

4C.1 Municipal Water Conservation (N-1)

4C.1.1 Description of Strategy

Water conservation refers to those methods and practices that either reduce the demand for water supply or increase the efficiency of the supply or use facilities so that available supply is conserved and made available for future use. Water conservation is typically a low-capital intensive alternative that water supply entities can pursue. All water supply entities and some major water right holders are required by Senate Bill 1 regulations to submit a Drought Contingency and Water Conservation Plan to the TCEQ for approval. These plans must detail the water supply entities' plans to reduce water demand at times when the demand threatens the total capacity of the water supply delivery system or overall supplies are low.

In 2001, the Texas Legislature amended the Texas Water Code to require Regional Water Planning Groups to consider water conservation and drought management measures for each water user group with a need (projected water shortage). The Water Conservation Implementation Task Force was created by Senate Bill 1094 to identify and describe Water Conservation Best Management Practices (BMPs) and provide a BMP Guide for use by Regional Water Planning groups in the development of the 2006 Regional Water Plans. Additional water conservation guidance reports include a TWDB report entitled, "Quantifying Effectiveness of Various Water Conservation Techniques in Texas," and a document entitled, "Strategies to Enhance Water Conservation in the Coastal Bend," specifically prepared to assist communities with water conservation in the Coastal Bend Area.

For regional water planning purposes, municipal water use is defined as residential and commercial water use. Municipal water is primarily for drinking, sanitation, cleaning, cooling, fire protection, and landscape watering for residential, commercial, and institutional establishments. A key parameter of municipal water use within a typical city or water service area is the number of gallons used per person per day (per capita water use). The objective of water conservation is to decrease the amount of water – measured in gallons per person per day (gpcd) – that a typical person uses.

The Water Conservation Implementation Task Force recommends that a standardized methodology be used for determining per capita per day (gpcd) municipal water use so as to allow consistent evaluations of effectiveness of water conservation measures among Texas cities that are located in the different climates and parts of Texas. The Task force further recommends

gpcd targets and goals that should be considered by retail public water suppliers when developing water conservation plans required by the state, as follows:

- All public water suppliers that are required to prepare and submit water conservation plans should establish targets for water conservation, including specific goals for per capita water use and for water loss programs using appropriate water conservation BMPs.
- Municipal Water Conservation Plans required by the state shall include per capita water-use goals, with targets and goals established by an entity giving consideration to a minimum annual reduction of 1 percent in total gpcd, based upon a 5-year moving average, until such time as the entity achieves a total gpcd of 140 gpcd or less, or
- Municipal water use (gpcd) goals approved by regional water planning groups.

Per capita water use was calculated using TWDB-approved population and water demand estimates based on water user surveys for each decade from 2000 to 2060. The per capita water use in 2000 and projected per capita water use in 2010, 2020, 2030, 2040, 2050, and 2060 include expected effects of low flow plumbing fixtures upon per capita water use and are shown for each municipal entity located in the Coastal Bend Region in Table 4C.1-1. The projected municipal water demands assume a 100 percent replacement of existing plumbing fixtures to water efficient fixtures by 2045 (assumed 2 percent per year replacement).¹ The 51 municipal entities of Region N are listed in Table 4C.1-1, in the order of low to high per capita water use, in year 2000 in four groupings as follows:

- Less than 140 gpcd,
- 140 to 164 gpcd,
- 165 to 199 gpcd, and
- 200 and greater gpcd.

The projected municipal water needs (shortages) were calculated for each municipal entity by subtracting projected municipal water demands, with plumbing fixture water conservation taken into account, from existing municipal water supplies. The purpose of the municipal water conservation water management strategy is to evaluate the potentials of additional municipal water conservation for inclusion in the Regional Water Plan to meet a part of the projected water needs (shortages) of each municipal entity.

¹ Correspondence with Kevin Kluge, TWDB, September 2004.

