EAST TEXAS REGIONAL WATER PLANNING AREA

2011 UPDATE OF THE REGIONAL WATER PLAN
FINAL PLAN

SEPTEMBER 1, 2010

EAST TEXAS
Regional Water Planning Group

ALAN PLUMMER ASSOCIATES, INC.

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List of Abbreviations/Acronyms

2006 Plan	2006 East Texas Regional Water Plan
2011 Plan	2011 East Texas Regional Water Plan
°F	degrees Fahrenheit
ac-ft per year	acre-feet per year
A-N WCID No. 1	Angelina-Nacogdoches Water Control & Improvement District No. 1
ANRA	Angelina and Neches River Authority
BBASC	Bay Basin and Bay Area Stakeholder Committee
BBEST	Bay and Basin Expert Science Team
bgl	below ground level
cfs	cubic feet per second
DB12	2010 Regional Water Planning Data Web Interface
DFCs	desired future conditions
ES	Executive Summary
ETRWPA	East Texas Regional Water Planning Area or Region I
ETRWPG	East Texas Regional Water Planning Group
GAM	groundwater availability model
GCD	groundwater conservation district
GMA	groundwater management areas
gpcd	gallons per capita per day
gpm	gallons per minute
HCWCID No. 1	Houston County Water Control & Improvement District No. 1
IFR	infrastructure financing report

List of Abbreviations/Acronyms (Cont.)

LNVA	Lower Neches Valley Authority
LNG	liquid natural gas
MAG	managed available groundwater
MCLs	maximum contaminant levels
mg/L	milligrams per liter
MGD	million gallons per day
msl	mean sea level
MW	megawatts
MWA	municipal water authority
MWD	municipal water district
No.	number
NRCS	National Resources Conservation Service
PCFWSD No. 1	Panola County Freshwater Supply District No. 1
pCi/L	picocuries per liter
ppt	parts per thousand
RWPs	Regional Water Plans
SB 1	Senate Bill 1
SB 2	Senate Bill 2
SB 3	Senate Bill 3
SDWA	Safe Drinking Water Act
SFA	Stephen F. Austin State University
SRA	Sabine River Authority
STATSGO	State Soil Geographic Database
SUD	special utility district

List of Abbreviations/Acronyms (Cont.)

SWPs	State Water Plans
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TCRP	Texas Clean Rivers Program
TDS	total dissolved solids
TDSHS	Texas Department of State Health Services
THC	Texas Historical Commission
TMDL	total maximum daily load
TPWD	Texas Parks and Wildlife Department
TSDC	Texas State Data Center
TWC	Texas Workforce Commission
TWDB	Texas Water Development Board
TXBCD	Texas Biological and Conservation Data System
μg/L	micrograms per liter
UWCD	underground water conservation district
UNRMWA	Upper Neches River Municipal Water Authority
USACE	United States Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAM	Water Availability Model
WMA	wildlife management area
WMSs	water management strategies
WSC	water supply corporation
WUGs	water user groups
WWP	wholesale water provider

List of Water Measurement Conversions

1 ac-ft	=	325,851 gallons
1 cfs	=	448.8 gpm
1 liter per second	=	15.85 gpm
1 MGD	=	1,120 ac-ft per year
1 MGD	=	694.444 gpm

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Executive Summary

In 1997 the State Legislature, through Senate Bill 1, determined that water planning should be accomplished at a regional level rather than with the centralized approach employed previously by the Texas Water Development Board (TWDB). To accomplish this task, the TWDB divided the state into 16 regional water planning areas and appointed representational Regional Water Planning Groups (RWPGs) to guide the development of each region's plan. In 2001, revised rules and guidelines from the TWDB were enacted through Senate Bill 2. The planning process is cyclic, with updated Regional Water Plans and State Water Plans produced every five years.

The designated water planning area for the east and southeast portions of Texas is the East Texas Regional Water Planning Area (ETRWPA), also known as Region I or the East Texas Region. The water planning process in the ETRWPA is guided by the East Texas Regional Water Planning Group (ETRWPG). These individuals are charged with the responsibility for development of the 2011 update to the ETRWPA water plan (the 2011 Plan). The ETRWPG is currently comprised of the following voting members representing specific community interests:

- David Alders - Agriculture
- Jeff Branick - Counties
- David Brock - Municipalities
- George Campbell - Other
- Jerry Clark - River Authorities
- Josh David - Other
- Chris Davis – Counties
- Mark Dunn – Small Businesses
- Michael Harbordt - Industries
- William Heugel – Public
- Dr. Joe Holcomb – Small Businesses
- Kelley Holcomb - Water Utilities
- Bill Kimbrough - Other
- Glenda Kindle - Public
- Duke Lyons - Municipalities
- Dale Peddy - Electric Power

- Hermon Reed - Agriculture
- Monty Shank - River Authorities
- Darla Smith - Industries
- Scott Hall - River Authorities
- Worth Whitehead - Water Districts
- Leon Young - Environment

At its core, the regional water planning process involves the evaluation of water demands, identification of water supplies, and development of water management strategies designed to meet potential water shortages. However, the process also involves the evaluation of a broad range of issues that directly relate to water planning. Some of these issues notably include protection of natural resources and agricultural resources, water conservation and drought contingency, and water management strategy quantity, reliability, and cost.

Regional water planning in the ETRWPA is a public process, involving frequent public meetings of the ETRWPG, careful consideration of the requests and needs of the various water user groups in the region, and an understanding of the need to allow for public comment throughout the planning cycle. For an in-depth discussion of any of the topics addressed in this Executive Summary, the reader is referred to the full report document of the 2011 Plan. An electronic copy of the Final 2011 Plan is available online at the ETRWPA website: http://www.etexwaterplan.org/ and at the TWDB website: http://twdb.state.tx.us.

ES.1 Regional Description

The ETRWPA consists of all or portions of the following 20 counties located in the Neches, Sabine, and Trinity River Basins, and the Neches-Trinity Coastal Basin:

Anderson	Jefferson	Rusk
Angelina	Nacogdoches	Sabine
Cherokee	Newton	San Augustine
Hardin	Orange	Shelby
Henderson(partial)	Panola	Smith (partial)
Houston	Polk (partial)	Trinity (partial)
Jasper	Rusk	

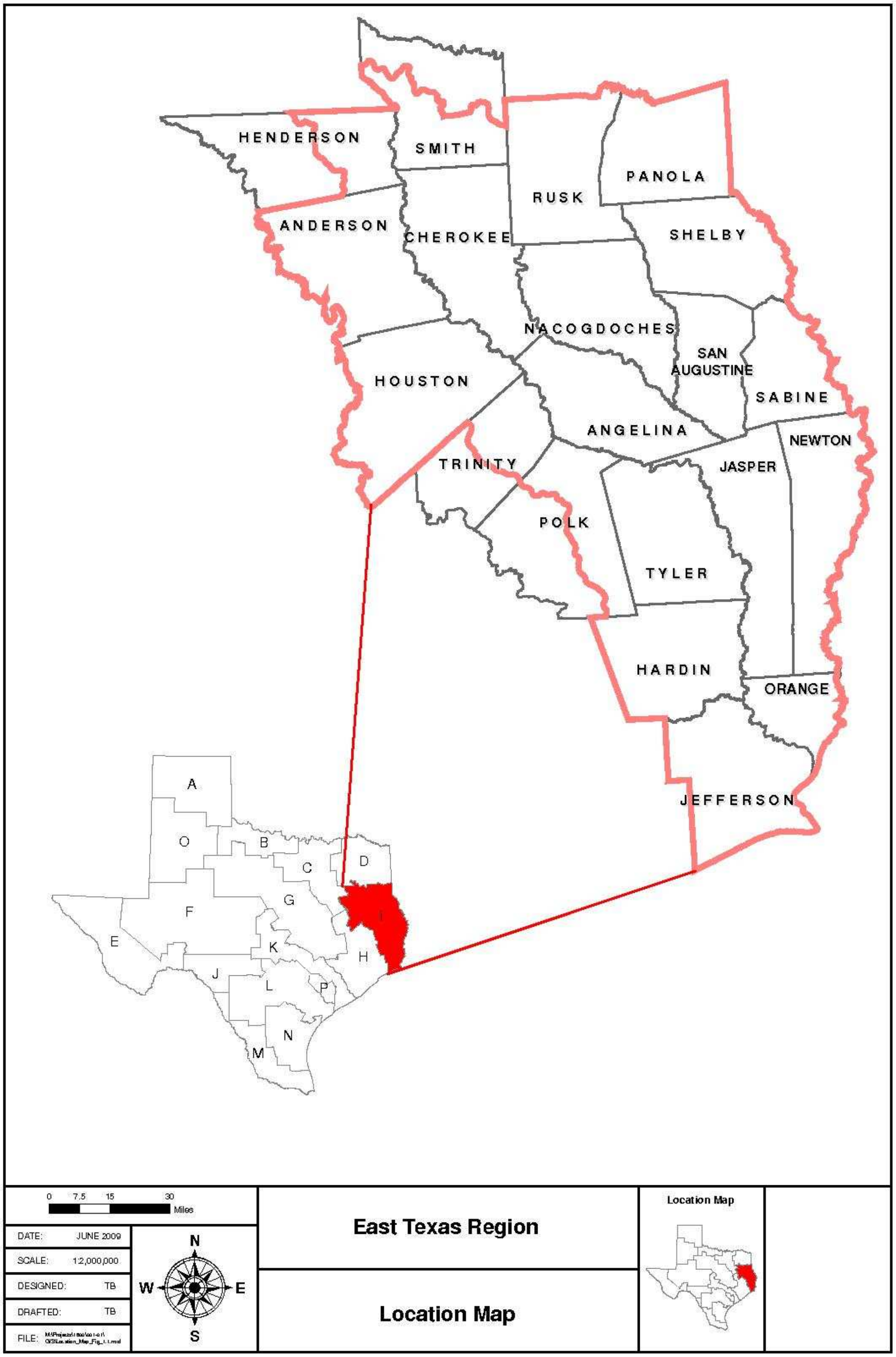
The region extends from the southeastern corner of the state for over 150 miles north and northwest as illustrated on Figure ES.1. The ETRWPA consists of approximately 10,329,800 acres of land, accounting for roughly six percent of the total area of the State of Texas.

Much of the ETRWPA is forested, supporting various types of timber industry. Plant nurseries are common in portions of the region. Oil production is scattered throughout the region, and beef cattle are prominent. Poultry production and processing are prevalent in Shelby and Nacogdoches Counties and very significant in Angelina and Panola Counties. There is diverse manufacturing in addition to timber industries. Commercial fishing is an important economic characteristic of Sabine Lake. Tourism is important in many areas, especially on and around large reservoirs, Sabine Lake, and the Gulf of Mexico. Timbered areas include a number of state parks and national forests, etc., that offer recreational and hunting opportunities.

Agriculture is a vital component of the ETRWPA economy and culture. According to the United States Department of Agriculture, the 20 counties that make up the ETRWPA contain over 9,000 farms with a total of over a million acres of crop land.

ES.2 Regional Population and Water Demands

Projecting the demand for water over the planning period is a crucial element of planning. Water demands were developed for six categories of use, including municipal, manufacturing, irrigation, steam-electric, mining, and livestock. Before municipal demands can be estimated, however, population projections must be developed. A summary of the population and water demand projections, as well as demand projections for wholesale water providers follows.


HENDERSON
SMITH
PANOLA
RUSK
ANDERSON
CHEROKEE
SHELBY
NACOGDOCHES
SAN AUGUSTINE
HOUSTON
SABINE
ANGELINA
NEWTON
TRINITY
JASPER
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East Texas Region
Location Map
Location Map

ES.2.1 Population Projections. In the 2006 Plan, the population of the ETRWPA was projected to increase from approximately 1.09 million people in 2010 to almost 1.5 million in 2060. For the 2011 Plan, the TWDB directed all regions to retain the population projections from the 2006 Plan for the 2011 update. The ETRWPG decided to keep the population projections for each county in the region at the level identified in the 2006 Plan, as well. Population shifts within counties were confined to Angelina and Nacogdoches Counties, where five new water user groups (WUGs) were identified.

It should be noted that for Smith County, and particularly for the City of Tyler, population estimates for the 2011 Plan are significantly below the Texas State Data Center estimates for population. This understatement of population for the City of Tyler could present a significant problem for water planning in the ETRWPA in the future if not corrected. Other water suppliers including the City of Nacogdoches and Woodville expressed concerns regarding a possible underestimate of population. .The ETRWPG's expectation is that the population of the region's constituent cities and counties will be appropriately adjusted in the next round of planning, based on the 2010 census, and that population projections will be more accurately reflected for Smith County and the City of Nacogdoches and Woodville.

ES.2.2 Water Demand Projections. Total water demand for the ETRWPG has been projected for the 2010 to 2060 planning period for six categories of water use, and is summarized as follows:

Water User Category	2010	2020	2030	2040	2050	2060
Municipal	189,559	196,828	202,761	208,193	218,705	233,622
Manufacturing	299,992	591,904	784,140	821,841	857,902	893,476
Irrigation	151,100	151,417	151,771	152,153	152,575	153,040
Steam-Electric	44,985	80,989	94,515	111,006	131,108	155,611
Livestock	23,613	25,114	26,899	29,020	31,546	34,533
Mining	21,662	37,297	17,331	18,385	19,432	20,314
Total for Region	**730,911**	**1,083,549**	**1,277,417**	**1,340,598**	**1,411,268**	**1,490,596**

The following changes to demand are included in the 2011 Plan:

- Increased steam-electric water demand in Angelina County.
- Municipal water demands for newly identified WUGs in Angelina and Nacogdoches Counties (no net change on a county-wide basis).
- Reduced manufacturing water demand for Angelina County.
- Increased manufacturing water demand for Jefferson County.
- Reduced irrigation water demands for Hardin and Jefferson Counties.
- Increased mining water demands in Angelina, Cherokee, and Nacogdoches Counties.
- New mining water demands for Shelby and San Augustine Counties.

ES.2.3 Wholesale Water Provider Demand Projections. Wholesale water providers are those that have contracts to sell more than 1,000 acre-feet per year (ac-ft per year) of water wholesale. Water may be provided wholesale either to municipal or manufacturing customers. As required, the ETRWPG must include such entities individually in the water plan. Wholesale water providers identified in the ETRWPA include the following:

- Angelina and Neches River Authority
- Angelina-Nacogdoches Water Control and Improvements District No. 1
- Athens Municipal Water Authority
- City of Beaumont
- City of Carthage
- City of Center
- City of Jacksonville
- City of Lufkin
- City of Nacogdoches
- City of Port Arthur
- City of Tyler
- Houston County WCID No. 1
- Lower Neches Valley Authority
- Panola County Freshwater Supply District No. 1
- Sabine River Authority
- Upper Neches River Municipal Water Authority

ES.3 Water Supplies in the East Texas Regional Water Planning Area

The ETRWPG identified currently available water supplies to the region by source and user. The supplies available by source are based on the supply available during drought-of-record conditions. Surface water and groundwater represent the primary types of sources of water supply, although there are other potentially significant types of sources as well. A summary of the available supplies within the ETRWPA follows:

Source of Supply	2000	2010	2020	2030	2040	2050	2060
Reservoirs (permitted)	1,966,474	1,962,698	1,958,512	1,954,328	1,950,141	1,945,955	1,941,769
Reservoirs (unpermitted)	340,300	330,874	321,857	312,841	303,825	294,808	285,790

Run-of-the-River (freshwater)	623,004	623,004	623,004	623,004	623,004	623,004	623,004
Run-of-the-River (brackish)	1,035,982	1,035,982	1,035,982	1,035,982	1,035,982	1,035,982	1,035,982
Groundwater	446,043	446,043	446,043	446,043	446,043	446,043	446,043
Local Supplies	13,094	13,094	13,094	13,094	13,094	13,094	13,094
Direct Reuse	1,518	1,518	1,518	1,518	1,518	1,518	1,518
Indirect Reuse	16,559	16,559	13,687	13,687	13,687	13,687	13,687
Total	**4,442,974**	**4,429,772**	**4,413,697**	**4,400,497**	**4,387,294**	**4,374,091**	**4,360,887**

Surface water supplies were determined using the TCEQ-approved Water Availability Models. In the ETRWPA, four river basins were evaluated: Neches, Neches-Trinity, Trinity, and Sabine.

In Texas, joint groundwater planning is conducted by Groundwater Conservation Districts. The counties in the ETRWPA fall into Groundwater Management Areas-11 or -14. The Texas Water Code now requires that the ETRWPG rely on estimates made by the Groundwater Management Areas that are determined from desired future conditions in the aquifer. However, desired future conditions were not established by the Groundwater Management Areas in the ETRWPA within the time frame required to be included in this regional water plan. Therefore, groundwater supplies have not been modified from the 2006 Plan.

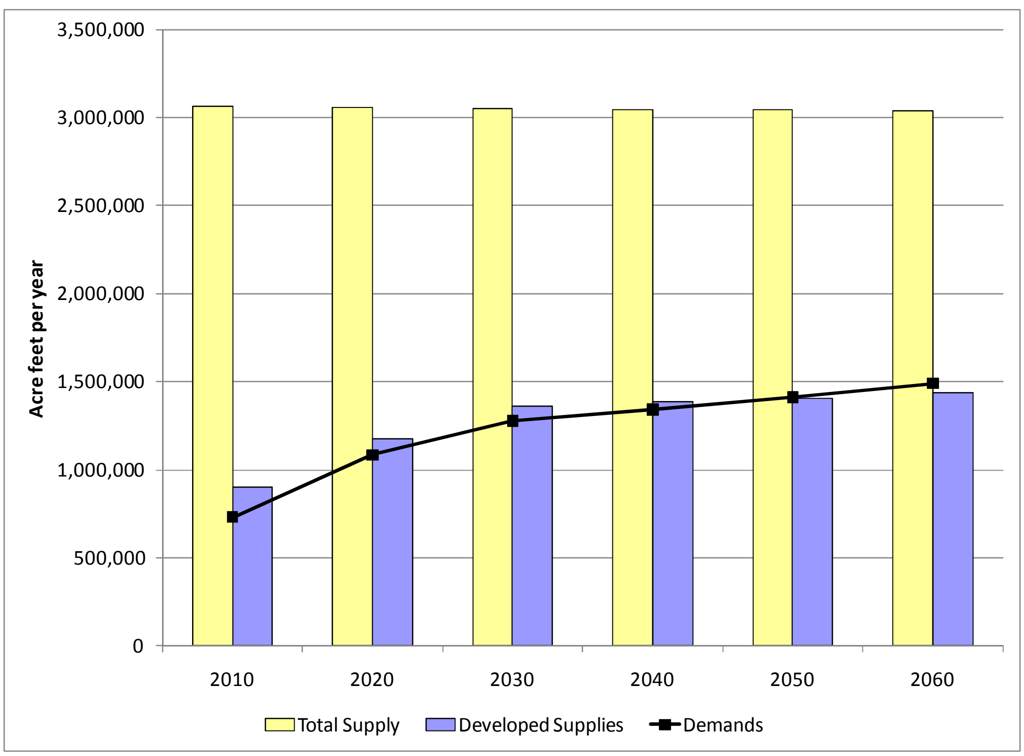
Other water supplies considered for planning purposes include reuse of treated wastewater, saline sources, and local supplies. Local supplies generally include stock ponds that do not require water rights permits, and local mining supplies. These supplies are assessed based on historical and current use.

ES.4 Water Management Strategies to Meet the Region's Needs

The development of water management strategies (WMSs) to meet projected water demands is a central element of water planning. The process of strategy development includes a comparison of demand to supplies, identification of shortages, and identification and evaluation of water management strategies to meet the shortages.

Figure ES.2 summarizes the comparison of total currently available water supply and total projected water demand for the ETRWPA. The region as a whole has a currently available surplus of 169,352 ac-ft per year in 2010, changing to a shortage of nearly 3,000 ac-ft per year by 2050, and increasing to a shortage of 55,867 by 2060. However, because not all water is available in all places, location-specific shortages can, and do, occur throughout the region. The actual total shortages of individual WUGs in the ETRWPA total 182,145 ac-ft per year by 2060.

Figure ES.2 Comparison of Regional Water Supplies to Demands



On a regional basis, sufficient supplies exist for municipal and irrigation water uses. Regional shortages are identified for manufacturing, steam-electric power, mining and livestock. The largest percentage of shortages is attributed to anticipated steam-electric power plant development in the region. The steam-electric power shortages are for projected growth that currently does not have an identified source or infrastructure. Most of the manufacturing shortages are the result of considerable growth in demands and supplies that are limited to existing contract amounts. Mining shortages are largely associated with new mining demands associated with natural gas development and mining demands in Hardin County that are no longer substantiated based on current use. Livestock water use is also expected to grow in some counties, which will require the development of additional resources and/or infrastructure. Even though the municipal water use shows a net surplus in every decade of the planning period, there are individual cities that are projected to have shortages during the planning period.

Twelve counties are identified with shortages over the planning horizon, with Anderson, Angelina, Nacogdoches, Newton, and Orange Counties having the largest projected shortages by 2060. Anderson and Angelina Counties are expected to have the largest percent shortages (52 and 57 percent) in 2060, and Tyler County is expected to have the largest percentage surplus (48 percent) in 2060. Projected surpluses and shortages by county for each decade of the planning period are summarized below.

County	Projected Shortages (ac-ft per year)					
	2010	2020	2030	2040	2050	2060
Anderson	4,230	-7,508	-9,688	-12,284	-15,428	-19,218
Angelina	-6,089	-18,070	-18,362	-23,058	-28,317	-34,632
Cherokee	4,788	3,373	4,595	4,393	4,065	3,532
Hardin	-5,080	-6,417	-7,120	-7,830	-8,645	-9,434
Henderson (P)	2,818	876	387	-89	-700	-1,455
Houston	2,012	1,536	973	370	-339	-1,154
Jasper	2,932	2,728	2,670	2,762	2,808	2,808
Jefferson	71,958	58,255	55,789	52,733	49,251	44,206
Nacogdoches	9,720	5,385	9,013	5,305	-6,827	-12,638

Newton	10,895	2,551	96	-2,930	-6,615	-11,096
Orange	19,110	13,537	6,890	141	-6,391	-13,947
Panola	4,321	4,028	3,849	3,686	3,512	3,252
Polk (P)	290	-75	-374	-602	-773	-959
Rusk	26,188	23,243	18,482	12,802	5,672	-3,305
Sabine	1,369	1,226	1,103	971	814	637
San Augustine	-1,419	-7,004	-104	-224	-380	-549
Shelby	1,059	-1,182	-1,072	-2,621	-4,504	-6,827
Smith (P)	17,874	15,669	13,707	11,744	8,163	3,167
Trinity (P)	128	94	90	73	50	25
Tyler	2,249	1,922	1,729	1,696	1,725	1,720
TOTAL	**169,352**	**94,167**	**82,653**	**47,038**	**-2,859**	**-55,867**

Note: The sum of needs by county shown in the table above is based on total supplies to the county less the total county demands. The sum of the individual needs of water user groups within a county will differ. These needs are shown in Chapter 4A, Table 4A.5

For the ETRWPA, 68 WUGs were identified with shortages that cannot be met by existing infrastructure and/or water supplies. A total of five wholesale water providers were identified as having shortages that cannot be met by existing infrastructure and/or supplies.

The ETRWPG evaluated long-term WMSs available to meet the demands in the ETRWPA. The strategies considered include the following:

- Water conservation and drought management
- Wastewater reuse
- Expanded use of existing supplies
- New supply development
- Interbasin transfers

Water management strategies and alternate water management strategies were evaluated using screening criteria established by the ETRWPG in order to assess the feasibility of the strategies. These criteria were adopted as guidelines, and strategies could be retained or dismissed at the discretion of the ETRWPG. The screening criteria included the following:

- The strategy must have an identified sponsor or authority.
- The strategy must consider the end use. This includes water quality, distance to end use, etc.
- The strategy should provide a reasonable percentage of the projected need (except conservation, which will be evaluated for all needs).
- The strategy must meet existing federal and state regulations.
- The strategy must be based on proven technology.
- The strategy must be able to be implemented.
- The strategy must be appropriate for regional water planning.

ES.5 Analysis of Impacts of Water Management Strategies

For the 2011 Plan, the ETRWPG reviewed selected water quality parameters, and addressed how water management strategies could affect water quality. In addition, potential impacts of moving water used for rural or agricultural purposes to urban uses were evaluated.

Water quality parameters selected by the ETRWPG as parameters that could be impacted by water management strategies included Total Dissolved Solids, Dissolved Oxygen, Nutrients, Metals, and Turbidity. The followig table summarizes how the various types of water management strategies could impact these key water quality parameters.

Water Quality Parameter	Water Management Strategy Types							
	Expanded Use of Surface Water	Inter-basin Transfers	New Reservoirs	Expanded Use of Ground-water	Indirect Reuse	Expanded Use of Local Supplies*	Voluntary Re-distribution **	Water Conser-vation***
TDS	•	•	•	•	•		•	
Dissolved Oxygen	•	•	•		•			
Nitrogen	•	•	•		•		•	
Phosphorus	•	•	•		•		•	
Metals	•	•	•	•	•		•	
Turbidity		•					•	

*Expanded use of local supplies would not typically be expected to have a significant impact on water quality.
**Voluntary Redistribution could have an impact on the water quality of the receiving water body
***Water conservation would not typically be expected to have a significant impact on water quality

As the population of the ETRWPA increases, municipal and industrial water demands will rise accordingly, even with the implementation of conservation measures. The largest proportion of additional municipal water supply that will be utilized in the ETRWPA over the planning period will be from expanded use of existing surface water supplies and, to some extent, development of new surface water supplies such as Lake Columbia. Surface water demand will increase for municipal and industrial water users. However, as currently planned, the expanded use of surface water is not expected to involve significant transfers of agricultural supplies to municipal or industrial supplies. The proposed increases in municipal water surface water supplies will rely on existing water rights or new water rights from currently unpermitted supplies.

ES.6 Water Conservation and Drought Management

Water conservation plans are long-term, permanent strategies to reduce water use. Drought contingency plans are similar to conservation plans in that they aim to reduce water use, but are only intended for temporary periods during drought conditions.

Some water demand projections 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. Within the ETRWPA, this amounts to about an 8 percent reduction in municipal water use (20,600 ac-ft per year) by the end of the planning period.

Conservation savings were also included in the steam-electric power demands. Demands for steam-electric power were developed with the assumption that long-term power needs will be met with more water-efficient facilities. The estimated water savings associated with the higher efficiency power plants is nearly 27 percent of the total demands or 57,100 ac-ft per year in the ETRWPA. Reductions in demands due to conservation were not quantified by the TWDB for manufacturing, mining, irrigation and livestock uses.

The TCEQ requires water conservation plans for all municipal and industrial water users with surface water rights of 1,000 ac-ft per year or more and irrigation water users with surface water rights of 10,000 ac-ft 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. In the ETRWPA, 28 entities hold municipal or industrial rights in excess of 1,000 ac-ft per year and three entities have irrigation water rights greater than 10,000 ac-ft per year.

Conservation activities for municipal water users in the ETRWPA are focused primarily on education and public awareness programs, reduction of unaccounted for water through maintenance of water systems, and water rate structures that discourage water waste.

The ETRWPA is a water-rich region and water conservation in the region is driven by economics and not by lack of water supply. The ETRWPG believes that water users in the ETRWPA will implement advanced water conservation measures (i.e. savings associated with active conservation measures) as economic conditions dictate to each individual user. Currently, over one fourth of the municipal water users in the ETRWPA have per capita water use less than 100 gallons per person per day and 57 percent are less than the Water Conservation Implementation Task Force recommended state average of 140 gallons per person per day. While municipal use represents about 20 percent of the total regional water demands, the potential savings from advanced municipal conservation are relatively small. This opinion may change as economics and water supply conditions change in East Texas.

Drought management is a temporary strategy to conserve available water supplies during times of drought or emergencies. This strategy is not recommended to meet long-term growth in demands, but rather acts as a means to minimize the adverse impacts of water supply shortages during drought. The TCEQ requires drought contingency plans for wholesale water suppliers and irrigation districts, as well as retail public water suppliers serving 3,300 or more connections.

The majority of the drought contingency plans in the ETRWPA use trigger conditions based on a combination of water supply and demands placed on the water distribution system. All plans include measures that range from voluntary water restrictions in Stage I to mandatory restrictions in the final stage. Some drought contingency plans include an emergency stage not directly related to drought, but rather related to system rupture or failure.

ES.7 The 2011 Plan and Long-Term Protection of Water and Agricultural Resources

An important goal of water planning is the long-term protection of resources that contribute to water availability, and to the quality of life in the State. One requirement for the 2011 plan is to describe how the plan is consistent with the long-term protection of the State's water resources, agricultural resources, and natural resources.

ES.7.1. Protection of Water Resources. To be consistent with the long-term protection of water resources, the 2011 Plan must recommend strategies that minimize threats to the region's sources of water over the planning period. The water management strategies identified in Chapter 4 were evaluated for threats to water resources. The recommended strategies represent a comprehensive plan for meeting the needs of the region while effectively minimizing threats to water resources. Some of the major strategies for the 2011 Plan are as follows:

- Water conservation
- Indirect reuse
- Development of Lake Columbia
- Use of water from Toledo Bend by Regions C and D
- Optimized use of existing surface water resources
- Optimized use of groundwater

ES.7.2 Protection of Agricultural Resources. Agriculture is an important economic cornerstone of the ETRWPA. Even with adequate rainfall, irrigation is a critical aspect of some agriculture in the region. Water availability modeling for the region's river basins indicates adequate availability of surface water to meet the projected irrigation demands for the planning period.

ES.7.3 Protection of Natural Resources. The ETRWPA contains abundant natural resources, which must be considered in water planning. Natural resources include threatened or endangered species; local, state, and federal parks and public land; and energy/mineral reserves.

The ETRWPA includes twenty species of birds, six mammals, 21 reptiles/amphibians, nine fish, and thirteen mollusks that are considered species of special concern, including some species classified as threatened or endangered. In general, water management strategies planned for the ETRWPA would not affect threatened or endangered species.

The ETRWPA contains national forests, wildlife refuges, and a preserve; as well as state parks, forests, and wildlife management areas. None of the water management strategies currently proposed for the ETRWPA is expected to adversely impact state or local parks or public land.

Much of the ETRWPA is heavily forested and timber is an important economic resource for the region. In general, water management strategies for the region would not be expected to significantly affect this use.

Numerous oil and gas wells are located within the ETRWPA, including the East Texas Oil Field, and four of the top 10 producing gas fields in the state. These resources represent an important economic base for the region. None of the water management strategies is expected to significantly impact oil, gas, or coal production in the region.

ES.7.4 Consistency of the 2011 Plan with Water Planning Requirements. To be considered consistent with long-term protection of the State's water, agricultural, and natural resources, the ETRWPA Water Plan must also be determined to be in compliance with the regulations and guidelines pertaining to water planning. The regulations for water planning are found in 31 Texas Administrative Code Chapters 357 and 358. The information, data, evaluation, and recommendations included in the 2011 Plan were evaluated and determined to demonstrate compliance with these regulations.

ES.8 Regional Water Planning and Legislative Recommendations

The 2011 Plan includes recommendations to the Texas Legislature regarding future regional water planning activities. The ETRWPG was charged with considering recommendations for ecologically unique stream segments, unique reservoir sites, and general water planning needs.

ES.8.1 Unique Stream Segments. The ETRWPG considered available information regarding potential unique stream segments in the region and voted to not recommend any stream segments in the region for unique status. The ETRWPG concluded that sufficient programs are already in place to protect the regions' streams from inappropriate reservoir construction.

ES.8.2 Unique Reservoir Sites. The ETRWPA has a long history of water supply planning and reservoir development. There are numerous sites that have been identified as being hydrologically and topographically unique for reservoir development. Two sites in the ETRWPA are currently designated as unique: Lake Columbia and Fastrill Reservoir. Lake Columbia received its unique designation by the State Legislature through SB 1362. Fastrill Reservoir was designated by the 79th Legislature through SB 3. Other sites have not previously been recommended for designation as unique.

The ETRWPG recognizes that reservoirs can have major impacts on the environment and that protection of the environment is already afforded through a process which is more thorough than the regional water planning effort. The ETRWPG is not recommending in this planning cycle that any additional proposed sites be designated as unique reservoir sites. The ETRWPG is recommending that these sites be recognized as potential long-term water management strategies for the time period more than fifty years in the future. The ETRWPG believes that the lengthy and thorough economic and environmental review process will determine if any of these reservoirs are constructed as opposed to any decision by the ETRWPG.

ES.8.3 Legislative Recommendations. The ETRWPG reviewed previous legislative recommendations made pursuant to regional water planning requirements and evaluated new potential recommendations. Proposed recommendations were brought to the ETRWPG for consideration. Legislative recommendations adopted by the ETRWPG for the 2011 Plan include the following:

- **Junior Water Rights.** The ETRWPG supports legislation allowing exemptions to junior water rights by contracts that reserve sufficient surface water to meet 125% of the total projected demand of the basin of origin for the next 50 years.

- **Flexibility in Determining Water Plan Consistency.** The ETRWPG recommends that the following steps be taken to address concerns that small cities and unincorporated areas may not have specific water needs and water management strategies identified in the regional water plan due to the nature of aggregating these entities. Hence, these entities may not be eligible for state funding assistance.

- The TWDB should add language to their guidance for funding that allows entities that fall under the planning limits to retain eligibility for state funding of water related projects without having specific needs identified in the regional water plans.

- The TWDB and the TCEQ should interpret existing legislation to give the maximum possible flexibility to water suppliers as they seek to serve the public and provide new supplies.

- Willing buyer/willing seller transactions of water rights and treated water should not be controlled by existing regulation. Such transactions may be beneficial to all concerned and may simply not have been foreseen in the planning process.

- The TWDB and TCEQ should make use of their ability to waive consistency requirements if local water suppliers elect strategies that differ from those in the regional plan.

- **Continued Funding by the State of the Regional Water Planning Process on a Five-Year Cycle.** The ETRWPG believes the grassroots planning effort created by Senate Bill 1 is important to the state of Texas and should be continued.

- **Groundwater Conservation Districts.** The ETRWPG recognizes the critical importance of groundwater conservation and proper management of this resource in the ETRWPA. Therefore, as an important component of regional planning, the ETWRPG encourages those portions of the ETRWPA not presently participating in a groundwater conservation district to carefully review groundwater management practices in their area and to consider whether creating or joining a groundwater conservation district would be appropriate.

- **Unique Reservoir Designation Limitations.** The ETRWPG recommends that the designation of unique reservoir for the sites currently designated be extended to 2060, which would be through the current planning period. The ETRWPG also recommends that the United State Army Corps of Engineers Mitigation Bank Review Teams have TWDB and appropriate regional water planning agencies be added to the teams.

- **Wastewater Reuse.** The ETRWPG recommends that current regulations as they pertain to wastewater reuse should be reviewed and amended, as necessary, to encourage the reuse of wastewater effluent.

- **Funding Expansion.** The ETRWPG recommends that the TWDB expand existing programs to assist entities with funding replacement and repairs to aging infrastructure and/or allow replacement of water supply infrastructure to be funded through the Water Infrastructure Fund program. In addition, the ETRWPG recommends that requirements for funding by the TWDB for the Economically Distressed Areas Program (EDAP) be revised to reduce unnecessary and difficult requirements for eligibility, including requirements for model subdivision planning.

- **Environmental Flows.** The ETRWPG acknowledges the importance of these studies for the future of its water resources and supports the efforts of the various advisory teams and stakeholders in this endeavor. The ETRWPG also recognizes the need for water for growth and economic development. The ETRWPG also recognizes that future flow conditions in Texas' rivers and streams must be sufficient to support a sound ecological environment that is appropriate for the area. However, the ETRWPG believes it is imperative that existing water rights be protected. In addition, SB 2 and SB 3 processes that relate to environmental flows should be closely coordinated with the SB 1 planning effort, involving regional water planning.

- **Uncommitted Water.** The ETRWPG opposes unilateral cancellation of uncommitted water contracts/rights; supports long term contracts that are required for future projects and drought periods; and, supports shorter term "interruptible" water contracts as a way to meet short term needs before long-term water rights are fully utilized.

ES.9 Infrastructure Financing Recommendations

The purpose of the infrastructure financing report is to identify funding needed to implement the WMSs recommended in the 2011 Plan. A survey of WUGs with identified infrastructure needs was conducted by the ETRWPG and the TWDB. The survey was conducted after the Initially Prepared Plan was approved by the ETRWPG.

Surveys were sent to 17 municipal WUGs and seven wholesale water providers with projected water shortages. Surveys were completed and returned for eight of the municipal WUGs and six of the wholesale water providers. There were 31 WUGs with needs identified in the 2011 Plan not surveyed. These WUGs were in the manufacturing, power generation, irrigation, livestock, and mining categories. In the IFR study, $1,348,737,330 of water supply and infrastructure needs were identified. Of that, $1,236,774,491 was the estimated cost of new surface water supply projects and major transmission systems. The remaining $111,962,839 was in development of new wells, local infrastructure, and public/private partnership projects. .

