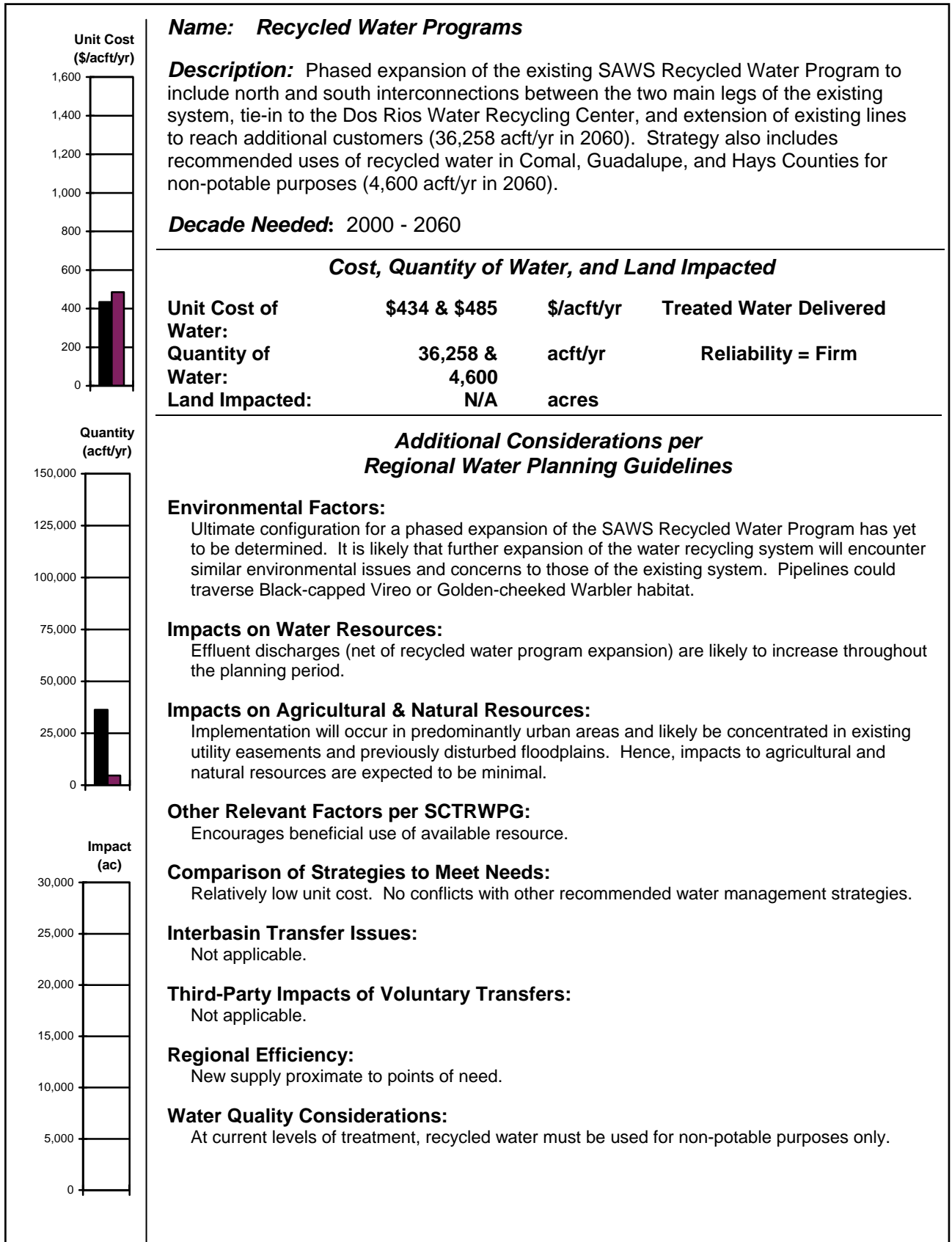


2006 South Central Texas Regional Water Plan Water Management Strategy Summary Sheet



4C.3 Recycled Water Programs

4C.3.1 Description of Water Management Strategy

The Recycled Water Programs water management strategy involves expansion of programs that reclaim municipal wastewater for non-potable uses such as irrigation of golf courses, parks, and open spaces of cities, landscape watering of large office and business complexes, cooling of large office and business complexes, steam-electric power plant cooling, process or wash water for mining operations, irrigation of farms that produce livestock feed and forage, irrigation of farms that produce sod, ornamentals, and landscape plants, and for instream uses such as riverwalks and waterways. This strategy is being used within the region by entities including SAWS, SARA, New Braunfels Utilities, the City of Seguin and the City of San Marcos and can be expanded as the quantities of municipal wastewater increase with population growth. An advantage of this strategy is that the water has already been developed and brought to the locations of many of the uses listed above. The phased expansion of the SAWS Recycled Water Program is described and evaluated below as a water management strategy to meet a part of the projected water needs of WUGs in Bexar County. In addition, information is provided about projected quantities and unit costs of recycle water for use in Comal, Guadalupe, and Hays Counties.

The San Antonio electric utility, City Public Service (CPS), has been using reclaimed wastewater for electric power generation for decades, and during the 1990s, the San Antonio Water System (SAWS) developed a Reuse Water Program.^{1,2} Phase I includes two main conveyance lines, with one line beginning at the Salado Creek Water Recycling Center (WRC) and extending north through the eastern part of the city, and the other beginning at the Leon Creek WRC and extending north through the western part of the city (Figure 4C.3.-1). Phase II of the Plan provides for interconnection of these two conveyance lines to allow east-west as well as north-south flow of recycle water. Subsequent expansion of the system may provide additional water supply to other parts of the city and Bexar County³.

¹ San Antonio Water System, "San Antonio Water System, Water Conservation and Reuse Plan," November 1998.

² Pape-Dawson Engineers, Inc., "Environmental Assessment System Interconnect Addendum," San Antonio Water System, September 2000.

³ US Bureau of Reclamation, "Reuse Water Storage Alternatives Assessment Report," San Antonio Water System, September 2000.