**Table 4C.1-1.
Municipal Water User Groups Projected Per Capita Water Use
(TWDB Projections)**

No.	Water User	County	Per Capita Water Use with Low Flow Plumbing Fixtures						
			2000	2010	2020	2030	2040	2050	2060
1	County-Other	Bee	77	74	72	70	68	67	67
2	Ingleside	San Patricio	83	77	75	73	72	72	72
3	Gregory	San Patricio	96	92	89	86	83	81	81
4	County-Other	Kenedy	100	96	94	91	89	88	88
5	Ingleside On The Bay	San Patricio	100	96	93	91	90	89	89
6	McCoy WSC	Live Oak	101	98	95	93	93	92	92
7	River Acres WSC	Nueces	102	97	94	92	91	90	90
8	County-Other	Brooks	103	99	96	93	90	89	89
9	Driscoll	Nueces	105	100	97	95	94	93	93
10	County-Other	San Patricio	105	101	98	95	92	91	91
11/12	San Diego ¹	Duval/Jim Wells	107	103	99	96	93	92	92
13	County-Other	Aransas	109	104	101	98	96	95	95
14	Odem	San Patricio	114	109	106	103	100	99	99
15	Ricardo WSC	Kleberg	115	107	105	104	103	103	103
16	County-Other	Jim Wells	117	114	111	108	105	104	104
17	Lake City	San Patricio	119	114	111	108	106	105	105
18	Portland	San Patricio	119	114	111	108	107	106	106
19	Mathis	San Patricio	119	115	112	109	106	104	104
20	Bishop	Nueces	124	120	117	114	111	109	109
21	Agua Dulce	Nueces	139	136	133	130	127	125	125
1	Choke Canyon WSC	McMullen	143	141	139	138	137	136	136
2	Choke Canyon WSC	Live Oak	143	141	139	138	137	136	136
3	County-Other	Live Oak	145	142	139	137	135	134	134
4	Taft	San Patricio	147	143	140	137	134	133	133
5	Aransas Pass	San Patricio	150	145	141	139	137	136	136
6	Fulton	Aransas	150	148	146	145	144	143	143
7	Aransas Pass	Aransas	150	145	141	139	137	136	136
8	Robstown	Nueces	151	148	145	142	139	137	137
9	Aransas Pass	Nueces	153	142	141	138	137	135	135
10	County-Other	Nueces	155	152	149	146	143	141	141
11	Kingsville	Kleberg	155	152	148	145	142	141	141
12	Sinton	San Patricio	163	160	156	153	150	149	149
13	Rockport	Aransas	164	161	158	156	154	153	153

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Table 4C.1-1 concluded

No.	Water User	County	Per Capita Water Use with Low Flow Plumbing Fixtures						
			2000	2010	2020	2030	2040	2050	2060
1	County-Other	Kleberg	165	161	158	156	154	153	153
2	Benavides	Duval	167	163	159	156	153	152	152
3	El Oso WSC	Bee	169	165	162	159	157	156	156
4	Live Oak El Oso WSC	Live Oak	169	165	162	159	157	156	156
5	Freer	Duval	172	168	164	161	158	157	157
6	Beeville	Bee	172	168	164	161	158	157	157
7	Corpus Christi	Nueces	179	175	171	168	166	165	165
8	Nueces County WCID #4	Nueces	187	181	179	178	177	177	177
9	County-Other	Duval	191	188	185	182	179	178	178
1	County-Other	McMullen	201	196	193	190	188	186	187
2	Three Rivers	Live Oak	202	198	195	192	189	188	188
3	George West	Live Oak	227	223	220	217	214	213	213
4	Orange Grove	Jim Wells	245	240	237	234	231	230	230
5	Alice	Jim Wells	248	244	241	238	235	234	234
6	Premont	Jim Wells	260	256	253	250	247	246	246
7	Falfurrias	Brooks	280	273	270	268	266	265	265
8	Port Aransas	Nueces	424	418	416	414	413	413	413

¹ San Diego is located in both Duval and Jim Wells Counties.

The City of Corpus Christi, the largest municipal water user in the Coastal Bend Region, has demonstrated significant water savings attributable to water conservation efforts over the last decade. The City's municipal water use was nearly 220 gpcd in 1990² and was reduced to 179 gpcd by 2000, a decrease of 41 gpcd (or 19 percent). According to TWDB water use projections, the City of Corpus Christi water use is anticipated to decline to 165 gpcd by 2060 (Table 4C.1-1).