ES.10 Public Participation and Adoption of Plan

Regional water planning in Texas is a public process, requiring strategy for ensuring that the region's citizens are able to participate in the process. Development and adoption of the final 2011 Plan included regular meetings of the ETRWPG, consultation with representatives of the major water user groups, publication of a region newsletter, distribution of regular press releases, and maintenance of a website for the ETRWPA. In addition, the ETRWPG held a Public Hearing to introduce the 2011 IPP and accept public comment. In all, comments were received from eight persons on behalf of various agencies or groups. These included one oral comment provided at the Public Hearing for the 2011 IPP, one hand-written response provided at the Public Hearing, and six letters received during the comment period. In four cases, the comments received related to a single issue of the commenter. The other comments received addressed multiple issues. Copies of comments and the ETRWPG responses to comments are included in Chapter 10.

The final *2011 East Texas Regional Water Plan* was submitted to the TWDB by September 1, 2010.

Chapter 1

Description of the Region

This document provides an update to the regional water plan for a portion of the State of Texas known as the East Texas Regional Water Planning Area (ETRWPA), or Region I. The region was established in 1997 as part of Senate Bill 1 (SB1), passed that year by the Texas Legislature. Pursuant to the formation of the ETRWPA a regional water planning group (known as East Texas Regional Water Planning Group or ETRWPG) was formed and charged with the responsibility to develop a plan for the management of water in the region to ensure its availability to the region's citizens for a 50-year planning horizon. Planning is performed in accordance with regional and state water planning requirements of the Texas Water Development Board (TWDB). The initial regional plan was adopted in 2001. Since that time, it has been updated one time in 2006 and amended once in 2008. This is the second update of the plan.

This second plan update (2011 Plan) will address a wide range of water planning issues, including a description of the region, population and water demand, water supply availability, water management strategies, water quality, conservation, regional resources, and infrastructure financing requirements. These elements may be found below and in subsequent chapters of the plan.

This chapter provides descriptive details for the ETRWPA. These details include a physical description of the region, climatological details, population projections, economic activities, sources of water and water demand, and regional resources. In addition, the chapter includes a discussion of threats to the region's resources and water supply, a general discussion of water conservation and drought preparation in the region, and a listing of ongoing state and federal programs in the ETRWPA that impact water planning efforts in the region.

1.1 General Introduction to the East Texas Regional Water Planning Area and the Regional Water Planning Group

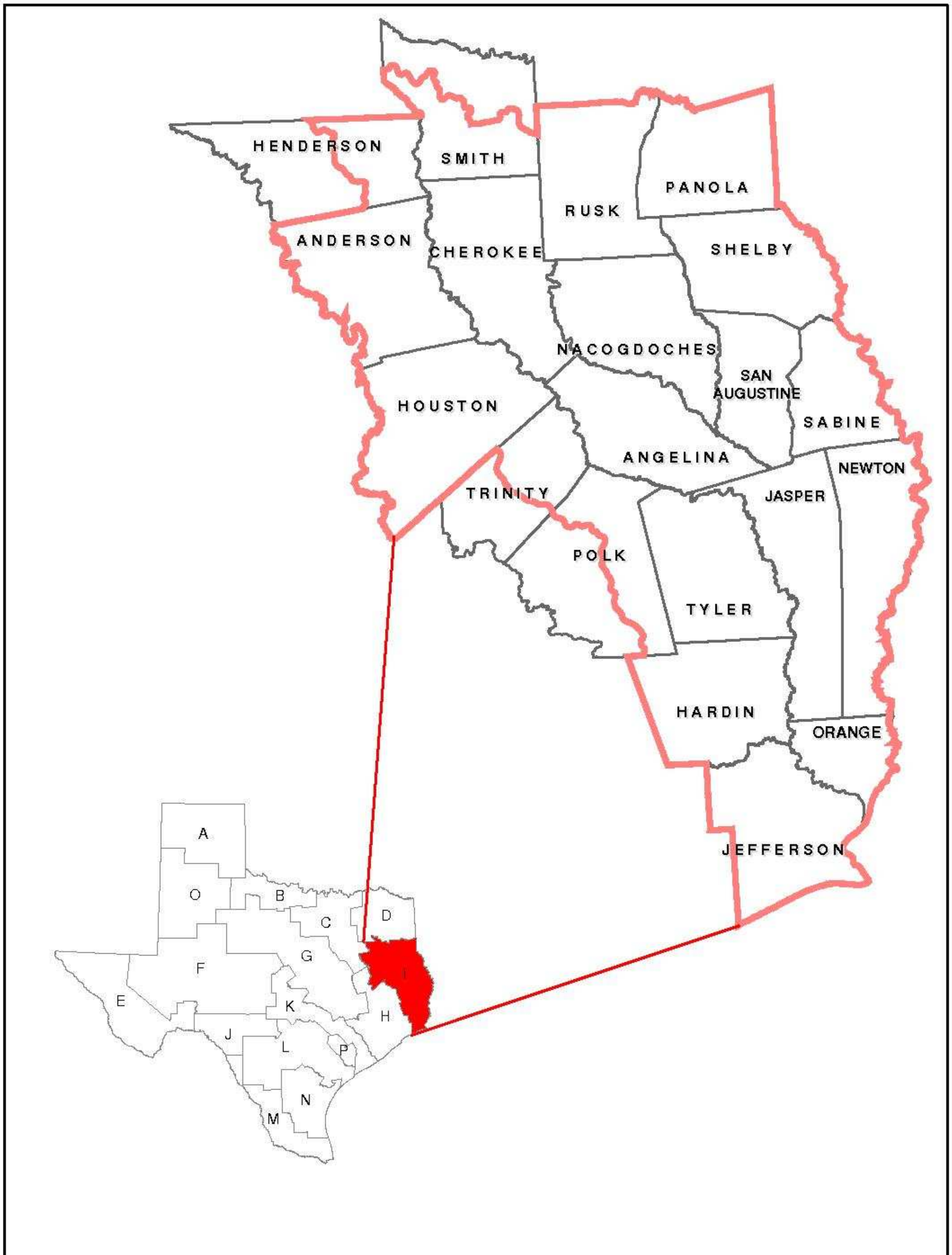
The ETRWPA consists of all or portions of 20 counties located in the Neches, Sabine, and Trinity River Basins, and the Neches-Trinity Coastal Basin. The region extends from the southeastern corner of the state for over 150 miles north and northwest as illustrated on Figure 1.1. The ETRWPA consists of approximately 10,329,800 acres of land. The ETRWPA accounts for roughly 6 percent of the total area of the State of Texas.

The ETRWPG consists of 22 representatives. These members represent the interests of the public, counties, municipalities, industries, agriculture, the environment, small businesses, electric generating utilities, river authorities, water districts, and water utilities. The City of Nacogdoches is the administrative contracting agency for the ETRWPG. The ETRWPG has retained the services of a team of engineering firms and other specialists to prepare the 2011 Plan. Table 1.1 provides a list of the ETRWPG representatives and the engineering consulting team involved in developing the 2011 Plan.

1.2 Physical Description

The ETRWPA is characterized by significant portions of several watersheds and natural geographic regions. Each watershed and area is described following.

1.2.1 River Basins. The ETRWPA includes portions of three major river basins, and one coastal basin. Most of the region falls within the Neches River Basin. In fact, the majority of the Neches River Basin is covered by the ETRWPA. The region also includes much of the Texas portion of the Sabine River Basin; portions of the Trinity River Basin in two counties; and a portion of the Neches-Trinity Coastal Basin in Jefferson County. Figure 1.2 illustrates the boundaries of the watersheds within the



0 7.5 15 30 Miles

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N W E S

East Texas Region

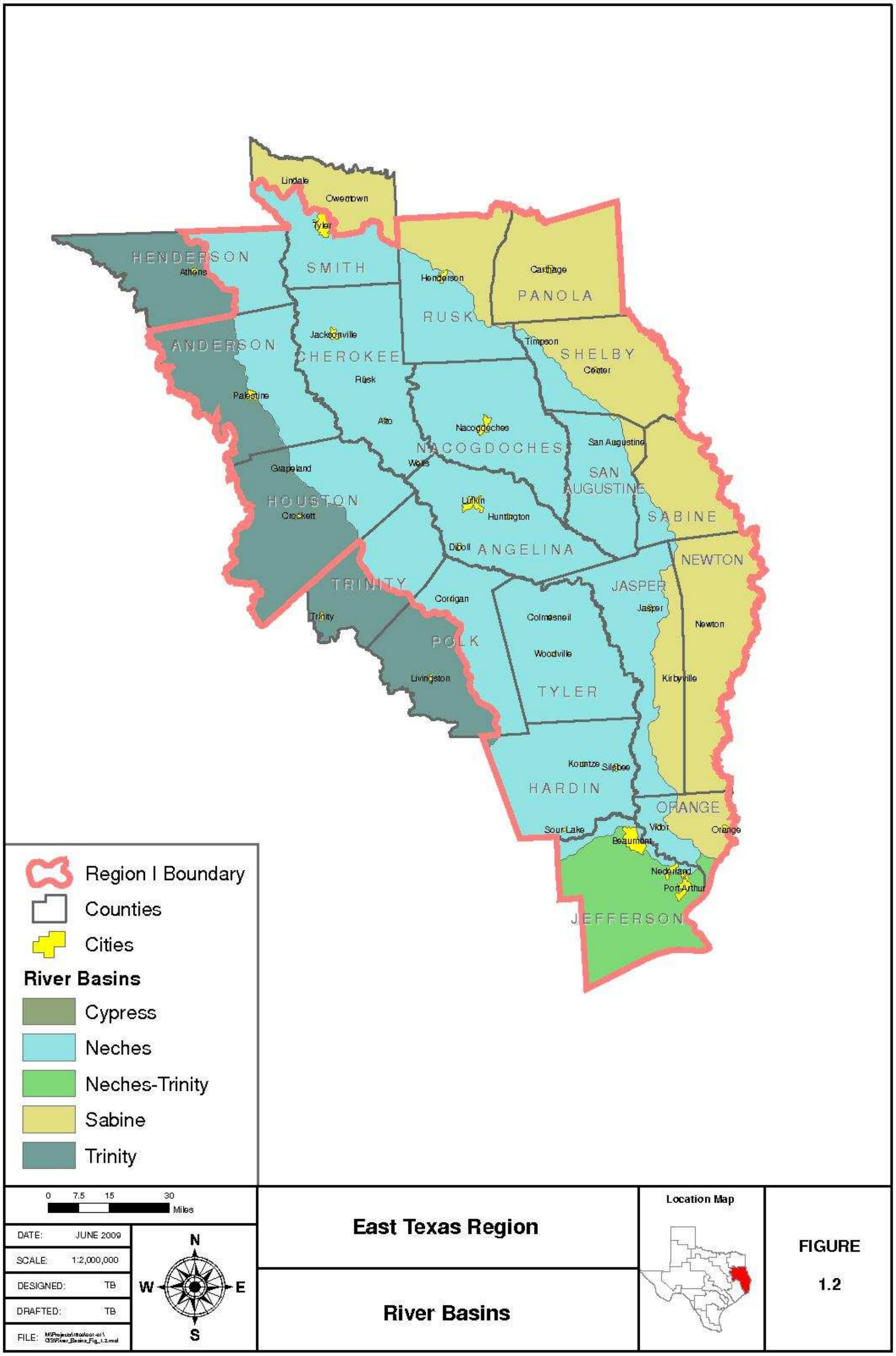
Location Map

Location Map

FIGURE 1.1

Table 1.1 East Texas Regional Water Planning Group Members and Engineering Team

Executive Committee			
Chair	Kelley Holcomb		
Vice-Chair	Worth Whitehead	2nd Vice Chair	Michael Harbordt
Secretary	Jerry Clark	Assistant Secretary	David Brock
At-Large	Ernest Mosby	At-Large	David Alders
Voting Membership			
Public	Glenda Kindle – *Retired*	William Heugel - *Retired*	
Counties	Jeff Branick – *Jefferson County*	Chris Davis – *Cherokee County*	
Municipalities	David Brock – *City of Jacksonville*	Duke Lyons – *City of San Augustine*	
Industries	Michael Harbordt – *Temple Inland Forest Products*	Darla Smith – *BASF Corporation*	
Agricultural	David Alders – *Carrizo Creek Corporation*	Hermon E. Reed, Jr. – *Cattlemen*	
Environmental	Dr. J. Leon Young – *Stephen F. Austin University*		
Small Business	Mark Dunn – *Dunn's Construction, LLC*	Dr. Joseph Holcomb - *Dentist*	
Electric Generating Utilities	Dale Peddy – *Entergy*		
River Authorities	Jerry Clark – *Sabine River Authority* Scott Hall – *Lower Neches Valley Authority*	Monty Shank –*Upper Neches River MWA*	
Water Districts	Worth Whitehead – *Rusk SWCD*		
Water Utilities	Kelley Holcomb – *Angelina-Neches River Authority*		
Other	Bill Kimbrough – *Retired* Josh David – *Livestock*	George P. Campbell – *Nacogdoches County*	
Non-Voting Membership			
James Alford	Trinity County	Steve Tyler	Region H Water Planning Group
Walter Glen		Bobby Praytor	City of Dallas Water Utilities
Temple McKinnon	Texas Water Development Board	Terry Stelly	Texas Department of Parks & Wildlife
Connie Standridge	Region C Water Planning Group	Adam Bradley	Region D Water Planning Group
Cynthia Duet	Louisiana Governor's Office of Coastal Activities	Linda F. Parker	Texas Department of Agriculture
Judge Sandra Hodges	Rusk County	Judge Floyd "Dock" Watson	Shelby County
James Porter	IMCAL		
Contracting Agency			
City of Nacogdoches			
Engineering Team			
Alan Plummer Associates, Inc.	Lead Engineer	G.E. Walker & Associates, LLC	Subconsultant Engineer
Freese & Nichols, Inc.	Subconsultant Engineer	LBG - Guyton & Associates	Subconsultant Groundwater Specialist


HENDERSON
Athens
SMITH
Lindale
Overton
Tyler
Henderson
Carthage
PANOLA
RUSK
ANDERSON
Jacksonville
CHEROKEE
Rusk
Timpson
SHELBY
Center
Palestine
Alto
Nacogdoches
NACOGDOCHES
San Augustine
SAN AUGUSTINE
Grapeland
Wells
HOUSTON
Crockett
Lufkin
Huntington
SABINE
Diboll
ANGELINA
NEWTON
TRINITY
JASPER
Jasper
Corrigan
Trinity
Colmesneil
Newton
POLK
Woodville
Livingston
Kirbyville
TYLER
Kountze
Silsbee
HARDIN
ORANGE
Sour Lake
Vidor
Orange
Beaumont
Nederland
Port Arthur
JEFFERSON
Region I Boundary
Counties
Cities
River Basins
Cypress
Neches
Neches-Trinity
Sabine
Trinity
0 7.5 15 30 Miles
DATE: JUNE 2009
SCALE: 1:2,000,000
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East Texas Region
River Basins
Location Map
FIGURE
1.2

ETRWPA. Streams in all the basins tend to flow from northwest to southeast. Approximately one square mile of the Cypress Creek Basin lies in the northeastern portion of Panola County. Additional descriptions of the Neches, Sabine, and Trinity River Basins, as well as of Sabine Lake, follow.

Neches River. The Neches River Basin originates in Van Zandt County, Texas, and flows for a distance of approximately 416 miles to Sabine Lake. In its course, the river passes through or forms a boundary for 14 counties. These include the ETRWPA counties of Smith, Henderson, Cherokee, Anderson, Houston, Angelina, Trinity, Polk, Tyler, Jasper, Hardin, Orange, and Jefferson. The drainage area for the entire basin is approximately 10,000 square miles. Approximately one-third of the basin area is comprised of the Angelina River Basin. Significant tributaries to the basin include Pine Island Bayou and Village Creek. The Neches River Basin contributes nearly six million acre-feet of water to Sabine Lake annually.

Sabine River. The Sabine River originates in Hunt County, Texas, in Region C. It flows for a distance of approximately 550 miles in a generally southeast direction to Sabine Lake. The river passes through or forms a boundary for six counties in the ETRWPA: Panola, Shelby, Sabine, Newton, Orange, and Jefferson Counties. Most of the river's course within the ETRWPA forms the boundary between Texas and Louisiana. The Sabine River Basin covers approximately 9,750 square miles, of which approximately 76% is in Texas. The remainder of the basin is located in Louisiana. The Sabine River Basin contributes approximately 6.4 million acre-feet of water to Sabine Lake annually.

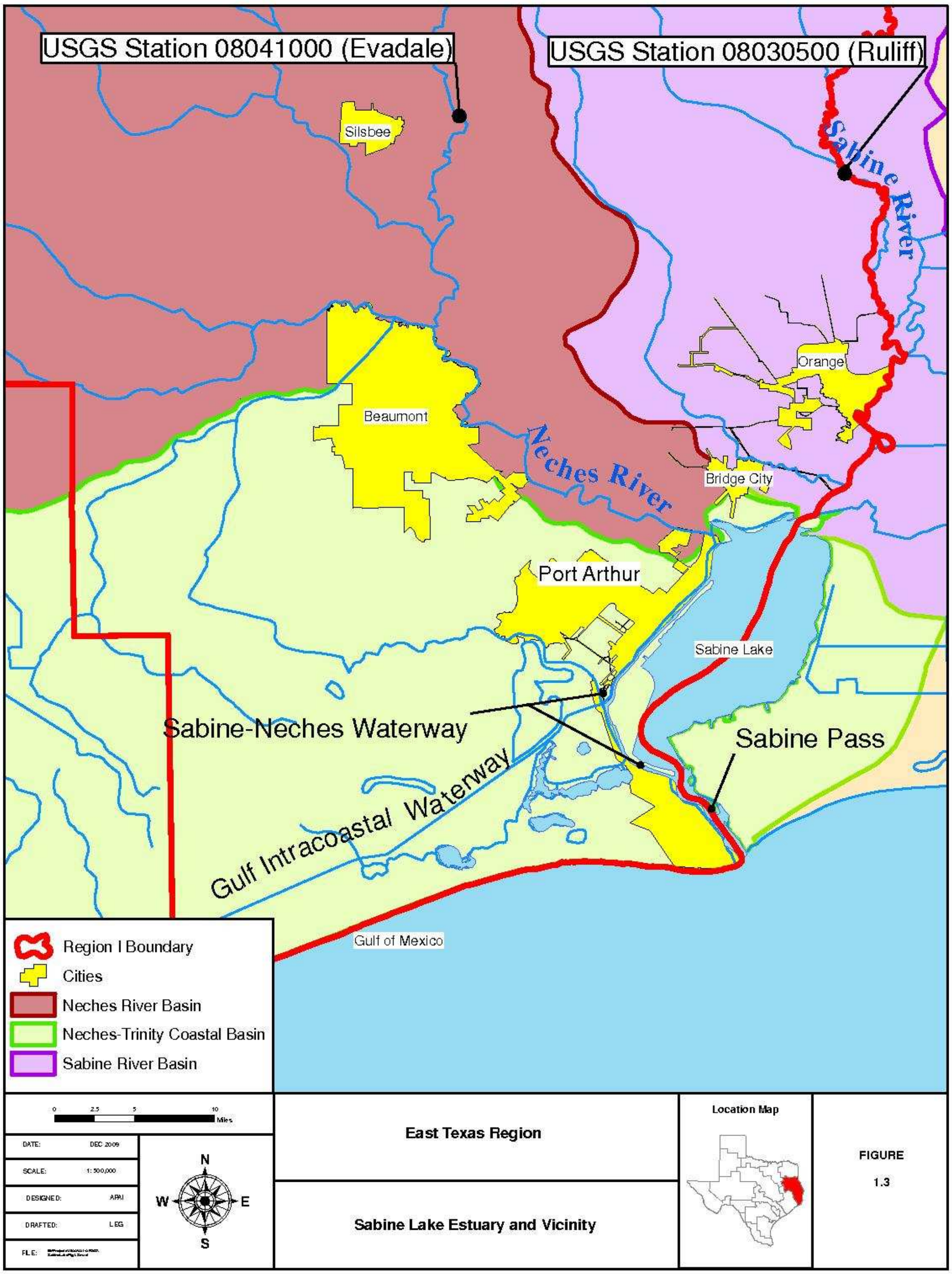
Neches-Trinity River. The coastal plain between the Neches River and Trinity River forms the Neches-Trinity Coastal Basin. The area is located in Jefferson County (in the ETRWPA) and Chambers County (in Region H). Maximum elevation in the basin is approximately 50 feet, although most of the basin is less than 25 feet in elevation. Total basin drainage area is approximately 770 square miles. In Jefferson County, the basin drains primarily to the Gulf Coast and to Sabine Lake. The Region I portion of the Neches-Trinity Coastal Basin is depicted in Figure 1.3.

Sabine Lake. Sabine Lake is a natural water body located on the Texas-Louisiana border in southeast Texas, approximately seven miles from the Gulf of Mexico. With a surface area for the main body of the lake of 55,000 to 60,000 acres, it is one of the smallest estuaries on the Texas Coast. The lake supports an extensive coastal wetland (i.e., salt marsh) system around much of the perimeter. Its small volume coupled with large freshwater inflows from the Sabine and Neches Rivers, result in a turnover rate of around 50 times per year. A map of Sabine Lake and vicinity is provided on Figure 1.3.

Sabine Lake is hydraulically connected to the Gulf of Mexico via Sabine Pass, a seven-mile long tidal inlet between the Gulf and the southern end of the lake. Historically, Sabine Pass was a narrow, shallow waterway. However, in the latter part of the 19th century, a ship channel (generally known today as the Sabine-Neches Waterway) was dredged in the pass and lake to enable deep-water navigation to inland ports. Over ensuing years, the Sabine-Neches Waterway has been expanded in length, depth, and width, and extended up into the Neches and Sabine Rivers.

Today, the Sabine-Neches Waterway extends from the Gulf of Mexico to Port Arthur on the western shore of Sabine Lake; to Beaumont upstream on the Neches River; and Orange, upstream on the Sabine River. The waterway is some 400 feet wide and 40 feet deep. The United States Army Corps of Engineers (USACE) is currently considering whether to further expand the channel to accommodate large ship traffic. The expansion could deepen the channel to 48 feet and widen it to as much as 700 feet.

Trinity River. The Trinity River is a major water body in the State, but only forms a small portion of the western boundary of the ETRWPA. In the region, it forms a boundary for Anderson and Houston Counties.


USGS Station 08041000 (Evadale)
USGS Station 08030500 (Ruliff)
Silsbee
Sabine River
Orange
Beaumont
Neches River
Bridge City
Port Arthur
Sabine Lake
Sabine-Neches Waterway
Sabine Pass
Gulf Intracoastal Waterway
Gulf of Mexico
Region I Boundary
Cities
Neches River Basin
Neches-Trinity Coastal Basin
Sabine River Basin
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Location Map
East Texas Region
Sabine Lake Estuary and Vicinity
FIGURE
1.3

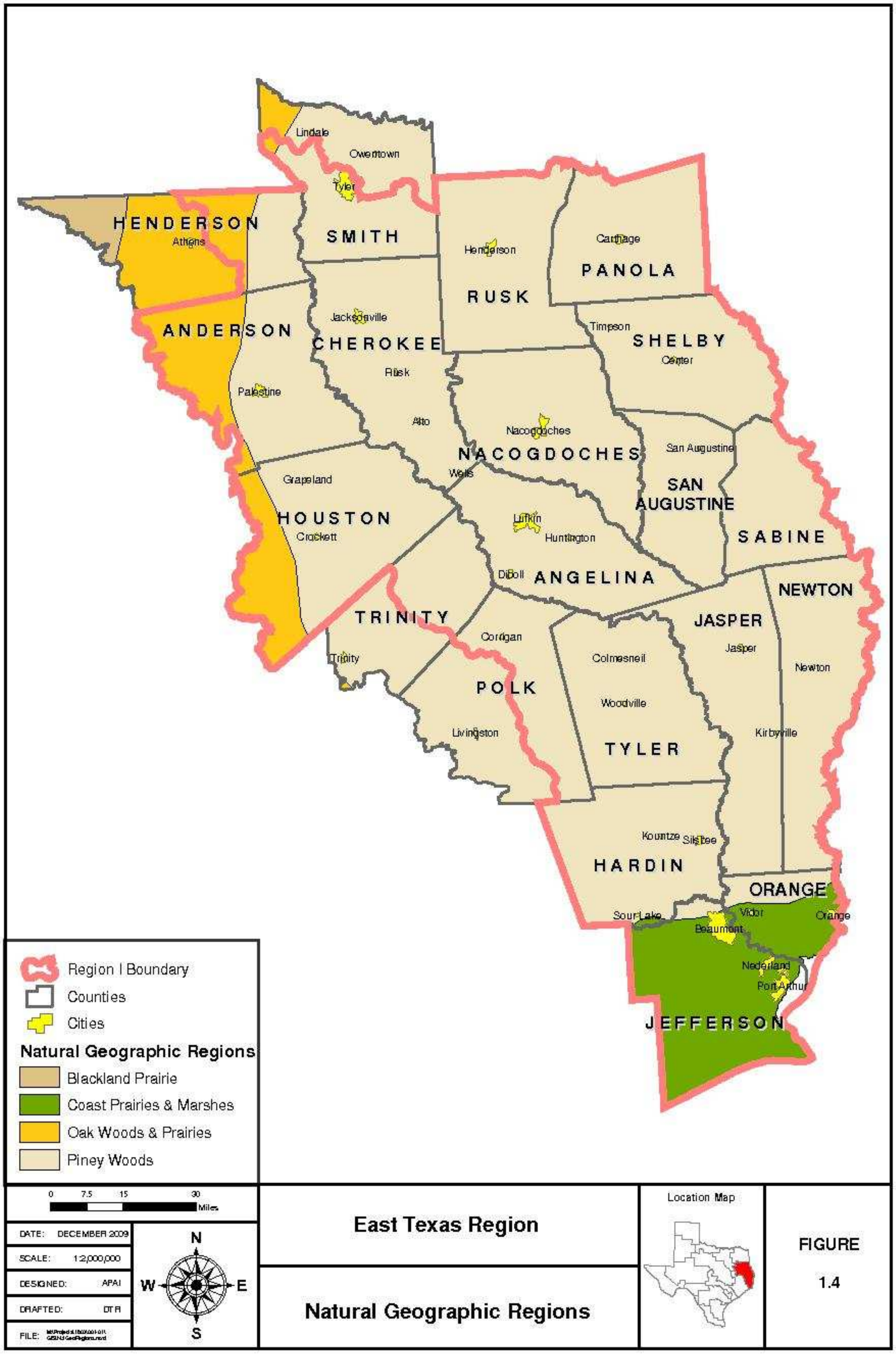
1.2.2 Topography and Geographic Areas. The ETRWPA is generally characterized by rolling to hilly surface features except near the Gulf Coast. The elevation in the region varies from sea level at its southern boundary on the Gulf of Mexico to 763 ft mean sea level (msl) at Tater Hill Mountain in Henderson County at its far northwest corner.

The area occupied by the counties of the region is further subdivided into natural geographic areas known as the Piney Woods, the Oak Woods and Prairies, the Coastal Prairies, and the Blackland Prairie. Figure 1.4 depicts the boundaries of these areas within the ETRWPA. They are further described following.

Piney Woods. The majority of the ETRWPA falls within the Piney Woods portion of the Texas Gulf Coastal Plain. Pine is the predominant timber of this region, although some hardwood timbers can be found interspersed amongst the pines and in the valleys of rivers and creeks. Longleaf, shortleaf, and loblolly pine are native to the region and slash pine, an introduced species, is also widely dispersed. Hardwoods include a variety of oaks, elm, hickory, magnolia, sweetgum, and blackgum. Lumber production is the principal industry of the area and practically all of Texas' commercial timber production comes from the Piney Woods region.

The soils and climate are adaptable to the production of a variety of fruit and vegetable crops. Cattle ranching is widespread and generally accompanied by the development of pastures. Economic growth in the area has also been greatly influenced by the large oil field discovered in Rusk and Smith Counties in 1931, and iron deposits are also worked in Rusk County. This area has a variety of clays, lignite coal, and other minerals that have potential for development.

Oak Woods and Prairies. Most of the northwestern portion of the ETRWPA (parts of Smith, Henderson, and Anderson Counties) fall within the Oak Woods and Prairies portion of the Texas Gulf Coastal Plains. Principal trees of this area are hardwoods such as post oak, blackjack oak, and elm. Riparian areas often have growths of pecan, walnut, and other trees with high water demands. Area upland soils are sandy and sandy loam,


HENDERSON
Athens
SMITH
Lindale
Overton
Tyler
RUSK
Henderson
PANOLA
Carthage
ANDERSON
Palestine
CHEROKEE
Jacksonville
Rusk
Alto
SHELBY
Timpson
Center
NACOGDOCHES
Nacogdoches
Wells
SAN AUGUSTINE
San Augustine
SABINE
HOUSTON
Grapeland
Crockett
ANGELINA
Lufkin
Huntington
Diboll
NEWTON
Newton
TRINITY
Trinity
JASPER
Jasper
Kirbyville
POLK
Corrigan
Livingston
TYLER
Colmesneil
Woodville
HARDIN
Kountze
Silsbee
Sour Lake
ORANGE
Vidor
Orange
Beaumont
Nederland
Port Arthur
JEFFERSON
Region I Boundary
Counties
Cities
Natural Geographic Regions
Blackland Prairie
Coast Prairies & Marshes
Oak Woods & Prairies
Piney Woods
0 7.5 15 30
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East Texas Region
Natural Geographic Regions
Location Map
FIGURE
1.4

while the bottomlands are sandy loams and clays. The Oak Woods and Prairies are somewhat spotty in character, with some insular areas of blackland soil and others that closely resemble those of the Piney Woods. The principal industry of the area is diversified farming and livestock raising. The Oak Woods and Prairies region also has lignite, commercial clays, and some other minerals.

Coastal Prairies. The southern portion of the ETRWPA (largely Jefferson and Orange Counties) is located within the segment of the Texas Gulf Coastal Plains known as the "Coastal Prairies." In general, this area is covered with a heavy growth of grass, and the line of demarcation between the prairies and the Pine Belt forests is very distinct. Soil of the Coastal Prairies is predominantly heavy clay. Cattle ranching is the principal agricultural industry, although significant rice production is also present. The Coastal Prairie has seen a large degree of industrial development since the end of World War II. The chief concentration of this development has been from the cities of Orange and Beaumont to Houston, and much of the development has been in petrochemicals.

Blackland Prairie. The most northwest portion of the ETRWPA (Henderson County) falls in the Blackland Prairie region of the Texas Gulf Coastal Plains. This region is naturally dominated by grassland, though stands of post oak, blackjack oak, and eastern red cedar are common. Riparian areas support forests of bur oak, shumard oak, sugar hackberry, elm, ash, eastern cottonwood, and pecan. Soils are generally characterized as calcareous, alkaline, heavy clay. Development in the area consists largely of conversion of native prairies to pastureland, cropland, and urban uses.

1.2.3 Navigation. In the ETRWPA, significant water navigation is generally limited to the coastal areas where the main stems of the Neches and Sabine Rivers and Sabine Lake are located. Navagation lanes are essentially located in tidally-influenced areas. Waters within the region used for navigation include the Sabine-Neches Waterway, Sabine Lake, and the Gulf Intercoastal Waterway, southern portions of the Neches, and Sabine Rivers. The 2011 Plan is not expected to have an adverse effect on navigation within the ETRWPA.

1.3 Climate

Data from the National Oceanic and Atmospheric Administration state climatologist indicate that the mean temperatures for the entire region varied from a minimum January temperature of 36 degrees Fahrenheit (°F) to a maximum July temperature of 93°F. Similarly, the average growing season for the entire ETRWPA was 247 days.

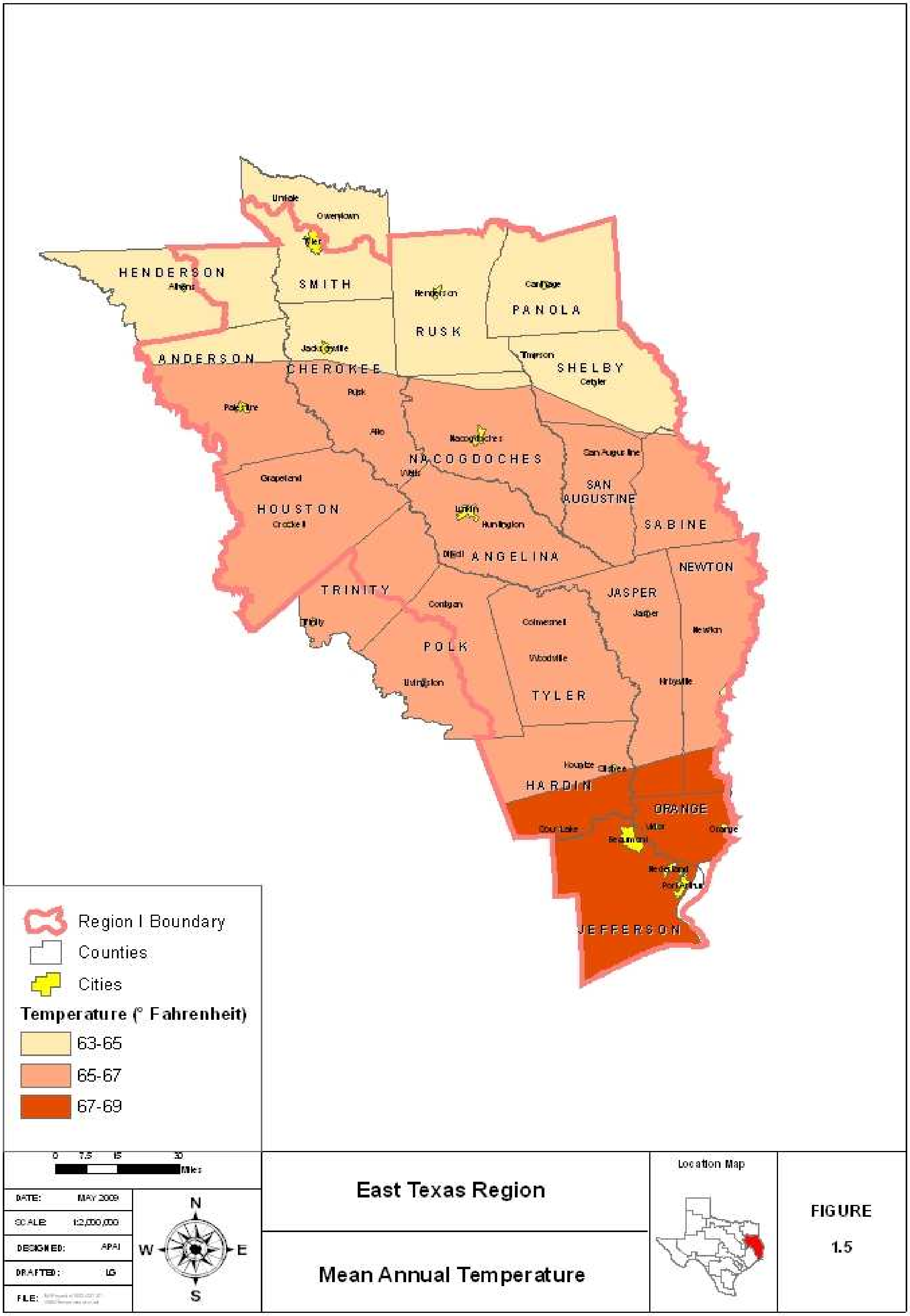
Precipitation generally increases from the northwest to southeast corners of the region, while evaporation increases in the opposite direction. Annual rainfall across the ETRWPA averaged 48.7 inches from 1971 through 2000, with the highest annual rainfall (59.04 inches) being recorded for Orange County and the lowest annual rainfall (42.03 inches) being recorded for Henderson County.[1] Average annual runoff ranges from approximately 10 inches in the northwest to 17 inches in the southeast. Average annual gross reservoir evaporation *(the rate of evaporation from a reservoir)* ranges from approximately 41 inches in the southeast to 55 inches in the northwest.

Figures 1.5 through 1.7 depict mean annual temperature, mean annual precipitation, and gross reservoir evaporation, respectively for the ETRWPA.

1.4 Population

The ETRWPA contains all or part of three metropolitan areas *(with cities of 50,000 or more population)*[2]:

- Beaumont-Port Arthur area at the south end (Jefferson, Orange, and Hardin Counties).
- Part of Longview area at the north end (portion of Kilgore).
- Most of the Tyler area at the north end (region includes the portion of Smith County in Neches basin, including most of Tyler).


