.

In the Region F area, 16 entities hold municipal or industrial rights in excess of 1,000 acre-feet per year and five entities have irrigation water rights greater than 10,000 acre-feet per year. Each of these entities is required to develop and submit to the TCEQ a water conservation plan. In addition, seven retail public suppliers are required to submit conservation plans to the TWDB. A list of the users in Region F which are required to submit water conservation plans is shown in Table 5B-8. Many more water users have contracts with regional water providers for 1,000 acre-feet per year or more. Presently, these water users are not required to develop water conservation plans unless the user is seeking state funding. However, TCEQ rules require that a wholesale water provider include contract language requiring water conservation plans or other conservation activities from its customers to assist in meeting the goals of the wholesale water provider's plan.[2]

To assist entities in the Region F area with developing water conservation plans, model plans for municipal water users, industrial users and irrigation districts can be accessed online at www.regionfwater.org and clicking on the Documents tab (http://www.regionfwater.org/index.aspx?id=Documents). Each of these model plans address the TCEQ requirements and is intended to be modified by each user to best reflect the activities appropriate to the entity. General model water conservation plan forms are also available from TCEQ in Microsoft Word and PDF formats. A printed copy of the form from TCEQ can be obtained by calling TCEQ at 512-239-4691 or by email to wcp@tceq.texas.gov.

Model Water Conservation Plans

Region F prepares model water conservation plans for municipal water users, industrial users, and irrigation districts. They are available on the Documents tab of the Region F website, www.regionfwater.org.

Table 5B-8
Water Users in Region F Required to Submit Water Conservation Plans

Municipal/Industrial Water Rights Holders		
Brown County WID #1	City of Menard	City of Coleman
City of Ballinger	City of San Angelo[a]	City of Junction
City of Big Spring[a]	City of Sweetwater[b]	CRMWD
City of Brady	City of Winters	Upper Colorado River Authority
Luminant Generation Co.	Texas Parks and Wildlife	Grayden Cedarworks
Retail Public Suppliers		
City of Andrews	City of Midland	City of Pecos
City of Brownwood	City of Odessa	City of Snyder
City of Fort Stockton		
Irrigation Water Rights Holders		
Pecos County WCID #1	Wayne Moore & W H Gilmore	Red Bluff Water Power Control District
Reeves County WID #1	City of San Angelo[a]	

a. These entities are also required to develop a conservation plan as a retail public provider.
b. City of Sweetwater is located in the Brazos G region but holds water rights in Region F.

5B.6 Other Water Conservation Recommendations

Region F encourages all water user groups to practice advanced conservation efforts to reduce water demand, not only during drought conditions, but as a goal in maintaining future supplies. This includes municipal, industrial, mining, and agricultural water users. As appropriate, municipal users should strive to reduce per capita water use to achieve the state-recommended goal of 140 gpcd use. Region F recognizes that some cities and rural communities may not achieve this level of reduction, but many communities have the opportunity to increase their water savings.

With irrigated agriculture being the largest water user in Region F, this sector has the greatest opportunities for water reductions due to conservation. The plan recommends strategies that would reduce the estimated irrigation water use by 63,232 acre-feet per year by 2070. Region F supports the implementation of any and all measures that effectively reduce water for agricultural purposes.

Region F supports and encourages the collaboration of multiple entities across the region to promote water conservation. This could be accomplished with the assistance of regional organizations, such as the GMAs and GCDs. Consistent messaging is important in continuing to maintain and/or increase conservation levels in the region. The TWDB provides a significant amount of information and services pertaining to water conservation that can be accessed at: http://www.twdb.texas.gov/conservation/.

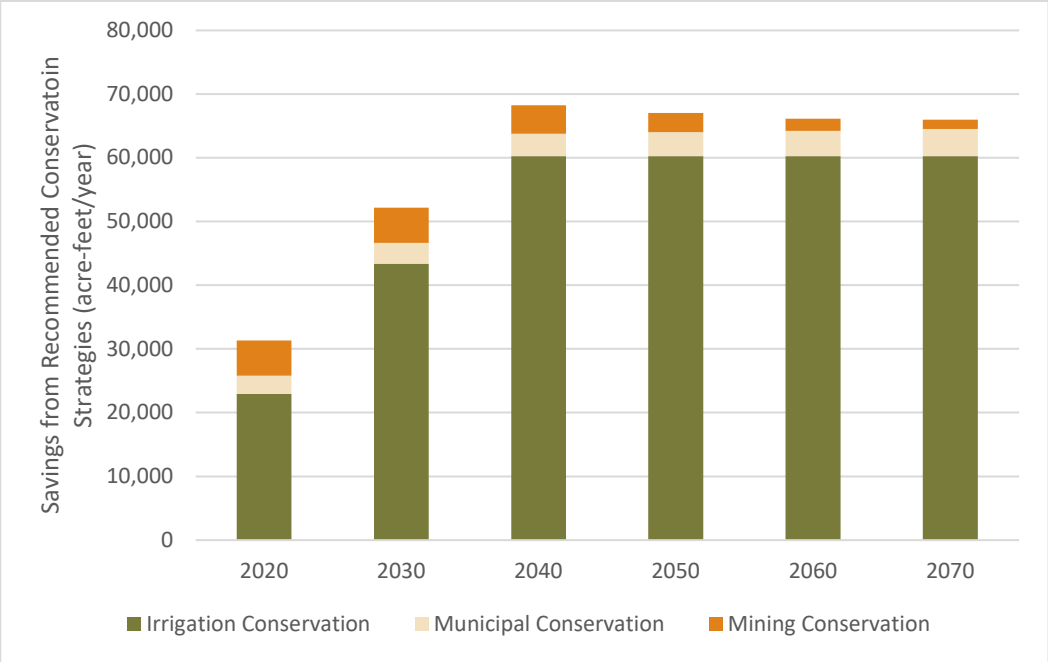
5B.7 Water Conservation Summary

Based on these analyses, it is estimated that implementing water conservation measures for municipal, agricultural, and mining users in Region F could save over 31,000 acre-feet by 2020 and nearly 66,000 acre-feet of water by 2070. Rising water costs and limited additional supplies will require increased water efficiency for all users and is encouraged by Region F.

Table 5B-9
Water Conservation Savings in Region F
-Values in acre-feet per year-

	2020	2030	2040	2050	2060	2070
Municipal Conservation	2,853	3,272	3,510	3,756	3,985	4,261
Irrigation Conservation	22,950	43,364	60,232	60,232	60,232	60,232
Mining Conservation	5,494	5,527	4,482	3,042	1,897	1,483
Total Conservation Savings	**31,297**	**52,163**	**68,224**	**67,030**	**66,114**	**65,976**

Figure 5B-1
Water Conservation Savings in Region F



LIST OF REFERENCES

[1] Texas Health and Safety Code. *Water Saving Performance Standards*, Title 5, Subtitle B § 372.002, 2019.

[2] Texas Administrative Code (TAC). 2018. Title 30, Part 1, Chapter 288, Subchapter A, Subchapter B, and Subchapter C, April 2019, downloaded from: http://texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=4&ti=30&pt=1&ch=288