Based on the success of the City's water conservation program, the Coastal Bend Regional Water Planning Group recommends that water user groups, with and without shortages, exceeding 165 gpcd should reduce consumption by 15 percent by 2060. For entities with projected water use equal or less than 165 gpcd in 2060, TWDB projections are recommended.

² City of Corpus Christi Water Conservation Plan, 1999.

In year 2000, in the Coastal Bend Water Planning Region, 34 municipal water users had per capita water use of less than 165 gpcd (Table 4C.1-1). Water users with less than 165 gpcd represented 36.03 percent of the population of the Region in 2000, and used 27.14 percent of the quantity of municipal water used in the Region in 2000 (Table 4C.1-2). In 2000, in the Region, 17.65 percent of the municipal entities had per capita water use of 165 to 199 gpcd. This group represented 57.18 percent of the region's population in 2000, and accounted for 61.95 percent of the municipal water used in the Region in 2000 (Table 1.1-2). Of the 51 municipal entities located in the region, eight (or 15.69 percent) had per capita water use greater than 200 gpcd, representing 6.79 percent of the Region's year 2000 population, and accounted for 10.91 percent of the municipal water use in the Region in 2000 (Table 4C.1-2).

Table 4C.1-2.
Municipal Water User Groups Number, Population,
and Water Use by Per Capita Water Use Levels
Coastal Bend Water Planning Region

<i>Per Capita Water Use in 2000 (gpcd)</i>	<i>Number of Municipal Entities</i>	<i>Percent of Municipal Entities</i>	<i>Population</i>		<i>Water Use</i>	
			<i>2000</i>	<i>Percent of Total</i>	<i>2000 (acft)</i>	<i>Percent of Total</i>
Less than 140	21	41.18%	116,105	21.45%	13,527	13.53%
140 to 164	13	25.49%	78,912	14.58%	13,603	13.61%
165 to 199	9	17.65%	309,427	57.18%	61,915	61.95%
200 and above	8	15.69%	36,740	6.79%	10,905	10.91%
Totals	51	100.00%	541,184	100.00%	99,950	100.00%

4C.1.2 Available Yield

Of the 51 municipal entities in Region N, 17 had per capita water use rates in year 2000 higher than the 165 gpcd goal established by the CBRWPG. Of these 17 municipal entities, ten had per capita water use rates higher than 165 gpcd in 2060. All municipal entities in the Coastal Bend Region are encouraged to conserve water, regardless of per capita consumption. However, a 15 percent reduction in per capita water use was recommended by the CBRWPG for those municipal entities with per capita use in 2060 greater than 165 gpcd. This conservation can be achieved in a variety of ways, including using these BMPs identified by the Water Conservation Implementation Task Force:

1. System Water Audit and Water Loss,
2. Water Conservation Pricing,
3. Prohibition on Wasting Water,
4. Showerhead, Aerator, and Toilet Flapper Retrofit,
5. Residential Toilet Replacement Programs with Ultra-Low-Flow toilets,
6. Residential Clothes Washer Incentive Program,
7. School Education,
8. Water Survey for Single-Family and Multi-Family Customers,
9. Landscape Irrigation Conservation and Incentives,
10. Water-Wise Landscape Design and Conversion Programs,
11. Athletic Field Conservation,
12. Golf Course Conservation,
13. Metering of all New Connections and Retrofitting of Existing Connections,
14. Wholesale Agency Assistance Programs,
15. Conservation Coordinator,
16. Reuse of Reclaimed Water,
17. Public Information,
18. Rainwater Harvesting and Condensate Reuse,
19. New Construction Graywater,
20. Park Conservation, and
21. Conservation Programs for Industrial, Commercial, and Institutional Accounts.

The water conservation water management strategy for municipal entities of the Coastal Bend Region is based upon BMPs listed above, quantities and costs of water conservation measures as reported in TWDB and TCEQ guidance documents,^{3,4} and the Water Conservation Implementation Task Force guidelines for water-use targets and goals listed previously. Since costs and savings presented in the Task Force Draft Report are general and have limited applicability, the list of specific BMPs is significantly reduced, as presented in Table 4C.1-3. Specific conservation measures are not assigned to each municipal entity to provide flexibility for entities to identify practical conservation strategies that fit their individual situation the best. It is also important to note that the list in Table 4C.1-3 has been identified primarily to estimate costs and water savings. A city may choose other BMPs not included in Table 4C.1-3 to reduce their per capita water use.