HENDERSON
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RUSK
PANOLA
ANDERSON
CHEROKEE
SHELBY
NACOGDOCHES
SAN AUGUSTINE
SABINE
HOUSTON
ANGELINA
NEWTON
TRINITY
JASPER
POLK
TYLER
HARDIN
ORANGE
JEFFERSON
Region I Boundary
Counties
Cities
Temperature (° Fahrenheit)
63-65
65-67
67-69
Miles
DATE: MAY 2009
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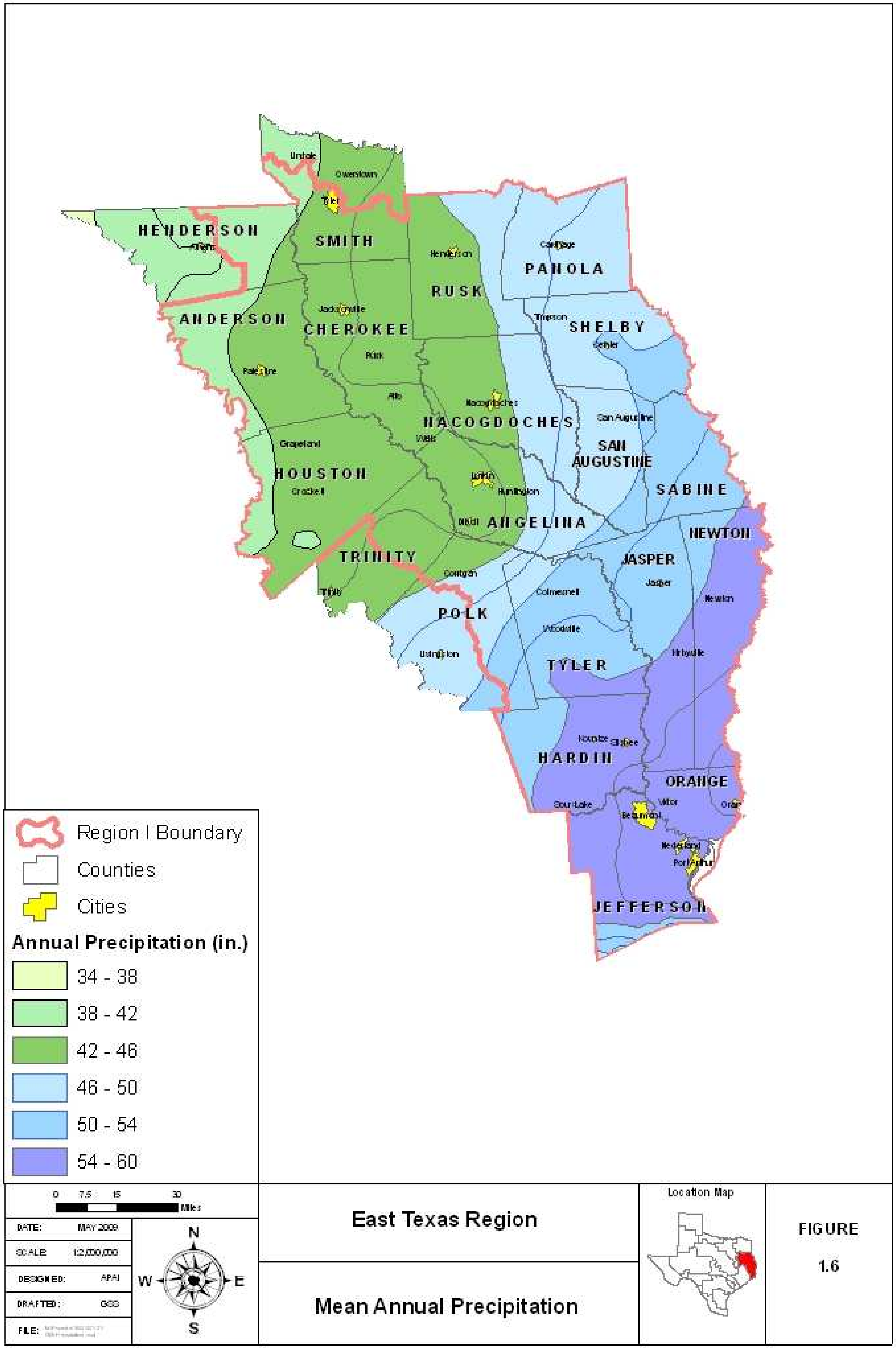
East Texas Region
Mean Annual Temperature
Location Map
FIGURE
1.5


HENDERSON
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HOUSTON
SABINE
ANGELINA
NEWTON
TRINITY
JASPER
POLK
TYLER
HARDIN
ORANGE
JEFFERSON
Tyler
Henderson
Carthage
Jacksonville
Palestine
Nacogdoches
Lufkin
Crockett
Jasper
Newton
Woodville
Livingston
Beaumont
Port Arthur
Region I Boundary
Counties
Cities
Annual Precipitation (in.)
34 - 38
38 - 42
42 - 46
46 - 50
50 - 54
54 - 60
0 7.5 15 30
Miles
DATE: MAY 2009
SCALE: 1:2,000,000
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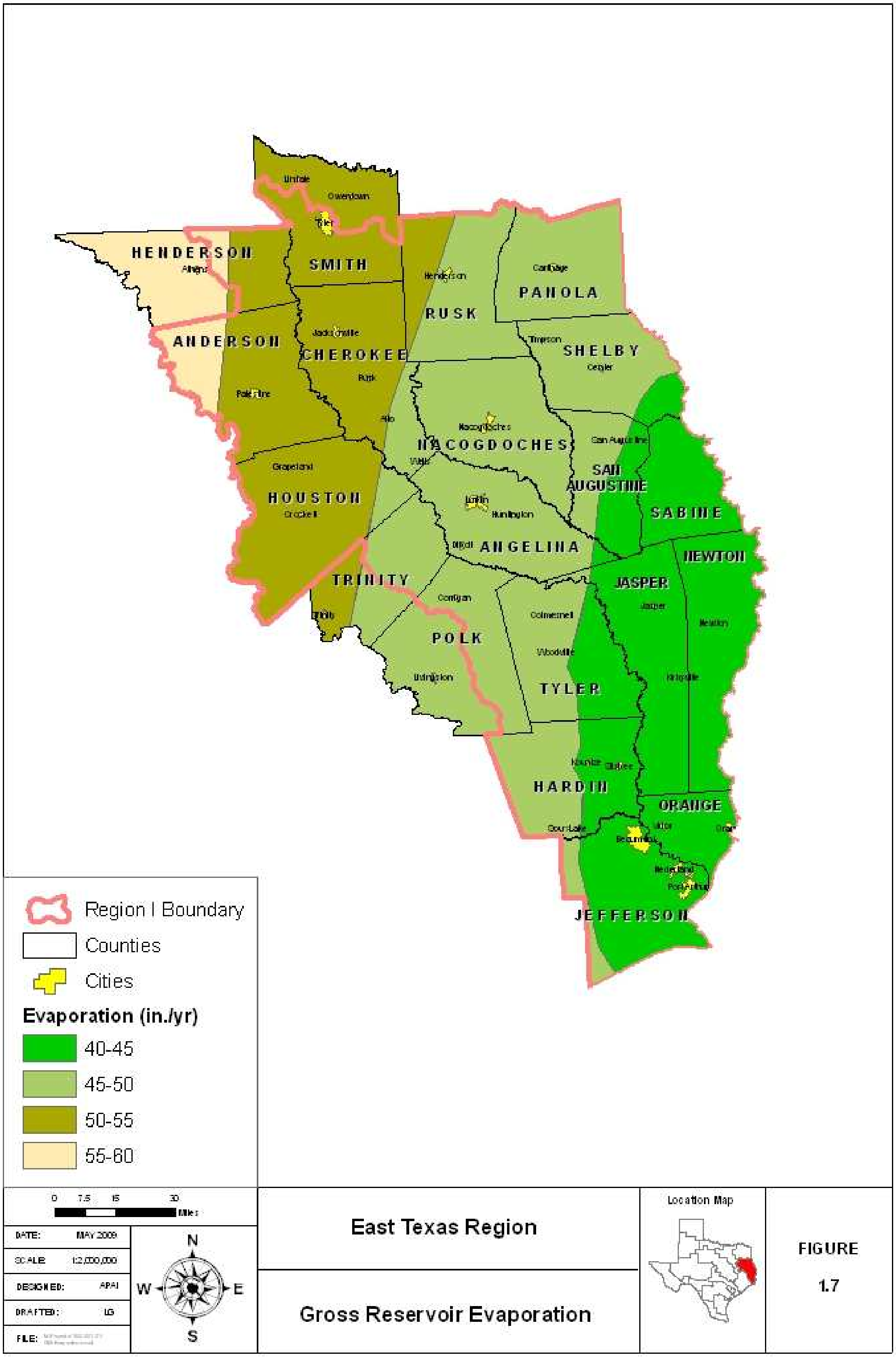
East Texas Region
Mean Annual Precipitation
Location Map
FIGURE
1.6


HENDERSON
SMITH
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SHELBY
NACOGDOCHES
SAN AUGUSTINE
HOUSTON
SABINE
ANGELINA
NEWTON
TRINITY
JASPER
POLK
TYLER
HARDIN
ORANGE
JEFFERSON
Region I Boundary
Counties
Cities
Evaporation (in./yr)
40-45
45-50
50-55
55-60
0 7.5 15 30 Miles
DATE: MAY 2009
SCALE: 1:2,000,000
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Location Map
East Texas Region
Gross Reservoir Evaporation
FIGURE
1.7

The combined metropolitan population (as of 2008) is approximately two-thirds of the total ETRWPA population.

The population in the region increased approximately 14.5 percent from 1990 through 2000, to approximately 1.01 million people. Growth in the region is expected to continueat an average rate approximately 8 percent per decade to approximately 1.48 million by 2060. The most recent census data (2000) and 2010 through 2060 population projections for the major cities located in the region are provided in Table 1.2.

Table 1.2 Current and Projected Populations of Major Cities

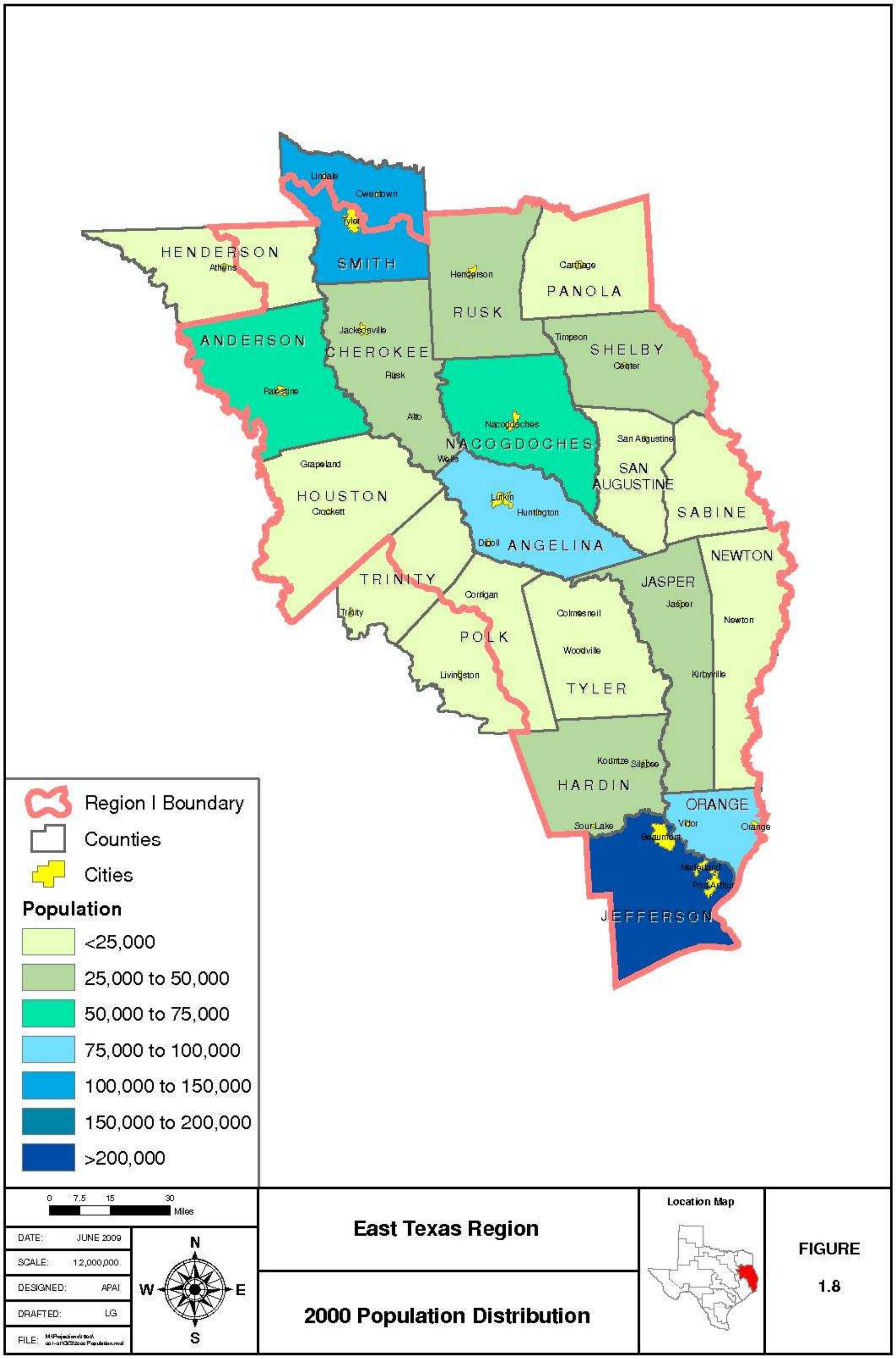
City	2000	2010[1]	2020[1]	2030[1]	2040[1]	2060[1]
Beaumont	113,866	113,866	113,866	113,866	113,866	113,866
Tyler *(Within ETRWPA),*[2,3]	83,650 *82,927*	89,571 *88,797*	93,997 *93,184*	98,409 *97,558*	102,809 *101,920*	119,994 *118,957*
Port Arthur	57,755	57,755	57,755	57,755	57,755	57,755
Nacogdoches	29,914	33,044	36,501	39,946	43,074	54,345
Lufkin	32,709	37,219	42,351	48,190	54,834	70,997
Region Total[1]	***317,171***	***330,681***	***343,657***	***357,315***	***371,449***	***415,920***

[1]Years 2010 through 2060 projections as approved by the TWDB including several revisions approved November 3, 2003, at the request of the ETRWPA.

[2]ETRWPA component disaggregated from total Tyler population.

[3]State population figures for Tyler in 2007 are somewhat higher than previously projected and would result in significantly higher projections for 2010 and beyond. Details of Tyler's increased population are addressed in Chapter 2.

Figures 1.8 and 1.9 show the relative distribution, by county, of the population in the ETRWPA. Figure 1.10 shows the anticipated growth for each county from 2000 through the end of the planning period, 2060. Additional details of population projections are provided in Chapter 2.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PANOLA
Carthage
ANDERSON
Palestine
CHEROKEE
Jacksonville
Rusk
Alto
Wells
SHELBY
Timpson
Center
NACOGDOCHES
Nacogdoches
SAN AUGUSTINE
San Augustine
SABINE
HOUSTON
Grapeland
Crockett
ANGELINA
Lufkin
Huntington
Diboll
TRINITY
Trinity
POLK
Corrigan
Livingston
TYLER
Colmesneil
Woodville
JASPER
Jasper
Kirbyville
NEWTON
Newton
HARDIN
Kountze
Silsbee
Sour Lake
ORANGE
Vidor
Orange
JEFFERSON
Beaumont
Nederland
Port Arthur
Region I Boundary
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East Texas Region
2000 Population Distribution
Location Map
FIGURE
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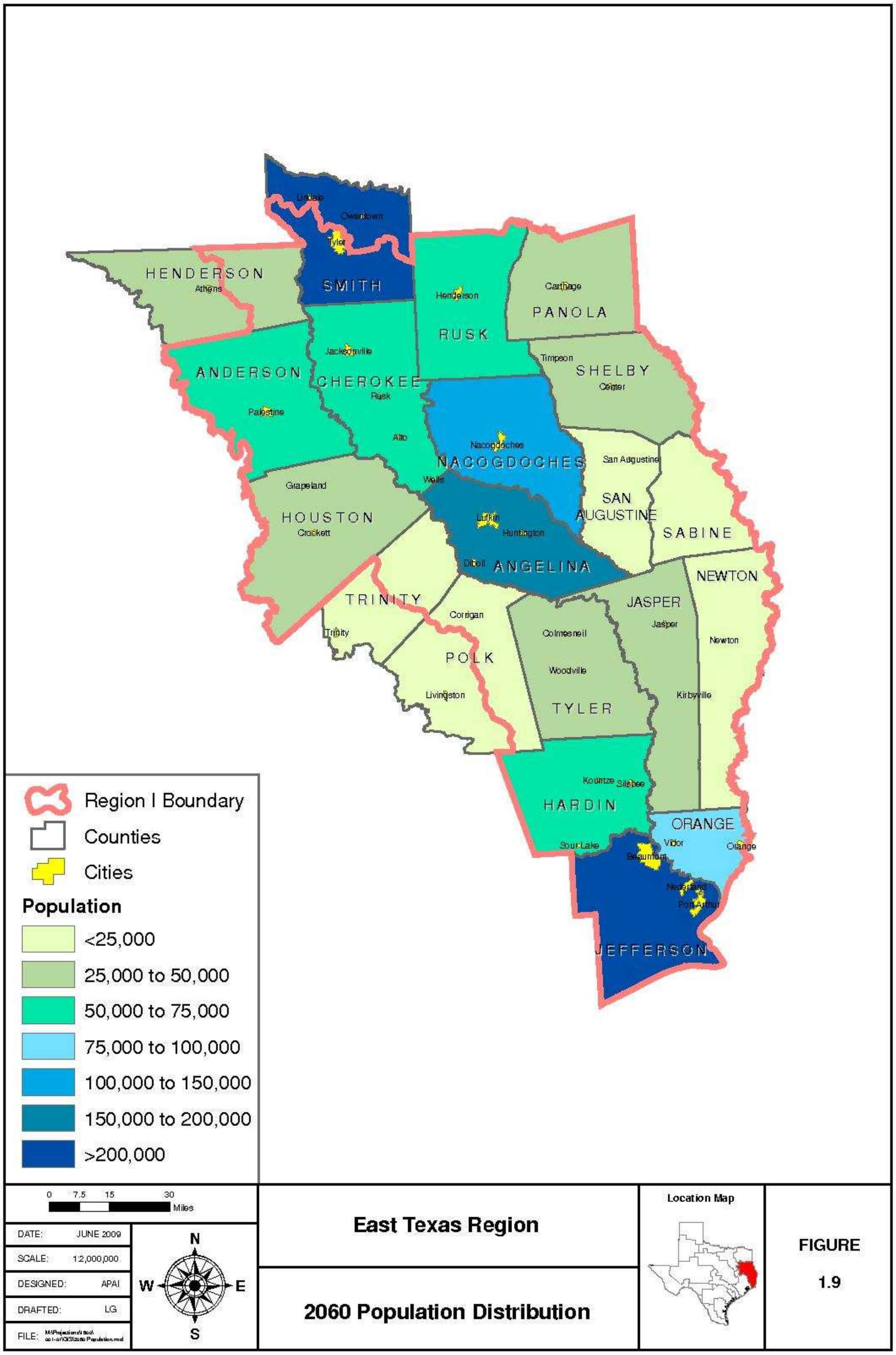
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SABINE
HOUSTON
Grapeland
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Corrigan
Livingston
TYLER
Colmesneil
Woodville
JASPER
Jasper
Kirbyville
NEWTON
Newton
HARDIN
Kountze
Silsbee
Sour Lake
ORANGE
Vidor
Orange
Beaumont
Nederland
Port Arthur
JEFFERSON
Region I Boundary
Counties
Cities
Population
<25,000
25,000 to 50,000
50,000 to 75,000
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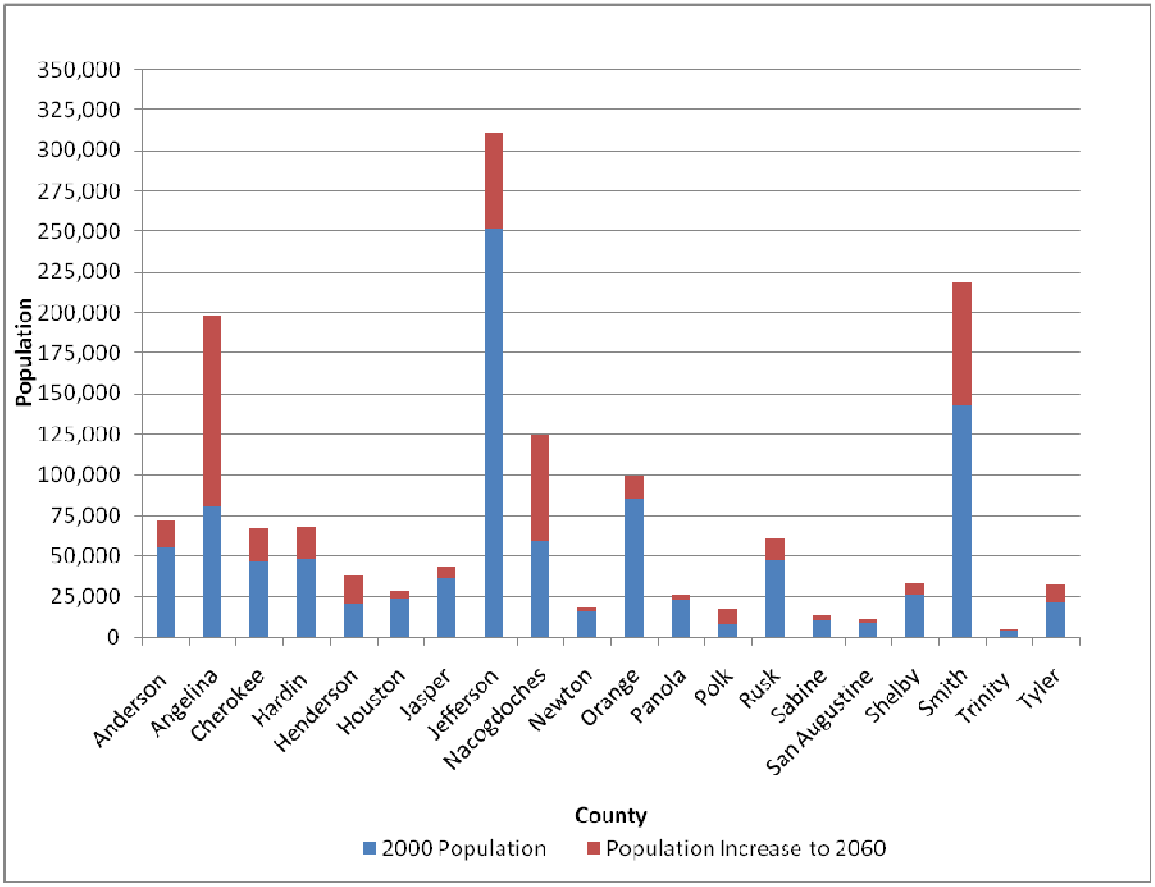
East Texas Region
2060 Population Distribution
Location Map
FIGURE
1.9

Figure 1.10 Population by County



1.5 Economic Activity

The overall economy of the region consists primarily of agriculture, agribusiness, mineral production, wholesale and retail trade, and manufacturing. Manufacturing includes the timber and petrochemical industries. Major water-using industries and irrigated crops are listed in Table 1.3.

Table 1.3 Major Manufacturing and Irrigation Water Uses

Industries	Crops
Petroleum Refining	Rice
Chemical and Allied Products	Soybeans
Lumber and Wood	Hay
	Vegetables

The Beaumont-Port Arthur metropolitan area, at the southern end of the region, has an economy based primarily on petroleum refining and chemical plants including petrochemicals. Other industries include a steel mill and paper mills, correctional facilities, as well as other timber products industries in Hardin County.

There are several seaports (Beaumont, Port Arthur, and Orange, plus several industrial docks), along with small amounts of shipyard activity. Industrial construction, including $3 billion in Jefferson County since 1997, has provided a significant amount of local employment in recent years. Agriculture in the area includes cattle, rice, and soybeans. Oil and gas production are significant.

Four campuses of the university system of the State of Texas are located in the area. Beaumont contains Lamar University and the adjacent Lamar Institute of Technology. Lamar State College-Port Arthur and Lamar State College-Orange are located in Port Arthur and Orange, respectively.

The Longview metropolitan area is located just outside the region, north of Rusk County. It is centered in Longview in Gregg County. However, the area contains very diversified manufacturing in the ETRWPA, particularly in Rusk County including brick manufacturing, power generation, steel fabrication, fiberglass specialties, and the timber industry. Rusk County also has state correctional facilities. No major ETRWPA cities are located in this area.

The Tyler metropolitan area, consisting of Smith County, lies partially within the northern end of the region. Tyler, the only major city in the area, lies almost entirely within the region. Local manufacturing includes air conditioning/heating equipment, cast iron pipe, tires, meat packing, and oil platform. However, the area is largely a commercial, educational, and medical center. Oil production and rose farming are prevalent in the area. The University of Texas at Tyler is also located in the City of Tyler.

Lufkin and Nacogdoches, the other major cities in the ETRWPA, do not presently classify as metropolitan areas but would do so by 2040 and 2060, respectively, according to the current TWDB population projections. These cities, located in adjacent micropolitan counties, have many similarities including timber products industries, poultry processing, and higher education. Lufkin also has a foundry and a truck trailer manufacturer, while Nacogdoches has manufacturers of valves, transformers, sealing products, and motor homes. Stephen F. Austin University is located in Nacogdoches.

The remainder of the region is largely forested and has various timber industries including paper mills in Southeast Texas. Oil production is scattered throughout the region, and beef cattle are prominent, being found in all of the counties in the region. Plant nurseries are common in the north part of the region. Poultry production and processing are prevalent in Shelby and Nacogdoches Counties and very significant in Angelina and Panola Counties. There is diverse manufacturing in addition to timber industries. Commercial fishing is an important economic characteristic of Sabine Lake. Tourism is important in many areas, especially on large reservoirs; in the southern end of the region near Sabine Lake and the Gulf of Mexico; and in many timbered areas which offer hunting opportunities.

Information from the Texas Workforce Commission (TWC) shows unemployment for the region varying from 5.2% in Nacogdoches County to 17.5% in Sabine County in 2009. Of the three workforce areas overlapping the region, the average annual wages for 2007 were as follows:[3]

- East Texas (northern counties): $28,476
- Deep East Texas (middle counties): $27,550
- South East Texas (Beaumont-Port Arthur metropolitan area): $28,911

1.6 Sources of Water

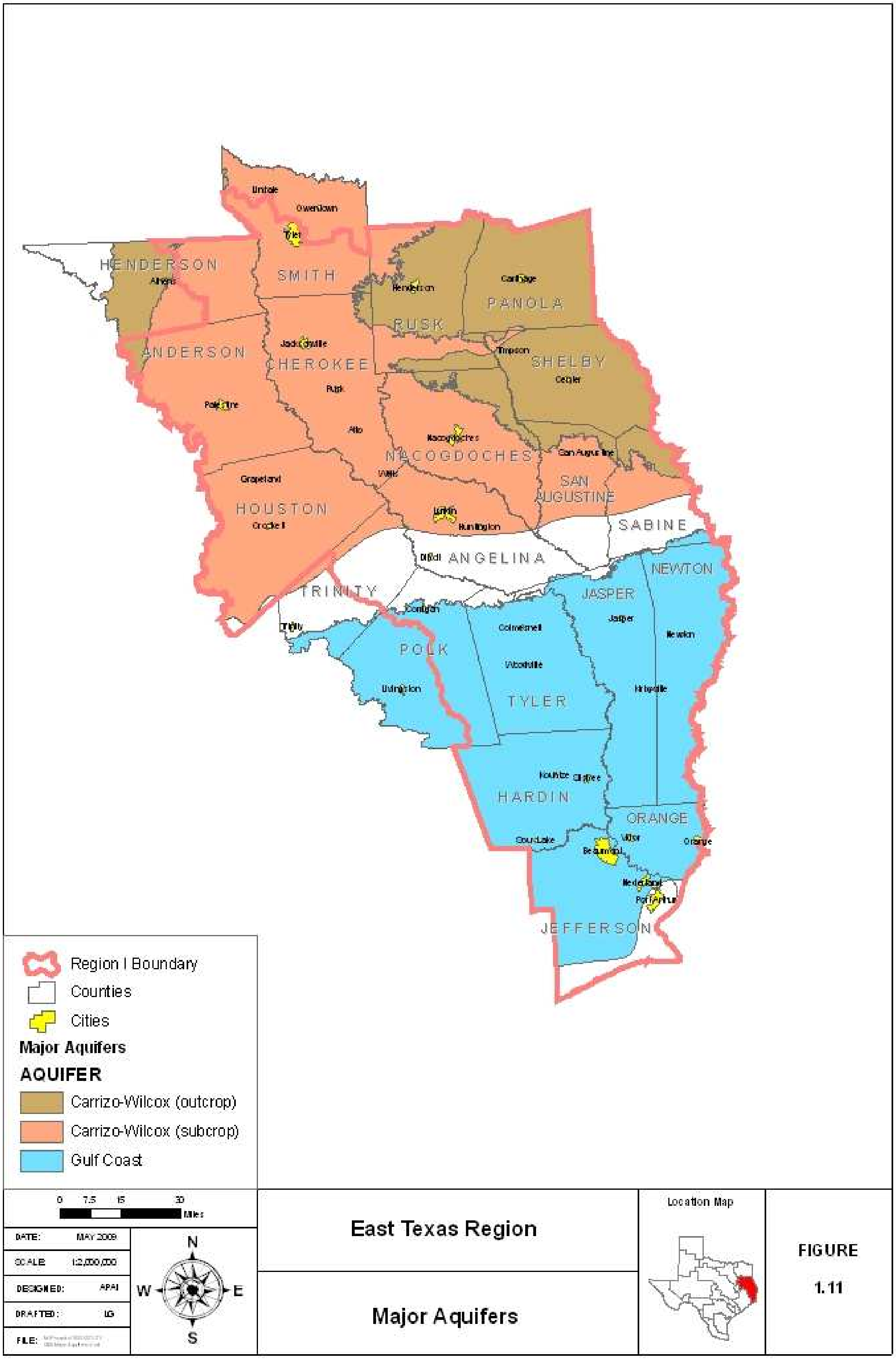
The ETRWPA obtains its supplies from both groundwater and surface water sources. Each source is described following.

1.6.1 Groundwater and Springs. The TWDB has identified two major aquifers and three minor aquifers in the region. The difference between the major and minor classification as used by the TWDB relates to the total quantity of water produced from an aquifer and not the total volume available.

The two major aquifers that underlie the region are known as the Carrizo-Wilcox and the Gulf Coast aquifer. The three minor aquifers, the Queen City, Sparta, and Yegua-Jackson aquifers, supply lesser amounts of water to the region. Figures 1.11 and 1.12 show the locations of the major and minor aquifers, respectively.

The following generalized descriptions of the major and minor aquifers and springs are based largely on the work of TWDB. A general discussion of water quality and groundwater availability is described in section 1.12 of this chapter. A more thorough discussion of groundwater availability is provided in Chapter 3.

Gulf Coast Aquifer. The Gulf Coast aquifer forms an irregularly shaped belt along the Gulf of Mexico from Florida to Mexico. In Texas, the aquifer provides water to all or parts of 54 counties, including 10 counties in the ETRWPA. It extends from the Rio Grande northeastward to the borders with Louisiana and Arkansas. The Gulf Coast aquifer provides the sole source of groundwater in the seven southern counties of the region.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NEWTON
TRINITY
JASPER
POLK
TYLER
HARDIN
ORANGE
JEFFERSON
Tyler
Henderson
Carthage
Jacksonville
Palestine
Nacogdoches
Lufkin
Beaumont
Port Arthur
Region I Boundary
Counties
Cities
Major Aquifers
AQUIFER
Carrizo-Wilcox (outcrop)
Carrizo-Wilcox (subcrop)
Gulf Coast
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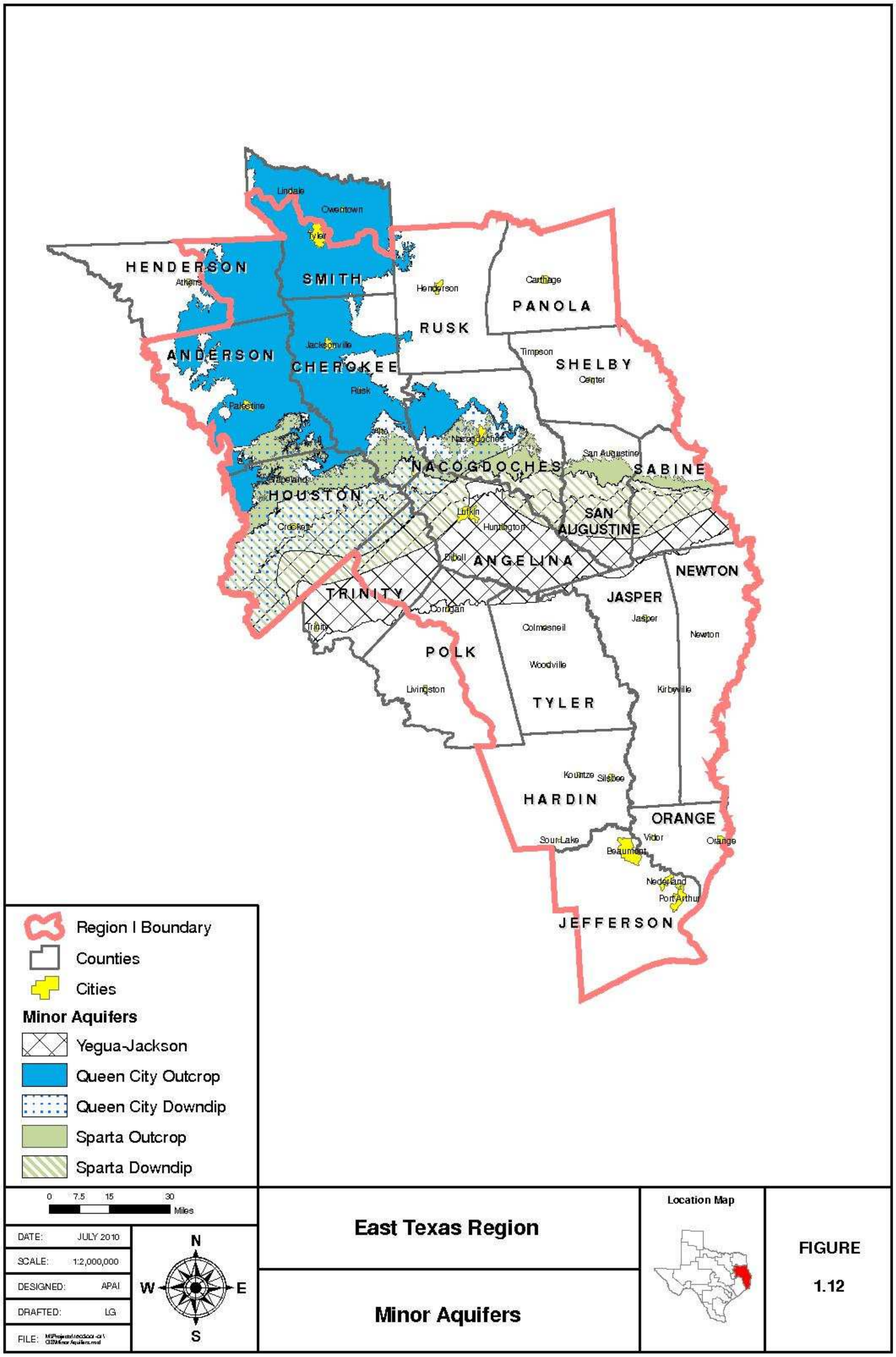
East Texas Region
Major Aquifers
Location Map
FIGURE
1.11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ANGELINA
NEWTON
TRINITY
JASPER
POLK
TYLER
HARDIN
ORANGE
JEFFERSON
Region I Boundary
Counties
Cities
Minor Aquifers
Yegua-Jackson
Queen City Outcrop
Queen City Downdip
Sparta Outcrop
Sparta Downdip
DATE: JULY 2010
SCALE: 1:2,000,000
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East Texas Region
Minor Aquifers
Location Map
FIGURE
1.12

The Gulf Coast aquifer contains various interconnected layers, some of which are aquicludes (impervious clay or rock layers). From bottom to top, the four main water-producing layers are the Catahoula, the Jasper, the Evangeline, and the Chicot, with the Evangeline and Chicot being the main sources of groundwater in Southeast Texas.

Total pumpage from the Gulf Coast aquifer in the region averaged approximately 99,064 acre-feet per year (ac-ft per year) during 2001, 2002, and 2003.

Carrizo-Wilcox Aquifer. The Carrizo-Wilcox aquifer is formed by the hydraulically connected Wilcox Group and the overlying Carrizo Formation of the Claiborne Group. This aquifer extends from the Rio Grande in south Texas northeastward into Arkansas and Louisiana, providing water to all or parts of 60 counties in Texas, including 13 in the ETRWPA. The Carrizo-Wilcox aquifer in the region occurs as a major trough caused by the Sabine Uplift near the Texas-Louisiana border.

Total groundwater pumpage from the Carrizo-Wilcox in the region averaged 75,219 ac-ft per year during 2001, 2002, and 2003. The largest urban areas dependent on groundwater from the Carrizo-Wilcox are located in central and northeast Texas and include the ETRWPA cities of Lufkin (Angelina County), Nacogdoches (Nacogdoches County), and Tyler (Smith County). Well yields of greater than 500 gallons per minute (gpm) are not uncommon.

In some wells, declines in the artesian portion of the Carrizo-Wilcox in this area have exceeded 200 feet. However, evaluation of 46 Carrizo-Wilcox wells scattered throughout the region that have been monitored since the 1960s indicates that the average water level decline from the 1960s to the 1990s is about 51 feet and ranges from 20 feet below ground level (bgl) to 263 feet (bgl). Significant water-level declines have occurred in the region around Tyler and the Lufkin-Nacogdoches area.

Much of this pumpage has been for municipal supply, but industrial pumpage is also significant. However, pumpage from industries has generally declined since the 1980s. Total pumpage from the Carrizo in Angelina and Nacogdoches counties has decreased since the 1980s and therefore, water levels have stabilized in these areas. In some wells, water levels have actually increased, although the wells are still being utilized.

