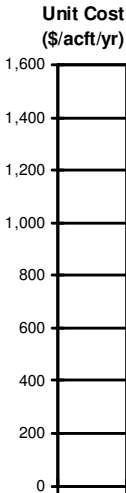
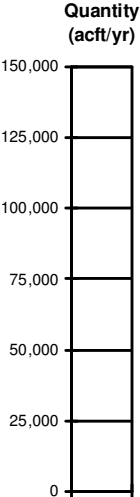
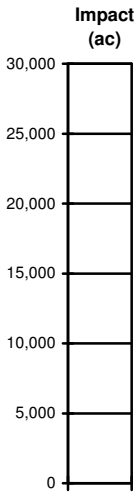


2011 South Central Texas Regional Water Plan Water Management Strategy Summary Sheet

	<p>Name: <i>Recycled Water Programs</i></p> <p>Description: The water management strategy includes recommended uses of recycled water for non-potable use for the following WUGs: Bexar County Industrial (17,734 acft/yr in 2060) and Comal County Industrial (9,022 acft/yr in 2060). Supply of the recycled water will come from SAWS, SARA, CCMA, and/or New Braunfels Utilities waste water treatment plants. The unit cost of water and yield resulting from implementing the projects is dependent upon the individual project.</p> <p>Decade Needed: 2000 - 2060</p>												
	<p>Cost, Quantity of Water, and Land Impacted</p>												
	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">Unit Cost of Water:</td> <td style="width: 25%;">Dependent upon project</td> <td style="width: 25%;">\$/acft/yr</td> <td style="width: 25%;">Recycled Water Delivered</td> </tr> <tr> <td>Quantity of Water:</td> <td>Dependent upon project</td> <td>acft/yr</td> <td>Reliability = Firm</td> </tr> <tr> <td>Land Impacted:</td> <td>N/A</td> <td>acres</td> <td></td> </tr> </table>	Unit Cost of Water:	Dependent upon project	\$/acft/yr	Recycled Water Delivered	Quantity of Water:	Dependent upon project	acft/yr	Reliability = Firm	Land Impacted:	N/A	acres	
Unit Cost of Water:	Dependent upon project	\$/acft/yr	Recycled Water Delivered										
Quantity of Water:	Dependent upon project	acft/yr	Reliability = Firm										
Land Impacted:	N/A	acres											
	<p>Additional Considerations per Regional Water Planning Guidelines</p>												
	<p>Environmental Factors: It is likely that implementation or expansion of current water recycling programs will have minimal effects on the environment due to project areas being contained within urban areas.</p> <p>Impacts on Water Resources: Effluent discharges are likely to increase throughout the planning period, even after considering recycled water programs.</p> <p>Impacts on Agricultural & Natural Resources: Implementation will occur in predominantly urban areas and likely be concentrated in existing utility easements and previously disturbed floodplains not located on the outcrop of the Edwards Aquifer. Hence, impacts to agricultural and natural resources are expected to be minimal.</p> <p>Other Relevant Factors per SCTRWP: Encourages beneficial use of available resource.</p> <p>Comparison of Strategies to Meet Needs: Relatively low unit cost. No conflicts with other recommended water management strategies.</p> <p>Interbasin Transfer Issues: Not applicable.</p> <p>Third-Party Impacts of Voluntary Transfers: Not applicable.</p> <p>Regional Efficiency: New supply proximate to points of need.</p> <p>Water Quality Considerations: At current levels of treatment, recycled water must be used for non-potable purposes only.</p>												
													

4C.5 Recycled Water Programs

4C.5.1 Description of Water Management Strategy

Recycled Water Programs is defined as projects that utilize treated wastewater effluent as a replacement for potable water where non-potable water could be used (irrigation, industrial cooling, etc), thereby reducing the overall demand for fresh water supply. Recycled water typically involves a capital project connecting the treatment plant discharge facilities to an individual area that has a relatively high, localized use that can be met with non-potable water. Examples most frequently include the irrigation of golf courses and other public lands and specific industries or industrial use areas. Few entities, if any, would be capable of utilizing their entire effluent capacity for recycled water at present. However, for the long term, it is likely that increased pressure on water supplies will result in an increased emphasis on recycled water. Downstream needs, both water rights and environmental instream uses, would have to be met. Any remaining flows after these needs are met could potentially be utilized. Virtually any water supply entity with a wastewater treatment plant could pursue a recycled water alternative, provided that downstream water rights do not have a claim for the entire return flow.