The present SAWS Recycled Water Program is capable of delivering about 35,000 acft/yr, with estimated consumptive reuse of 24,941 acft/yr, which is included as existing water supply of the South Central Texas Region. Recycled Water is used for non-potable purposes, including industrial purposes, office and business cooling towers, landscape irrigation, and streamflow augmentation. Such uses are direct substitutes for water previously obtained from the Edwards Aquifer, and thereby reduce the use of Edwards Aquifer water by the quantity of recycled water used. This water management strategy involves the expansion of the recycled water program to provide dependable water supplies for non-potable uses, bringing the total supply of recycled water in 2010 to a level sufficient to meet 20 percent of SAWS projected municipal and industrial water demands for the 2010 through 2060 projection period. A portion of the Southern Interconnection between Salado WRC and Dos Rios WRC has been completed. Facilities for future expansion are expected to include Southern Interconnections between the Leon Creek and Dos Rios WRCs as well as a Northern Interconnection linking the transmission lines originating at the Leon Creek and Salado Creek WRCs (Figure 4C.3-1).

4C.3.2 Water Availability

Increased treated wastewater volumes associated with increased municipal water use are potential sources of water to meet a part of the projected non-potable needs (shortages) of the SAWS service area.⁴ This reuse by SAWS may be accomplished directly (prior to stream discharge or “flange-to-flange”) or indirectly through bed and banks delivery to downstream diversion and/or storage sites, subject to applicable law. Direct and indirect reuse methods are both currently used by SAWS. However, it is most likely that direct reuse methods will be used in the expansion of the recycled water program, since indirect reuse of treated wastewater volumes derived from privately owned groundwater and/or interbasin transfer of surface water may be subject to fewer water rights or environmental flow constraints because these sources would not naturally have been present in the streams below wastewater treatment facilities.

For the purposes of consideration for inclusion in the South Central Texas Regional Water Plan, future expansion of SAWS Recycled Water Program is based on the goal of meeting 20 percent of projected municipal and industrial water demands with recycled water. The

⁴ Recycled water is also included in the plan for steam-electric power, mining, and non-potable municipal uses in Hays, Guadalupe, and Comal Counties (see Section 4B.1).