Sparta Aquifer. The Sparta aquifer extends in a narrow band across the state from the Frio River in South Texas northeastward to the Louisiana border in Sabine County. The Sparta Formation is part of the Claiborne Group deposited during the Tertiary Period and consists of sand and interbedded clay with more massive sand beds in the basal section.

Yields of individual wells are generally low to moderate, although most high-capacity wells average 400 to 500 gpm. Because the Carrizo aquifer underlies the Sparta, most public water supply wells and other large production wells are completed in the Carrizo, thus limiting the total pumpage from the Sparta.

Relatively large amounts of usable quality groundwater are contained within the rocks of the Sparta aquifer. Historically, availability has been considered 5 percent of the average annual rainfall on the aquifer in the Neches and Sabine River basins.

Queen City Aquifer. Like the Sparta, the Queen City aquifer extends in a band across most of Texas from the Frio River in South Texas northeastward into Louisiana. The Queen City Formation is composed mainly of sand, loosely cemented sandstone, and interbedded clays. Although large amounts of usable quality groundwater are contained in the Queen City, yields are typically low, but a few exceed 400 gpm.

In the Neches, Sulphur, Sabine, and Cypress Creek basins, availability from the Queen City aquifer based on recharge has been estimated at 5 percent of average annual precipitation. Because of the relatively low well yields, overdrafting of the aquifer has not occurred.

Yegua-Jackson. The Yegua-Jackson aquifer extends in a narrow band from the Rio Grande to Louisiana. In the ETRWPA the aquifer is located in the southern half of Sabine and San Augustine counties, the lower tip of Nacogdoches County, most of Angelina County, the sourthern portion of Houston County, those portions of Polk and

Trinity Counties located in the ETRWPA, and small northern portions of Tyler, Jasper, and Newton Counties. The Yegua-Jackson aquifer is a complex association of sand, silt and clay deposited during the Tertiary Period.

Springs. There are over 250 springs of various sizes documented in the region. A description of the springs is provided in Section 1.9.7. Most springs in the region discharge less than 10 gpm.

None of the springs are used for water supply[4]. The Jasper County spring was used as source water for a local Texas Parks and Wildlife Department (TPWD) fish hatchery in the 1970s.

Groundwater Quality. Groundwater quality is affected by natural conditions as well as man-made contamination. The Texas Water Commission (predecessor agency to the Texas Commission on Environmental Quality) has stated, "Natural contamination probably affects the quality of more groundwater in the state than all other sources of contamination combined."[5] In the Gulf Coast aquifer, salt water intrusion is an important form of natural contamination because of the proximity of the Gulf of Mexico.

Under natural conditions, in the absence of pumping, a layer of salt water underlies the lighter fresh water layer with a well-defined interface between the two layers. At any given point, especially near the coast, deeper aquifers may be filled with salt water, very shallow aquifers may contain all fresh water, and an intermediate aquifer may be contained in the interface between the two.

Heavy pumpage has caused an updip migration, or saltwater intrusion, of poor quality water into the aquifer beyond its natural limits. A 1990 TWDB report indicated that salt water conditions are a problem in Orange County in the heavily pumped areas around Orange and Vidor. The previously referenced Texas Water Commission report also indicates high chloride concentrations in most of Jefferson County. Much of the migration is lateral, but some localized vertical coning occurs in wells that draw from levels above the interface between salt and fresh water. In coning, some salt water is drawn up into the pumping well from below along with the fresh water at the intake level.

Salt water is also found farther inland, but usually at greater depths than in coastal areas. Salinity problems also occur in the vicinity of salt domes.

In some areas, natural contamination results from substances in the soil or in the aquifer media. Radioactivity is present in groundwater from natural causes, particularly in a belt across the ETRWPA including the area lacking major or minor aquifers. Some areas have nuisance substances in the groundwater such as iron, manganese, and sulfates affecting the taste or color of the water.

Man-made aquifer pollution may result from improper waste disposal, leaking underground tanks. Wood preservation operations, pesticide use in agriculture, and improperly constructed wells.[5, 6] There is no current evidence indicating problems associated with man-made pollution.

The Gulf Coast aquifer generally contains good quality water except in portions of Jefferson and Orange Counties. The Carrizo-Wilcox aquifer for the most part has good water except for high dissolved solids and salinity in a band along its south boundary. Iron is a widespread problem in the aquifer, but sulfates and chlorides are found only in scattered locations other than chlorides along the south boundary.[6]

The Sparta aquifer produces water of excellent quality throughout most of its extent in the region; however, water quality deteriorates with depth in the downdip direction. Throughout most of its extent, the chemical quality of the Queen City aquifer water is excellent, however, quality deteriorates with depth in the downdip direction.

The Yegua aquifer produces good water only in a limited area. Iron is a problem, and the water from at least one location has been described as sodium bicarbonate water.

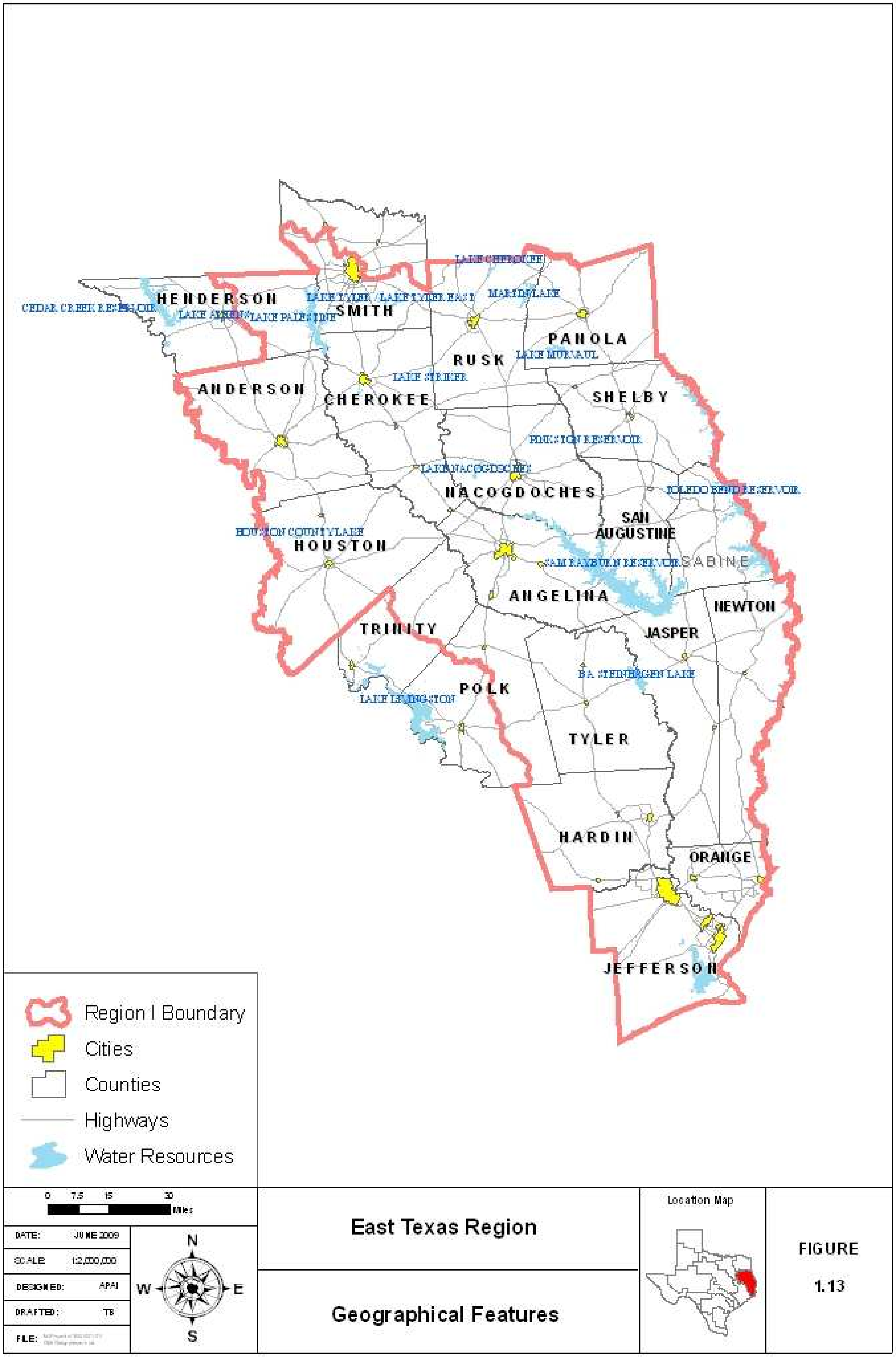
1.6.2 Surface Water. Surface water may be obtained directly from streams and rivers, but in the ETRWPA, most surface water is provided by fourteen existing water supply reservoirs. Locations of major reservoirs and geographical features are shown on Figure 1.13. Table 1.4 contains pertinent data for the major water supply reservoirs in the region including ten in the Neches River Basin, three in the Sabine River Basin, and one in the Trinity River Basin. One proposed reservoir, Lake Columbia in the Neches River Basin is also included in Table 1.4.

Surface water quality in the region varies between water bodies. Stream and lake segments with water quality problems identified by the Texas Commission on Environmental Quality (TCEQ) as impaired are discussed in Section 1.12. None of the segments in the region indicate problems as drinking water sources. Aquatic life, fish consumption, and recreation uses are sometimes not supported in the water bodies.

Fish consumption is the subject of Texas Department of State Health Services (TDSHS) advisories in a number of segments, mostly in reservoirs as a result of mercury found in certain species of fish.[7] The mercury concentration in the water was negligible and did not present problems for recreation or water supply.[8, 9]

Even though the water in the reservoirs and streams is usable as a drinking water source, surface water generally requires more extensive treatment than groundwater. This additional treatment includes sedimentation, filtration, and disinfection.

Salt water intrusion is a major concern in the tidal reaches of streams, especially since ship channels between the Gulf of Mexico and Sabine Lake were dredged around the beginning of the twentieth century. The salt water, being heavier than fresh water, tends to settle on the bottom of the channel similar to the way it underlies fresh water in aquifers. The horizontal and vertical extent of the salt water layer varies according to several factors including fresh water inflow and tidal influence. The salt water barrier in the Neches River keeps the salt water from reaching Lower Neches Valley Authority (LNVA) and City of Beaumont raw water supply intakes.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East Texas Region
Geographical Features
Location Map
FIGURE
1.13

Table 1.4 Major Water Supply Reservoirs

Reservoir Name	Owner	Conservation Pool Elevation (ft msl)	Area (ac)	Capacity (ac-ft)	Firm Yield (ac-ft per year)[(1)]
Neches River Basin					
Lake Athens	Athens MWA	440	1,520	32,790	6,145
Lake Columbia[2]	ANRA	315	10,000	187,839	75,700
Lake Jacksonville	City of Jacksonville	422	1,320	30,500	6,200
Lake Nacogdoches	City of Nacogdoches	279	2,219	41,140	17,450
Lake Naconiche[3]	Nacogdoches County	348	692	8,708	3,239
Lake Palestine	Upper Neches River MWA	345	25,560	411,300	209,500
Lake Pinkston	City of Center	298	523	7,380	3,800
Lake Tyler/Tyler East	City of Tyler	375.4	4,880	73,700	30,925
Sam Rayburn	Corps of Engineers	164.4	114,500	2,898,300	820,000
B. A. Steinhagen	Corps of Engineers	83	13,700	94,200	
Striker Creek Reservoir	Angelina-Nacogdoches WCID No. 1	292	2,400	26,960	20,600
Sabine River Basin					
Lake Cherokee[4]	Cherokee Water Company	280	3,987	46,700	29,120
Lake Murvaul	Panola Co. FWSD No. 1	265	3,800	45,815	22,380
Toledo Bend Reservoir[5]	SRA	172	181,600	4,472,900	750,000
Trinity River Basin					
Houston County	Houston Co. WCID No. 1	260	1,282	19,500	3,500

[1] Firm yield is the lesser of 2000 firm yield or permitted diversion unless otherwise noted.

[2] Lake Columbia is permitted but not yet constructed. Lake Columbia is in the process of U.S. Army Corps of Engineers permitting.

[3] Lake Naconiche has been constructed and is currently filling. The firm yield for Lake Naconiche is estimated. Nacogdoches County is planning to amend its water right to add municipal users in the future.

[4] Lake Cherokee lies partially in Gregg County and is used outside the region.

[5] Capacity information obtained from SRA.

Pollution from industrial discharges has also been a major concern, although industries have been required to improve the quality of their effluent over what it was several decades ago. Salt water intrusion, which was exacerbated by dredging of the Sabine-Neches Waterway, has disqualified the lower segments of the Sabine and Neches Rivers from use as drinking water supplies.

1.6.3 Special Water Resources. Special water resources are defined by the Texas Administrative Code as surface water resources where the water rights are owned in whole or in part by an entity in another region, water supply contract or existing water supply option agreement results in water from the surface water resource being supplied to an entity in another regional water planning area. Special water resources within the ETRWPA include Lake Athens, Lake Cherokee, and Lake Palestine. Planning for these resources was coordinated with water rights holders and regions where the water is currently being used or planned to be used. Water plan development considered special water resources in the ETRWPA in order to protect the water rights, water supply contracts, and water supply option agreements associated with the special water resources to ensure that water supplies obligated to meet demands outside the ETRWPA are not impacted.

1.7 Wholesale Water Providers

Water is made available for use in the region by retail and wholesale water providers (WWPs). The majority of retail water comes from major water suppliers. The definition of a WWP is included in Title 31 of the Texas Administrative Code (TAC) Chapter 357.2(8) and is as follows: "Wholesale water provider - Any person or entity, including river authorities and irrigation districts, that has contracts to sell more than 1,000 ac-ft per year of water wholesale in any one year during the five years immediately preceding the adoption of the last regional water plan. The regional water planning groups shall include as WWPs others persons and entities that enter or that the regional water planning group expects or recommends to enter contracts to sell more than 1,000 ac-ft per year of water wholesale during the period covered by the plan."

1.7.1 Angelina and Neches River Authority. The Angelina and Neches River Authority (ANRA), headquartered in Lufkin, has jurisdiction over the middle portion of the Neches basin including the Angelina basin, and portions of Jasper and Orange Counties in the Neches basin. ANRA holds the permit for the proposed Lake Columbia, with rights to approximately 85,507 ac-ft per year for distribution. ANRA serves as the lead agency in the Neches River Basin for the Clean Rivers Program within its own jurisdiction as well as that of the Upper Neches River Municipal Water Authority. ANRA also owns and operates a water and sewer system in a subdivision near Jasper, a regional wastewater facility in northwestern Angelina County,[9] and a biosolids composting facility in Cherokee County.

1.7.2 Angelina-Nacogdoches Water Control & Improvement District No. 1. The Angelina-Nacogdoches Water Control & Improvement District No. 1 (A-N WCID No. 1) owns and operates Lake Striker in Rusk and Cherokee Counties. Currently, the only demand on A-N WCID No. 1 is for steam-electric power in Cherokee County. Supplies have previously been provided to a paper mill that is presently closed.

1.7.3 Athens Municipal Water Authority. The Athens Municipal Water Authority (MWA) provides water to the City of Athens, which is located in both Region C and the ETRWPA, and the Texas Freshwater Fisheries Center at Lake Athens. Athens MWA has 8,500 ac-ft per year of water rights in Lake Athens. The firm yield of the lake was estimated at 6,145 ac-ft per year. However, the intake structure for the fish hatchery does not allow the water level to drop below 431 feet msl and maintain inflow to hatchery. Using this operational constraint, the yield of Lake Athens is 2,900 ac-ft per year. The Athens MWA also has a wastewater reuse authorization, but the infrastructure is not in place to utilize this source.

1.7.4 City of Beaumont. The City of Beaumont draws water from two sources in roughly equal amounts. The three wells are located in the Loeb community in southern Hardin County a short distance north of the City. Beaumont also draws surface water from the Neches River at two points upstream from its water treatment plant. A portion of the raw water is transmitted to a refinery south of the City. The rest of the water is treated and fed into the City of Beaumont water system.

Water in the system, whether from the wells or from the river, is used for in-city municipal customers; for various industries inside and outside the City; for wholesale customers including two nearby water districts; and for state, federal, and county correctional facilities south of the City. Two other water districts have standby service from Beaumont. The City holds rights to 49,897 ac-ft per year from the Neches River. The City of Beaumont also has a reserve supply contract with LNVA for water in Sam Rayburn Reservoir.

1.7.5 City of Carthage. The City of Carthage provides wholesale water to County-Other customers in Panola County and manufacturing customers. The City currently obtains its water from groundwater from the Carrizo-Wilcox aquifer and surface water from Panola County Fresh Water Supply District (FWSD) via Lake Murvaul.

1.7.6 City of Center. The City of Center currently obtains water from Lake Center and Lake Pinkston for use within the City and for distribution to its municipal and industrial customers. Several water supply corporations have emergency interconnections with the City, one of which receives part of its normal supply from the City of Center. Local industries include two poultry plants, a hardwood flooring plant, and manufacturers of store fixtures, shelters, and portable cooling equipment.[10] The City of Center owns and operates Lake Center, with rights to 1,460 ac-ft per year of municipal water. Water from Lake Pinkston is pumped from the Neches River Basin to the City of Center, and the City holds rights to 3,800 ac-ft per year of water in Lake Pinkston.

1.7.7 City of Jacksonville. The City of Jacksonville draws water partially from wells and partially from Lake Jacksonville, from which it holds water rights of 6,200 ac-ft per year. *(The City also holds a total of 1,200 ac-ft per year of water rights in Lake Acker.)* Jacksonville supplies several wholesale customers including the Afton Grove, Craft-Turney, Gum Creek, and North Cherokee Water Supply Corporations.

Jacksonville also supplies water to local industries including feed mills, candy manufacturing, meat packing, timber products, furniture manufacturing, medical equipment, heat exchanger cores, plastic products, printing equipment, electric signs, copper products, wooden baskets, venting, and metal fabrication.[11]

1.7.8 City of Lufkin. The City of Lufkin currently draws its water from City-owned wells. It has recently purchased the former Abitibi Bowater groundwater well field and surface water rights associated with Lake Kurth in Angelina County. The City of Lufkin also has 28,000 ac-ft per year of surface water rights in Sam Rayburn Reservoir. In addition to its own municipal customers, the City supplies water to a number of industries as well as wholesale entities, the City of Diboll, City of Huntington and the Angelina Fresh Water District.

1.7.9 City of Nacogdoches. The City of Nacogdoches draws part of its supply from wells located in and near the City, with the remainder coming from Lake Nacogdoches ten miles west of the City *(water rights of 20,162 ac-ft per year).* An increasing percentage of the water comes from the lake as water demand increases and the wells approach the end of their useful life. The City supplies water to its own municipal customers, including Stephen F. Austin State University (SFA) and several hundred retail customers outside the City. Various industries in and near the City of Nacogdoches are also supplied by the City.

Outside wholesale customers supplied by Nacogdoches on a full-time basis include one water district and one water supply corporation. One other water district and at least two other water supply corporations are interconnected for emergency use. The City of Nacogdoches has bought out one neighboring water supply corporation and taken over its system.

1.7.10 City of Port Arthur. The City of Port Arthur draws all of its water supply from the LNVA canal system that extends to the City. After treating the water in its plant constructed in the late 1990s, it supplies water to a wholesale customer (a state park) and to various nearby industries, some of which use City water only for domestic use. Port Arthur has taken over the water system for one plant just outside the City.

1.7.11 City of Tyler. The City of Tyler draws water partially from wells but primarily from surface water sources. One source consists of nearby Lake Tyler and Lake Tyler East, which are interconnected by a channel so as to function as one lake. Tyler also completed a new surface water plant on Lake Palestine in 2003.

Tyler supplies a number of local industries including steel fabrication, building fasteners, oil platforms, machine shops, plastics industries, timber industries, paper products, air conditioners, food industries, sportswear, industrial gases, signs, trailers, concrete products, tires, rubber extrusions, fishing lures, oil and gas refining, asphalt, iron pipe, refractory materials, automotive equipment, and silk flowers.[12] Tyler also provides part of the water supply for the City of Whitehouse and for a nearby water supply corporation.

An older and smaller City lake, Lake Bellwood, provides raw water for two golf courses and for a tire manufacturer.

The City of Tyler water rights include 40,000 ac-ft per year from Lake Tyler/Tyler East and 2000 ac-ft per year from Lake Bellwood. Tyler is also entitled by contract to 67,213 ac-ft per year (60 million gallons per day [MGD]) from Lake Palestine.

1.7.12 Houston County Water Control & Improvement District No. 1. The Houston County Water Control & Improvement District No. 1 (HCWCID No. 1) owns and operates Houston County Lake northwest of Crockett. It has no retail customers other than one industry, but supplies water to several wholesale customers in the county. These customers consist of three cities (Crockett, Grapeland, and Lovelady) and Consolidated Water Supply Corporation (Consolidated WSC). Consolidated WSC has a multi-county service area that includes over half of Houston County. The WSC has several thousand connections in Houston County as well as connections in neighboring counties.

The Cities of Crockett, Grapeland, and Lovelady have one well each to supplement the wholesale water supply, while the Consolidated WSC has seven wells within the county. The first two cities resell water to the Consolidated WSC to supply some of its isolated systems.

HCWCID No. 1 has a surface water treatment plant with water rights to 3,500 ac-ft per year from Houston County Lake.

1.7.13 Lower Neches Valley Authority. The LNVA has water rights to a total of 1,173,876 ac-ft per year from Sam Rayburn Reservoir/Lake B. A. Steinhagen System *(both owned and operated by the U.S. Army Corps of Engineers)* and the Neches River. LNVA draws water from the Neches River far downstream from the two lakes as well as from Pine Island Bayou. LNVA distributes, through its canal system, approximately 1.2 million acre-feet of water annually to cities, industries, and farmers in the Southeast Texas area. In particular, LNVA provides raw water for most of the cities and water districts in Jefferson County.

The LNVA has constructed a permanent salt water barrier on the Neches River, protecting its canal intakes and those of the City of Beaumont from salt water intrusion. This barrier helps conserve surface water in the reservoirs, since it is no longer necessary to release water during dry periods to keep the salt water pushed away from the intakes.

The LNVA completed, in October 2004, a regional water plant in Chambers County (just outside the region) to treat its own canal water for the Bolivar Peninsula (also outside the region).

In addition to most of the lower portion of the Neches River Basin, the LNVA has jurisdiction over the Neches-Trinity Coastal Basin. LNVA also serves as the lead agency for implementation of the Clean Rivers Program within its jurisdiction.

1.7.14 Panola County Freshwater Supply District No. 1. The Panola County Freshwater Supply District No. 1 (PCFWSD No. 1) owns and operates Lake Murvaul in the ETRWPA. Created in 1953, the district provides water exclusively to the City of Carthage from its rights to 21,280 ac-ft per year of municipal water and 1,120 ac-ft per year of industrial water in Lake Murvaul. The City of Carthage in turn, provides wholesale service to five water supply corporations and a privately owned system, in some cases as the sole supplier.

1.7.15 Sabine River Authority. The Sabine River Authority (SRA), created in 1949 by the Texas Legislature, was originally formed as a conservation and reclamation district. SRA is responsible for controlling, storing, preserving and distributing the waters of the Sabine River and its tributaries throughout the Texas portion of the Sabine River Basin for beneficial use. SRA also serves as the lead agency for implementation of the Clean Rivers Program in the basin.

Within the region, the SRA owns and operates Toledo Bend Reservoir jointly with the Sabine River Authority of Louisiana. SRA supplies raw water via contracts with municipalities, water-supply corporations and industrial users in Texas. SRA holds rights to approximately 750,000 ac-ft per year in the reservoir.

The SRA also holds run-of-the-river rights, which are associated with SRA's Canal System. Those rights include 100,400 ac-ft per year for municipal and industrial use, and 46,700 ac-ft per year for irrigation use.

1.7.16 Upper Neches River Municipal Water Authority. The Upper Neches River Municipal Water Authority (UNRMWA), headquartered at Lake Palestine, was created in 1953. The agency is the part owner, authorized agent, and operator of Lake Palestine on the Neches River. UNRMWA holds rights to some 238,000 ac-ft per year in Lake Palestine, from which it distributes raw water to municipalities and other contract buyers in the region.

Several entities participated in the construction of Lake Palestine and hold contract rights for water from the lake. These entities include the cities of Palestine and

Tyler within the ETRWPA. Additionally, Dallas Water Utilities (DWU) and the Tarrant Regional Water District (TRWD) are cooperating to construct the Integrated Pipeline, which will deliver water to Dallas and Tarrant Counties from Lake Palestine, as well as Cedar Creek Lake and Richland-Chambers Reservoir. The pipeline will have a capacity of approximately 350 MGD, with 150 MGD for Dallas and 200 MGD for TRWD. Dallas' contract with the UNRMWA and an interbasin transfer permit allowing the use of water from Lake Palestine in the Trinity River Basin provide Dallas 114,337 acre-feet per year (102 MGD) of water from Lake Palestine. TRWD's capacity in the Integrated Pipeline will deliver about 179,000 acre-feet per year (160 MGD) from Cedar Creek Lake and Richland-Chambers Lake.

1.8 Current and Projected Water Demands

The demand for water in the ETRWPA is expected to grow from 875,189 ac-ft per year in the year 2010 to a total of 1,405,971 ac-ft per year in 2060. The water demands, in the regional water planning process, is categorized into six major user groups; municipal, manufacturing, irrigation, steam electric, livestock and mining. A more detailed description for each user group is found in Chapter 2. The demand for the Years 2000 and 2060 for each of the major groups is shown on Figures 1.14 and 1.15.

The total demand in this planning cycle is approximately 2 percent higher than the 2006 planning cycle. The projected demand on supplies does not include future demands for supplies that are located in the ETRWPA and identified as strategies for other regions.

Most major demand in the region centers around larger cities or metropolitan areas. In particular, over half of the current and projected water demand lies in Jefferson and Orange Counties in Southeast Texas. In that area the two dominant water usages are manufacturing and irrigation, the latter occurring mainly in Jefferson County. However, large volumes of water use can occur away from large cities as in the case of outlying industries and steam-power generating plants.

Figure 1.14
2000 Distribution of Water Demand

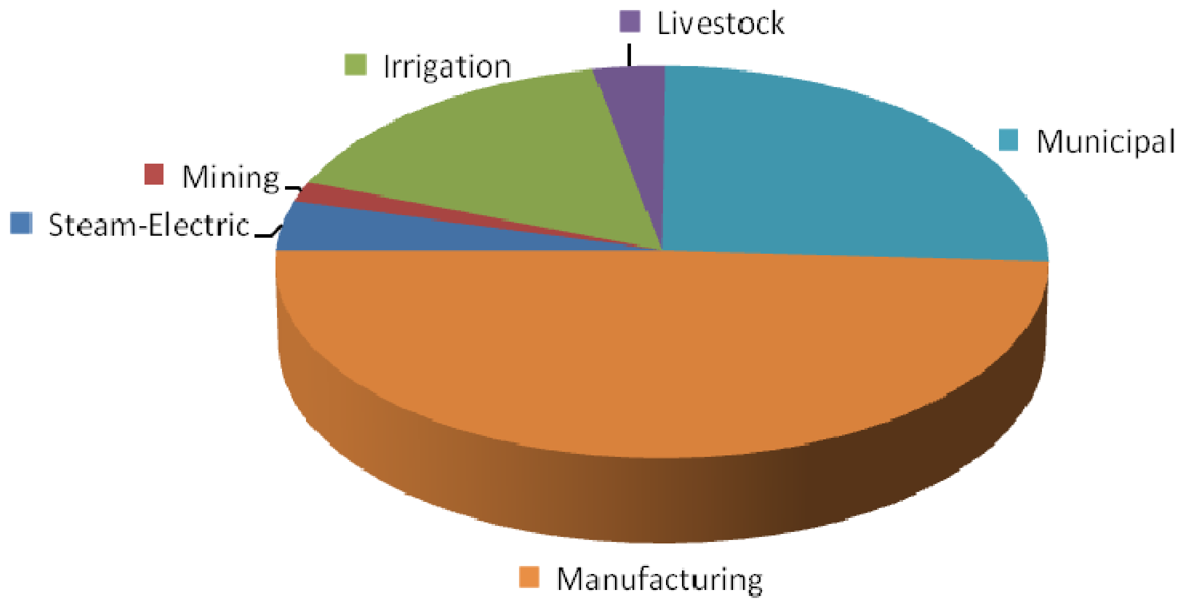
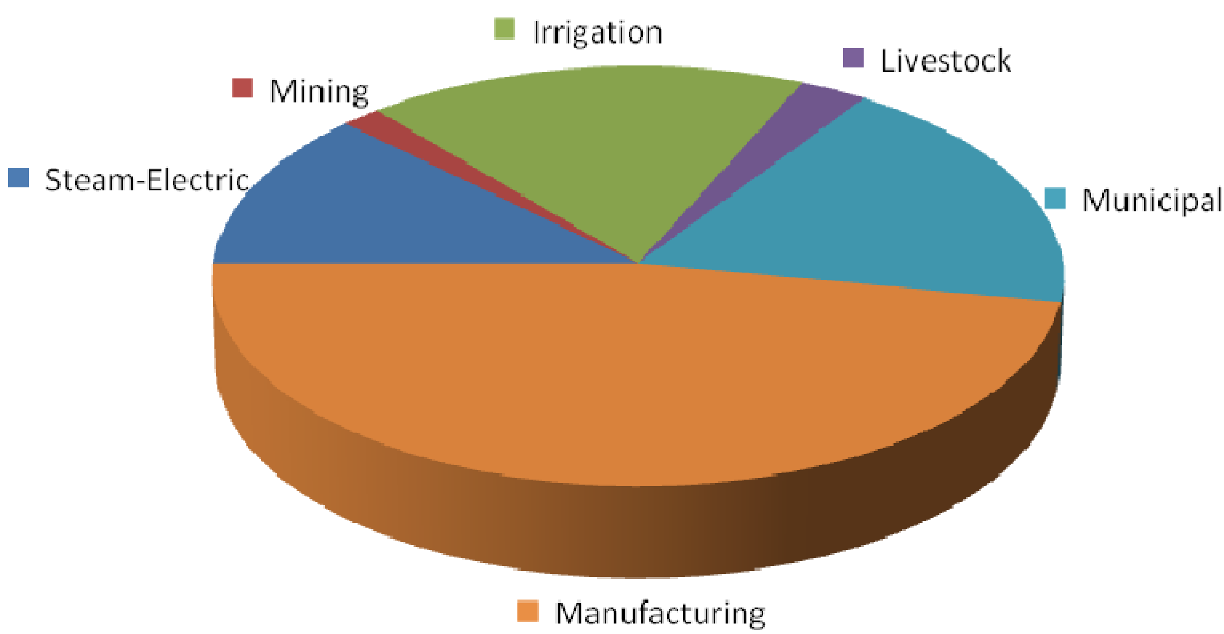


Figure 1.15
2060 Distribution of Water Demand



For purposes of this report, major demand centers have been selected according to varying criteria. A county was selected if its total water usage *(without depending on a single industry)* exceeded 40,000 ac-ft per year. In counties that were not selected as a whole, a single industry was selected if it had 20,000 ac-ft per year or more and represented the majority of usage in the county. Anticipated future power plants or increased usage by power plants was assumed to represent a single facility.

There are currently five major demand centers. An additional three major demand centers are expected to become prominent by 2060, are summarized in Table 1.5. Jefferson and Orange Counties are listed together as one demand center because of the unified nature of the metropolitan area. Other counties listed as demand centers are Angelina and Nacogdoches Counties in the middle of the region and Smith County at the northern end. Outside the listed counties, two existing and two anticipated industries – a paper mill and three steam-electric generating plants – are listed as demand centers in themselves. These facilities account for the vast majority of water usage in their counties, which otherwise would not constitute major demand centers.

1.9 Natural Resources and Agricultural Resources

Natural resources within the ETRWPA include timber, wetlands, estuaries, endangered or threatened species, ecologically significant streams, springs, and state or federal parkland and preserves. Agricultural resources are defined as prime farmland. Groundwater should be considered another primary resource for the region. Other natural resources include oil, natural gas, sand and gravel, lignite, salt and clay. Various major resources are described in the following subsections.

1.9.1 Timber. The primary natural resource in the region is timber. An abundance of pine and hardwood forests is evidenced by the numerous national and state parks and forests including the Angelina National Forest, Big Thicket National Preserve, Davy Crockett National Forest, and Sabine National Forest.

Table 1.5 Major Demand Centers

Description of Demand Center or User	2010 Water Use		2060 Water Use	
	Dominant Use	Ac- ft per Year	Dominant Use	Ac- ft per Year
Angelina County	Manufacturing and Steam-Electric	25,238	Manufacturing	48,356
Paper Mill in Jasper County	Manufacturing	58,916	Manufacturing	74,069
Jefferson and Orange Counties	Irrigation and Manufacturing	356,717	Irrigation, Manufacturing, and Steam-Electric	699,370
Nacogdoches County	N/A	<20,000	City of Nacogdoches and Steam-Electric	25,898
Power Plant in Rusk County	Steam-Electric	18,805	Steam-Electric	53,074
Smith County	Municipal	24,244	City of Tyler	32,253
Anderson County	N/A	<20,000	Steam-Electric	21,853
Newton County	N/A	<20,000	Steam-Electric	27,317

1.9.2 Wetlands. Wetlands are areas characterized by a degree of flooding or soil saturation, hydric soils, and plants adapted to growing in water or hydric soils.[13] Wetlands are beneficial in several ways; they provide flood attenuation, bank stabilization, water-quality maintenance, fish and wildlife habitat, and opportunities for hunting, fishing, and other recreational activities.[13] There are significant wetland resources in the region, especially near rivers, lakes, and reservoirs.

Texas wetlands types and characteristics are summarized in Table 1.6. Most Texas wetlands are palustrine bottomland hardwood forests and swamps, and most of the state's palustrine wetlands are located in the flood plains of East Texas rivers.[13] Table 1.7 shows the bottomland hardwood acreage associated with the four major rivers in the region.

Table 1.6 Texas Wetland Types and Characteristics

Wetland Classifications	Definition	Vegetation/Habitat Types
Palustrine	Freshwater bodies and intermittently or permanently flooded open-water bodies of less than 20 acres in which water is less than 6.6 feet dep. [3]	Predominantly trees; shrubs; emergent, rooted herbaceous plants; or submersed/floating plants. [2]
Estuarine	Tidal wetlands in low-wave-energy environments where the salinity of the water is greater than 0.5 parts per thousand (ppt) and is variable due to evaporation and mixing of freshwater and seawater. [2]	Emergent plants; intertidal unvegetated mud or sand flats and bars; estuarine shrubs; subtitdal open water bays (deep water habitat). [3]
Lacustrine	Wetlands and deepwater habitats with all of the following characteristics[4]: (1) situated in a topographical depression or in a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30% areal coverage; (3) total area exceeds 20 acres.	Nonpersistent emergent plants, submersed plants, and floating plants [3].
Riverine	Freshwater wetlands within a channel, with two exceptions [3]: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with salinity greater than 0.5 ppt.	Nonpersistent emergent plants, submersed plants, and floating plants [3].
Marine	Tidal wetlands that are exposed to waves and currents of the Gulf of Mexico and to water having salinity greater than 30 ppt [3].	Intertidal beaches, subtidal open water (deep water habitat) [3].