Recycled water can be classified into two forms, defined by how the effluent water is handled:

1. Direct Reuse – Pipe treated wastewater directly from wastewater plant to place of use (also called “flange-to-flange”).
2. Indirect Reuse – Discharge treated wastewater to river, stream, or lake for subsequent diversion downstream (also called “bed and banks”).

All possible recycled water projects considered for implementation within Region L and described in the following section are classified as direct reuse projects. All direct reuse water supply options assume that treated wastewater remains under the control (in pipelines or storage tanks) at all times from treatment to point of use by the entity treating the wastewater and/or supplying recycled water.

Recycled water quality and system design requirements are regulated by the Texas Commission on Environmental Quality (TCEQ) by 30 TAC §210. TCEQ allows two types of recycled water as defined by the use of the water and the required water quality:

- Type 1 – Public or food crops generally can come in contact with recycled water; and
- Type 2 – Public or food crops cannot come in contact with recycled water.

Current TCEQ criteria for recycled water are shown in Table 4C.5-1. Trends across the country indicate that criteria for unrestricted recycled water will likely tend to become more stringent over time. The water quality required for Type 1 recycled water is more stringent with lower requirements for oxygen demand (BOD₅ or CBOD₅), turbidity, and fecal coliform levels.

**Table 4C.5-1.
TCEQ Quality Standards for Recycled Water**

<i>Parameter</i>	<i>Allowable Level</i>
Type 1 Recycled Water	
BOD ₅ or CBOD ₅	5 mg/L
Turbidity	3 NTU
Fecal Coliform	20 CFU / 100 ml ¹
Fecal Coliform (not to exceed)	75 CFU / 100 ml ²
Type 2 Recycled Water	
For a system other than a pond system	
BOD ₅	20 mg/L
or CBOD ₅	15 mg/L
Fecal Coliform	200 CFU / 100 ml ¹
Fecal Coliform (not to exceed)	800 CFU / 100 ml ²
Type 2 Recycled Water	
For a pond system	
BOD ₅	30 mg/L
Fecal Coliform	200 CFU / 100 ml ¹
Fecal Coliform (not to exceed)	800 CFU / 100 ml ²
¹ geometric mean	
² single grab sample	

A general evaluation of recycled water for multiple water user groups (WUGs) with needs and potential wastewater sources were utilized to evaluate a broad range of potential recycled water supplies.

4C.5.2 General Evaluation of Direct Reuse Potential for Multiple Water User Groups

4C.5.2.1 Potential Recycled Water Needs

A number of water user groups with needs have the potential to utilize recycle water as a water management strategy. These include:

- Bexar County Industrial;
- Comal County Industrial;
- Bexar County Mining;
- Comal County Mining;
- Hays County Mining;
- SAWS;
- San Marcos;
- City of Marion;
- City of Floresville;
- SS WSC; and
- County Line WSC.

The needs of two water user groups can be completely met with the Recycle Water Programs water management strategy (Table 4C.5-2) in the 2011 South Central Texas Regional Water Plan. Three WUGs (Bexar County Mining, Comal County Mining, and Hays County Mining) were also considered for this strategy, but because the mining operations are located over the Edwards Aquifer Outcrop, the use of recycle water is discouraged. Each of the other WUGs could use recycled water to meet the non-potable portion of their needs, however for regional planning purposes, it is assumed that their needs will be met by other projects. Table 4C.5-2 lists the water user groups with potential needs for recycled water by decade for 2010 through 2060 and their corresponding possible source of recycled water.