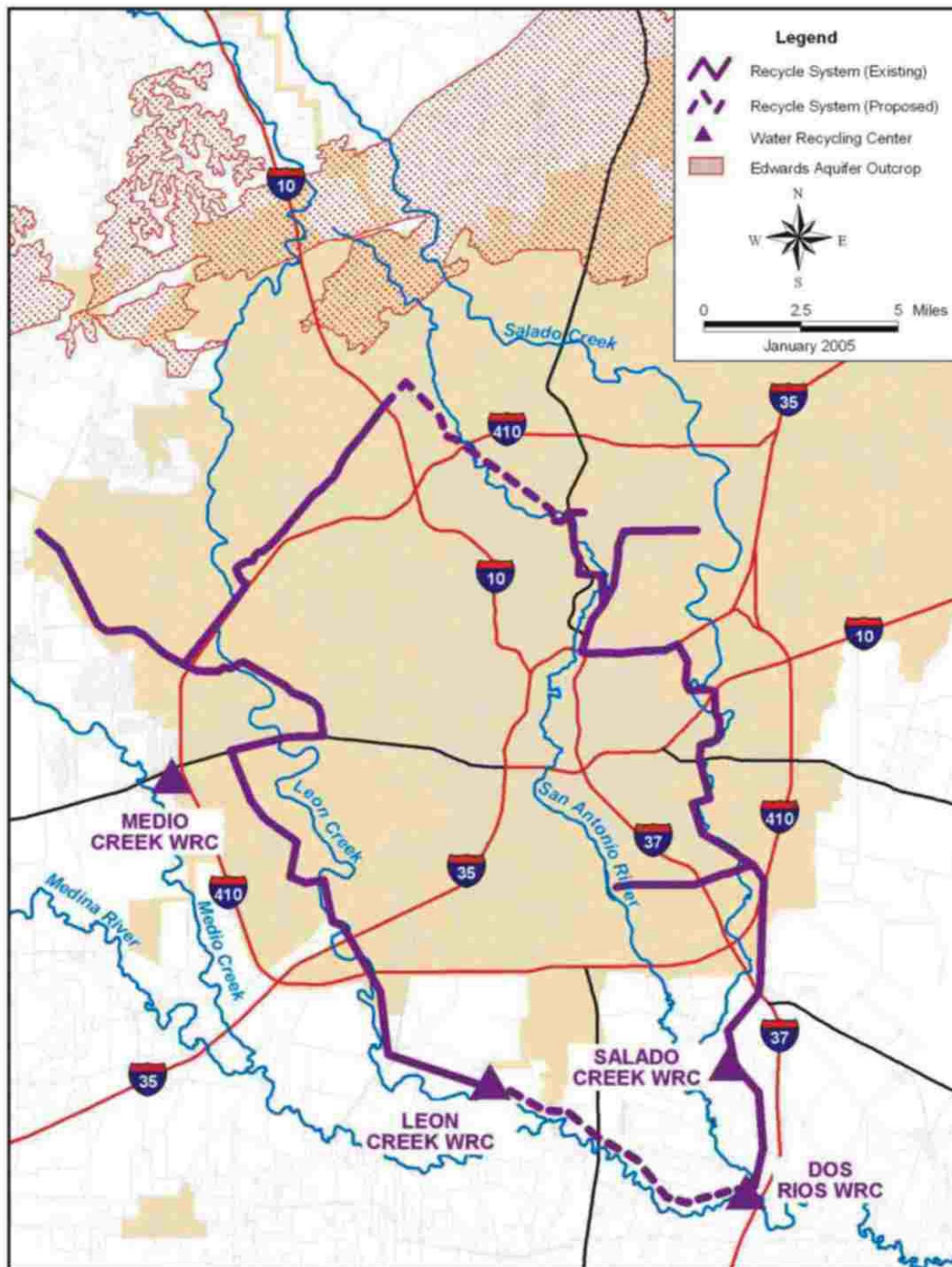


Figure 4C.3-1. Map of City of San Antonio Showing Phases I and II of Recycle Program

estimated future quantities of recycled water potentially available for use in San Antonio, after adjusting projected demands to account for recommended municipal water conservation projections for San Antonio (Section 4C.1.1, Table 4C.1-10, Vol. II), increase from 18,712 acft/y in 2010 to 36,258 acft/yr in 2060 (Table 4C.3-1). The projected remaining effluent, after

accounting for quantities of use by SAWS recycle programs that is likely to be discharged to the San Antonio River and/or tributary streams increases from 65,479 acft/yr in 2010 to 91,798 acft/yr in 2060 (Table 4C.3-1). These projected effluent volumes will be available for downstream water rights, reclamation through bed and banks transfer, and instream uses.