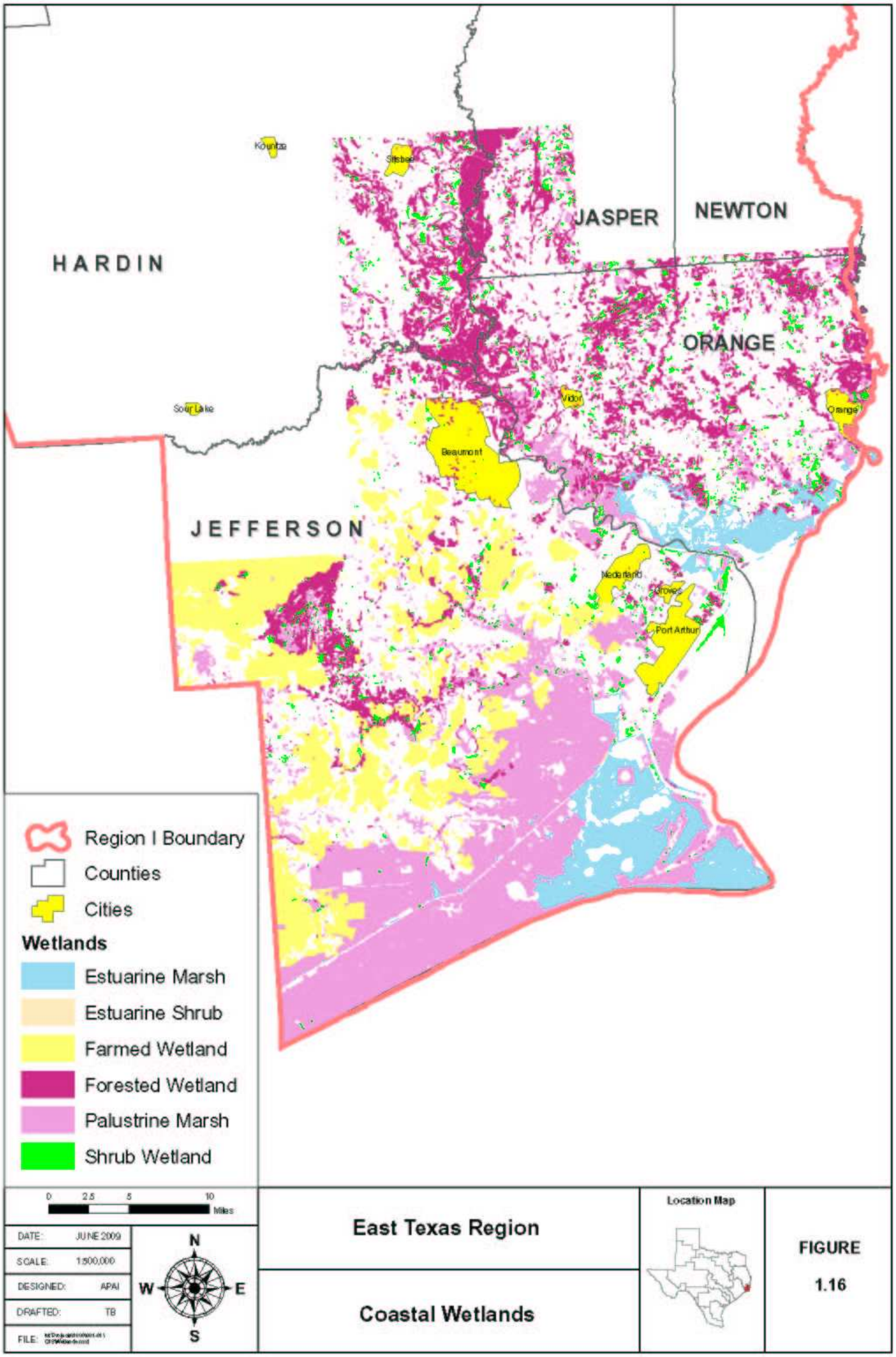
The TPWD, in a study of natural resources in Smith, Cherokee, Rusk, Nacogdoches, and Angelina Counties,[14] found the most extensive wetlands in the study area were water oak-willow and oak-blackgum forests along the Neches, Angelina, and Sabine Rivers. In the same study, TPWD noted the presence of a significant bald cypress-water tupelo swamp along the Neches River in Angelina County.[14] TPWD identified specific stream segments in the region that they classify as being priority bottomland hardwood habitat;[7] these segments will be discussed in later sections.

Table 1.7 1980 Geographical Distribution of Bottomland Hardwood Associated with Selected Rivers*

River	Area (acres)	Amount Located in ETRWPA
Trinity River	305,000	Small portion
Neches River	257,000	Almost all
Sabine River	255,000	Approximately half of the Texas portion of the Sabine River Basin is located in ETRWPA.
Angelina River	88,000	All

* Information obtained from [5]

In the coastal part of the region, palustrine wetlands such as swamps and fresh marshes occupy flood plains and line the shores of tidal freshwater reaches of sluggish coastal rivers.[13] Much of the palustrine wetlands area in Jefferson County is farmed wetlands used for rice growing. Figure 1.16 shows the density of palustrine wetlands in the coastal part of the region. In the U.S. Fish and Wildlife Service (USFWS) study area, palustrine emergent wetlands were most prevalent in Jefferson County, palustrine forested wetlands were most prevalent in Newton, Jasper, Orange, and Hardin Counties, and palustrine scrub-shrub was most prevalent in Newton, Jasper, Orange, and Hardin Counties. Some concentrations of palustrine shrub wetlands were also found in Jefferson County.


HARDIN
JASPER
NEWTON
ORANGE
JEFFERSON
Kountze
Silsbee
Sour Lake
Vidor
Beaumont
Orange
Nederland
Groves
Port Arthur
Region I Boundary
Counties
Cities
Wetlands
Estuarine Marsh
Estuarine Shrub
Farmed Wetland
Forested Wetland
Palustrine Marsh
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East Texas Region
Coastal Wetlands
Location Map
FIGURE
1.16

Estuarine wetlands such as salt marshes and tidal flats are the next most prevalent type of wetland areas. Estuarine wetlands are very common in the area around Sabine Lake,[15] particularly the emergent kind.

Three other kinds of wetlands cover a smaller area in the region but are ecologically significant:[15] lacustrine, riverine, and marine wetlands. See Table 1.6 above for a description of these types of wetlands.

Section 404 of the Clean Water Act mandates that, when impacts to wetlands are unavoidable, the impacts to wetlands must be mitigated by replacing the impacted wetland with a similar type of wetland. Mitigation may include restoration and rehabilitation of native wetlands or construction of new wetlands. One wetland mitigation project, the Blue Elbow Swamp Mitigation Project, was identified near the mouth of the Sabine River. This mitigation project was established by the Texas Department of Transportation to compensate for future impacts to wetlands[16].

1.9.3 Estuaries. The Sabine-Neches Estuary includes Sabine Lake, the Sabine-Neches and Port Arthur Canals, and Sabine Pass. The Sabine-Neches Estuary covers about 100 square miles. The Neches and Sabine River Basins and part of the Neches-Trinity Coastal Basin contribute flow to the estuary.[17]

In the estuary, freshwater from the Sabine and the Neches Rivers meets saltwater from the Gulf of Mexico. Although the estuary is influenced by the tide, it is protected from the full force of Gulf waves and storms due to its inland location. The Sabine-Neches Estuary is important for fish, shellfish, and wildlife habitat and for sport and commercial fishing.

1.9.4 Endangered or Threatened Species. The TPWD has identified species of special concern in the region (See Appendix 1-A). Included are 19 species of birds, eight insects, six mammals, 15 reptiles/amphibians, nine fish, 13 mollusks, 22 vascular plants, and two crustaceans. These species are either listed as threatened or endangered at the state level or have limited range within the state. The TPWD maintains a list of species of special concern in the Texas Biological and Conservation Data System (TXBCD).

1.9.5 Ecologically Significant River and Stream Segments. In each river basin in Texas, the TPWD has identified stream segments that it classifies as being ecologically unique.[18] Stream segments have been placed on this list because they have met criteria based on factors related to biological function, hydrologic function, presence of riparian conservation areas, high water quality/exceptional aquatic life/high aesthetic value, and threatened or endangered species/unique communities. Table 1.8 lists stream segments within the ETRWPA, meeting one or more of the criteria. Figure 1.17 shows geographically where the stream segments are located. Additional discussion of ecologically significant stream segments in the ETRWPA is found in Chapter 8.

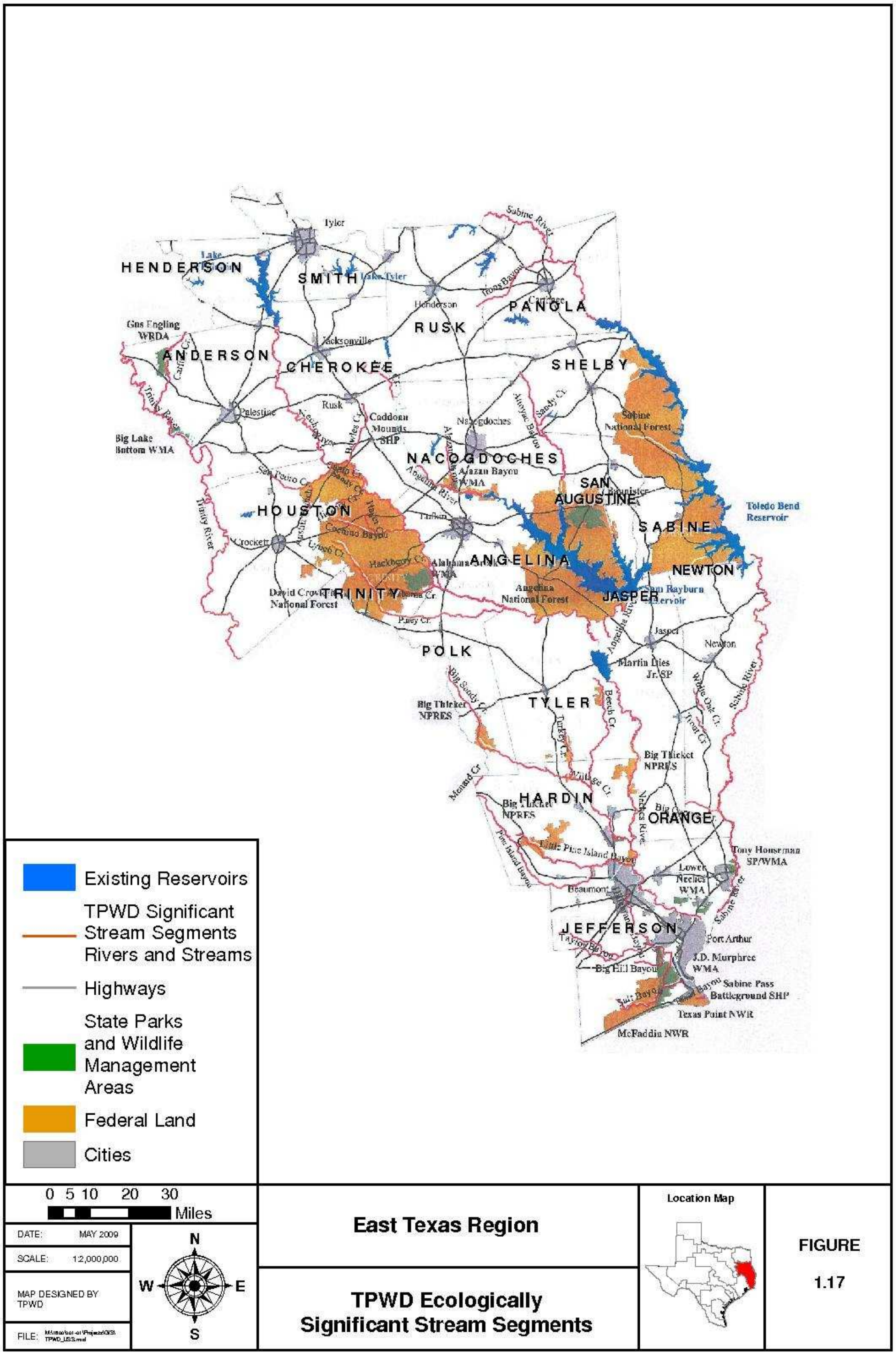
1.9.6 State and Federal Parks, Management Areas, and Preserves. The state and federal governments own and operate a number of parks, management areas, and preserves in the Region. Table 1.9 summarizes these facilities.

1.9.7 Springs. Over 250 springs of various sizes are documented in the ETRWPA.[4] Most of the springs discharge less than 10 gpm and are inconsequential for most water supply planning purposes. However, springs are an important source of water for local supplies and provide crucial water for wildlife and, in some cases, livestock.

Based on discharge measurements collected mainly in the 1970s, 28 springs in the region discharge between 20 and 200 gpm and there are seven springs that discharge between 200 and 2,000 gpm. It should be noted that Brune did not cover Anderson, Angelina, Henderson, Houston, or Trinity Counties. In addition, Brune did not document any springs with flow greater than 20 gpm in Jefferson, Orange or Panola County. U.S. Geological Survey (USGS) information was reviewed and only two springs with flows greater than 20 gpm, Black Ankle Springs in San Augustine and King's Spring in Polk County, were identified. The springs identified by Brune and USGS are shown on the attached Figure 1.18.

Table 1.8 TPWD Ecologically Significant Segments in East Texas

River or Stream Segment	Biological Function	Hydrologic Function	Riparian Conservation Area	High Water Quality/ Aesthetic Value	Endangered Species/ Unique Communities	Total # of Criteria Met
Alabama Creek			•			1
Alazan Bayou	•		•		•	3
Upper Angelina River	•		•		•	3
Lower Angelina River	•		•		•	3
Attoyac Bayou					•	1
Austin Branch			•			1
Beech Creek			•	•		2
Big Cypress Creek				•		1
Big Hill Bayou	•		•			2
Big SandyCreek	•		•	•		4
Bowles Creek			•			1
Camp Creek			•		•	2
Catfish Creek			•	•	•	3
Cochino Bayou			•			1
Hackberry Creek			•		•	2
Hager Creek			•			1
Hickory Creek			•			1
Hillebrandt Bayou			•			1
Irons Bayou				•		1
Little Pine Island Bayou			•			1
Lynch Creek			•		•	2
Menard Creek			•			1
Mud Creek					•	2
Upper Neches River			•	•	•	4
Lower Neches River			•	•	•	4
Pine Island Bayou						1
Piney Creek				•	•	3
Upper Sabine River	•			•	•	3
Middle Sabine River	•		•	•		2
Lower Sabine River	•		•			2
Salt Bayou	•		•			2
San Pedro Creek			•			1
Sandy Creek (Trinity Co.)			•			2
Sandy Creek (Shelby Co.)						1
Taylor Bayou			•			2
Texas Bayou			•			1
Trinity River	•		•			3
Trout Creek			•			1
Turkey Creek			•			1
Village Creek	•		•	•		4
White Oak Creek				•		1



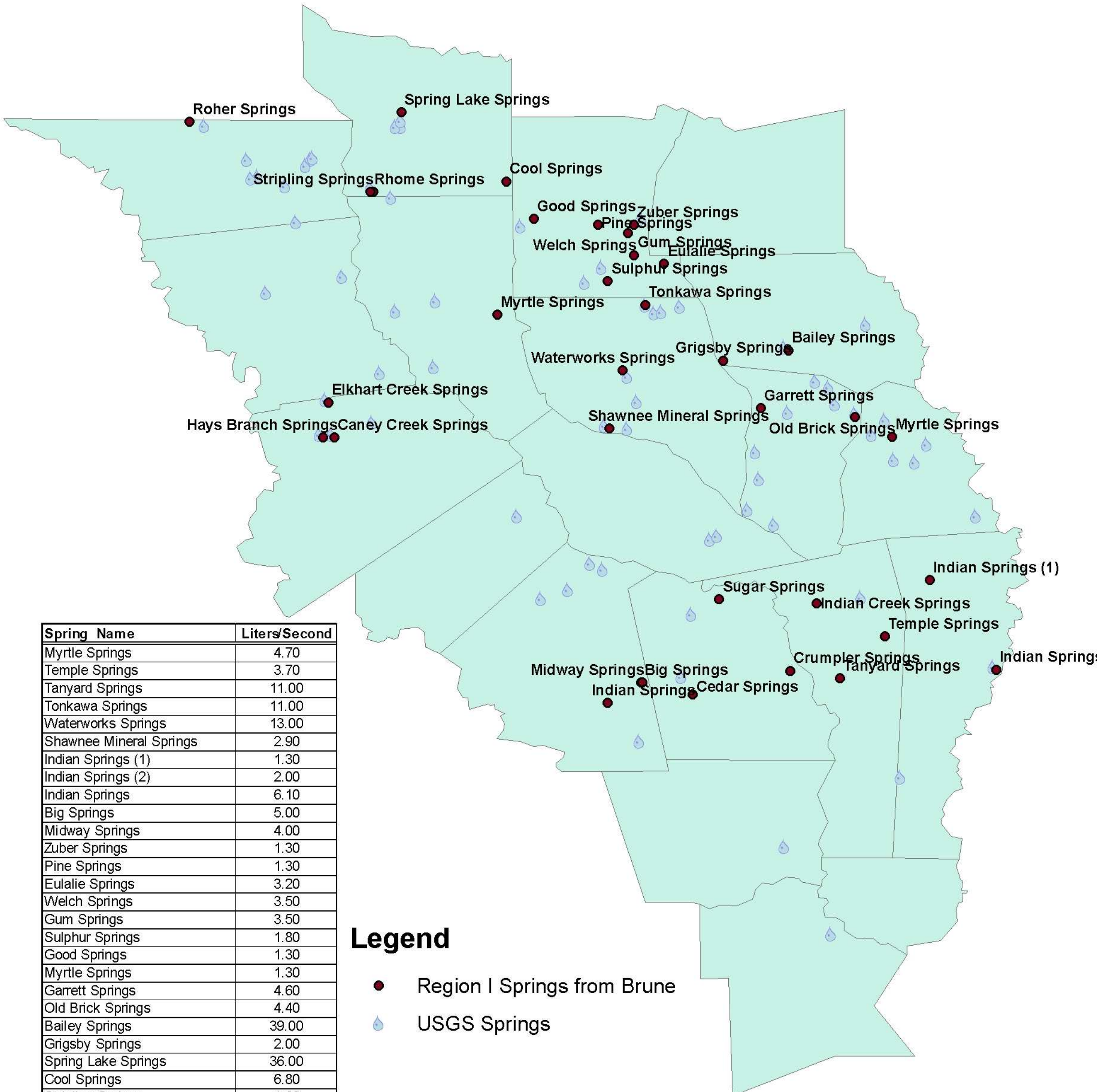
East Texas Region

TPWD Ecologically Significant Stream Segments

FIGURE 1.17

Table 1.9 State and Federal Parks, Management Areas, and Preserves

Owner/Operator	Name	County
Texas Parks and Wildlife Dept.	Martin Creek Lake State Park	Rusk
	Rusk/Palestine State Park	Cherokee and Anderson
	Mission Tejas State Park	Houston
	Martin Dies Jr. State Park	Jasper and Tyler
	Village Creek State Park	Hardin
	Sea Rim State Park	Jefferson
	Gus Engeling Wildlife Management Area	Anderson
	North Toledo Bend Wildlife Management Area	Shelby
	Bannister Wildlife Management Area	San Augustine
	Moore Plantation Wildlife Management Area	Sabine and Jasper
	AngelinaNeches/Dam B. Wildlife Management Area	Jasper and Tyler
	Lower Neches Wildlife Management Area	Orange
	J.D. Murphree Wildlife Management Area	Jefferson
	Alazan Bayou Wildlife Management Area	Nacogdoches
Texas Forest Service	E.O. Siecke State Forest	Newton
	Masterson State Forest	Jasper
	John Henry Kirby Memorial State Forest	Tyler
	I.D. Fairchild State Forest	Cherokee
Texas State Historical Commission	Caddoan Mounds State Historical Park	Cherokee
	Sabine Pass Battleground State Historical Site	Jefferson
U.S. Army Corps of Engineers (USACE)	Sam Rayburn Reservoir	
	Town Bluff Dam, B.A. Steinhagen Lake	
U.S. Fish and Wildlife Service (USFWS)	Neches National Widlife Refuge	Anderson, Cherokee
	Texas Point National Wildlife Refuge	Jefferson
	McFaddin National Wildlife Refuge	Jefferson
National Forest Service	Angelina National Forest	San Augustine, Angelina, Jasper, and Nacogdoches
	Davy Crockett National Forest	Houston and Trinity
	Sabine National Forest	Sabine, Shelby, San Augustine, Newton, and Jasper
National Park Service	Big Thicket National Preserve	Polk, Tyler, Jasper, Hardin, Jefferson, and Orange



Spring Name	Liters/Second
Myrtle Springs	4.70
Temple Springs	3.70
Tanyard Springs	11.00
Tonkawa Springs	11.00
Waterworks Springs	13.00
Shawnee Mineral Springs	2.90
Indian Springs (1)	1.30
Indian Springs (2)	2.00
Indian Springs	6.10
Big Springs	5.00
Midway Springs	4.00
Zuber Springs	1.30
Pine Springs	1.30
Eulalie Springs	3.20
Welch Springs	3.50
Gum Springs	3.50
Sulphur Springs	1.80
Good Springs	1.30
Myrtle Springs	1.30
Garrett Springs	4.60
Old Brick Springs	4.40
Bailey Springs	39.00
Grigsby Springs	2.00
Spring Lake Springs	36.00
Cool Springs	6.80
Stripling Springs	1.60
Rhome Springs	1.30
Sugar Springs	1.60
Crumpler Springs	3.30
Cedar Springs	5.50
Roher Springs	11.67
Elkhart Creek Springs	96.28
Hays Branch Springs	50.97
Caney Creek Springs	48.14
Indian Creek Springs	360.00

Figure 1.18 Springs

East Texas Regional Water Planning Area

Brune reported a flow of 12.7 cubic feet per second (cfs) in the spring-fed Indian Creek in Jasper County, about five miles northwest of Jasper. This water was used at a TPWD fish hatchery.

Other notable springs are Spring Lake Springs in Smith County (570 gpm in 1979), Bailey Springs in Shelby County (620 gpm in 1976), Caney Creek Springs in Houston County (760 gpm in 1965), Hays Branch Springs in Houston County (810 gpm in 1965), Elkhart Creek Springs in Houston County (1,500 gpm in 1965).

1.9.8 Agriculture/Prime Farmland. Prime farmland is defined by the National Resources Conservation Service (NRCS) as "land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses."[19] As part of the National Resources Inventory, the NRCS has identified prime farmland throughout the country.

Figure 1.19 shows the distribution of prime farmland in the ETRWPA. Each color in this figure represents the percentage of prime farmland of any type. There are four categories of prime farmland in the NRCS State Soil Geographic Database (STATSGO) for Texas: prime farmland, prime farmland if drained, prime farmland if protected from flooding or not frequently flooded during the growing season, and prime farmland where irrigated. Most counties in the region have significant prime farmland areas.

Table 1.10 shows 2007 agriculture statistics for the counties in the region[20] (portions of Henderson, Smith, Polk, and Trinity Counties are located in other Regions). The following general statements may be made regarding the region:[21]

- In any one year, approximately 25% of farmland is cropland.
- In any one year, approximately 50% of cropland is harvested.
- Excluding Jefferson County, approximately 2% of cropland is irrigated. In Jefferson County, approximately 11% of cropland is irrigated.
- Poultry production generates the largest agricultural product sales in Angelina, Nacogdoches, Panola, Shelby, Sabine, and San Augustine Counties.

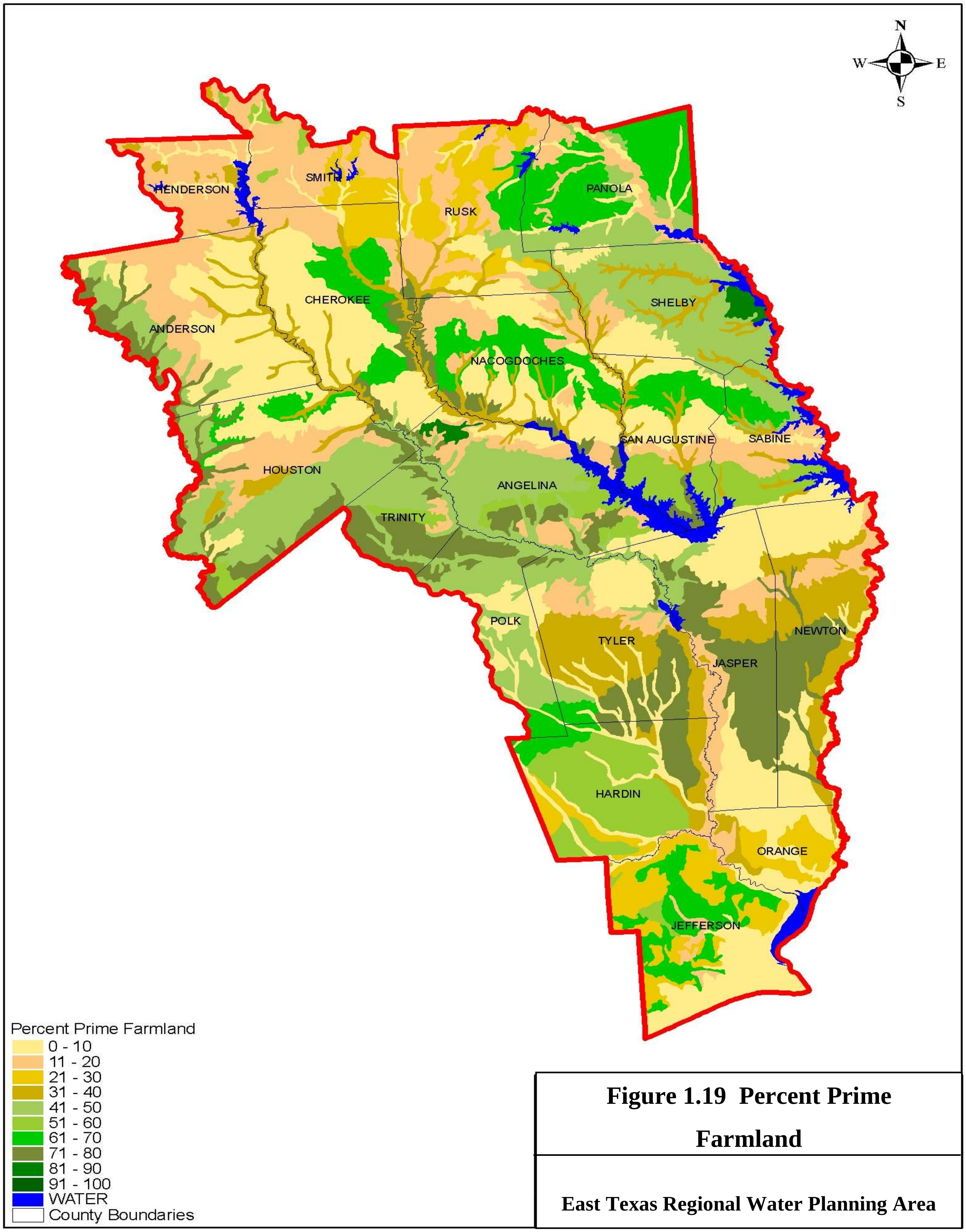


Figure 1.19 Percent Prime Farmland

East Texas Regional Water Planning Area

Table 1.10 U.S. Department of Agriculture
2007 Agricultural Statistics for Counties of the ETRWPA

Category	Anderson	Angelina	Cherokee	Hardin	Henderson	Houston	Jasper	Jefferson	Nacogdoches	Newton
Farms	1,771	1,109	1,625	699	2,109	1,562	920	793	1,277	403
Total Farm Land (acres)	346,142	115,258	294,383	91,189	318,452	440,462	95,928	333,255	265,131	59,236
Crop Land (acres)	74,892	43,253	76,592	22,100	86,495	109,201	20,192	153,620	59,353	8,083
Harvested Crop Land (acres)	46,120	15,492	49,026	7,659	57,128	59,097	11,399	32,234	30,279	4,050
Irrigated Crop Land (acres)	2,325	467	1,147	971	1,328	4,574	310	16,896	535	104
Market Value Crops ($1,000)	12,885	2,021	89,095	3,430	19,123	9,050	2,910	13,158	5,349	619
Market Value Livestock ($1,000)	26,475	27,417	51,162	2,884	25,390	31,603	3,753	13,609	311,938	1,477
Total Market Value ($1,000)	39,361	29,438	140,256	6,314	44,513	40,654	6,663	26,767	317,287	2,095
Livestock and Poultry:										
Cattle and Calves Inventory	59,917	22,293	62,691	7,773	64,535	83,948	13,657	40,693	46,328	5,354
Hogs and Pigs Inventory	(D)	233	141	235	636	(D)	100	160	197	65
Sheep and Lambs Inventory	500	317	98	258	267	(D)	201	139	90	54
Layers and Pullets Inventory	13,079	62,012	72,939	2,310	3,833	(D)	2,184	1,493	513,918	1,434
Broilers and Meat-Type Chickens Sold	(D)	7,003,357	8,628,993	170	(D)	200	(D)	0	98,366,618	(D)
Crops Harvested (acres):										
Corn for Grain or Seed	0	15	0	8	16	2,238	23	146	0	(D)
Cotton	(D)	0	(D)	0	0	(D)	0	0	0	0
Hay	42,328	14,201	45,474	5,756	53,215	47,925	9,266	16,709	29,318	3,792
Rice	0	0	0	(D)	0	0	0	13,016	0	0
Sorghum for Grain or Seed	0	0	0	0	0	(D)	0	(D)	0	0
Soybeans for beans	0	0	0	(D)	(D)	(D)	0	139	0	0
Wheat for Grain	0	0	0	175,355	(D)	(D)	0	0	(D)	0
Farms	675	1,042	812	1,521	223	346	1,123	2,514	576	792
Total Farm Land (acres)	63,748	217,757	131,664	300,900	31,724	72,640	197,791	302,359	108,974	84,253

**Table 1.10 U.S. Department of Agriculture
2007 Agricultural Statistics for Counties of the ETRWPA (Cont.)**

Category	Orange	Panola	Polk	Rusk	Sabine	San Augustine	Shelby	Smith	Trinity	Tyler
Crop Land (acres)	15,159	50,745	23,720	67,334	7,812	12,837	45,460	91,797	27,340	19,671
Harvested Crop Land (acres)	5,046	28,856	13,781	36’456	4,132	7,394	26,735	59,561	15,682	10,634
Irrigated Crop Land (acres)	553	371	1,440	848	16	114	600	2,651	310	437
Market Value Crops ($1,000)	(D)	2,704	3,923	17,456	292	1,406	4,191	42,499	1,266	(D)
Market Value Livestock ($1,000)	3,009	60,739	6,012	38,664	8,164	54,233	398,924	25,503	7,965	(D)
Total Market Value ($1,000)	(D)	63,443	9,935	56,120	8,456	55,639	403,115	68,002	9,231	21,763
Livestock and Poultry:										
Cattle and Calves Inventory	8,528	38,948	17,430	48,924	6,080	13,232	42,722	55,302	22,689	12,908
Hogs and Pigs Inventory	176	119	158	295	134	25	50	236	86	132
Sheep and Lambs Inventory	150	144	7	202	0	0	182	327	30	135
Layers and Pullets Inventory	1,501	(D)	138	(D)	236	217,840	1,371,757	5,485	362	2,080
Broilers and Meat-Type Chickens Sold	460	20,543,700	0	8,818,669	(D)	19,573,422	122,457,821	(D)	(D)	(D)
Crops Harvested (acres):										
Corn for Grain or Seed	0	(D)	(D)	0	(D)	6	0	16	0	7
Cotton	0	0	0	(D)	0	0	0	0	0	0
Hay	4,442	27,976	12,147	34,879	3,267	7,212	25,471	53,662	15,378	7,366
Rice	(D)	0	0	0	0	0	0	0	0	0
Sorghum for Grain or Seed	(D)	0	0	0	0	0	0	0	0	0
Soybeans for beans	0	0	0	0	0	0	0	(D)	0	0
Wheat for Grain	0	0	0	0	0	0	(D)	(D)	0	(D)

TOTALS FOR ALL COUNTIES:	
Total Farm Land (acres)	3,871,246
Crop Land (acres)	1,015,656
Crop Land/Total Farm Land (%)	26.23%
Harvested Crop Land (acres)	520,752
Harvested/Total Crop Land (%)	51.27%
Irrigated Crop Land (acres)	35,997
Irrigated/ Total Crop Land (%)	3.54%

SPECIAL FOR JEFFERSON COUNTY:	
Irrigated/ Total Crop Land (%)	11.0%
COUNTIES OTHER THAN JEFFERSON:	
Irrigated Crop Land (acres)	19,101
Irrigated/ Total Crop Land (%)	1.88%

(D) – Withheld to avoid disclosing data for individual farms

- Cattle and calf production generates the largest agricultural product sales in Anderson, Houston, Henderson, Rusk, Trinity, Polk, Jasper, Tyler, Orange, Hardin, and Newton Counties.

- Nursery and greenhouse crops generate the largest agricultural product sales in Cherokee and Smith Counties.

- Rice crops generate the largest agricultural product sales in Jefferson County.

1.10 Archeological Resources

The Texas Historical Commission (THC) maintains the Texas Historic Sites Atlas, a database containing historic county courthouses, National Register properties, historical markers, museums, sawmills, and neighborhood surveys.[22] This database contains a very large amount of data. The THC does not release information on archeological sites to the general public.

The most prominent archeological site in the ETRWPA is Caddoan Mounds State Historic Site, a 94-acre park in Cherokee County west of Nacogdoches. This area was the home of Mound Builders of Caddo origin who lived in the region for 500 years beginning about 800 A.D. The site offers exhibits and interpretive trails through its reconstructed sites of Caddo dwellings and ceremonial areas, including two temple mounds, a burial mound, and a village area.[23]

1.11 Mineral Resources

Mineral resources include petroleum production and coal mining operations. Various types of mineral resources in the ETRWPA are described below.

1.11.1 Petroleum Production. Oil and natural gas fields are significant natural resources in portions of the region. There are low densities of producing oil wells in each county in the region. The East Texas Oil Field, a portion of which is located in Rusk County, ranked third in Texas in oil production in 1997. There are high densities of producing natural gas wells in Rusk, Panola, Nacogdoches, Jasper, and Newton Counties, with lesser densities in the other counties in the region. In 1997, four of the top 20 producing natural gas fields in the state are located in the region.[24]

- Carthage Gas Field in Panola County
- Oak Hill Gas Field in Rusk County
- Double A Wells Gas Field in Polk and Tyler Counties
- Brookeland Gas Field in Jasper and Newton Counties

Figures 1.20 through 1.22 depict oil and gas resources in the state, including the ETRWPA.

1.11.2 Lignite Coal Fields. Figure 1.23 shows lignite coal resources located in the region.[25] The Wilcox Group of potential deep basin lignite (200-2,000 feet in depth) underlies significant portions of Henderson, Smith, Cherokee, Rusk, and Nacogdoches Counties. The Jackson-Yegua Group of potential deep basin lignite underlies significant portions of Houston, Trinity, Polk, Angelina, Nacogdoches, San Augustine, and Sabine Counties. Finally, bituminous coal underlies a small portion of Polk County in the region.

1.12 Threats to Agricultural and Natural Resources in the Region Due to Water Quality or Quantity Problems

A lack of water or lack of water of adequate quality can present a significant threat to agricultural and natural resources. Some of the most significant potential threats in the ETRWPA are described below.

1.12.1 Water Quality Threats. Water quality in the region is generally very good. The TCEQ monitors surface water quality and documents quality through its water quality inventory. Concerns about water quality impacts to aquatic life, contact recreation, or fish consumption are documented by the TCEQ.[7] Appendix 1-B contains a list of the reaches with concerns. Appendix 1-C addresses groundwater quality issues in the region.

Figure 1.20 Top Producing Oil Wells

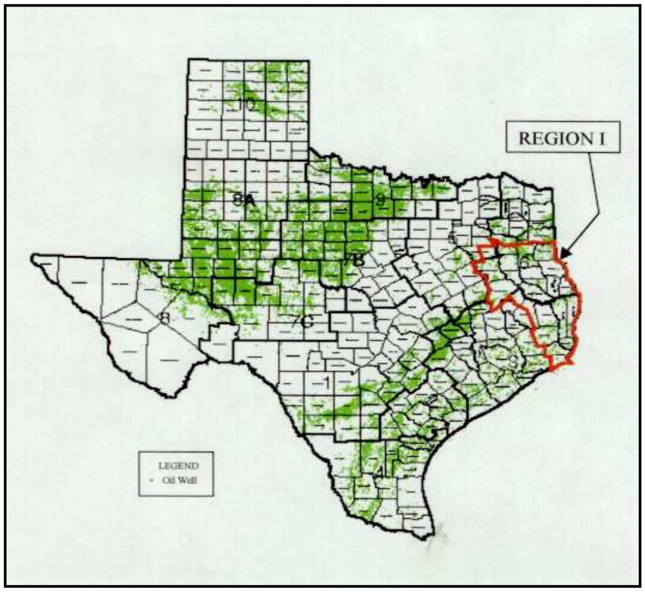


Figure 1.21 Top Producing Oil and Gas Fields

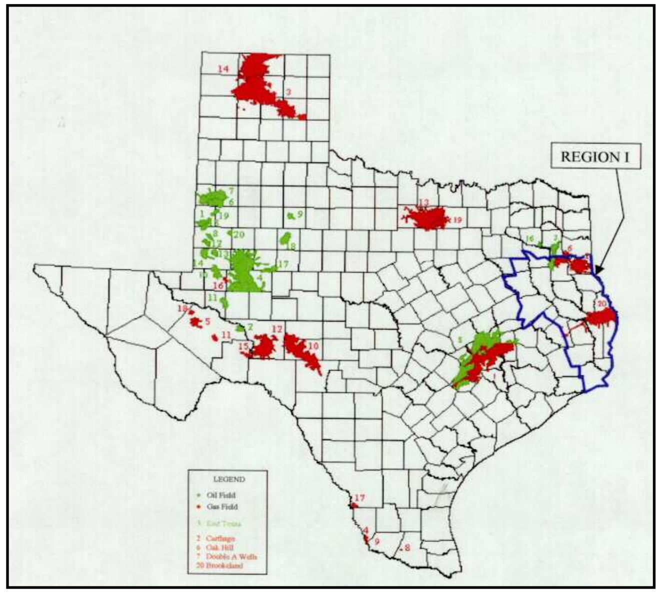


Figure 1.22 Top Producing Gas Wells

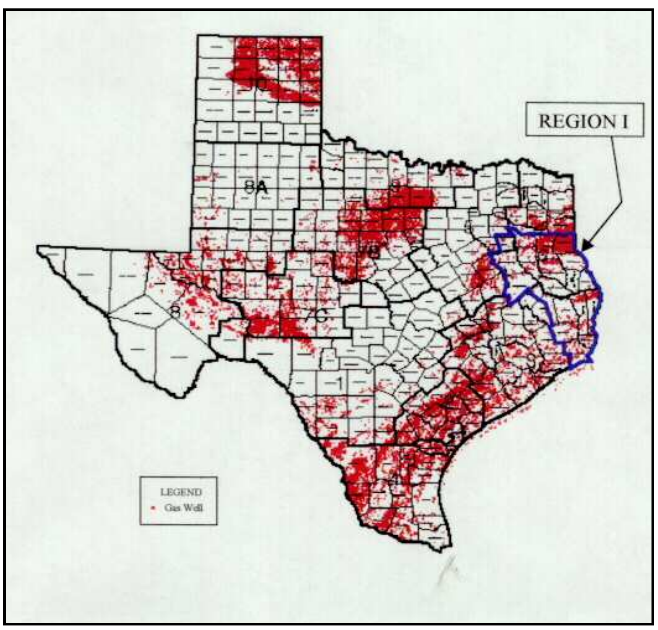
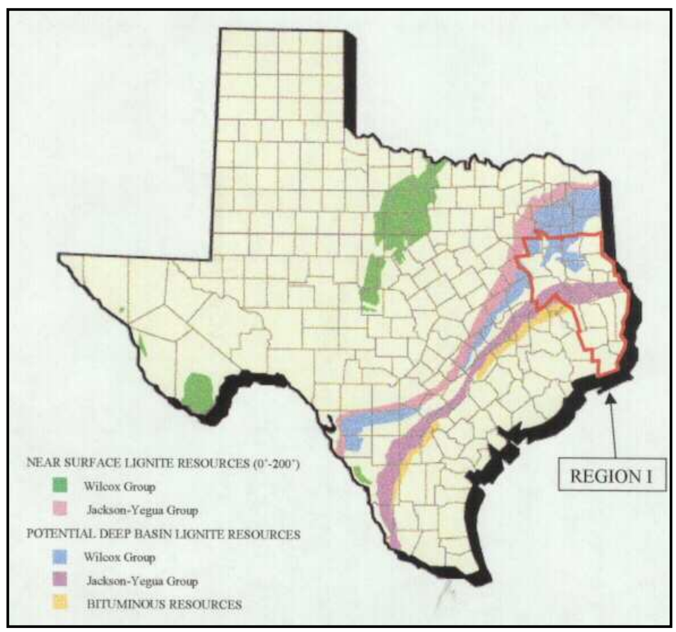


Figure 1.23 Texas Lignite Coal Resources



1.12.2 Drawdown of Aquifers. Overpumping of aquifers poses a small risk to household water use and livestock watering in localized rural areas. If water levels decline, the cost of pumping water increases and water quality may change. In some cases, wells that are completed in the outcrop may go dry or wells constructed in a way that restricts the lowering of pumps may not be usable. These wells may need to be redrilled to deeper portions of the aquifer or abandoned altogether. Significant water level declines have been reported in localized areas in both the Carrizo-Wilcox and Gulf Coast aquifers,[26] the major aquifers in the region. Groundwater conservation districts work to ensure that the risk of excessive drawdown is minimized.