³ TWDB, GDS Associates, "Quantifying the Effectiveness of Various Water Conservation Techniques in Texas," July 2003.

⁴ TCEQ Water Audit, August 26, 2002.

**Table 4C.1-3.
Possible Water Conservation Techniques (BMPs)**

	<i>Rural</i>		<i>Suburban</i>		<i>Urban</i>	
	<i>Water Savings (gpcd)</i>		<i>Water Savings (gpcd)</i>		<i>Water Savings (gpcd)</i>	
	<i>Maximum</i>	<i>Typical*</i>	<i>Maximum</i>	<i>Typical*</i>	<i>Maximum</i>	<i>Typical*</i>
Indoor Conservation						
Toilet Retrofit ¹	10.5	4.2	10.5	4.3	10.5	4.4
Showerheads and Aerators ¹	5.5	2.2	5.5	2.2	5.5	2.3
Clothes Washer Rebate ¹	5.4	4.8	5.3	4.8	4.7	4.2
Outdoor Conservation						
Irrigation Audit-High User ¹	19.4	0.8	19.1	0.8	14.9	0.7
Rainwater Harvesting ¹	12.0	0.6	11.7	0.6	10.4	0.5
Rain Barrels ¹	1.3	0.4	1.3	0.4	1.3	0.4
Landscape Irrigation & Incentives ²	62.3	12.4	105.5	12.4	32.0	12.4
Seasonal water use reduction ³	5.0	1.8	5.0	1.8	5.0	1.8
General Conservation						
Unaccounted for losses ³	7.8	—	7.8	—	7.8	—
Public Education Programs ³	7.8	3.1	7.8	3.1	7.8	3.1
Total	136.9	30.3	179.4	30.3	99.8	29.8

¹ GDS Associates, July 2003.
² Water Conservation Implementation Task Force, typical based on 15 percent reduction of outdoor water use and maximum based on 30 percent reduction of outdoor water use. Outdoor water use = Total Water Use - 72.5 gpcd (indoor).
³ TCEQ Water Audit, August 2002.
* Typical water savings calculated based on potential savings identified by GDS Associates divided by number of people potentially affected as reported in "Quantifying the Effectiveness of Various Water Conservation Techniques in Texas," TWDB, GDS Associates, Austin, TX, July 2003.

A description of water conservation BMPs listed in Table 4C.1-3 to assist municipal entities exceeding 165 gpcd in 2060 achieve a 15 percent reduction in water use or 165 gpcd by 2060 is presented below, and includes indoor, landscape irrigation, and general water conservation methods.

Indoor Water Conservation: An average demand reduction of 13 gpcd for Coastal Bend municipal entities is included in the TWDB per capita water use projections associated with replacing plumbing fixtures. The TWDB water use projections have a maximum built-in per capita reduction of 16 gpcd from 2000 to 2060, which assumes 100 percent participation in low flow plumbing fixture programs. The amount of additional indoor water conservation is calculated based upon the potential typical water conservation of 11 gpcd, which assumes

50 percent participation in toilet retrofit/showerhead programs and 45 percent participation in clothes washer rebate. The potential amount of “additional” indoor conservation beyond the savings included in the TWDB projections was determined for the projected population at the respective projection dates, by subtracting the plumbing fixtures effects already in the water demand projections. For municipal entities that already have a built-in reduction exceeding 11 gpcd in TWDB per capita water use projections, no additional savings would be expected from indoor water conservation.

Landscape Irrigation Water Conservation: In addition to the indoor water conservation measures described above, the water conservation water management strategy for municipal entities for the Coastal Bend Region includes landscape irrigation. The estimated potentials are based upon the following conditions and assumptions:

1. For those municipal entities having year 2060 water use of 165 to 200 gpcd, landscape irrigation potential can be 15 percent of water use above 75 gpcd.
2. For those WUGs having year 2060 water use greater than 200 gpcd, landscape irrigation potential can be as much as 30 percent of water use greater than 75 gpcd.