The projected quantities of potentially available recycle water for industrial, steam-electric power generation and mining uses in Comal, Guadalupe, and Hays Counties increase from 587 acft/y in 2010 to about 4,600 acft/yr in 2060.

**Table 4C.3-1.
Estimated Potential Quantities of Recycled Water¹
San Antonio Water System**

	2000 acft	2010 acft	2020 acft	2030 acft	2040 acft	2050 acft	2060 acft
Projected Demand							
Municipal	172,815	198,065	220,078	241,043	256,842	272,214	287,593
Industrial	21,252	25,951	29,497	32,775	36,068	38,965	42,112
Conservation (-)		5,752	7,318	8,795	10,490	15,698	23,711
Net Projected Demand ²	194,067	218,264	242,257	265,023	282,420	295,481	305,994
Estimated Total Effluent ³	116,440	130,958	145,354	159,014	169,452	177,289	183,596
Current Recycle Quantities ⁴	24,941	24,941	24,941	24,941	24,941	24,941	24,941
Future Recycle Quantities		18,712	23,510	28,064	31,543	34,155	36,258
Total Recycle Goal ⁵	38,813	43,653	48,451	53,005	56,484	59,096	61,199
Remaining Effluent	77,627	87,306	96,903	106,009	112,968	118,192	122,398
¹ All quantities in acre-feet per year. ² SAWS municipal demand plus Bexar County industrial demand less municipal water conservation projections for SAWS. ³ Calculated as 60 percent of Net Projected Demand. ⁴ Quantity shown is estimated consumptive use of recycled water. System capacity is about 35,000 acft/yr. ⁵ Calculated as 20 percent of Net Projected Demand.							

4C.3.3 Environmental Issues

It is likely that further expansion of the water recycling system will encounter environmental issues and concerns similar to those encountered in the implementation of the existing system. Expansion of the SAWS Recycled Water Program will occur within Bexar County, which lies at the junction of the Edwards Plateau (thin, rocky soils), Blackland Prairie (thick, clayey soils), and Rio Grande Plains (sandy soils) physiographic provinces. Bexar County is drained by tributaries of the Medina and San Antonio Rivers and underlain by the Edwards Aquifer from which San Antonio and San Pedro Springs periodically emanate. Flora and fauna of Bexar County are representative of the Edwards Plateau, Blackland Prairie, and South Texas Plains vegetation areas. Urban and agricultural development within the county have had an influence on native terrestrial, riparian, and aquatic biota and have created cultural resources of historical, archaeological, and socio-economic importance.

As indicated in Table 4C.3-1, treated effluent quantities in excess of those planned to be recycled are expected to increase throughout the 50-year planning horizon as a result of increasing water use and development of new water supplies from downstream, out-of-basin, and/or groundwater sources. Hence, downstream flows in the San Antonio River are expected to increase over time, potentially resulting in improved reliability of existing water rights, enhanced instream uses, and additional freshwater inflows to the Guadalupe Estuary.

Applicable regulations define three classifications of recycled water based on the level of water quality as reflected in measurable parameters including BOD5, turbidity, and fecal coliform. SAWS expects to utilize only Type I recycled water which is of high quality and can be used in areas where the likelihood of public contact may be high. Non-food crops and landscaped areas may be irrigated using Type I recycled water without restriction, however, food crops so irrigated must be processed prior to human consumption. Water produced by the Salado, Leon, and Dos Rios Water Recycling Centers presently complies with the specified quality parameters for Type I recycled water. Significant environmental impacts from the expanded reuse program are more likely to arise from utility construction than from the quality of the recycled water.

Implementation of an expanded distribution system for recycled water will occur in predominantly urban areas and likely be concentrated in existing utility easements and previously disturbed floodplains. Evaluations of new utility easements and stream crossings for

potential impacts to endangered species or unique habitats prior to clearing or construction will provide the information needed to avoid those impacts.

Endangered species listed for Bexar County (Table 4C.3-2) include the Black-capped Vireo, Golden-cheeked Warbler, two migratory bird species, six arachnids, and three beetles. Some care may be necessary should recycled water pipelines traverse preferred habitat for these endemic species. Black-capped Vireos are insectivorous songbirds that nest in low shrubland.