Overpumping of aquifers also poses a threat to estuarine wetlands. Between 1955 and 1992, approximately 19,900 acres of estuarine intertidal emergent wetlands were lost in Texas as a result of submergence (drowning) and erosion, probably due to faulting and land subsidence resulting from the withdrawal of underground water and oil and gas.[15] These losses occurred primarily between Freeport and Port Arthur. The risk of land subsidence is smaller for inland areas than for coastal areas due to the difference in compaction characteristics of the aquifers. In addition, groundwater conservation districts work to ensure that subsidence risks are minimized.

Overpumping of aquifers in coastal regions can lead to saltwater intrusion, where saltwater is drawn updip into the aquifer or moves vertically into fresh water portions of the aquifer and degrades the aquifer water quality. Saltwater intrusion into the Gulf Coast aquifer has occurred previously in central and southern Orange County[26] and Jefferson County.

1.12.3 Insufficient Instream/Environmental Flows. Certain flow quantities and frequencies are necessary to maintain the fish and wildlife habitat in the region. Insufficient flow quantities and patterns could pose a threat to fish and wildlife habitat. Additionally, certain flow quantities or a physical barrier are required to control upstream encroachment of saltwater. Additional discussion of environmental flows is provided in Chapter 3.

At times of low flow in the rivers, the 0.5 parts per thousand (ppt) isohaline (the dividing line between "freshwater" and "saltwater") moves upstream; conversely, at times of high flow in the rivers, the 0.5 ppt isohaline moves downstream. Upstream saltwater encroachment can adversely affect freshwater habitat and the suitability of water quality for water supply purposes.

In line with the recommendations of the 1997 State Water Plan, the Neches River Salt Water Barrier has been constructed at a location north of Beaumont below the confluence of the Neches River and Pine Island Bayou. The project, completed in 2003, prevents saltwater from reaching the freshwater intakes of Lower Neches River cities, industries, and farms during periods of low flow. The project is a gated structure, allowing adjustment to prevent saltwater intrusion while maintaining flows. It is also equipped with a gated navigation channel to enable the passage of watercraft around the barrier.

1.12.4 Inundation Due to Reservoir Development. The 1984 State Water Plan[27] recommended development of five reservoirs, as listed in Table 1.11. The ANRA has a state permit to construct Lake Columbia and is in the process of obtaining the necessary federal permits. The effects on natural resources of new reservoir construction at four of the five sites recommended in the 1984 State Water Plan will be discussed below, because these reservoirs appear to be the most likely to be constructed.

In addition, the 1997 State Water Plan identified alternative reservoir development sites in the region,[28] as listed in Table 1.12.

Table 1.13 shows the impacts of new reservoir development at the four potential reservoir sites on the surrounding land and on protected species.

For the reservoirs recommended in the 1984 Plan, TPWD divided the inundated acreage into Resource Categories, depending on the quality of the habitat.[27] Resource Category (1) habitat is categorized as high value habitat, unique habitat, or irreplaceable habitat for which mitigation is not possible.

Table 1.11 Recommended Development of Reservoirs (1984 State Water Plan)[8]

Reservoir, River Location	County
Lake Columbia, on Mud Creek	Cherokee
Rockland Reservoir, on the Neches River	Angelina, Trinity, Polk, Tyler, and Jasper
Fastrill Reservoir, on the Neches River	Anderson, Cherokee, and Houston
Bon Wier Reservoir, on the Sabine River	Newton County, Texas and Beauregard Parish, Louisiana.
Tennessee Colony Reservoir, on the main stem of the Trinity River	Freestone, Navarro, Henderson, and Anderson Counties *(partially in Region C)*.

Table 1.12 Recommended Alternative Reservoir Development Sites (1997 State Water Plan)[28]

Reservoir	County
Newton, Big Cow Creek, and Little Cow Creek	Newton
Dam A	Jasper
Rockland	Tyler
Cochino	Trinity
Big Elkhart, Hurricane Bayou, Gail, and Mustang	Houston
Fastrill and Catfish Creek	Anderson
Ponta	Nacogdoches, Cherokee, and Rusk
Attoyac	Nacogdoches (would overlap Shelby and/or San Augustine Counties)
Tenaha	Shelby
Stateline	Panola
Socagee Reservoir	Panola
Carthage Reservoir	Panola, Rusk, Harrison, and Gregg
Cherokee II	Rusk
Rabbit Creek	Smith and Rusk
Kilgore	Smith, Rusk, and Gregg
State Highway 322 Stages I and II*	Rusk
Fredonia Lake*	Rusk and Harrison

*Other reservoir sites[9]

Resource Category (2) habitat is categorized as high value habitat, scarce habitat or becoming scarce, for which mitigation is possible with an established goal of no net loss of in-kind habitat value. From a practical standpoint, Category (2) habitat for the proposed reservoir sites depicts types of habitats such as wetlands and riparian bottomland forest areas that reflect high natural resource values and high sensitivity regarding destruction.

Category (3) habitat includes abundant and medium to high value habitat (for the evaluation species) with a mitigation goal of no net loss of habitat value while minimizing loss of in-kind habitat value. Category (4) habitat includes remaining medium to low value habitat for which habitat value deterioration would be minimal.

The proposed Lake Columbia site is categorized as excellent habitat for turkey and gray squirrel and modest habitat for deer. In the proposed reservoir location, Mud Creek is a "pristine area that provides excellent stream habitat." TPWD has identified Mud Creek as a significant stream segment due to its high bottomland hardwood resource value.[18] It should be noted that a comprehensive environmental impact study for Lake Columbia has been prepared and was published on January 29, 2010 [29].

The proposed Rockland Reservoir would impact the bottomland hardwood site known as the "Middle Neches River," which USFWS has identified as a Priority 1 preservation area. In addition, three USFWS Priority 2 bottomland hardwood preservation areas would be impacted: "Neches River South," "Piney Creek," and "Russell Creek." The USFWS defines Priority 1 as "excellent quality bottomlands of high value to waterfowl" and Priority 2 as "good quality bottomlands with moderate waterfowl benefits."[30]

The USACE designed the Tennessee Colony Reservoir in 1979, but the project encountered numerous concerns about conflicts with development of lignite in the area and with existing communities and water supply lakes. The project has been deferred pending removal of the lignite.[31]

Table 1.13 Potential Impacts of Development on Land Reservoir Area and Protected Species

Potential Impacts		Potential Reservoir Site: Columbia [29]	Rockland	Bon Weir	Tennessee Colony
Inundated Land** (acres)	Mixed bottomland hardwood forest (2)	5,351	27,300	14,600	34,800
	Swamp/Flooded Hardwood Forest (2)	NA	NA	2,300	NA
	Pine-hardwood forest (3)	2,247	50,800	10,400	NA
	Post Oak-Water Oak-Elm Forest (3)	NA	NA	NA	19,200
	Grassland (4)	2,616	NA	NA	9,600
	Other	409	21,400	7,800	21,500
	TOTAL	**10,133**	**99,500**	**35,100**	**85,100**
Endangered Species Potentially Impacted	Arctic peregrine falcon	•	•	•	•
	Black-capped vireo				•
	Eskimo Curlew				•
	Interior least tern		•		
	Red-cockaded woodpecker	•	•	•	•
	Whooping crane				•
Threatened Species Potentially Impacted	Alligator snapping turtle	•	•	•	•
	American swallow-tailed kite	•	•	•	•
	Bachman's sparrow	•	•	•	•
	Bald Eagle	•	•	•	•
	Black bear	•	•	•	•
	Blue sucker		•	•	
	Creek chubsucker	•	•	•	
	Louisiana pigtoe	•	•	•	•
	Louisiana pine snake	•	•	•	•
	Northern scarlet snake	•	•	•	•
	Paddlefish	•	•	•	•
	Reddish egret		•	•	
	Sandbank pocketbook	•	•	•	•
	Southern hickorynut	•	•	•	•
	Texas heelsplitter	•	•	•	•
	Texas horned lizard	•	•	•	•
	Texas pigtoe	•	•	•	•
	Timber rattlesnake	•	•	•	•
	White-faced ibis	•	•	•	•
	Wood stork	•	•	•	•

The USFWS has identified two preservation areas that would be affected by construction of the Tennessee Colony Reservoir. The first is an area known as "Boone Fields," located adjacent to the Trinity River between Saline Branch Creek and Catfish Creek, which contains upland forest and some bottomlands. The USFWS has classified this site as a Priority 5 preservation site. The reservoir would also affect a hardwood bottom in Region C known as "Tehuacana Creek." The USFWS has also classified this site as a Priority 5 preservation site. The USFWS defines Priority 5 as "sites proposed for elimination from further study because of low and/or no waterfowl benefits."[30]

Construction of the Tennessee Colony Reservoir would inundate approximately 13,800 acres of bottomland, which comprise the Richland Creek Wildlife Management Area (WMA) in Region C. The TPWD acquired this area as mitigation for wildlife losses associated with the construction of Richland-Chambers Dam and Reservoir in Region C.[30] The WMA is located in Freestone County on the west side of the Trinity River within the boundaries of the proposed Tennessee Colony Reservoir.

The Tennessee Colony Reservoir is an alternative to two Region C water supply projects recommended in the 1997 state water plan. If the Tennessee Colony Reservoir were built, neither the Tehuacana Creek Reservoir (located in Region C) nor the diversion of water from the Trinity River would be necessary.[32]

1.13 Threats and Constraints on Water Supply

Water supplies in the ETRWPA may be threatened by conditions outside of the region. Some significant potential threats are discussed following.

1.13.1 Interstate Allocation. The allocation of water in the Sabine River Basin between Texas and Louisiana is a vital factor in any water study involving the Texas portion of the basin. As noted earlier, the river forms the state line for the downstream half of its length after heading in Texas far from the state line. Almost all of the basin upstream from the state line is in Texas. However, Texas does not have completely unrestricted access to the water in that area.

The Sabine River Compact, executed in 1953, provides for allotment of the water between Texas and Louisiana.[33] This agreement was not only ratified by the two state legislatures but also approved by Congress.

Texas has unrestricted access to the water in the upper reach of the river except for the requirement of a minimum flow of 36 cfs at the junction between the river and the state line. Texas may construct reservoirs in the upper reach and use their water either there or in the downstream reach without loss of ownership.

Any reservoir constructed on the downstream reach must be approved by both states. The ownership, operating cost, and water yield are proportional to the portions of the construction cost paid by the two states. To date, Toledo Bend is the only reservoir constructed in the lower reach. In the case of Toledo Bend, the states split the cost equally and have equal ownership of the lake and the water rights.

Any unappropriated water in the lower reach (not contained in or released from a reservoir) is divided equally between the two states. Since Toledo Bend extends to a point upstream from the junction of the river and the state line, the only water in that category is the water entering the river downstream from the dam.

The water in any reservoir on a tributary to the downstream reach can be used in the state where it is located, but that usage comes out of the state's share of the water in the river.

1.13.2 Inter-region Diversions. The City of Dallas (Region C) has contractual rights to 114,337 acre-feet of water from Lake Palestine in the Neches basin. The City does not presently have the facilities to transport and treat the water, but anticipates the required construction by 2015. A long-range potential strategy to transfer water from Toledo Bend Reservoir to reservoirs located in Region C is under consideration. The ETRWPG undertook a study in 2008 on the potential cost and environmental impacts of a pipeline project for such a transfer. The recommendations from this study are included in Chapter 4C of this report.

1.13.3 Interception in Other Regions. It should be noted that large portions of the Sabine and Trinity basins are upstream from the region, as well as a small portion of the Neches basin. The upper Trinity basin includes the Dallas-Fort Worth area. The upper Sabine basin contains numerous medium sized cities as well as smaller communities. Large amounts of surface water are already being used by the upstream communities, and this usage can be expected to increase dramatically in the future along with population growth. The SRA has contracts to provide over 300,000 ac-ft per year to the Dallas area from reservoirs in the upper Sabine basin.

1.14 Drought Preparation, Water Conservation, and Water Loss

Water conservation and drought contingency planning represent important components of the water planning process. Water conservation includes measures that may be taken to reduce water consumption under all conditions and at all times. While water conservation does not generally eliminate the need for future water supply sources, it can result in the ability to delay development of costly strategies. Water conservation improves the effective use of existing sources. Drought management is designed to preserve existing water supplies during extreme dry periods. Drought management strategies are, therefore, temporary measures intended to result in significantly reduced water use in a short period of time. Drought contingency and water conservation are discussed further in the following subsections.

1.14.1 Drought Contingency. Many larger communities and other suppliers provide water to neighboring systems on a wholesale basis, either full time or as a standby source. Most of these water suppliers are required to have water conservation plans. Included in each water conservation plan is a drought contingency plan for acute shortages. Many entities have been required in recent years to develop drought contingency plans as a separate requirement, or to upgrade such plans which were already contained in their water conservation plans. Required elements of drought contingency plans include trigger conditions for specific actions such as requests for voluntary water reduction, surcharges, or rationing.

1.14.2 Water Conservation. The TWDB began requiring water conservation plans during the middle 1980s as a condition for TWDB funding for water or sewer facilities in excess of $500,000. The TCEQ also requires such plans for surface water users, pursuant to state legislation.

Legislation in 2003 tightened the requirements for water conservation and drought contingency plans and required the water suppliers to review the plans every five years. One requirement is that specific five- and ten- year targets for water use reduction be included in the plans. Additionally, drought contingency plans must include specific targets for water reduction during various stages of emergency. Most requirements in the new law became effective May 1, 2005.

Wholesale water suppliers must pass water conservation and drought contingency requirements on to their wholesale customers. The wholesale customer may be required to develop its own plan or alternatively to follow the requirements in the supplier's plan. These requirements must be included in any new, renewed, or amended water supply contracts. Contracts must include provisions to pass on the requirements to any lower tier water suppliers to which the wholesale customer resells water, so that they will apply to any systems being supplied either directly or indirectly from the initial wholesale supplier.

Water conservation and drought contingency plans in the ETRWPA must now be coordinated with the ETRWPG. Drought contingency plans for water user groups and wholesale water providers must be updated, if necessary, to remain consistent with the regional water plan.

1.14.3 Water Loss and Water Audit. The 78th Texas Legislature passed legislation in 2005 requiring retail public utilities that provide potable water to perform a water audit, computing the utility's most recent annual water loss every five years. The TWDB established new requirements for water audit reporting, which require public utilities to audit their water system once every five years and report water loss data to the TWDB. The first set of water loss data was to be submitted to the TWDB by March 31, 2006. The TWDB funded a study to evaluate water loss survey responses from all retail utilities in Texas, and published the report, *An Analysis of Water Loss as Reported by Public Water Suppliers in Texas*[34] in 2007. The Executive Summary of this report and a comparison of water loss on a regional basis is provided in Appendix 1-D.

The study evaluated water loss survey responses to determine water loss performance by regional water planning area. Based on data from responding utilities, the study reported that the ETRWPA demonstrates one of the highest average non-revenue water percentages at approximately 25%. Of this percentage, 5.5% may be attributed to unbilled, unmetered water use. Unbilled, unmetered water use is the amount of authorized water consumption that was neither metered nor billed and represents the amount of water for which the utility does not receive compensation. The report recommends that regions with high average non-revenue water percentages consider steps to recover lost revenue from unbilled authorized consumption.

1.14.4 Groundwater Conservation Districts and Groundwater Management Areas. Groundwater conservation districts (GCDs) were created by the legislature for the purpose expressed in Chapter 36 of the Texas Water Code as follows:

> Sec. 36.0015. PURPOSE. In order to provide for the conservation, preservation, protection, recharging, and prevention of waste of groundwater, and of groundwater reservoirs or their subdivisions, and to control subsidence caused by withdrawal of water from those groundwater reservoirs or their subdivisions, consistent with the objectives of Section 59, Article XVI, Texas Constitution, GCDs may be created as provided by this chapter. Groundwater conservation districts created as provided by this chapter are the state's preferred method of groundwater management through rules developed, adopted, and promulgated by a district in accordance with the provisions of this chapter.

More specifically, these districts are granted authority to regulate the spacing and/or production rate from water wells. In some cases, districts may regulate or prohibit exportation of groundwater from the district, provided the exportation did not begin before June 1, 1997. Districts may impose a fee for water exported from the district.

Districts are required to develop ten-year groundwater management plans and to provide the plan (and any amendments) to applicable regional planning groups. Districts must establish permitting systems for new or modified wells and must keep on file copies of drilling logs.

The TWDB has divided the state into sixteen groundwater management areas (GMAs)as required by the legislature. These areas were established on the basis of political and aquifer boundaries for the purpose of planning and regulation. (A GMA is only a designated geographic area, not an entity with board members, staff, or governing power.) GCDs within each GMA are required to share planning information, develop Desired Future Conditions (DFCs), and estimate Managed Available Groundwater (MAG) for permitting purposes.

The boundaries of the ETRWPA encompass GMAs 11 and 14. GMA 11 lies north of the northern lines of Polk, Tyler, Jasper, and Newton Counties in Region I and generally covers the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers. GMA 14 encompasses the Gulf Coast aquifer including Polk, Tyler, Jasper, and Newton Counties and counties to the south toward the Texas coast.

Most counties in the ETRWPA are covered by a GCD. Following is a brief description of the county breakdown among GCDs.

Anderson, Henderson and Cherokee Counties. The Neches and Trinity Valleys GCD, created in 2001 and headquartered at Jacksonville, covers Cherokee County and almost all of Anderson County, both in the ETRWPA, as well as Henderson County *(which overlaps Regions C and the ETRWPA)*. The remainder of Anderson County, in the Palestine-

Montalba area, is covered by the Anderson County Underground Water Conservation District, created in 1987 and headquartered at Montalba.

Angelina and Nacogdoches Counties. Angelina and Nacogdoches Counties are covered by the Pineywoods GCD, created in 2001 and headquarted in Lufkin. The GCD has regulations including a permitting system for water wells within its territory.

Jasper, Newton, Tyler, and Hardin Counties. The Southeast Texas GCD, headquartered in Kirbyville, regulates groundwater in these four counties and was created by the legislature in 2003.

Polk County. Polk County is covered by the Lower Trinity GCD that was created by the 79th Legislature.

Panola County. The Panola County GCD was created by the 80th Legislature, has been confirmed by local election in 2007, and has a management plan in place.

Rusk County. The Rusk County GCD, headquartered northeast of Henderson, covers Rusk County. The District was created by the legislature in 2003.

Counties Not Covered by Groundwater Conservation Districts. Houston, Jefferson, Orange, Sabine, San Augustine, Shelby, Smith, and Trinity Counties are not covered by any confirmed or pending GCD.

1.15 Consideration of Existing Water Planning Efforts and Programs

The ETRWPA published its first round of regional water planning in 2001. This plan was updated on schedule in 2006. The 2011 Plan makes up the second update to the regional water plan. Over the course of these planning efforts, other ongoing planning efforts, as well as existing water resource programs, have been an integral part of the process. Following is a summary of planning efforts and existing programs that have been considered and utilized by the ETRWPG.

1.15.1 State, Regional, and Local Water Management Planning. Water planning in the ETRWPA incorporates a mixture of water planning efforts, past and present. The 1990 Texas Water Plan, a state-level planning effort, determined that there was a geographic disparity in water availability. As a result of that finding, the Trans-Texas Water Program (TTWP) was created. The TTWP developed sound regional water management strategies for areas of southeast, south-central, and west-central Texas. It considered issues associated with the rapid growth of the Houston, San Antonio, Austin, and Corpus Christi areas; and the possibility of moving water from the water-rich areas of southeast Texas (essentially the ETRWPA now) to these more urbanized demand centers. In 1998, the Phase II Report of the TTWP determined that southeast Texas could play an important role in meeting expected regional demands by exporting water to central Texas. The report looked at a 50-year planning horizon and identified 13 water management strategies that could be implemented to satisfy long-range demands in the study area. Among the conclusions of the TTWP were the following:

- Southeast Texas (essentially the ETRWPA) possessed adequate surface and groundwater resources to supply its own demands and support meeting demands of other areas of south-central and west-central Texas.
- Water conservation, wastewater reclamation, and systems operations can extend the period of adequate supply and delay the need for new resources development in the Houston metropolitan area.
- The Neches Salt Water Barrier would create additional supply from existing resources.
- Contractual transfers of existing supplies can result in additional reduced conveyance requirements.
- Interbasin transfer of water will be needed to meet future water requirements of both the southeast and central Texas areas.
- Desalination is not an economic or environmentally appropriate strategy for use in the southeast area.

The TTWP was a turning point in regional water planning in Texas. The TTWP resulted in the adoption of Senate Bill 1 in 1997, which mandated regional water planning for the entire state and was the inception of Region I, or the ETRWPA.

Since 1997, the area known as the ETRWPA has relied largely on the regional water planning process for development of long-range water plans. However, there are a number of ongoing efforts within the region aimed at planning for future water needs. These efforts have been recognized by the ETRWPG and their results incorporated into the regional planning process.

Local planning efforts within the region have included water conservation plans developed by water user groups and wholesale water providers. Chapter 6 includes further discussion of these plans. In addition, groundwater conservation districts within the region have prepared groundwater management plans as well as water conservation plans aimed at providing a degree of long-range planning for groundwater resources under their jurisdiction. Groundwater conservation districts are identified in Section 1.14.4 of Chapter 1.

1.15.2 Texas Clean Rivers Program. The Texas Clean Rivers Program (TCRP) was established with the promulgation of the Clean Rivers Act of 1991. TCRP provides for biennial assessments of water quality to identify and prioritize water quality problems within each watershed and subwatershed. In addition, TCRP seeks to develop solutions to water quality problems identified during the biennial assessments. The TCEQ administers the program.

The TCEQ contracts with fifteen regional agencies to conduct the required stream assessments in the various river basins. With the exception of the International Boundary and Water Commission and one water district, these agencies are river authorities. Each agency posts recent assessment reports for its territory on its web site.

Agencies conducting the stream assessments within ETRWPA are:

- Angelina and Neches River Authority (Lufkin) (upper portion of Neches River Basin).
- Lower Neches Valley Authority (Beaumont) (lower portion of Neches River Basin plus Neches-Trinity Coastal Basin).
- Northeast Texas Municipal Water District (Hughes Springs) (Cypress Creek Basin).
- Sabine River Authority of Texas (Orange) (Sabine River Basin).
- Trinity River Authority of Texas (Arlington) (Trinity River Basin).

1.15.3 Safe Drinking Water Act. The Safe Drinking Water Act (SDWA), passed in 1974 and amended in 1986 and 1996, allows the U.S. Environmental Protection Agency to set drinking water standards. These standards are divided into two categories: National Primary Drinking Water Regulations (primary standards that must be met by all public water suppliers) and National Secondary Water Regulations (secondary standards that are not enforceable, but are recommended). Primary standards protect water quality by limiting contaminant levels that are known to adversely affect public health and are anticipated to occur in water. Secondary standards have been set for contaminants that may pose a cosmetic or aesthetic risk to the public (e.g., taste, odor, or color).

Standards cover various categories of parameters which have been determined to be harmful if present in more than specified concentrations. These include certain organic, inorganic, and radioactive substances; and pathogens as indicated by coliform bacteria. Surface water treatment must achieve a specified removal or inactivation of other designated pathogens (*Cryptosporidium* oocysts, *Giardia* cysts, and viruses).

Minimum and maximum disinfectant residuals must be maintained. Disinfection byproducts, which increase as the water travels through the distribution system, have limits. Turbidity and total organic carbon are regulated for surface water. Lead and copper must not leach out from home plumbing in more than trace amounts. Other standards cover qualitative parameters including color, corrosivity, odor, and pH.

Additionally, certain unregulated substances must be monitored in an effort to determine whether they should become regulated. The lists of regulated and monitored parameters are revised from time to time as more is learned about them. A candidate list of additional parameters for regulation must be published every five years. The draft 2004 list includes ten microbial and 42 chemical parameters.[35]

The TCEQ requires public water systems to meet primary standards and, when practical, secondary standards. A water system must meet a number of requirements, including all primary standards to gain recognition as an Approved Public Water System. To be recognized as a Superior Public Water System, the system must also meet all secondary standards.

1.15.4 Water for Texas. Developed by the TWDB, this comprehensive State Water Plan identifies current and prospective water uses, water supplies, and water users. The plan also identifies needed water-related management measures, facility needs, and costs, and offers recommendations to better manage the State's water resources through Year 2050. This plan was adopted by the TWDB in August 1997.

The first cycle of regional water planning, which was completed in 2001, resulted in an updated state water plan, *Water for Texas 2002*, which addressed the same issues but was developed on a regional basis. SB1 had established sixteen planning regions within the state. In each region, local representatives worked with consultants to develop a regional water plan to submit to the TWDB by 2001. The TWDB, after review and approval of each regional plan, consolidated the plans into a state plan which was finalized in 2002. The second comprehensive state plan was finalized in 2007.

Each regional plan includes a section in which water supply strategies are recommended for each water user group *(such as a city or industrial sector within a county),* which has a forecast water shortage. Strategies may be as simple as renewing a contract for purchased water, or as involved as constructing a new water supply reservoir.

The plan is being updated every five years by the regions on an ongoing basis. The third five-year cycle, which includes this report, will result in regional plans in 2011 and a state plan in 2012.

1.15.5 Comprehensive Sabine Watershed Management Plan. This report was completed in December 1999. It was prepared for the SRA of Texas in conjunction with the TWDB, Contract # 97-483-214; Freese and Nichols, Inc., Brown and Root, Inc., and LBG-Guyton Associates. This plan was developed over a period from 1996 through 1999 as an update to a 1985 master plan for the basin. The plan points out the two distinct geographic regions of the basin, upstream and downstream from the upstream end of Toledo Bend Reservoir in Panola County.

TWDB consensus planning population and water use projections showed water use in the Upper Basin to increase from 197,000 to 457,000 ac-ft per year from 1990 to 2050. Lower Basin use was shown to increase from 79,000 to 164,000 ac-ft per year from 1990 to 2050. No new water supplies for the Lower Basin were recommended. A total of 93,000 ac-ft per year of new supplies were recommended for the Upper Basin, including a proposed Prairie Creek Reservoir.

1.15.6 Water Availability Modeling for the Neches River Basin. This report dated April 1999, was prepared for the Texas Natural Resource Conservation Commission (predecessor agency to the TCEQ) by Brown and Root, Inc., Freese and Nichols, Inc., Espey Padden Consultants, Inc., and Crespo Consulting Services, Inc. The study determined naturalized stream flows *(the flows which would occur without the effects of human activity such as consumption and return flows)* and developed a model to determine water available to meet water rights.

Naturalized stream flows averaged 6.3 million ac-ft per year, with a minimum of 1.4 million ac-ft per year in 1967. Water rights total 4 million ac-ft per year. Cancellation of selected water rights would have little effect on reliability for the remaining rights.

1.15.7 Trinity River Basin Master Plan. This study has been updated various times, most recently 2001. Water use projections show water use in the Upper Basin (*all counties north of Freestone and Anderson*) to increase from 904,000 ac-ft per year to 2,165,000 ac-ft per year from 1990 to 2040. Middle and Lower Basin use is shown to increase from 141,100 ac-ft per year to 302,400 ac-ft per year from 1990 to 2040. The groundwater component of the Middle and Lower Basin usage is shown to increase from 40 MGD to 63 MGD during the same period.

The firm yield of existing and under-construction major reservoirs within the Trinity Basin was 2,325,100 ac-ft per year. Several new reservoirs were recommended, including Tennessee Colony. The Tennessee Colony reservoir *(partially within the ETRWPA)* is not shown as an immediate need. The plan recommended construction of the reservoir when needed for flood control and/or water supply. Coordination with lignite mining was also pointed out, so that all feasible lignite mining within the reservoir area could be performed before construction.

A number of other recommended reservoirs are included in the plan, including several smaller reservoirs within the ETRWPA in Anderson and Houston Counties.

1.16 Special Studies

In 2008 and early 2009, the TWDB funded five special projects for the ETRWPA, to be conducted prior to preparation of the 2011 Plan. The studies were undertaken by the ETRWPG consulting team. To the extent practical, these studies have been considered in the development of the 2011 Plan and their findings incorporated into the plan. Their findings are summarized below.

1.16.1 Special Study No. 1: Interregional Coordination on the Toledo Bend Project. The 2007 State Water Plan recommends moving water from Toledo Bend Reservoir in East Texas to water providers in Region C to satisfy primarily projected increased water demands in the Dallas-Fort Worth Metroplex. The project consists of transporting up to 500,000 to 700,000 acre-feet per year of water from Toledo Bend Reservoir to other lakes in Texas. The Toledo Bend Project is a recommended water management strategy for the North Texas Municipal Water District, Tarrant Regional Water District and the Sabine River Authority, and it is an alternative water management strategy for Dallas Water Utilities and the Upper Trinity Regional Water District. Since this study was recommended in the 2007 State Water Plan, there have been on-going developments regarding future water supplies for the participants of this project.

This study was conducted to better understand the impacts of these developments on the proposed Toledo Bend Project, and update the strategy descriptions. The major tasks included: 1) coordination with the major participants and confirmation of supply amounts and delivery locations, 2) review and update schematic transmission routes, 3) identify potential impacts to receiving reservoirs, 4) review naturalized flows to Sabine Lake and compare these flows to the Texas Parks and Wildlife Department's recommended freshwater inflows, and 5) update capital costs and develop life cycle costs for the refined project. This special study was utilized in the 2011 Plan primarily in the development of costs used by Region C in development of this strategy for use in the Region C plan. However, the study also enabled the ETRWPG to better consider potential environmental impacts associated with the potential transfer of water from one basin to another.

1.16.2 Special Study No. 2: Regional Solutions for Small Water Suppliers. The purpose of this study was to identify small municipal water suppliers that do not meet certain requirements of the Texas Administrative Code (30 TAC 290) and to determine the feasibility of a regional water strategy to meet the deficiencies. Only the systems meeting both the applicable size and needs criteria were covered in the study.

Small WUGs are defined for purposes of state and regional water planning as those serving a population of less than 1500 (typically, 500 connections). Smaller systems typically have fewer resources to use in their long range planning. The needs addressed in this study are limited to facility sizing and drinking water quality. More specifically, the sizing issues consist of quantity of water supply and total water storage. Water quality problems for the purpose of this study are any violations of the primary (health related) drinking water standards. This study supports regional water planning by increasing the degree of participation of applicable small water systems in the regional water plan. These systems are afforded an opportunity to consider regional solutions for their problems, involving wholesale purchase of water from another supplier. Alternately they could propose other types of solutions. In either case, they were made more conscious of alternate solutions. In many cases, the local system operators provided valuable input to the Regional Water Planning Group and its consultants. As individual strategies are selected, the overall strategy for the Region can be formed more accurately.

1.16.3 Special Study No. 3: Study of Municipal Water Uses to Improve Water Conservation Strategies and Projections. This study provided for a survey of WUGs in the ETRWPA in order to gain an improved understanding of current water conservation practices and to use the findings for development of conservation strategies and projections of water conservation savings in the region.

In August 2008, water production and sales surveys were mailed to 65 WUGs in the ETRWPA with approximately 1,000 connections or more. A total of 27 WUGs returned the completed survey with useable information, constituting a 42% response rate. Survey data were received from a diverse range of WUGs. In 2007, the number of connections for responding WUGs ranged from approximately 880 connections to 41,500 connections. Approximately one half of the WUGs had less than 2,000 connections. Three surveys were received from WUGs with more than 10,000 connections. In aggregate, the response represents roughly 39% of the total population of the ETRWPA.

The survey results suggest that current water use among responding WUGs in Region I is efficient and may be generally lower than other areas of the state on a per capita basis. These data suggest that the identification and development of cost-intensive measures for additional active water conservation in Region I may not be justified at this time. The results of this study were considered in the update to Chapter 6 of the 2011 Plan, regarding water conservation in the ETRWPA.

1.16.4 Special Study No. 4: Lake Murvaul Study. The 2006 Plan indicated a projected deficit for steam electric power in Rusk County beginning in 2020. This deficit is attributed to increased demands at the Luminant Martin Lake facility located in northeast Rusk County. The proposed strategies to meet these needs include: 1) exercise a contract option with the city of Dallas for water from Lake Fork, and 2) increase the supply from Toledo Bend Reservoir. Collectively, these strategies provide 28,074 acre-feet per year. For this study, Lake Murvaul was considered as an alternate source of water for the Luminant facility in lieu of some of the other recommended surface water supplies or local groundwater.

Lake Murvaul is owned by the City of Carthage and the sale of water from this project could be a potential revenue source for the City. Considering these factors, the ETRWPG authorized Special Study No. 4 to evaluate the feasibility of using water from Lake Murvaul for steam electric power demands at the Luminant Energy Martin Lake facility.

Luminant Energy was contacted regarding the concept of using unpermitted yield from Lake Murvaul to supply water to the steam electric plant at Martin Lake. However, Luminant Energy indicated that at this time Luminant has no plans for obtaining water from Lake Murvaul to supply Martin Lake. Luminant Energy has exercised its contract option with the City of Dallas and can now transfer 12,000 acre-feet per year from Lake Fork to the station at Martin Lake. Luminant has built a pipeline to use this water. Based on this information, further work on this study was suspended, with permission of the TWDB and the ETRWPG.

1.16.5 Special Study No. 5: Liquid Natural Gas Refinery Expansions in Jefferson County. The LNVA provides water supply for the majority of industrial users in Jefferson County. Near the end of the planning cycle for the 2006 Plan, a number of significant proposed industrial expansions related to refining liquid natural gas (LNG) came to the attention of the ETRWPG. The impact of these potential expansions on water supply could not be defined prior to the completion of the 2006 Plan. However, the need for water for these facilities could be significant. Therefore, the ETRWPG authorized a study to identify the potential impact of the proposed LNG facilities on water resources in the ETRWPA.

Water management strategies were evaluated for impacts as addressed in Chapter 4D of the 2006 Plan. The evaluation was based on a numeric evaluation from most desirable (1) to least desirable (5) and is provided in the following table. The major potential impact was determined to the crossing of wetlands during the construction process. The long-term impact after construction was expected to be minimal. The results of this study were considered and incorporated as appropriate into the development of WMS in Chapter 4C of the 2011 Plan.

Chapter 2

Current and Projected Population and Water Demand

An understanding of the demand for water in the region is a basic requirement of water planning. The demand for water is based, in part, on population projections for the region. In this chapter, projected population growth for the ETRWPA is examined. Water demand projections have also been developed for the various categories of water use and for WWPs.

2.1 Methodology for Updating Demands

For the 2006 Plan, the TWDB provided initial population and demand projections for water users in the region. The ETRWPG forwarded the population projections to the respective entities within the ETRWPA Region for review. Considering the comments received, the projections were revised and adopted by the ETRWPG and the TWDB.