**Table 4C.5-2.
General Recycled Water Potential**

<i>WUG</i>	<i>Proximate WW Treatment Facility</i>	<i>2010 Projected Need (acft/yr)</i>	<i>2020 Projected Need (acft/yr)</i>	<i>2030 Projected Need (acft/yr)</i>	<i>2040 Projected Need (acft/yr)</i>	<i>2050 Projected Need (acft/yr)</i>	<i>2060 Projected Need (acft/yr)</i>
Bexar County Industrial	SAWS, SARA and CCMA	1,500	5,048	8,396	11,689	14,587	17,734
Comal County Industrial	New Braunfels Utilities	5,199	6,033	6,784	7,514	8,141	9,022

4C.5.2.2 Potential Recycled Water Supply

The supply from recycled water that would be potentially available for any entity would be that portion of their wastewater effluent stream that is over and above any currently planned recycled water and any commitments made to downstream water rights and environmental flows. Of this potential, the amount that can actually be recognized depends on the availability of suitable users within an economical distance from the treatment plant. If individual high water use industrial plants or open land that benefits from irrigation, such as golf courses, are located relatively close to the plant, then recycled water can provide a substantial benefit to water supplies.

Information regarding each of the water utility districts with an available or projected supply of recycled water within an economical distance of a WUG with recycled water needs is listed in Table 4C.5-3.

**Table 4C.5-3.
Possible Recycled Water Supply**

<i>Proximate WW Treatment Facility</i>	<i>2010 Projected Supply (acft/yr)</i>	<i>2020 Projected Supply (acft/yr)</i>	<i>2030 Projected Supply (acft/yr)</i>	<i>2040 Projected Supply (acft/yr)</i>	<i>2050 Projected Supply (acft/yr)</i>	<i>2060 Projected Supply (acft/yr)</i>
SAWS	0	15,127	15,127	15,127	15,127	15,127
SARA	0	2,241	2,241	2,241	2,241	2,241
CCMA	6,722	9,859	16,580	16,580	16,580	16,580
New Braunfels Utilities	5,933	7,414	9,142	10,853	12,609	14,558
San Marcos Utilities	1,127	3,023	4,927	6,998	9,239	10,967

4C.5.2.3 Meeting Demands

The recycled water supply is sufficient to meet the projected needs for the two industrial WUGs in the region. Utilization of this water source is contingent on whether a potential use for the wastewater effluent exists within an economical distance from the treatment plant. Tables 4C.5-4 and 4C.5-5 itemize the projected supplies to meet the projected demands by decade for each water user group.

**Table 4C.5-4.
Bexar County Industrial Recycled Water Needs, Supply, and Shortages**

	2010 (acft/yr)	2020 (acft/yr)	2030 (acft/yr)	2040 (acft/yr)	2050 (acft/yr)	2060 (acft/yr)
Projected Needs	1,500	5,048	8,396	11,689	14,587	17,734
Supply from SAWS	0	15,127	15,127	15,127	15,127	15,127
Supply from SARA	0	2,241	2,241	2,241	2,241	2,241
Supply from CCMA	6,722	9,859	16,580	16,580	16,580	16,580
Shortages	0	0	0	0	0	0

**Table 4C.5-6.
Comal County Industrial Recycled Water Needs, Supply, and Shortages**

	2010 (acft/yr)	2020 (acft/yr)	2030 (acft/yr)	2040 (acft/yr)	2050 (acft/yr)	2060 (acft/yr)
Projected Needs	5,199	6,033	6,784	7,514	8,141	9,022
Supply from NBU	5,933	7,414	9,142	10,853	12,609	14,558
Shortages	0	0	0	0	0	0

4C.5.3 Environmental Issues

A summary of environmental issues is presented in Table 4C.5-7.

**Table 4C.5-7.
Environmental Issues: General Recycled Water**

Implementation Measures	Development of additional wastewater treatment plant facilities, distribution pipelines, and pump stations. Avoidance of project locations on the Edwards Aquifer recharge zone is desirable.
Environmental Water Needs / Instream Flows	Possible low impact on in-stream flows due to decreased effluent.
Bays and Estuaries	Possible low impact on freshwater inflows during drought due to decreased effluent.
Fish and Wildlife Habitat	Possible impacts depending on changes in volume of effluent and locations of recycled water projects.
Cultural Resources	No impact anticipated.
Threatened and Endangered Species	Possible impacts depending on project location and habitat for listed species.
Comments	Assumes needed infrastructure will be in urbanized areas.