Thickets where vegetation extends to ground level. Golden-cheeked Warblers prefer habitat consisting of mature oak-juniper woodlands located along steep escarpments and canyons. The listed invertebrate species (arachnids and beetles) are all endemic to karst features or caves located in north and northwest Bexar County. The listed migratory bird species tend to avoid areas of concentrated human development.

Cultural resources protection on public lands in Texas is afforded by the Antiquities Code of Texas (Title 9, Chapter 191, Texas Natural Resource Code of 1977), the National Historic Preservation Act (PL96-515), and the Archeological and Historic Preservation Act (PL93-291). Based on the review of available records housed at the Texas Archeological Research Laboratory in Austin, eight cultural resource sites appear to occur within the proposed project area. Table 4C.3-3 lists the archeological sites within a one-mile corridor of the SAWS Recycled Water Program project area. Considering that the owner or controller of the project will likely be a political subdivision of the State of Texas (i.e. river authority, municipality, county, etc.), they will be required to coordinate with the Texas Historical Commission regarding if the project will affect waters of the United States or wetlands, the project sponsor will also be required to coordinate with the U.S. Army Corps of Engineers regarding impacts to cultural resources.

4C.3.4 Engineering and Costing

The planned expansion of the SAWS Recycled Water Program would more than double the distribution capacity of the existing system during the next fifty-five years. Other than the planned Southern Interconnections of the water recycling centers (wastewater treatment facilities) and the Northern Interconnection of the existing distribution systems, specific elements of an expanded system are unknown at this time. Hence, estimates of cost for expansion of system capacity by 36,258 acft/yr by 2060 are based upon actual and projected costs for

Table 4C.3-2
Important Species* Having Habitat or Known to Occur
in County Potentially Affected by
San Antonio Water System (SAWS) Recycled Water Program; Phased Expansion (L-21)

Common Name	Scientific Name	Impact Value	Multiplier Based on Status	Adjusted Impact	Summary of Habitat Preference	Listing Entity		Potential Occurrence in County
						USFS ¹	TPWD ¹	
American Peregrine Falcon	<i>Falco peregrinus anatum</i>	0	3	0	Open country; cliffs	DL	E	Nesting/ Migrant
Arctic Peregrine Falcon	<i>Falco peregrinus tundrius</i>	0	2	0	Open country; cliffs	DL	T	Nesting/ Migrant
Big Red Sage	<i>Salvia penstemonoides</i>	2	1	2	Moist Creek and stream bed edges; historic; introduced in native plant nursery trade			Resident
Black Bear	<i>Ursus americanus</i>	0	2	0	Mountains, broken country, woods, brushlands, forests	T/SA; NL	T	Resident
Black-capped Vireo	<i>Vireo atricapillus</i>	0	3	0	oak-juniper woodlands with distinctive patchy, two-layered aspect; shrub and tree layer with open, grassy spaces	LE	E	Nesting/ Migrant
Black Spotted Newt	<i>Notophthalmus meridionalis</i>	1	2	2	Found in wet or sometimes wet areas, such as arroyos, canals, ditches, or shallow depressions; Gulf Coastal Plain of the San Antonio River		T	Resident
Braken Bat Cave Meshweaver	<i>Cicurina venii</i>	0	3	0	Small eyeless spider, in Karst features in western Bexar County.	LE		Resident
Bracted twistflower	<i>Streptanthus bracteatus</i>	2	1	2	endemic, openings in juniper-oak woodlands, rocky slopes			Resident
Cagle's Map Turtle	<i>Graptemys caglei</i>	1	2	2	Guadalupe River System, transition areas between riffles and pools, nests within 30 ft of water's edges	C1	T	Resident
Cave Myotis Bat	<i>Myotis velifer</i>	2	1	2	colonial, and cave dwelling; hibernates in limestone caves of Edwards Plateau			Resident
Cokendolpher Cave Harvestman	<i>Texella cokendolpheri</i>	0	3	0	Small eyeless harvestman, karst features in north-central Bexar county.	LE		Resident
Comal Blind Salamander	<i>Eurycea tridentifera</i>	0	2	0	Endemic; semi-troglobitic; found in springs and waters of caves in Bexar and Comal Co		T	Resident

Table 4C.3-2 (Continued)