General Water Conservation: A municipality can determine unaccounted for water losses by performing a water audit, which includes collecting information that can then be used to calculate unaccounted for water loss using the following equation:

$$\text{Unaccounted for water} = \text{Water production/purchased (gallons)} - \text{Water Sales (gallons)}$$

To maximize the benefits of this conservation strategy, the utility uses this audit information to revise meter testing and repairs, reduce unmetered use, improve accuracy of the utility’s metering system, and implement effective water loss management strategies. Factors that affect the amount of unaccounted for water include density of the system, age of the system, construction quality of the system, and accuracy of the water metering.⁵

The TCEQ reports that unaccounted for water losses of 15 percent or less are acceptable for communities greater than 5,000 people. Losses above 15 percent may be an area of concern and provide conservation potentials. Rural communities in the Coastal Bend may experience as high as 20 percent unaccounted for losses,⁶ which presents an opportunity to conserve at least 5 percent of per capita water use by taking measures to reduce unaccounted for losses.

⁵ Naismith Engineering, Inc., “Strategies to Enhance Water Conservation in the Coastal Bend,” April 1999.

⁶ Conversation with Carl Crull, HDR, January 2005.

In addition to unaccounted for water losses, public information programs can be an important and key element to having water users save water inside homes and commercial structures, in landscaping and lawn watering, and in recreation uses. Public information and education can work in two ways to accomplish water conservation. One way is to inform and convince water users to obtain and use water-efficient plumbing fixtures and appliances, to adopt low water use landscaping plans and plants, to find and repair plumbing leaks, to use gray water for permissible uses (e.g., lawn and shrubbery watering where regulations allow), and to take advantage of water conservation incentives where available.

A second way public information and education can work to conserve water is to inform water users of ways to manage and operate existing and new fixtures and appliances so that less water is used. This includes ideas and practices such as washing full loads of clothes and dishes; using a pail of water instead of a flowing hose to wash automobiles; turning the water off while brushing one's teeth, washing one's hands, or shaving; and watering lawns, gardens, and shrubs during evening—as opposed to daytime—hours.

To assist communities and water supply entities with their conservation planning, the TWDB has prepared a publication entitled *Water Loss Manual*. Additionally a document entitled *Strategies to Enhance Water Conservation in the Coastal Bend* was specifically prepared to assist communities in the Coastal Bend Area with water conservation (included in Appendix E of 2001 Plan). Both the TWDB and Coastal Bend Area documents include a water audit to assist each community in assessing their system.

After subtracting demand reductions already incorporated into the TWDB demand projections, a 15 percent reduction in per capita water use for those cities and county-others using greater than 165 gpcd in 2060 would result in savings—less water used—of 721 acft in 2030 and 2,415 acft in 2060, as seen in Table 4C.1-4. Note: Water savings are only included for 10 of the 17 municipal entities, since seven of the entities have a projected water use equal or less than 165 gpcd in 2060. As can be seen in Table 4C.1-5, the average per capita water use for cities exceeding 165 gpcd in 2000 with additional conservation is approximately 7 percent lower than without additional conservation.

**Table 4C.1-4.
Potential Additional Water Conservation Savings for Water User Groups having
2060 Per Capita Water Use Greater than 165 gpcd**

Water User	County	Housing Area	Water Demand Reduction via Additional Water Conservation											
			2010		2020		2030		2040		2050		2060	
			gpcd	acft/yr	gpcd	acft/yr	gpcd	acft/yr	gpcd	acft/yr	gpcd	acft/yr	gpcd	acft/yr
Nueces County WCID #4	Nueces	Suburban	0	0	0	0	3	56	5	135	9	261	12	384
County-Other	Duval	Rural	1	6	3	13	4	21	5	27	8	44	12	63
County-Other	McMullen	Rural	1	1	2	2	5	3	8	5	10	7	16	10
Three Rivers	Live Oak	Rural	1	3	3	8	5	14	7	18	11	27	16	34
George West	Live Oak	Rural	1	5	4	14	7	25	10	33	14	45	20	57
Orange Grove	Jim Wells	Rural	2	3	5	8	8	14	11	18	16	28	22	38
Alice	Jim Wells	Rural	2	50	5	133	9	219	12	306	17	438	23	585
Premont	Jim Wells	Rural	3	9	6	22	10	36	13	49	19	70	25	92
Falfurrias	Brooks	Rural	0	1	4	38	9	95	14	156	20	228	27	309
Port Aransas	Nueces	Suburban	5	28	13	115	22	238	31	406	42	615	52	843
Total			—	104	—	353	721	—	1,155	—	1,764	—	2,415	