Municipal water demands were calculated based on the projected populations and current gallons per capita per day (gpcd) usages, allowing for reduction in demands associated with water conservation achieved through eventual compliance with plumbing codes. Demands for other use categories (manufacturing, irrigation, steam-electric, livestock, and mining) were developed with input from representatives of these areas.

For the 2011 Plan update, the population and water demand projections adopted for the 2006 water plan were reviewed in light of changed conditions and new water user groups (WUGs). No changes were made to the total regional population. Five new WUGs were identified in the region. These WUGs are water supply corporations that were found to meet the TWDB criteria for designation as a WUG. New population and demands projections were developed for these entities.

The following changes to water demands are included in the 2011 Plan:

- Increased steam-electric water demand in Angelina County.
- Municipal water demands for newly identified WUGs in Angelina and Nacogdoches Counties (no net change on a county-wide basis).
- Reduced manufacturing water demand for Angelina County.
- Increased manufacturing water demand for Jefferson County.
- Reduced irrigation water demands for Hardin and Jefferson Counties.
- Increased mining water demands in Angelina, Cherokee, and Nacogdoches Counties.
- New mining water demands for Shelby and San Augustine Counties.

Correspondence related to these changes is provided in Appendix 2-A. A summary of population estimates and water demands by county and basin are shown in Appendix 2-B.

2.2 Population Growth

The population in the ETRWPA is projected to increase from 1,011,317 to 1,482,448 from 2000 to 2060. The major centers of population – Jefferson, Smith and Angelina Counties – comprise nearly 50% of the population through the entire planning period. The projection of population growth from 2010 to 2060 by county is presented on Figure 2.1. The expected annual change in population for each county, using average annual growth during the planning period, is presented on Figure 2.2. The largest change in percentage growth is expected in the Nacogdoches, Angelina, and Polk County areas. The distribution of population by county and individual entity is provided in Table 2.1.

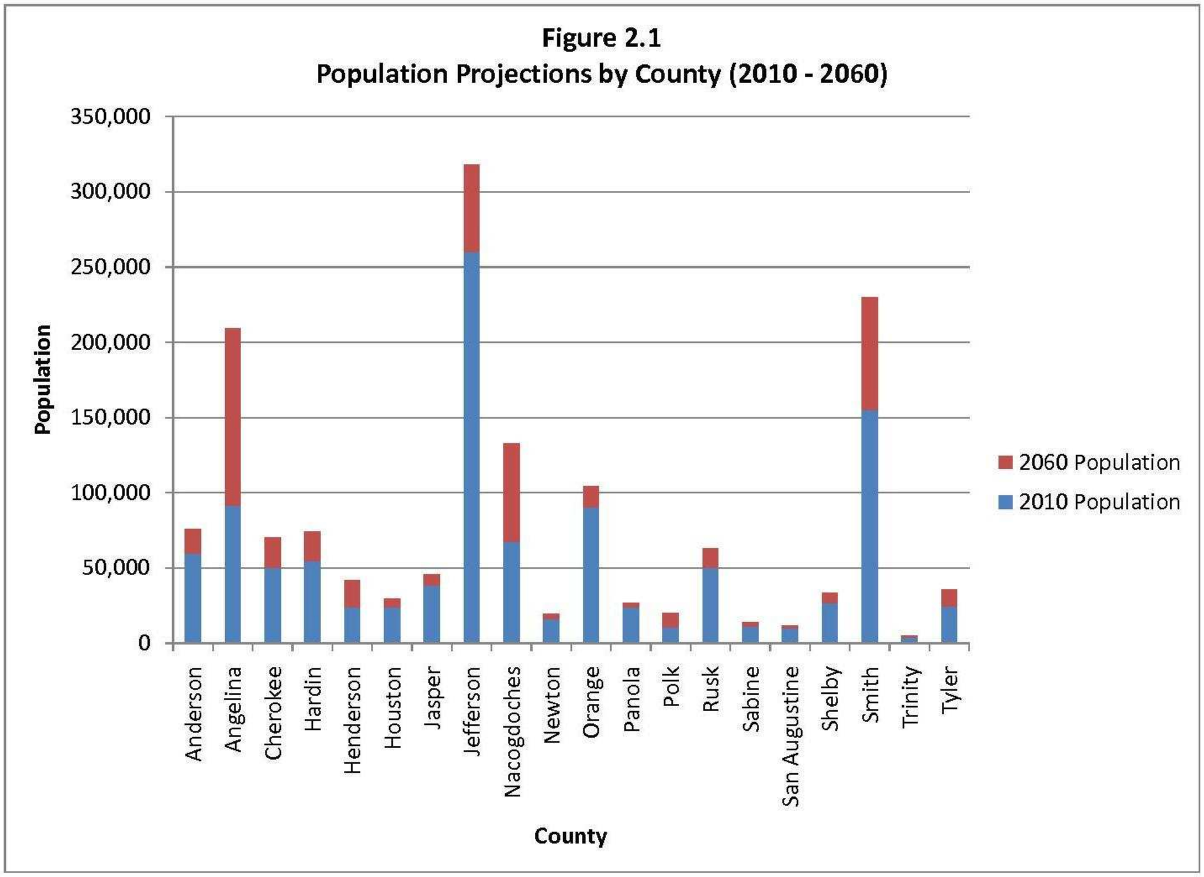


Figure 2.1
Population Projections by County (2010 - 2060)
350,000
300,000
250,000
200,000
150,000
100,000
50,000
0
Population
2060 Population
2010 Population
Anderson
Angelina
Cherokee
Hardin
Henderson
Houston
Jasper
Jefferson
Nacogdoches
Newton
Orange
Panola
Polk
Rusk
Sabine
San Augustine
Shelby
Smith
Trinity
Tyler
County

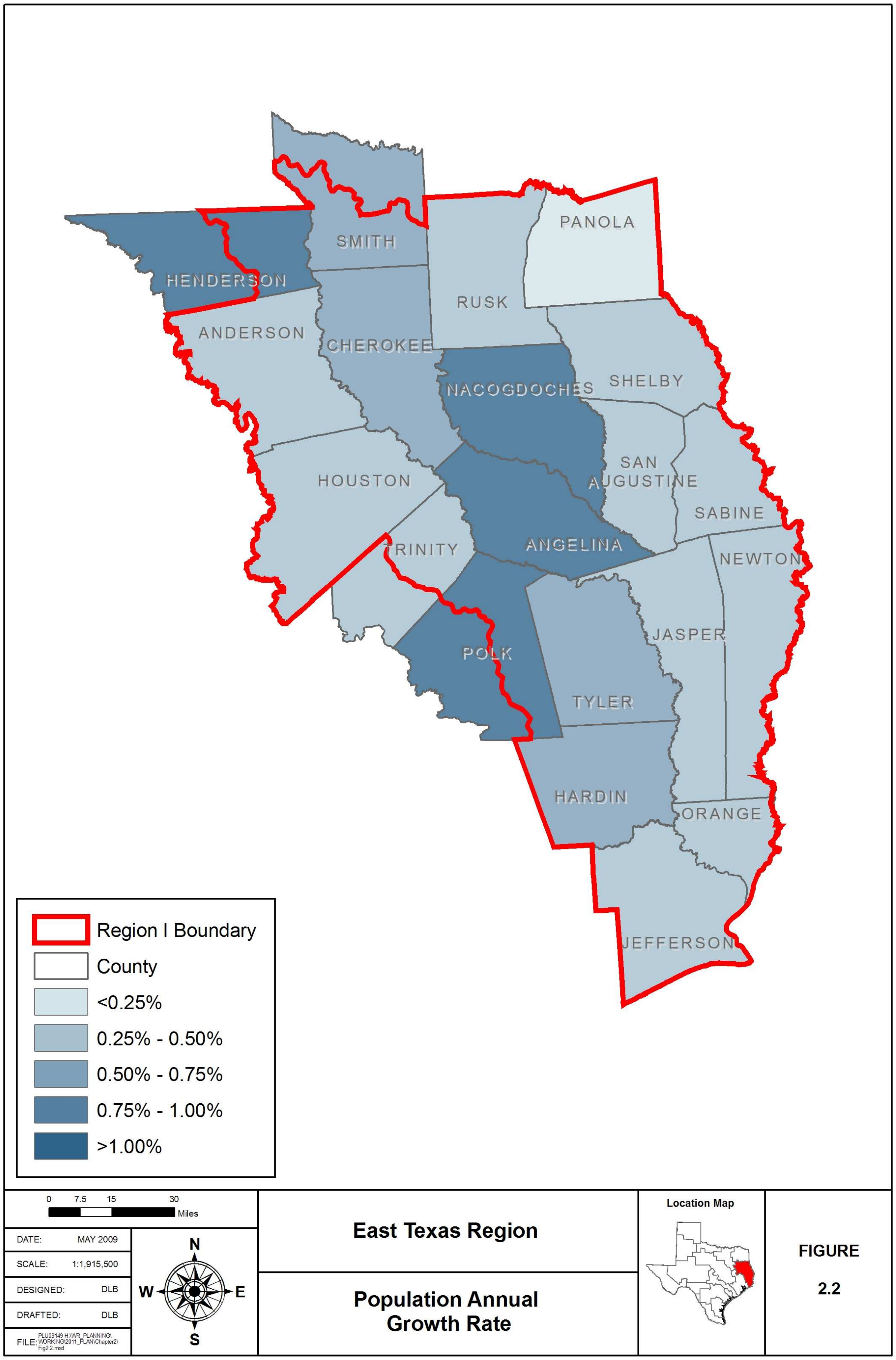

PANOLA
SMITH
HENDERSON
RUSK
ANDERSON
CHEROKEE
NACOGDOCHES
SHELBY
SAN AUGUSTINE
HOUSTON
SABINE
TRINITY
ANGELINA
NEWTON
JASPER
POLK
TYLER
HARDIN
ORANGE
JEFFERSON
Region I Boundary
County
<0.25%
0.25% - 0.50%
0.50% - 0.75%
0.75% - 1.00%
>1.00%
0 7.5 15 30 Miles
DATE: MAY 2009
SCALE: 1:1,915,500
DESIGNED: DLB
DRAFTED: DLB
FILE:
N
W
E
S
East Texas Region
Population Annual Growth Rate
Location Map
FIGURE 2.2

Table 2.1 Distribution of Population by County/Entity

Original figures taken from TWDB Board Revisions dated Feb. 5, 2005

County/Entity	Historical	Projections					
Anderson County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Brushy Creek WSC	2,928	3,155	3,332	3,466	3,604	3,712	3,805
Consolidated WSC	1,447	1,560	1,647	1,713	1,781	1,834	1,881
County-Other	24,445	26,344	27,821	28,934	30,091	30,994	31,768
Elkhart	1,215	1,309	1,383	1,438	1,496	1,541	1,579
Four Pine WSC	2,727	2,939	3,104	3,228	3,357	3,458	3,544
Frankston	1,209	1,303	1,376	1,431	1,488	1,533	1,571
Palestine	17,598	18,965	20,028	20,830	21,663	22,313	22,870
Walston Springs WSC	3,540	3,815	4,029	4,190	4,358	4,488	4,601
Anderson County Total	***55,109***	***59,390***	***62,720***	***65,230***	***67,838***	***69,873***	***71,619***
Angelina County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Central WCID of Angelina County	6,302	6,564	6,886	7,283	7,783	8,470	9,380
County-Other	14,354	15,180	16,197	17,451	19,031	21,197	24,069
Angelina WSC	3,344	3,537	3,774	4,066	4,434	4,939	5,608
Redland WSC	2,264	2,394	2,555	2,752	3,001	3,343	3,796
Diboll	5,470	6,449	7,654	9,137	11,007	13,574	16,976
Four Way WSC	2,972	4,503	6,388	8,708	11,634	15,649	20,970
Hudson	3,792	5,021	6,535	8,398	10,747	13,971	18,243
Hudson WSC	6,208	7,579	9,268	11,346	13,967	17,564	22,331
Huntington	2,068	2,306	2,598	2,958	3,412	4,035	4,861
Lufkin	32,709	37,219	42,351	48,190	54,834	62,394	70,997
Zavalla	647	647	647	647	647	647	647
Angelina County Total	***80,130***	***91,399***	***104,853***	***120,936***	***140,497***	***165,783***	***197,878***
Cherokee County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Alto	1,190	1,290	1,404	1,502	1,592	1,681	1,786
Alto Rural WSC	4,500	4,806	5,156	5,456	5,732	6,006	6,329
Bullard	53	54	55	56	57	58	59
County-Other	6,836	6,288	5,555	4,406	2,811	2,110	1,690
Craft-Turney WSC	4,575	5,672	7,032	8,719	10,810	12,000	13,000
Jacksonville	13,868	14,543	15,316	15,978	16,587	17,191	17,904
New Summerfield	998	1,290	1,624	1,910	2,173	2,434	2,742
North Cherokee WSC	3,489	4,116	4,834	5,449	6,015	6,576	7,238
Rusk	5,085	5,525	6,029	6,461	6,858	7,252	7,717
Rusk Rural WSC	2,970	3,166	3,391	3,584	3,761	3,937	4,145

Table 2.1 Distribution of Population by County/Entity (Cont.)

County/Entity	Historical	Projections					
Southern Utilities Company	2,286	2,525	2,799	3,034	3,250	3,464	3,717
Troup	40	44	49	53	57	61	66
Wells	769	774	780	785	789	793	798
Cherokee County Total	***46,659***	***50,093***	***54,024***	***57,393***	***60,492***	***63,563***	***67,191***
Hardin County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	11,311	12,824	13,909	14,402	14,913	15,441	15,989
Kountze	2,115	2,398	2,601	2,693	2,788	2,887	2,990
Lake Livingston Water Supply and Sewer Service Company	88	100	108	112	116	120	124
Lumberton	8,731	9,899	10,736	11,117	11,511	11,919	12,342
Lumberton MUD	7,269	8,241	8,939	9,256	9,584	9,923	10,275
North Hardin WSC	6,500	7,370	7,993	8,276	8,570	8,874	9,188
Silsbee	6,393	7,248	7,861	8,140	8,429	8,728	9,037
Sour Lake	1,667	1,890	2,050	2,123	2,198	2,276	2,356
West Hardin WSC	3,999	4,534	4,918	5,092	5,272	5,459	5,653
Hardin County Total	***48,073***	***54,504***	***59,115***	***61,211***	***63,381***	***65,627***	***67,954***
Henderson County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Athens	236	380	536	690	848	1,040	1,283
Berryville	891	977	1,071	1,164	1,259	1,375	1,521
Bethel-Ash WSC	2,391	3,096	3,860	4,614	5,387	6,330	7,521
Brownsboro	796	949	1,115	1,279	1,447	1,652	1,910
Brushy Creek WSC	732	837	951	1,063	1,178	1,318	1,495
Chandler	2,099	2,385	2,695	3,001	3,314	3,696	4,179
County-Other	13,113	14,004	14,971	15,923	16,904	18,097	19,604
Murchison	592	642	696	749	804	871	955
RPM WSC	443	495	552	608	665	735	823
Henderson County Total	***21,293***	***23,765***	***26,447***	***29,091***	***31,806***	***35,114***	***39,291***
Houston County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Consolidated WSC	12,965	13,391	13,732	14,281	14,852	15,446	16,064
County-Other	1,020	1,053	1,080	1,123	1,169	1,216	1,264
Crockett	7,141	7,376	7,563	7,866	8,180	8,507	8,848
Grapeland	1,451	1,499	1,536	1,599	1,662	1,729	1,798
Lovelady	608	628	644	670	696	724	753
Houston County Total	***23,185***	***23,947***	***24,555***	***25,539***	***26,559***	***27,622***	***28,727***
Jasper County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	20,643	22,244	23,624	24,439	24,647	24,647	24,647
Jasper	7,657	8,315	8,883	9,218	9,303	9,303	9,303

Table 2.1 Distribution of Population by County/Entity (Cont.)

County/Entity	Historical	Projections					
Jasper County WCID No. 1	4,000	4,319	4,595	4,757	4,799	4,799	4,799
Kirbyville	2,085	2,251	2,395	2,480	2,501	2,501	2,501
Mauriceville WSC	1,219	1,316	1,400	1,450	1,462	1,462	1,462
Jasper County Total	***35,604***	***38,445***	***40,897***	***42,344***	***42,712***	***42,712***	***42,712***
Jefferson County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Beaumont	113,866	113,866	113,866	113,866	113,866	113,866	113,866
Bevil Oaks	1,346	1,346	1,346	1,346	1,346	1,346	1,346
China	1,112	1,096	1,072	1,051	1,035	1,018	987
County-Other	16,364	21,249	28,265	34,588	39,464	44,381	53,675
Groves	15,733	15,733	15,733	15,733	15,733	15,733	15,733
Jefferson County WCID No. 10	4,497	4,923	5,534	6,085	6,509	6,937	7,747
Meeker MUD	2,835	3,322	4,022	4,653	5,139	5,629	6,556
Nederland	17,422	18,052	18,958	19,775	20,404	21,039	22,238
Nome	515	549	598	643	677	712	777
Port Arthur	57,755	57,755	57,755	57,755	57,755	57,755	57,755
Port Neches	13,601	13,956	14,466	14,926	15,281	15,638	16,314
West Jefferson County MWD	7,005	7,853	9,071	10,169	11,016	11,870	13,484
Jefferson County Total	***252,051***	***259,700***	***270,686***	***280,590***	***288,225***	***295,924***	***310,478***
Nacogdoches County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Appleby WSC	3,218	4,341	5,481	6,560	7,749	9,985	12,345
County-Other	8,810	9,802	10,810	11,762	12,812	14,788	16,872
D&M WSC	5,160	5,742	6,331	6,890	7,506	8,662	9,883
Melrose WSC	3,039	3,381	3,729	4,057	4,419	5,101	5,820
Woden WSC	2,281	2,538	2,799	3,046	3,317	3,829	4,369
Cushing	637	683	730	774	823	915	1,012
Garrison	844	844	844	844	844	844	844
Lily Grove SUD	2,300	3,229	4,172	5,064	6,047	7,896	9,847
Nacogdoches	29,914	33,044	36,501	39,946	43,074	49,198	54,345
Swift WSC	3,000	3,753	4,517	5,240	6,037	7,535	9,116
Nacogdoches County Total	***59,203***	***67,357***	***75,914***	***84,183***	***92,628***	***108,753***	***124,453***
Newton County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	9,384	9,967	10,417	10,476	10,790	11,114	11,447
Mauriceville WSC	457	485	507	510	525	541	557
Newton	2,459	2,612	2,730	2,745	2,827	2,912	3,000
South Newton WSC	2,772	2,944	3,077	3,094	3,187	3,282	3,381
Newton County Total	***15,072***	***16,008***	***16,731***	***16,825***	***17,329***	***17,849***	***18,385***

Table 2.1 Distribution of Population by County/Entity (Cont.)

County/Entity	Historical	Projections					
Orange County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Bridge City	8,651	9,264	9,681	9,851	9,924	10,075	10,184
County-Other	31,924	32,563	32,998	33,177	33,252	33,411	33,527
Mauriceville WSC	5,944	9,467	11,866	12,848	13,265	14,137	14,769
Orange	18,643	18,643	18,643	18,643	18,643	18,643	18,643
Pine Forest	632	632	632	632	632	632	632
Pinehurst	2,274	2,274	2,274	2,274	2,274	2,274	2,274
Rose City	519	519	519	519	519	519	519
South Newton WSC	828	1,108	1,299	1,377	1,410	1,479	1,529
Vidor	11,440	11,922	12,251	12,386	12,443	12,562	12,648
West Orange	4,111	4,111	4,111	4,111	4,111	4,111	4,111
Orange County Total	***84,966***	***90,503***	***94,274***	***95,818***	***96,473***	***97,843***	***98,836***
Panola County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Beckville	752	790	806	820	831	840	846
Carthage	6,664	7,000	7,146	7,263	7,362	7,444	7,497
County-Other	14,432	15,159	15,476	15,728	15,944	16,121	16,235
Gill WSC	693	728	743	755	766	774	780
Tatum	215	226	231	234	238	240	242
Panola County Total	***22,756***	***23,903***	***24,402***	***24,800***	***25,141***	***25,419***	***25,600***
Polk County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Corrigan	1,721	2,232	2,720	3,132	3,409	3,580	3,759
County-Other	6,314	8,190	9,981	11,490	12,508	13,132	13,789
Polk County Total	**8,035**	***10,422***	***12,701***	***14,622***	***15,917***	***16,712***	***17,548***
Rusk County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	26,005	27,930	29,754	30,789	31,307	32,741	36,271
Easton	37	61	83	96	102	120	163
Elderville WSC	2,282	2,518	2,741	2,868	2,931	3,107	3,539
Henderson	11,273	11,358	11,438	11,484	11,506	11,570	11,726
Kilgore	2,580	2,580	2,580	2,580	2,580	2,580	2,580
Mount Enterprise	525	540	554	562	566	577	605
New London	987	1,026	1,063	1,084	1,094	1,123	1,194
Overton	2,215	2,363	2,503	2,582	2,621	2,732	3,003
Southern Utilities Company	399	426	451	465	472	492	541
Tatum	960	960	960	960	960	960	960
West Gregg WSC	109	112	114	115	116	118	123
Rusk County Total	***47,372***	***49,874***	***52,241***	***53,585***	***54,255***	***56,120***	***60,705***

Table 2.1 Distribution of Population by County/Entity (Cont.)

County/Entity	Historical	Projections					
Sabine County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	1,740	1,875	1,952	2,010	2,070	2,133	2,197
G-M WSC	6,643	7,157	7,451	7,675	7,905	8,142	8,386
Hemphill	1,106	1,192	1,241	1,278	1,316	1,356	1,396
Pineland	980	1,056	1,099	1,132	1,166	1,201	1,237
Sabine County Total	***10,469***	***11,280***	***11,743***	***12,095***	***12,457***	***12,832***	***13,216***
San Augustine County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	5,712	6,203	6,328	6,490	6,685	6,886	7,023
G-M WSC	759	824	841	862	888	915	933
San Augustine	2,475	2,688	2,742	2,812	2,897	2,984	3,043
San Augustine County Total	***8,946***	***9,715***	***9,911***	***10,164***	***10,470***	***10,785***	***10,999***
Shelby County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Center	5,678	5,974	6,363	6,668	6,896	7,092	7,306
County-Other	16,481	17,417	18,647	19,614	20,333	20,953	21,632
Joaquin	925	974	1,038	1,088	1,126	1,158	1,193
Tenaha	1,046	1,046	1,046	1,046	1,046	1,046	1,046
Timpson	1,094	1,120	1,154	1,181	1,201	1,218	1,237
Shelby County Total	***25,224***	***26,531***	***28,248***	***29,597***	***30,602***	***31,467***	***32,414***
Smith County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Arp	901	965	1,013	1,061	1,109	1,189	1,295
Bullard	1,097	1,284	1,424	1,563	1,702	1,936	2,245
Community Water Company	1,050	1,340	1,557	1,773	1,989	2,352	2,832
County-Other	4,750	4,253	3,807	3,409	3,052	2,732	2,446
Crystal Systems, Inc.	276	321	355	389	423	480	555
Dean WSC	4,310	5,111	5,710	6,307	6,903	7,904	9,229
Jackson WSC	2,449	3,832	4,650	5,535	6,420	7,000	7,550
Lindale	673	673	673	673	673	673	673
Lindale Rural WSC	2,246	2,714	3,064	3,413	3,761	4,346	5,119
New Chapel Hill	553	635	697	758	819	922	1,058
Noonday	515	550	576	602	628	672	730
Overton	57	61	64	67	70	75	81
RPM WSC	201	228	249	269	289	323	368
Southern Utilities Company	33,640	36,295	38,496	40,620	42,736	47,202	53,328
Troup	1,909	2,113	2,266	2,418	2,570	2,825	3,163
Tyler[1]	82,927	88,332	92,372	96,399	100,415	107,168	116,102
Whitehouse	5,346	6,305	7,022	7,736	8,449	9,647	11,232
Smith County Total	***142,900***	***155,012***	***163,995***	***172,992***	***182,008***	***197,446***	***218,006***

Table 2.1 Distribution of Population by County/Entity (Cont.)

County/Entity	Historical						Projections
Trinity County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	2,857	3,186	3,435	3,518	3,660	3,817	3,960
Groveton	542	604	652	668	660	633	610
Trinity County Total	***3,399***	***3,790***	***4,087***	***4,186***	***4,320***	***4,450***	***4,570***
Tyler County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Colmesneil	638	756	872	946	974	974	974
County-Other	11,271	13,363	15,398	16,707	17,209	17,209	17,209
Lake Livingston Water Supply and Sewer Service Company	88	104	120	130	134	134	134
Tyler County WSC	6,459	7,658	8,824	9,574	9,862	9,862	9,862
Woodville	2,415	2,863	3,299	3,580	3,687	3,687	3,687
Tyler County Total	***20,871***	***24,744***	***28,513***	***30,937***	***31,866***	***31,866***	***31,866***
Total for ETRWPA	***1,011,317***	***1,090,382***	***1,166,057***	***1,232,138***	***1,294,976***	***1,377,760***	***1,482,448***

[1]The Texas State Data Center (TSDC) is responsible for maintaining current population estimates for the State. The TSDC 2007 inter-census population estimates for the ETRWPA were provided to the ETRWPG by the TWDB. It should be noted that for most counties in the region, the projection error between the TWDB 2007 interpolated population (i.e., population based on the 2000 census population and the ETRWPA 2010 population projection) and that of the TSDC was relatively small. However, for Smith County, and particularly for the City of Tyler, the TWDB estimates are significantly below the TSDC estimates. This understatement of population for the City of Tyler could present a significant problem for water planning in the ETRWPA if not corrected. Other water suppliers including the City of Nacogdoches and Woodville expressed concerns regarding a possible underestimate of population. The ETRWPG's expectation is that the population of the region's constituent cities and counties will be appropriately adjusted in the next round of planning, based on the 2010 census.

2.3 Water Demands

Municipal water demands have been compiled for each WUG in the region. Likewise, demands for WWPs and for the various categories of water use have been compiled.

For the ETRWPA, the total increase in water demand is expected to increase from 730,911 ac-ft per year to 1,490,596 ac-ft per year between 2010 and 2060. Table 2.2 shows a summary of the water usage by water use category for each decade of the planning period. The percentage of total water used for each of the six WUGs for 2010 and 2060 are shown on Figures 2.3 and 2.4.

Table 2.2 Summary of Water Usage by Use Category and Decade (ac-ft per year)

Water User Category	2006	2010	2020	2030	2040	2050	2060
Municipal	178,646	189,559	196,828	202,761	208,193	218,705	233,622
Manufacturing	237,474	299,992	591,904	784,140	821,841	857,902	893,476
Irrigation	104,150	151,100	151,417	151,771	152,153	152,575	153,040
Steam-Electric	30,599	44,985	80,989	94,515	111,006	131,108	155,611
Livestock	20,571	23,613	25,114	26,899	29,020	31,546	34,533
Mining	8,357	21,662	37,297	17,331	18,385	19,432	20,314
Total for Region	**579,797**	**730,911**	**1,083,549**	**1,277,417**	**1,340,598**	**1,411,268**	**1,490,596**

Figure 2.3
2010 Distribution of Water Demand

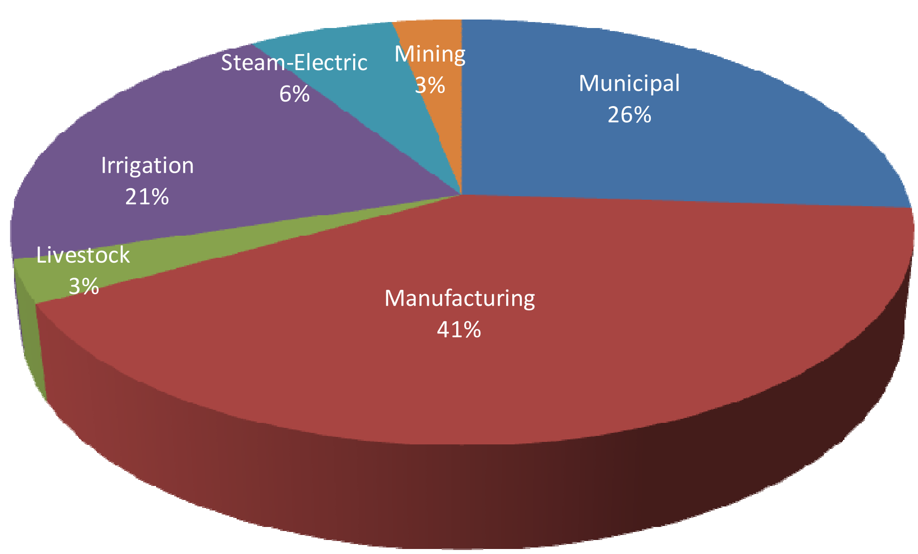
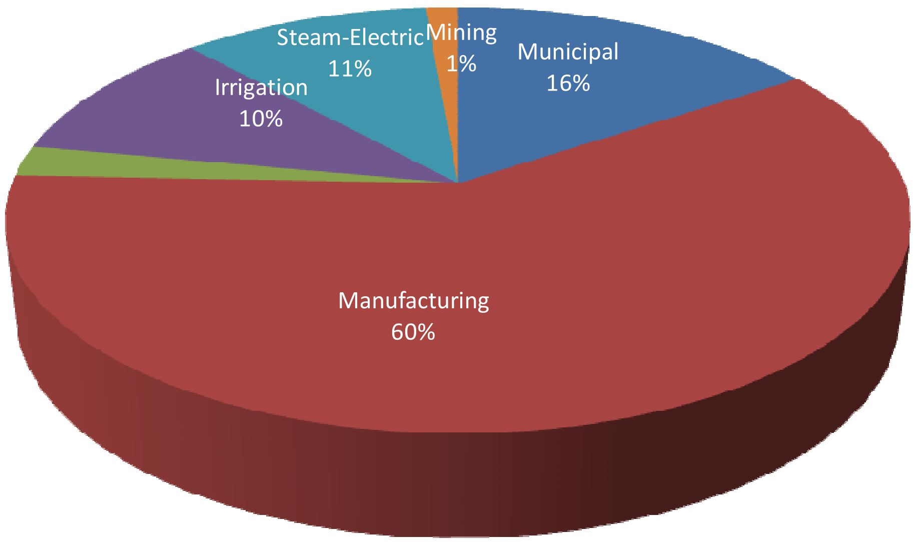


Figure 2.4
2060 Distribution of Water Demand



Details of each water use category are provided below.

2.3.1 Municipal Demands. Municipal water use includes both residential and commercial use. Residential use includes single and multi-family housing. Commercial demand is composed of water used by small businesses, institutions, and public offices. It does not include water used by industry. Municipal water demand projections are estimated by multiplying the projected population of an entity by the entity's projected per capita water use by decade. The per capita water uses were adjusted in the 2006 Plan to account for implementation of the State Water-Efficiency Plumbing Act. The estimated water savings in the year 2060, afforded by the savings projected into the per capita consumption, is approximately 20,600 ac-ft per year. Table 2.3 provides a summary of the calculated municipal use by entities in the ETRWPA.

Table 2.3 Historical and Projected Municipal Water Demand by County(ac-ft per year)

City/County	Historical	Projected					
Anderson County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Brushy Creek WSC	266	272	276	280	278	282	289
Consolidated WSC	122	127	129	129	127	130	133
County-Other	5,147	5,459	5,672	5,801	5,932	6,075	6,227
Elkhart	170	177	183	185	188	192	196
Four Pine WSC	272	283	292	296	301	306	314
Frankston	492	524	547	564	582	598	612
Palestine	3,529	3,717	3,837	3,920	4,004	4,099	4,202
Walston Springs WSC	408	427	438	441	444	452	464
Anderson County Total	***10,406***	***10,986***	***11,374***	***11,616***	***11,856***	***12,134***	***12,437***
Angelina County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Central WCID of Angelina Co	678	676	686	702	724	778	862
County-Other	1,955	1,819	1,887	1,975	2,089	2,303	2,615
Angelina WSC	275	424	440	460	487	537	609
Redland WSC	230	287	298	311	329	363	412
Diboll	858	968	1,123	1,310	1,554	1,901	2,377
Four Way WSC	256	368	501	673	886	1,192	1,597
Hudson	459	579	732	931	1,168	1,518	1,982
Hudson WSC	563	654	768	902	1,095	1,358	1,726
Huntington	227	243	262	288	325	380	457
Lufkin	6,778	7,546	8,444	9,446	10,565	11,951	13,599
Zavalla	89	86	84	82	80	78	78
Angelina County Total	***12,368***	***13,650***	***15,224***	***17,080***	***19,302***	***22,359***	***26,315***
Cherokee County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Alto	220	233	248	261	273	286	304
Alto Rural WSC	383	393	404	409	411	424	447
Bullard	13	13	13	13	13	13	14
County-Other	995	902	790	617	378	272	218
Craft-Turney WSC	436	515	614	742	908	995	1,078
Jacksonville	3,402	3,502	3,637	3,741	3,827	3,948	4,111
New Summerfield	165	208	258	302	338	379	427
North Cherokee WSC	344	387	439	482	519	560	616
Rusk	1,122	1,194	1,283	1,353	1,421	1,495	1,591
Rusk Rural WSC	349	358	372	381	388	401	423
Southern Utilities Company	392	421	458	486	513	543	583
Troup	6	6	6	7	7	8	8
Wells	124	122	121	119	117	115	116
Cherokee County Total	***7,951***	***8,254***	***8,643***	***8,913***	***9,113***	***9,439***	***9,936***

Table 2.3 Historical and Projected Municipal Water Demand by County(ac-ft per year) (Cont.)

City/County	Historical	Projected					
Hardin County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	1,685	1,853	1,963	1,984	2,005	2,058	2,131
Kountze	282	306	323	326	328	336	348
Lake Livingston WS & SSC	6	6	7	7	7	7	7
Lumberton	1,301	1,430	1,515	1,544	1,573	1,615	1,673
Lumberton MUD	1,734	1,929	2,073	2,125	2,179	2,245	2,325
North Hardin WSC	626	685	716	714	720	736	762
Silsbee	974	1,072	1,136	1,149	1,161	1,193	1,235
Sour Lake	162	176	184	183	182	186	193
West Hardin WSC	291	315	325	325	325	330	342
Hardin County Total	***7,061***	***7,772***	***8,242***	***8,357***	***8,480***	***8,706***	***9,016***
Henderson County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Athens	44	77	107	136	163	199	246
Berryville	119	126	134	142	149	162	179
Bethel-Ash WSC	206	250	303	351	404	468	556
Brownsboro	136	158	182	206	232	263	304
Brushy Creek WSC	66	72	79	86	91	100	114
Chandler	369	409	453	494	538	596	674
County-Other	2,644	2,761	2,901	3,032	3,162	3,365	3,645
Murchison	131	139	148	157	166	179	196
RPM WSC	64	69	75	80	86	95	106
Henderson County Total	***3,779***	***4,061***	***4,382***	***4,684***	***4,991***	***5,427***	***6,020***
Houston County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Consolidated WSC	1,089	1,095	1,077	1,072	1,064	1,090	1,134
County-Other	176	178	179	182	186	192	199
Crockett	1,416	1,438	1,449	1,480	1,512	1,553	1,615
Grapeland	260	264	265	270	275	283	294
Lovelady	75	75	75	76	76	78	81
Houston County Total	***3,016***	***3,050***	***3,045***	***3,080***	***3,113***	***3,196***	***3,323***
Jasper County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	2,706	2,815	2,911	2,929	2,871	2,844	2,844
Jasper	1,510	1,602	1,682	1,714	1,699	1,688	1,688
Jasper County WCID No. 1	318	324	329	325	312	306	306
Kirbyville	446	474	494	506	501	499	499
Mauriceville WSC	98	100	104	104	103	103	103
Jasper *County Total*	***5,078***	***5,315***	***5,520***	***5,578***	***5,486***	***5,440***	***5,440***

Table 2.3 Historical and Projected Municipal Water Demand by County (ac-ft per year) (Cont.)

City/County	Historical	Projected					
Jefferson County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Beaumont	27,550	27,040	26,657	26,275	25,892	25,636	25,636
Bevil Oaks	143	137	133	128	124	121	121
China	171	165	157	151	145	140	136
County-Other	1,503	1,880	2,438	2,906	3,272	3,679	4,449
Groves	3,260	3,190	3,137	3,085	3,031	2,996	2,996
Jefferson County WCID No. 10	605	640	700	750	787	832	929
Meeker MUD	289	324	379	423	461	498	580
Nederland	4,059	4,125	4,268	4,387	4,456	4,573	4,834
Nome	121	127	136	144	150	157	172
Port Arthur	9,898	9,704	9,510	9,315	9,122	8,993	8,993
Port Neches	1,782	1,782	1,782	1,789	1,780	1,804	1,882
West Jefferson County MWD	949	1,029	1,148	1,264	1,345	1,436	1,631
Jefferson County Total	***50,330***	***50,143***	***50,445***	***50,617***	***50,565***	***50,865***	***52,359***
Nacogdoches County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Appleby WSC	580	763	945	1,117	1,311	1,678	2,074
County-Other	1,582	1,120	1,199	1,265	1,349	1,540	1,758
D&M WSC	178	656	702	741	790	902	1,030
Melrose WSC	232	386	414	436	465	531	606
Woden WSC	277	290	310	328	349	399	455
Cushing	123	129	135	140	147	162	179
Garrison	153	149	147	144	141	139	139
Lily Grove SUD	314	423	533	641	752	982	1,224
Nacogdoches	6,903	7,625	8,423	9,218	9,939	11,352	12,540
Swift WSC	403	483	567	640	730	903	1,093
Nacogdoches County Total	***10,745***	***12,024***	***13,375***	***14,670***	***15,974***	***18,589***	***21,098***
Newton County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	1,104	1,128	1,132	1,103	1,100	1,120	1,154
Mauriceville WSC	37	37	37	37	37	38	39
Newton	463	480	495	489	497	509	524
South Newton WSC	255	257	259	253	253	257	265
Newton County Total	***1,859***	***1,902***	***1,923***	***1,882***	***1,887***	***1,924***	***1,982***
Orange County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Bridge City	940	965	977	960	934	936	947
County-Other	4,577	4,559	4,473	4,385	4,284	4,267	4,282
Mauriceville WSC	479	721	877	921	936	998	1,042
Orange	3,863	3,801	3,738	3,675	3,613	3,571	3,571
Pine Forest	75	73	71	69	67	65	65

Table 2.3 Historical and Projected Municipal Water Demand by County (ac-ft per year) (Cont.)