Correll's false dragon-head	<i>Physostegiacorrellii</i>	1	1	1	Wet soils including roadside ditches, irrigation channels			Resident
Edwards Plateau Spring Salamander	<i>Eurycea sp. 7</i>	1	1	1	Endemic; troglitic; springs, seeps, cave streams, and creek headwaters			Resident
Elmendorf's Onion	<i>Allium elmendorffii</i>	1	1	1	Endemic; deep sands derived from Queen City and similar Eocene formations			Resident
Golden-cheeked Warbler	<i>Dendroica chrysoparia</i>	0	3	0	Juniper-oak woodlands; dependent on mature Ashe juniper (cedar) for nests	LE	E	Nesting/ Migrant
Government Canyon Bat Cave Spider	<i>Neoleptoneta microps</i>	0	3	0	Small, eyeless or essentially eyeless spider; karst features in N and NW Bexar Co.	LE		Resident
Government Canyon Bat Cave Spider	<i>Neoleptoneta microps</i>	0	3	0	Small, eyeless or essentially eyeless spider; karst features in N and NW Bexar Co.	LE		Resident
Government Canyon Bat Cave Meshweaver	<i>Cicurina vespera</i>	0	3	0	Small, eyeless spider, karst features in northwestern Bexar County.	LE		Resident
Ground Beetle #1	<i>Rhadine exilis</i>	0	3	0	Eyeless beetle, karst features in northern Bexar County.	LE		Resident
Ground Beetle #2	<i>Rhadine infernalis</i>	1	3	1	Small eyeless ground beetle; karst features in northern and western Bexar County.	LE		Resident
Guadalupe Bass	<i>Micropterus treculi</i>	1	1	1	Perennial streams of the Edward's plateau region			Resident
Helotes Mold Beetle	<i>Bastrisodes venyivi</i>	1	3	3	Small, essentially eyeless mold beetle; karst features in N and NW Bexar Co.	LE		Resident
Henslow's Sparrow	<i>Ammodramus henslowii</i>	1	1	1	Weedy fields or cut over areas; bare ground for running and walking			Nesting/ Migrant
Indigo Snake	<i>Drymarchon corais erebennus</i>	1	2	2	Grass prairies and sand hills; usually thornbush woodland and mesquite savannah of coastal plain		T	Resident
Keeled Earless Lizard	<i>Holbrookia propinqua</i>	1	1	1	Coastal dunes, Barrier islands and sandy areas			Resident
Madla's Cave Spider	<i>Cicurina madla</i>	1	3	3	Small, eyeless or essentially eyeless spider; karst features in N and NW Bexar Co.	LE		Resident
Manfreda Giant-skipper	<i>Stallingsia maculosus</i>	0	1	0	Small insect.			Resident
Mimic Cavesnail	<i>Phreatodrobia imitata</i>	0	1	0	Subaquatic found in two wells penetrating the Edwards Aquifer			

Table 4C.3-2 (Concluded)