4C.5.4 Engineering and Costing

The required improvements to implement a recycled water supply would be expected to vary considerably between entities based on the upgrades required both in treatment and integration. Therefore, general cost estimates were developed for varying recycled water scenarios as described in Table 4C.5-8. To provide more flexibility in the types of recycled water applications possible, the scenarios assume the use of a type 1 wastewater effluent.

**Table 4C.5-8.
Recycled Water Scenarios**

Scenario #	Treatment	Integration
1	Existing WWTP is achieving treatment that meets the Type 1 effluent requirements. Treatment upgrade includes only the addition of chlorine for distribution.	Treated wastewater is supplied to demand location(s) from central WWTP by addition of piping and pump station.
2	Existing WWTP is nearly achieving treatment that meets the Type 1 effluent requirements. Treatment upgrade includes tertiary treatment and chlorine.	Treated wastewater is supplied to demand location(s) from central WWTP by addition of piping and pump station.

Scenarios 1 and 2, include central storage at the wastewater plant with recycled water delivered to demand location on an as needed basis. An alternate delivery option not included here is a more decentralized recycled water system with storage located at the point of use. Providing storage at the point of use may decrease required pipeline and pump station size because the water can be transported at a more uniform rate to fill storage tanks at the point of use. However, installation of storage tanks at the point of use may be problematic in highly urbanized areas or undesirable near high public use areas.

Cost estimates were developed for each of the scenarios with required facilities for each scenario shown in Table 4C.5-8. The demand for recycled water used for irrigation of golf courses, parks, schools, crops, or other landscapes will vary seasonally. For planning purposes, the application rates in Table 4C.5-9 are assumed to determine the available project yield for varying sizes of recycled water facilities. Recycled water facilities are sized for the peak usage periods, and consequently, the average annual rate of usage may be considerably lower than the peak usage. For a recycled water system with typical application rates, as shown in Table 4C.5-10, the annual available project yield is 57 percent of the recycled water system capacity. Available project yield may be higher than 57 percent of maximum capacity for systems

supplying a large portion of the recycled water to industrial or other users that have a more uniform recycled water demand.

**Table 4C.5-9.
Recycled Water Scenarios 1, and 2 Required Distribution Facilities**

Facility	Maximum Capacity (MGD)				Description
	0.5	1	5	10	
Pump Station, HP	127	248	1,209	2,332	Capacity to deliver maximum daily demand in 6 hours
Storage Tank, MG	0.5	1	5	10	Store one days treated recycled water at WWTP
Pipeline, Size in Inches (Length in Miles)	12 (2)	16 (2)	33 (3) 18 (2) 12 (1)	48 (4) 18 (3) 12 (2)	Capacity to deliver maximum daily demand in 6 hours
Available Project Yield, acft/yr (MGD)	319 (0.28)	638 (0.57)	3,193 (2.85)	6,385 (5.7)	Yield is 57 percent of maximum treatment capacity based on seasonal use shown in Table 4C.5-7

**Table 4C.5-10.
Recycled Water Irrigation Application Rate**

Use Level	Application Rate	Duration
Peak	1.25 in/week	4 months
Normal	0.75 in/week	3 months
Below Normal	0.25 in/week	5 months
Average	0.71 in/week	weighted
Average/Peak	0.71 / 1.25 = 0.57	

Irrigation water for landscapes such as golf courses and parks will generally be applied during periods when these areas are not being utilized, typically at night. Therefore, the distribution facilities are sized to deliver the total daily demand in a 6-hour period. Pumping facilities are sized to provide a residual pressure of 60 psi at the delivery point.

Table 4C.5-11 shows annual cost of recycled water per 1,000 gallons for a range of project scenarios and capacities. These costs are for general planning purposes and will vary

significantly depending on the specific circumstances of an individual water user group. Tables 4C.5-12 and 4C.5-13 show the total project capital costs and total operations and maintenance costs for recycled water supplies, respectively.