**Table 4C.1-5.
Coastal Bend Region Average Per Capita Water Use for
Expected and Advanced Conservation (gpcd)**

<i>Type of Conservation</i>	<i>Region Average</i>		<i>Average for Water Users >165 gpcd in 2000</i>	
	<i>2030</i>	<i>2060</i>	<i>2030</i>	<i>2060</i>
TWDB projections	145	142	205	202
TWDB plus additional conservation	143	137	200	188

4C.1.3 Environmental Issues

Environmental impacts from water conservation measures in the Coastal Bend Region are not associated with direct physical impacts to the natural environment. Some of the indoor conservation measures recommended could reduce the amount of treated wastewater available to send to the Nueces Bay and estuary during low flow times, which could be offset by possible positive impact resulting from higher reservoir levels.

4C.1.4 Engineering and Costing

Of all the indoor water conservation activities, clothes washer rebates are the most costly, ranging in cost from \$677/acft to \$726/acft, as seen in Table 4C.1-6. For outdoor conservation activities, rain barrels are the most costly program. Costs varied significantly for reducing seasonal water use, unaccounted for loss, and public education programs, and therefore were not presented. For example, a city's cost of a meter replacement and leak detection program, generally part of the utilities' operation and maintenance budget, would vary based on size and age of utility operation and will increase the cost per acft of water conservation activities.

The costs for various water conservation strategies are presented in Table 4C.1-6. Those strategies with costs less than \$500/acft were averaged to calculate program costs. The average cost of municipal water conservation for suburban entities is \$342/acft water saved and \$323/acft water saved for rural entities and includes toilet retrofit, installation of low flow showerhead and aerators, irrigation audits, and landscape incentives. The total program costs for municipal entities having per capita use greater than 165 gpcd in 2060 are presented in Table 4C.1-7. Total conservation potential costs for Region N are estimated at \$34,227 in 2010 and increasing to \$803,457 by 2060. The CBRWPG has expressed a desire to offer BMPs to encourage

conservation while maintaining flexibility for municipal users to adopt strategies that suit them the best.

**Table 4C.1-6.
Costs of Possible Water Conservation Techniques (BMPs)**

	<i>Rural</i>	<i>Suburban1</i>	<i>Urban</i>
	<i>Water Costs (per acft supply realized)</i>	<i>Water Costs (per acft supply realized)</i>	<i>Water Costs (per acft supply realized)</i>
	<i>Typical</i>	<i>Typical</i>	<i>Typical</i>
Indoor Conservation			
Toilet Retrofit ²	\$390	\$457	\$367
Showerheads and Aerators ²	\$69	\$78	\$64
Clothes Washer Rebate ²	\$725	\$726	\$677
Outdoor Conservation			
Irrigation Audit-High User ²	\$434	\$434	\$434
Rainwater Harvesting ²	\$640	\$640	\$591
Rain Barrels ²	\$1,248	\$1,248	\$1,153
Landscape Irrigation & Incentives ³	\$400	\$400	\$400
Seasonal water use reduction ³	N/A	N/A	N/A
General Conservation			
Unaccounted for losses ⁴	N/A	N/A	N/A
Public Education Programs ⁴	N/A	N/A	N/A

¹ Suburban costs typically higher than rural costs since more multi-family dwellings are in suburban communities and have higher costs to implement indoor conservation programs.
² GDS Associates, July 2003.
³ Water Conservation Implementation Task Force, typical based on 15 percent reduction of outdoor water use and maximum based on 30 percent reduction of outdoor water use. Outdoor water use= Total Water Use- 72.5 gpcd (indoor).
⁴ TCEQ Water Audit, August 2002.