Mountain Plover	<u>Charadrius montanus</u>	1	1	1	Non-breeding-shortgrass plains and fields, plowed fields and sandy deserts			Nesting/ Migrant
Parks' Jointweed	<i>Polygonella parksii</i>	1	1	1	South Texas Plains; subherbaceous annual in deep loose sands, spring-summer			Resident
Plains Spotted Skunk	<i>Spilogale putorius interrupta</i>	0	1	0	Prefers wooded, brushy areas and tallgrass prairie, fields, prairies, croplands, fence rows, farmyards, forest edges			Resident
Robber Baron Cave Spider	<i>Cicurina baronia</i>	1	3	3	Small, eyeless or essentially eyeless spider; karst features in N and NW Bexar Co.	LE		Resident
Sandhill woollywhite	<i>Hymenopappuscar rizoanus</i>	1	1	1	Endemic, deep loose sands of Carrizo, disturbed areas			Resident
Spot-tailed earless Lizard	<i>Holbrookia lacerata</i>	1	1	1	Central & Southern Texas; oak-juniper woodlands and mesquite-prickly pear			Resident
Texas Garter Snake	<i>Thamnophis sirtalis annectens</i>	1	1	1	Varied, especially wet areas; bottomlands and pastures			Resident
Texas Horned Lizard	<i>Phrynosoma cornutum</i>	1	2	2	Varied, sparsely vegetated uplands, grass, cactus, brush		T	Resident
Texas Salamander	<u>Eurycea neotenes</u>	1	2	2	Endemic, in caves, springs and seeps.		T	Resident
Texas Tortoise	<i>Gopherus berlandieri</i>	1	2	2	Open brush with grass understory; open grass and bare ground avoided; occupies shallow depressions at base of bush or cactus, underground burrows, under objects; active March-Nov		T	Resident
Toothless Blindcat	<i>Trogloglanis pattersoni</i>	0	2	0	Troglobitic, blind catfish endemic to the San Antonio pool of the Edward's Aquifer		T	Resident
White-faced Ibis	<i>Pelagus chihi</i>	0	2	0	Prefers freshwater marshes, sloughs, and irrigated rice fields		T	Migrant
Whooping Crane	<i>Grus americana</i>	0	3	0	Potential migrant	LE	E	Migrant
Widemouth Blindcat	<i>Satan eurystomus</i>	1	2	2	troglobitic, blind catfish endemic to the San Antonio pool of the Edward's Aquifer		T	Resident
Wood Stork	<i>Mycteria americana</i>	1	2	2	Forages in prairie ponds, ditches, and shallow standing water formerly nested in TX		T	Migrant
Zone-tailed Hawk	<i>Buteo albonotatus</i>	1	2	2	Arid, open country including deciduous or pine-oak woodland; nests in various habitats and sites		T	Nesting/ Migrant
<p>¹Texas Parks and Wildlife Department (TPWD), Unpublished 2005, March 2005, Data and Map Files of the Wildlife Science Research and Diversity Division maintained by TPWD, Austin, Texas.</p> <p>* LE/LT= Federally Listed Endangered/Threatened E/SA, T/SA= Federally Listed Endangered/Threatened by Similarity of Appearance C1= Federal Candidate for Listing DL, PDL= Federally Delisted/Proposed for Delisting NL= not Federally Listed E, T= State Listed Endangered/Threatened PE, PT= Federally Proposed Endangered/ Threatened Blank = Rare, but no regulatory listing status</p>								

**Table 4C.3-3.
Previously Recorded Sites within 1-Mile Corridor of the
Proposed Southern and Northern Interconnections
SAWS Recycled Water Program.**

Sites	41BX120
	41BX124
	41BX125
	41BX226
	41BX1152
	41BX567
	41BX1572
	41BX1575

development of the existing 35,000 acft/yr system, which was \$125,300,000 (1999 dollars)⁵ plus estimated costs for the planned interconnections (remaining Southern (Leon Creek WRC to Dos Rios WRC) = \$6,157,000 and Northern = \$8,225,000 – both in 2004 dollars).⁶ Assuming debt service at an annual percentage rate of 6 percent for 30 years, the annual unit cost for development of the existing system was about \$260 per acft (1999 dollars). Applying this unit cost to the planned 36,258 acft/yr expansion of system capacity and adding estimated costs for the planned interconnections results in a Total Project Cost for expansion of the SAWS Recycled Water Program of about \$154,764,000, adjusted to second quarter 2002 dollars. Amortizing this Total Project Cost and accounting for estimated operations and maintenance and pumping energy costs results in an estimated Total Annual Cost of \$15,742,107 and an Annual Unit Cost of Water of \$434 per acft or \$1.33 per 1000 gallons).

The Cities of New Braunfels, San Marcos, and Seguin are selling treated municipal effluent to steam-electric power plants and mining operations at prices ranging from \$108/acft to about \$485/acft.

4C.3.5 Implementation Issues

Since SAWS has successfully implemented substantial phases of its Recycled Water Program, there do not appear to be major implementation issues to overcome in expansion of the program. Implementation of recommended Recycled Water Programs to meet projected water needs in Comal, Guadalupe, and Hays Counties will require the negotiation of supply agreements

⁵ San Antonio Express-News, December 8, 1999.

⁶ San Antonio Water System, Personal Communication, February, 1 2005.

between entities treating wastewater and water user groups seeking to purchase treated wastewater. Significant factors in such agreements may include points of delivery and financial responsibility for transmission systems to convey water from source to user. If transmission is to be accomplished via the bed and banks of a stream or river, certain authorizations may need to be obtained from the Texas Commission on Environmental Quality.

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