Table 4C.5-11.
General Recycled Water Annual Cost of Water
(\$ per 1,000 gal available project yield)
September 2008 Prices

Scenario	Capacity (MGD)			
	0.5	1	5	10
1	\$4.00	\$2.94	\$1.91	\$1.69
2	\$7.61	\$5.57	\$3.47	\$3.04
Debt Service (6 percent for 20 years)				

Table 4C.5-12.
General Recycled Water Total Project Capital Cost
(\$ per gallon maximum capacity)
September 2008 Prices

Scenario	Maximum Capacity (MGD)			
	0.5	1	5	10
1	\$7.91	\$5.67	\$3.73	\$1.87
2	\$11.10	\$7.96	\$4.97	\$2.48

Table 4C.5-13.
General Recycled Water Total Operations and Maintenance Cost
(\$ per 1,000 gallons)
September 2008 Prices

Scenario	Maximum Capacity (MGD)			
	0.5	1	5	10
1	\$0.69	\$0.56	\$0.35	\$0.30
2	\$2.95	\$2.23	\$1.39	\$1.23

The general recycled water costs are utilized to develop the cost estimates for individual water user groups shown in Table 4C.5-14. The recycled water project maximum capacity (MGD) for each water user group was developed based on the “2060 Projected Need” and “2060 Potential Recycled Water,” as shown in Tables 4C.5-2 and 4C.5-3.

Table 4C.5-14.
Unit Cost Estimate Summaries
Recycled Water as a Water Management Strategy for Multiple Water User Groups
September 2008 Prices

Water User Group	Costing Scenario	Unit Cost (\$/acft)					
		2010	2020	2030	2040	2050	2060
Bexar County Industrial	1	\$580	\$580	\$98	\$881	\$881	\$205
Comal County Industrial	1	\$580	\$580	\$98	\$98	\$98	\$98

4C.5.5 Implementation Issues

This water supply option has been compared to the plan development criteria, as shown in Table 4C.5-16, and the option meets each criterion. Each community that pursues recycled water will need to investigate concerns that would include at a minimum:

- Amount of treated effluent available, taking into consideration downstream water commitments and discharge permit restrictions.
- Potential users, primarily individual large-scale users that could utilize non-potable water (e.g., certain industries) and irrigated lands (e.g., golf courses and park areas).
- Capital costs of constructing needed distribution systems connecting the treatment facilities to the areas of recycled water.

Recycled water requires a TCEQ permit. Requirements specific to pipelines needed to link wastewater treatment facilities to recycled water customers may include:

- U.S. Army Corps of Engineers Section 404 permit(s) for pipeline stream crossings; discharges of fill into wetlands and waters of the United States for construction; and other activities;
- TPDES Storm Water Pollution Prevention Plan; and
- TPWD Sand, Shell, Gravel and Marl permit for construction in state-owned streambeds.

**Table 4C.5-16.
Comparison of General Recycled Water Option
to Plan Development Criteria**

<i>Impact Category</i>	<i>Comment(s)</i>
A. Water Supply 1. Quantity 2. Reliability 3. Cost	1. Potentially important source, up to 25 percent of demand 2. High reliability 3. Reasonable
B. Environmental factors 1. Environmental Water Needs 2. Habitat 3. Cultural Resources 4. Bays and Estuaries 5. Threatened and Endangered Species 6. Wetlands	1. Produces instream flows—low to moderate impact 2. Possible low impact 3. None or low impact 4. None or low impact 5. Possible impact 6. None or low impact
C. Impact on Other State Water Resources	No apparent negative impacts on state water resources; benefit accrues to demand centers by more efficient use of available water supplies; no effect on navigation
D. Threats to Agriculture and Natural Resources	Generally positive effect to agriculture and natural resources by avoiding need for new supplies
E. Equitable Comparison of Strategies Deemed Feasible	Option is considered to meet municipal and industrial shortages
F. Requirements for Interbasin Transfers	Not applicable
G. Third Party Social and Economic Impacts from Voluntary Redistribution	Could offset the need for voluntary redistribution of other supplies