4C.1.5 Implementation Issues

There are several issues that may slow down the efforts of water conservation activities. The most crucial is to get water customers to change their water use habits. Effective public outreach and education can go a long way to reducing water use, but in the end the effectiveness of any program is dependent upon the individual. A key element to the Drought Contingency and Water Conservation Plan that each city has been required to submit to the TCEQ is the curtailment of water use during drought. Enforcement of these restrictions—usually ones that limit lawn watering—is often difficult. Lastly, retrofit programs can be expensive, and may not be a budget priority for many cities.

**Table 4C.1-7.
Costs of Water Conservation for Selected Water Conservation Techniques
for Water User Groups having 2060 Per Capita Water Use Greater than 165 gpcd**

Water User	County	Housing Area	Cost per acft	Cost of Water Savings via Additional Water Conservation					
				2010 (dollars)	2020 (dollars)	2030 (dollars)	2040 (dollars)	2050 (dollars)	2060 (dollars)
Nueces County WCID #4	Nueces	Suburban	\$342	\$0	\$0	\$19,183	\$46,189	\$89,333	\$131,206
County-Other	Duval	Rural	\$323	\$1,856	\$4,336	\$6,746	\$8,792	\$14,096	\$20,204
County-Other	McMullen	Rural	\$323	\$208	\$564	\$1,085	\$1,704	\$2,209	\$3,255
Three Rivers	Live Oak	Rural	\$323	\$815	\$2,666	\$4,425	\$5,938	\$8,650	\$11,075
George West	Live Oak	Rural	\$323	\$1,497	\$4,632	\$7,974	\$10,707	\$14,510	\$18,447
Orange Grove	Jim Wells	Rural	\$323	\$830	\$2,461	\$4,385	\$5,974	\$9,088	\$12,114
Alice	Jim Wells	Rural	\$323	\$16,214	\$42,833	\$70,811	\$98,923	\$141,513	\$189,080
Premont	Jim Wells	Rural	\$323	\$2,911	\$7,078	\$11,675	\$15,955	\$22,645	\$29,830
Falfurrias	Brooks	Rural	\$323	\$216	\$12,179	\$30,550	\$50,480	\$73,770	\$99,910
Port Aransas	Nueces	Suburban	\$342	\$9,681	\$39,430	\$81,488	\$138,823	\$210,465	\$288,337
Total				\$34,227	\$116,179	\$238,321	\$383,484	\$586,279	\$803,457

4C.1.6 Evaluation Summary

An evaluation summary of this water management option is provided in Table 4C.1-8.

**Table 4C.1-8.
Evaluation Summary of Municipal Water Conservation**

Impact Category	Comment(s)
a. Water Supply 1. Quantity 2. Reliability	1. Firm Yield: 2,415 per acft/yr 2. Cost: Ranges from \$69 to \$1,248 per acft water saved (based on BMP selected.)
b. Environmental factors 1. Instream flows 2. Bay and Estuary Inflows 3. Wildlife Habitat 4. Wetlands 5. Threatened and Endangered Species 6. Cultural Resources 7. Water Quality a. dissolved solids b. salinity c. bacteria d. chlorides e. bromide f. sulfate g. uranium h. arsenic i. other water quality constituents	1. Some impact due to decreased return flows, which could be offset by possible positive impact resulting from higher reservoir levels. 2. Some impact due to decreased return flows, which could be offset by possible positive impact resulting from higher reservoir levels. 3. Some impact due to decreased return flows, which could be offset by possible positive impact resulting from higher reservoir levels. 4. Some impact due to decreased return flows, which could be offset by possible positive impact resulting from higher reservoir levels. 5. None. 6. No cultural resources affected. 7. None or low impact.
c. Impacts to State water resources	• No apparent negative impacts on water resources
d. Threats to agriculture and natural resources in region	• None
e. Recreational impacts	• None
f. Equitable Comparison of Strategies	• Standard analyses and methods used
g. Interbasin transfers	• None

Continued on next page.

Table 4C.1-8 Concluded

h. Third party social and economic impacts from voluntary redistribution of water	<ul style="list-style-type: none">• None
i. Efficient use of existing water supplies and regional opportunities	<ul style="list-style-type: none">• Improvement over current conditions
j. Effect on navigation	<ul style="list-style-type: none">• None
k. Consideration of water pipelines and other facilities used for water conveyance	<ul style="list-style-type: none">• None

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