City/County	Historical	Projected					
Pinehurst	344	336	329	321	313	308	308
Rose City	86	84	83	81	79	78	78
South Newton WSC	76	97	109	113	112	116	120
Vidor	1,601	1,629	1,619	1,595	1,561	1,562	1,572
West Orange	548	530	516	502	488	479	479
Orange County Total	***12,589***	***12,795***	***12,792***	***12,622***	***12,387***	***12,380***	***12,464***
Panola County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Beckville	129	133	133	132	131	131	132
Carthage	2,187	2,274	2,297	2,311	2,317	2,326	2,343
County-Other	1,665	1,698	1,681	1,656	1,625	1,607	1,619
Gill WSC	89	94	96	97	99	100	100
Tatum	28	29	28	28	28	27	28
Panola County Total	***4,098***	***4,228***	***4,235***	***4,224***	***4,200***	***4,191***	***4,222***
Polk County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Corrigan	216	270	320	358	378	389	408
County-Other	884	1,110	1,319	1,480	1,583	1,647	1,730
Polk County Total	***1,100***	***1,380***	***1,639***	***1,838***	***1,961***	***2,036***	***2,138***
Rusk County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	2,622	2,660	2,733	2,759	2,700	2,787	3,088
Easton	5	8	11	12	13	15	21
Elderville WSC	294	324	353	369	378	400	456
Henderson	2,450	2,417	2,396	2,367	2,333	2,320	2,351
Kilgore	543	532	520	512	503	500	500
Mount Enterprise	71	71	71	70	68	69	73
New London	220	225	228	230	228	232	248
Overton	394	413	429	434	432	447	491
Southern Utilities Company	68	71	74	74	75	77	85
Tatum	125	122	118	115	112	110	110
West Gregg WSC	15	15	15	15	15	15	16
Rusk County Total	***6,807***	***6,858***	***6,948***	***6,957***	***6,857***	***6,972***	***7,439***
Sabine County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	424	449	461	468	476	485	500
G-M WSC	640	665	668	662	655	666	686
Hemphill	349	371	382	389	397	406	418
Pineland	209	221	227	230	232	237	244
Sabine County Total	***1,622***	***1,706***	***1,738***	***1,749***	***1,760***	***1,794***	***1,848***
San Augustine County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	601	625	623	618	614	624	637
G-M WSC	73	77	75	74	74	75	76
San Augustine	851	915	925	939	957	979	999
San Augustine County Total	***1,525***	***1,617***	***1,623***	***1,631***	***1,645***	***1,678***	***1,712***

Table 2.3 Historical and Projected Municipal Water Demand by County (ac-ft per year) (Cont.)

City/County	Historical	Projected					
Shelby County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Center	1,577	1,633	1,718	1,785	1,823	1,867	1,923
County-Other	2,049	2,087	2,172	2,241	2,255	2,300	2,375
Joaquin	145	148	155	158	160	163	168
Tenaha	194	191	187	184	180	178	178
Timpson	180	179	181	181	180	181	184
Shelby County Total	***4,145***	***4,238***	***4,413***	***4,549***	***4,598***	***4,689***	***4,828***
Smith County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Arp	166	173	178	183	188	200	218
Bullard	269	309	338	366	395	447	518
Community Water Company	89	137	188	211	232	271	327
County-Other	1,059	929	823	726	643	572	512
Crystal Systems, Inc.	58	65	71	77	82	93	108
Dean WSC	473	538	582	629	673	761	889
Jackson WSC	234	288	333	384	431	463	499
Lindale	154	150	148	146	145	144	144
Lindale Rural WSC	375	438	484	531	577	662	780
New Chapel Hill	105	118	127	137	146	163	187
Noonday	98	102	105	107	110	117	127
Overton	10	11	11	11	12	12	13
RPM WSC	29	32	34	36	38	42	47
Southern Utilities Company	5,680	6,058	6,296	6,507	6,750	7,402	8,363
Troup	267	286	297	311	322	351	393
Tyler	24,244	25,528	26,385	27,211	28,007	29,771	32,253
Whitehouse	862	982	1,070	1,153	1,240	1,405	1,636
Smith County Total	***34,172***	***36,144***	***37,470***	***38,726***	***39,991***	***42,876***	***47,014***
Trinity County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
County-Other	538	585	619	623	640	663	688
Groveton	105	114	121	122	118	113	109
Trinity County Total	***643***	***699***	***740***	***745***	***758***	***776***	***797***
Tyler County	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Colmesneil	64	72	80	84	84	83	83
County-Other	1250	1,422	1,587	1,684	1,696	1,677	1,677
Lake LivingstonWater Supply & Sewer Service Company	6	7	7	8	8	8	8
Tyler County WSC	514	575	633	665	663	652	652
Woodville	571	661	750	802	818	814	814
Tyler County Total	***2,405***	***2,737***	***3,057***	***3,243***	***3,269***	***3,234***	***3,234***
Total for ETRWPA	***46,521***	***189,559***	***196,828***	***202,761***	***208,193***	***218,705***	***233,622***

Municipal water use is expected to grow from 189,559 ac-ft per year to 233,622 ac-ft per year during the planning period. This represents an approximate 23% increase in municipal water demand. The projected increase for each county is illustrated on Figure 2.5. Most of the increased demand will occur in Angelina, Nacogdoches, and Smith Counties. The average annual percent increase in each county for municipal demand over the planning period is represented on Figure 2.6.

2.3.2 Manufacturing Demands. Manufacturing demands are expected to increase from 299,992 ac-ft per year to 893,476 ac-ft per year during the planning period. Table 2.4, Figure 2.7, and Figure 2.8 summarize the manufacturing usage by the counties. The average annual projected growth for manufacturing water use is shown on Figure 2.9.

Manufacturing water demand in the ETRWPA is concentrated primarily in Jefferson and Orange Counties. These two counties account for almost 70% of all manufacturing water use in 2010, and over 86% in 2060. Use is mainly in the petrochemical industry.

Angelina and Jasper Counties will comprise an additional 26% of use in 2010. Although manufacturing water demand will increase in these two counties over the planning period, their percentage of use in the region will decrease to approximately 12% by 2060.

2.3.3 Irrigation Demands. Irrigation in Jefferson County accounts for over 91% of all water used for irrigation in the ETRWPA. Water use for irrigation is presented in Table 2.5. Other major irrigation counties in the ETRWPA, after Jefferson County, are Hardin, Houston, and Orange Counties. The projection of irrigation use for these counties is presented on Figure 2.10. The usage for the remaining counties is shown on Figure 2.11.

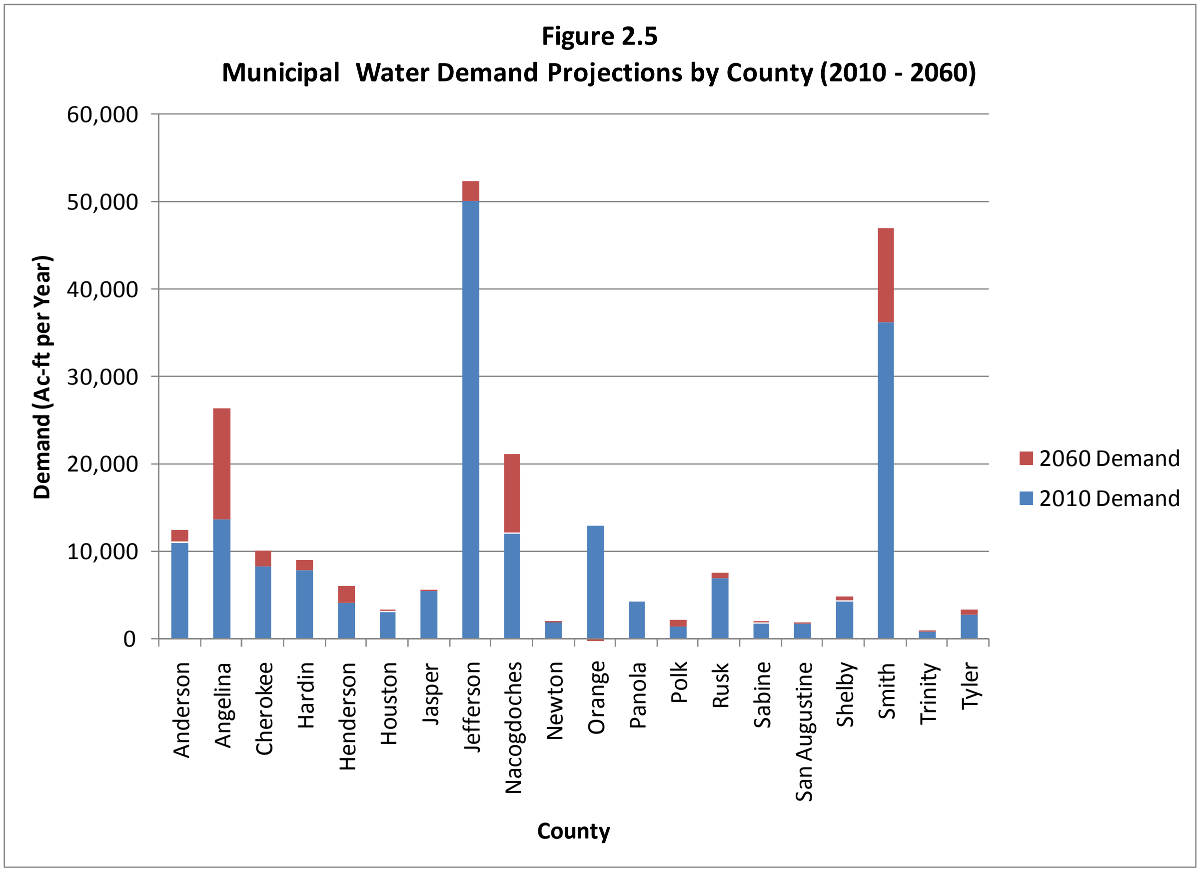


Figure 2.5
Municipal Water Demand Projections by County (2010 - 2060)
60,000
50,000
40,000
30,000
20,000
10,000
0
Demand (Ac-ft per Year)
Anderson
Angelina
Cherokee
Hardin
Henderson
Houston
Jasper
Jefferson
Nacogdoches
Newton
Orange
Panola
Polk
Rusk
Sabine
San Augustine
Shelby
Smith
Trinity
Tyler
County
2060 Demand
2010 Demand

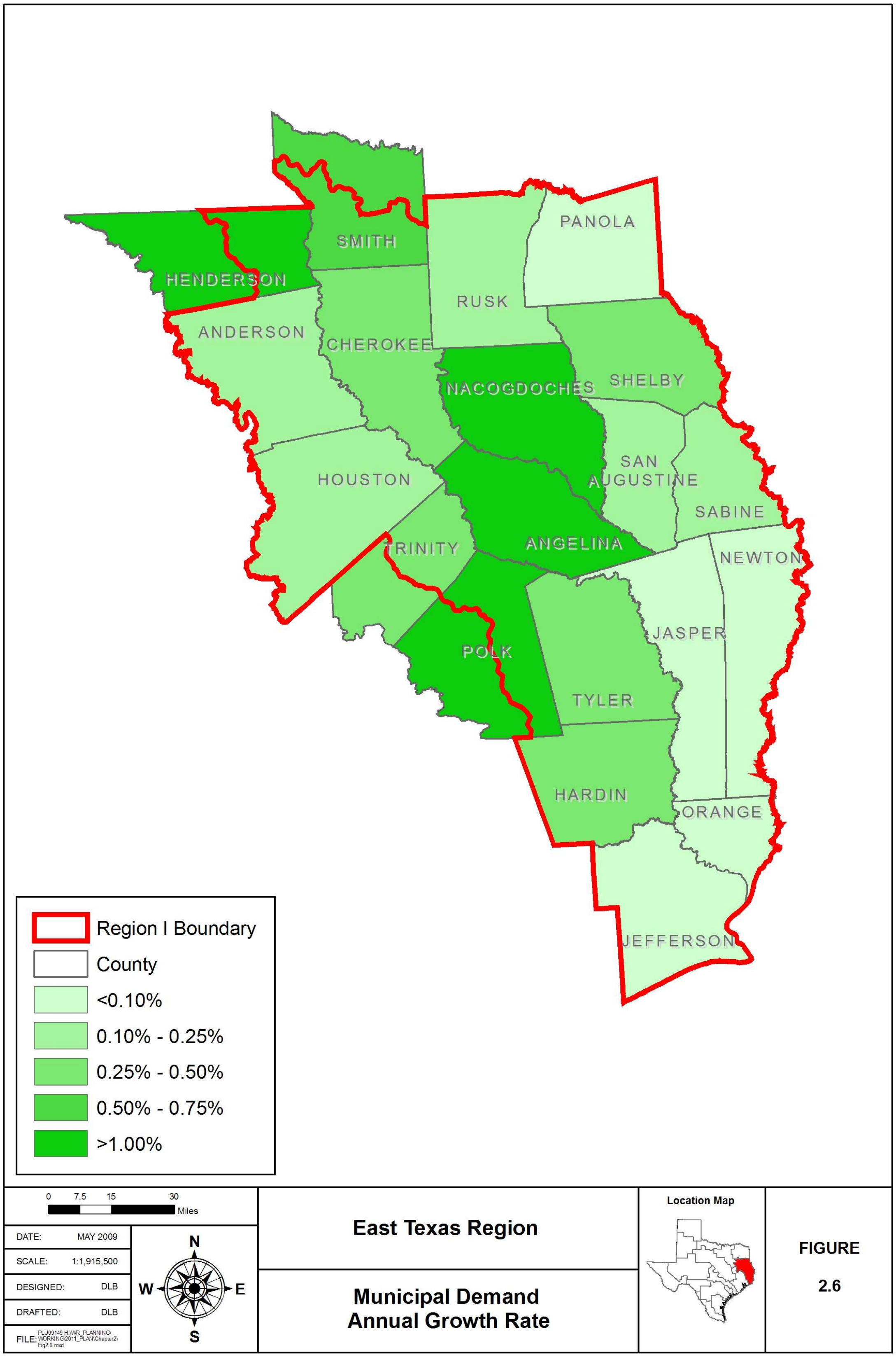

SMITH
HENDERSON
PANOLA
RUSK
ANDERSON
CHEROKEE
NACOGDOCHES
SHELBY
HOUSTON
SAN AUGUSTINE
SABINE
TRINITY
ANGELINA
NEWTON
JASPER
POLK
TYLER
HARDIN
ORANGE
JEFFERSON
Region I Boundary
County
<0.10%
0.10% - 0.25%
0.25% - 0.50%
0.50% - 0.75%
>1.00%
0 7.5 15 30
Miles
DATE: MAY 2009
SCALE: 1:1,915,500
DESIGNED: DLB
DRAFTED: DLB
FILE:
N
W
E
S
East Texas Region
Municipal Demand
Annual Growth Rate
Location Map
FIGURE
2.6

Table 2.4 Historical and Projected Manufacturing Water Demand by County
(ac-ft per year)

County	Historical 2006	Projections					
		2010	2020	2030	2040	2050	2060
Anderson	46	0	0	0	0	0	0
Angelina	7,282	14,750	23,500	25,980	28,490	30,720	33,100
Cherokee	136	718	784	839	891	934	1,007
Hardin	137	146	165	182	200	216	233
Henderson	0	12	14	16	18	20	22
Houston	99	169	190	209	227	243	263
Jasper	55,565	64,267	67,649	70,162	72,359	74,006	74,069
Jefferson	121,798	151,672	423,258	603,321	629,171	655,034	680,914
Nacogdoches	2,369	2,288	2,553	2,786	3,016	3,214	3,468
Newton	32	678	793	899	1,006	1,103	1,196
Orange	43,710	57,624	64,461	70,439	76,399	81,690	87,641
Panola	764	1,357	1,437	1,500	1,561	1,614	1,720
Polk	529	619	725	825	930	1,026	1,110
Rusk	31	82	90	97	103	108	116
Sabine	157	359	427	490	554	611	662
San Augustine	7	6	7	8	9	10	11
Shelby	1,469	1,360	1,508	1,637	1,766	1,880	2,019
Smith	3,342	3,846	4,297	4,697	5,081	5,407	5,854
Trinity	0	0	0	0	0	0	0
Tyler	1	39	46	53	60	66	71
Total for ETRWPA	**237,474**	**299,992**	**591,904**	**784,140**	**821,841**	**857,902**	**893,476**

Figure 2.7
Manufacturing Demand in Industrial Counties

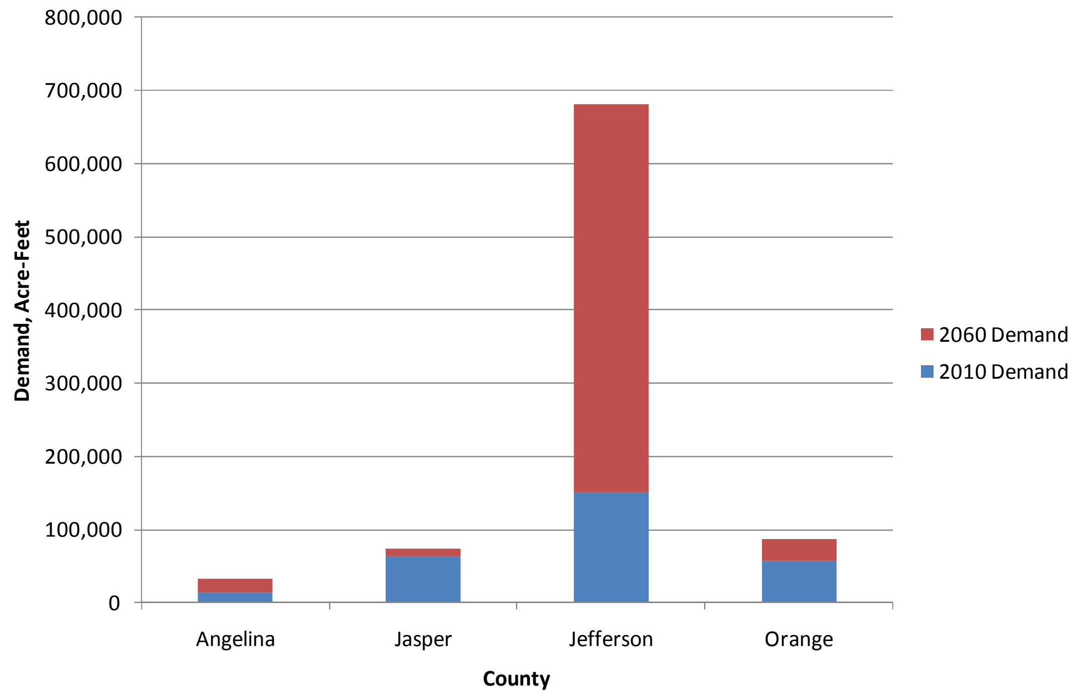
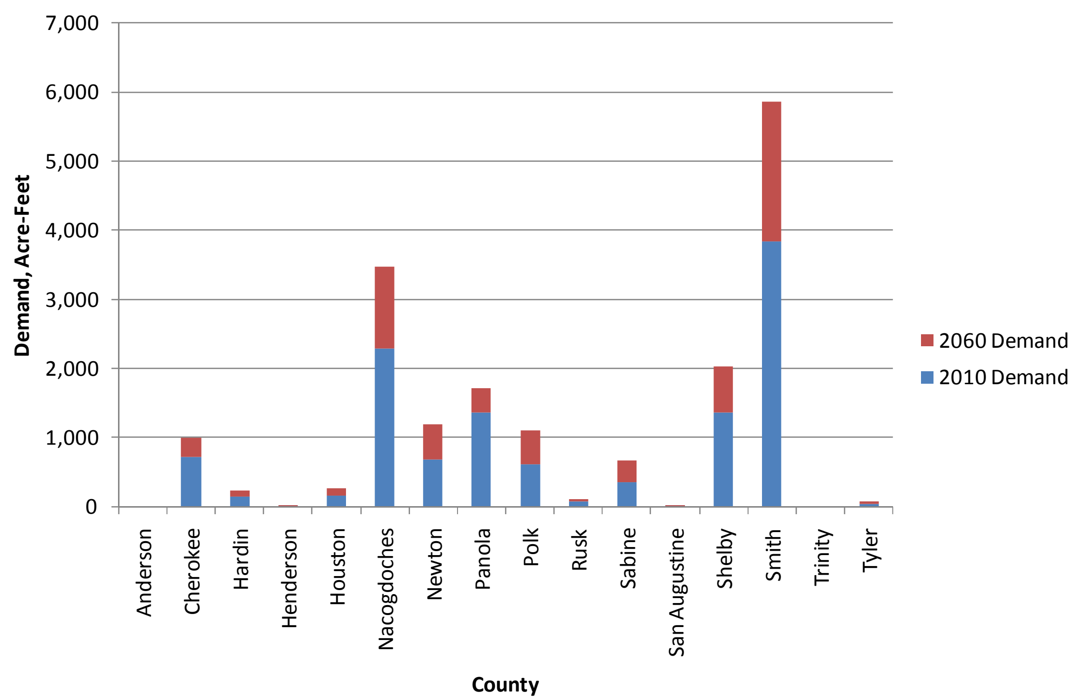


Figure 2.8
Manufacturing Demand in Non-Industrial Counties



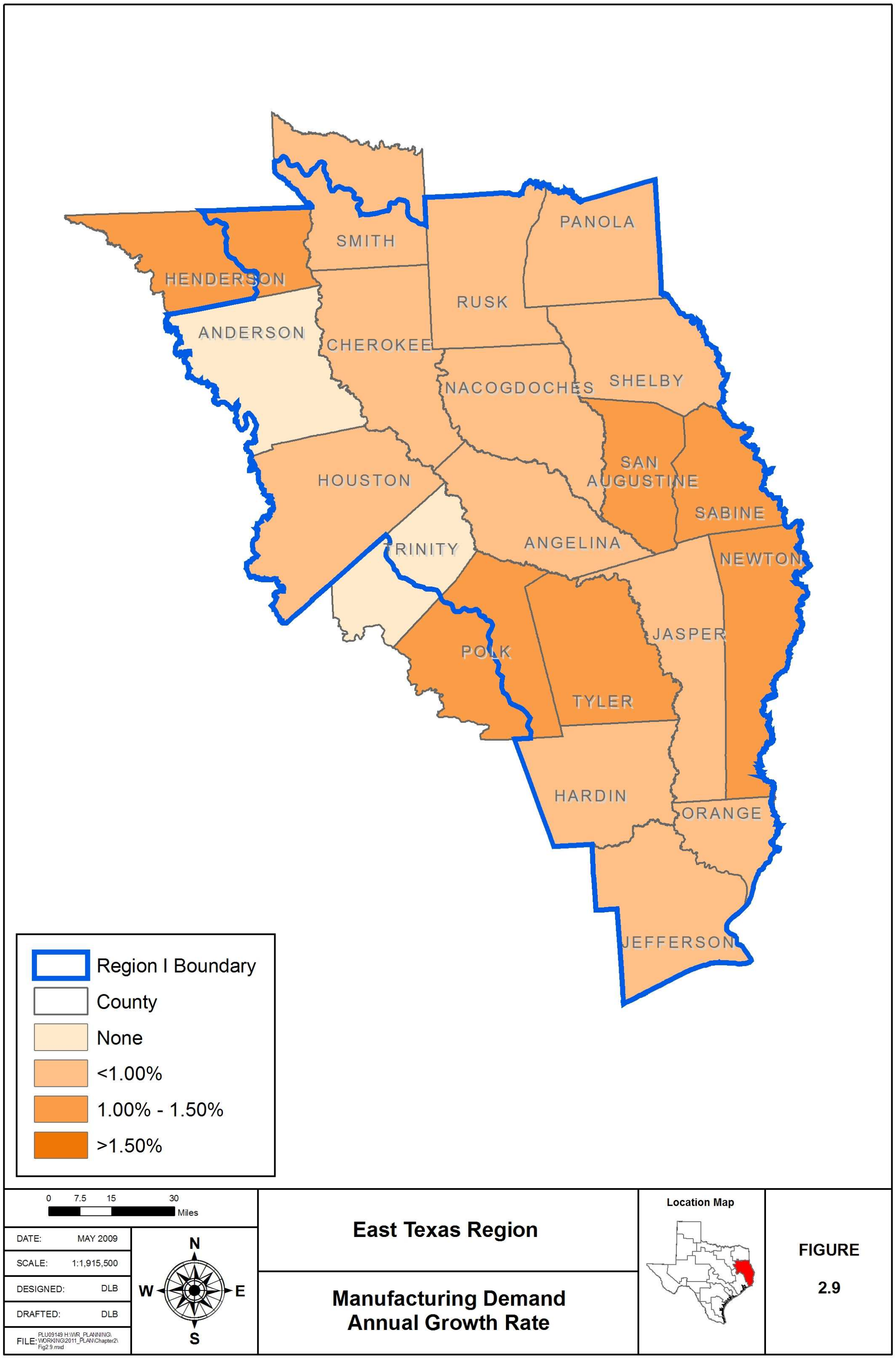

SMITH
PANOLA
HENDERSON
RUSK
ANDERSON
CHEROKEE
SHELBY
NACOGDOCHES
SAN AUGUSTINE
HOUSTON
SABINE
TRINITY
ANGELINA
NEWTON
JASPER
POLK
TYLER
HARDIN
ORANGE
JEFFERSON
Region I Boundary
County
None
<1.00%
1.00% - 1.50%
>1.50%
0 7.5 15 30
Miles
DATE: MAY 2009
SCALE: 1:1,915,500
DESIGNED: DLB
DRAFTED: DLB
FILE:
N
W
E
S
East Texas Region
Manufacturing Demand
Annual Growth Rate
Location Map
FIGURE
2.9

Table 2.5 Historical and Projected Irrigation Water Demand by County
(ac-ft per year)

County	Historical 2006	Projections					
		2010	2020	2030	2040	2050	2060
Anderson	305	212	212	212	212	212	212
Angelina	234	30	30	30	30	30	30
Cherokee	254	321	321	321	321	321	321
Hardin	978	3,502	3,502	3,502	3,502	3,502	3,502
Henderson	384	10	10	10	10	10	10
Houston	2,990	2,739	3,024	3,343	3,691	4,077	4,503
Jasper	36	0	0	0	0	0	0
Jefferson	90,244	140,000	140,000	140,000	140,000	140,000	140,000
Nacogdoches	400	302	302	302	302	302	302
Newton	375	367	367	367	367	367	367
Orange	6,250	2,509	2,509	2,509	2,509	2,509	2,509
Panola	18	0	0	0	0	0	0
Polk	100	135	135	135	135	135	135
Rusk	100	126	126	126	126	126	126
Sabine	0	0	0	0	0	0	0
San Augustine	63	225	225	225	225	225	225
Shelby	27	27	30	34	37	41	46
Smith	892	566	595	626	657	689	723
Trinity	0	0	0	0	0	0	0
Tyler	500	29	29	29	29	29	29
Total for ETRWPA	**104,150**	**151,100**	**151,417**	**151,771**	**152,153**	**152,575**	**153,040**

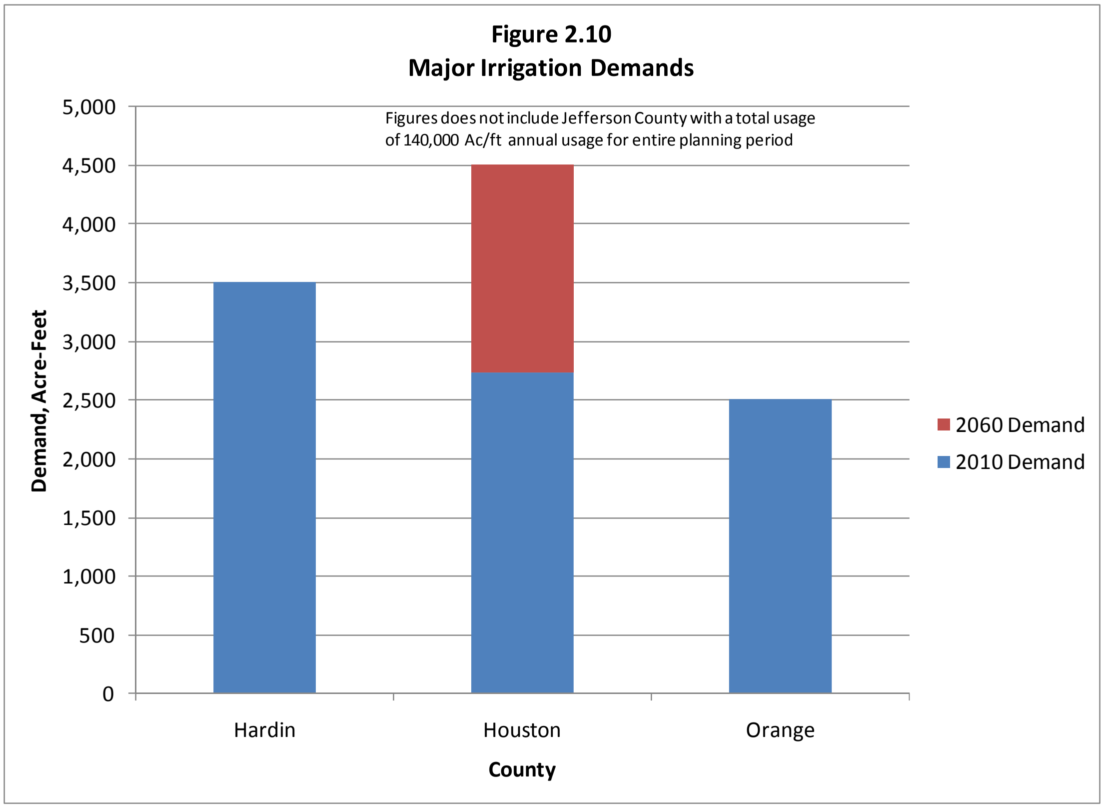


Figure 2.10
Major Irrigation Demands
Figures does not include Jefferson County with a total usage of 140,000 Ac/ft annual usage for entire planning period
Demand, Acre-Feet
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Hardin
Houston
Orange
County
2060 Demand
2010 Demand

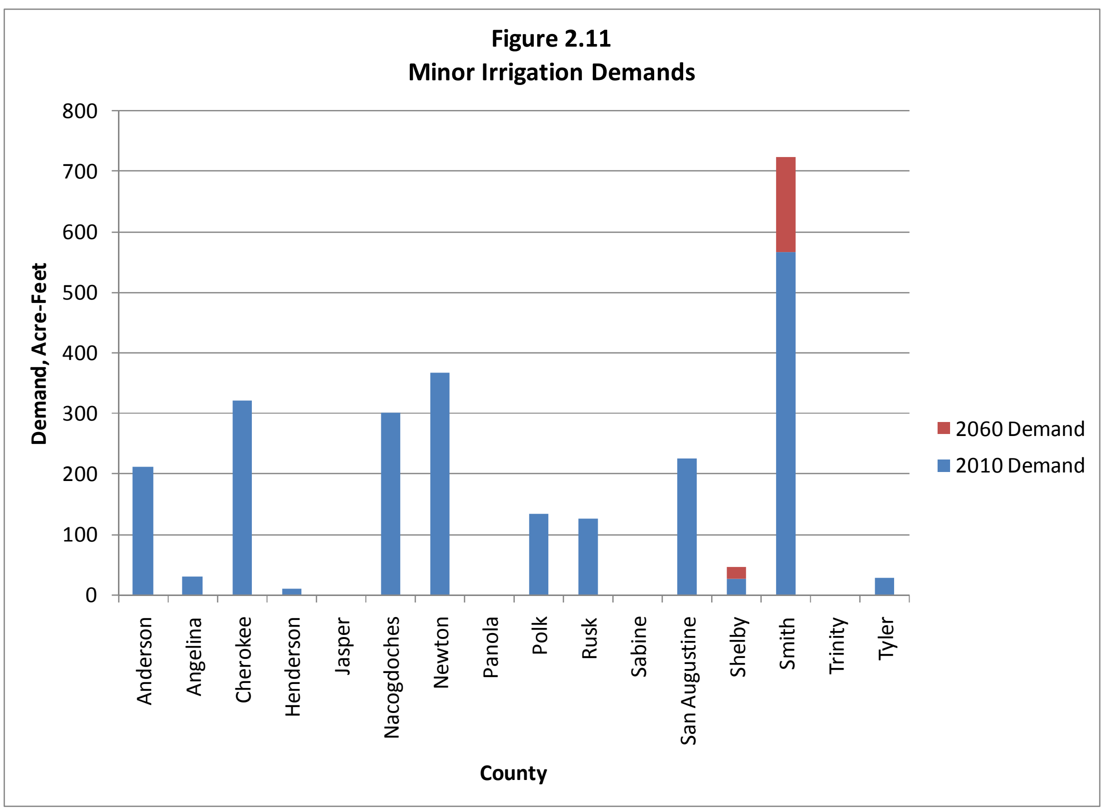


Figure 2.11
Minor Irrigation Demands
Demand, Acre-Feet
800
700
600
500
400
300
200
100
0
Anderson
Angelina
Cherokee
Henderson
Jasper
Nacogdoches
Newton
Panola
Polk
Rusk
Sabine
San Augustine
Shelby
Smith
Trinity
Tyler
County
2060 Demand
2010 Demand

2.3.4 Steam-Electric Demands. Counties in the ETRWPA with existing steam-electric power facilities are Cherokee, Newton, Orange, and Rusk Counties. The demands for this user group were taken from a report, "Power Generation Water Use in Texas for the Years 2000 through 2060," prepared by representatives of Investor-Owned Utility Companies of Texas.[1] Subsequent to the 2003 report, several proposed facilities or expansions have been delayed or cancelled, and new power facilities in Angelina and Nacogdoches Counties are being developed. Cancelled facilities include power plants in Nacogdoches, Jefferson, Newton, Anderson, and Rusk Counties. While these facilities are not moving forward at this time, the ETRWPG anticipates that the region is a prime location for new facilities to provide additional power that is needed for Texas. No changes to the steam-electric power demands for these counties were made.

There are two new power facilities currently being developed in the ETRWPA. The Aspen Power Facility is a 50-megawatts (MW) biomass electric plant planned to be located in Lufkin. Nacogdoches Power is developing a 100-MW biomass electric generating facility, which is expected to be online by 2011. New water demands for the Aspen Power Facility were developed and are included in this update for Angelina County. The projected demands in the 2006 Regional Water Plan for Nacogdoches County included cancelled facilities sufficient for the new Nacogdoches Power Facility; therefore, no changes were made to steam-electric demands for Nacogdoches County.

The usage in the ETRWPA is expected to increase from 44,985 ac-ft per year to 155,611 ac-ft per year during the planning period. Rusk County accounts for approximately 55 percent of the usage in the region. The report indicates the demand for Rusk County to be associated with two existing power plants. The only county adding new demands since the 2006 Regional Water Plan is Angelina County. The projected demands for steam-electric usage are included in Table 2.6. Figure 2.12 shows the projected demand by county for 2010 and 2060. Figure 2.13 shows the counties with steam-electric demands.

Table 2.6 Historical and Projected Steam-Electric Power Water Demand by County (ac-ft per year)

County	Historical	Projections					
	2006	2010	2020	2030	2040	2050	2060
Anderson	0	0	11,306	13,218	15,549	18,390	21,853
Angelina	0	1,000	1,000	1,000	1,000	1,000	1,000
Cherokee	743	2,245	1,790	2,093	2,462	2,912	3,460
Hardin	0	0	0	0	0	0	0
Henderson	0	0	0	0	0	0	0
Houston	0	0	0	0	0	0	0
Jasper	0	0	0	0	0	0	0
Jefferson	0	0	13,426	15,696	18,464	21,838	25,951
Nacogdoches	0	4,828	6,911	8,079	9,504	11,241	13,358
Newton	0	5,924	14,132	16,522	19,436	22,987	27,317
Orange	4,698	6,228	4,966	5,805	6,829	8,077	9,598
Panola	0	0	0	0	0	0	0
Polk	0	0	0	0	0	0	0
Rusk	25,158	24,760	27,458	32,102	37,762	44,663	53,074
Sabine	0	0	0	0	0	0	0
San Augustine	0	0	0	0	0	0	0
Shelby	0	0	0	0	0	0	0
Smith	0	0	0	0	0	0	0
Trinity	0	0	0	0	0	0	0
Tyler	0	0	0	0	0	0	0
Total for ETRWPA	**30,599**	**44,985**	**80,989**	**94,515**	**111,006**	**131,108**	**155,611**

Note: Historical use estimates were obtained from the Texas Water Development Board.

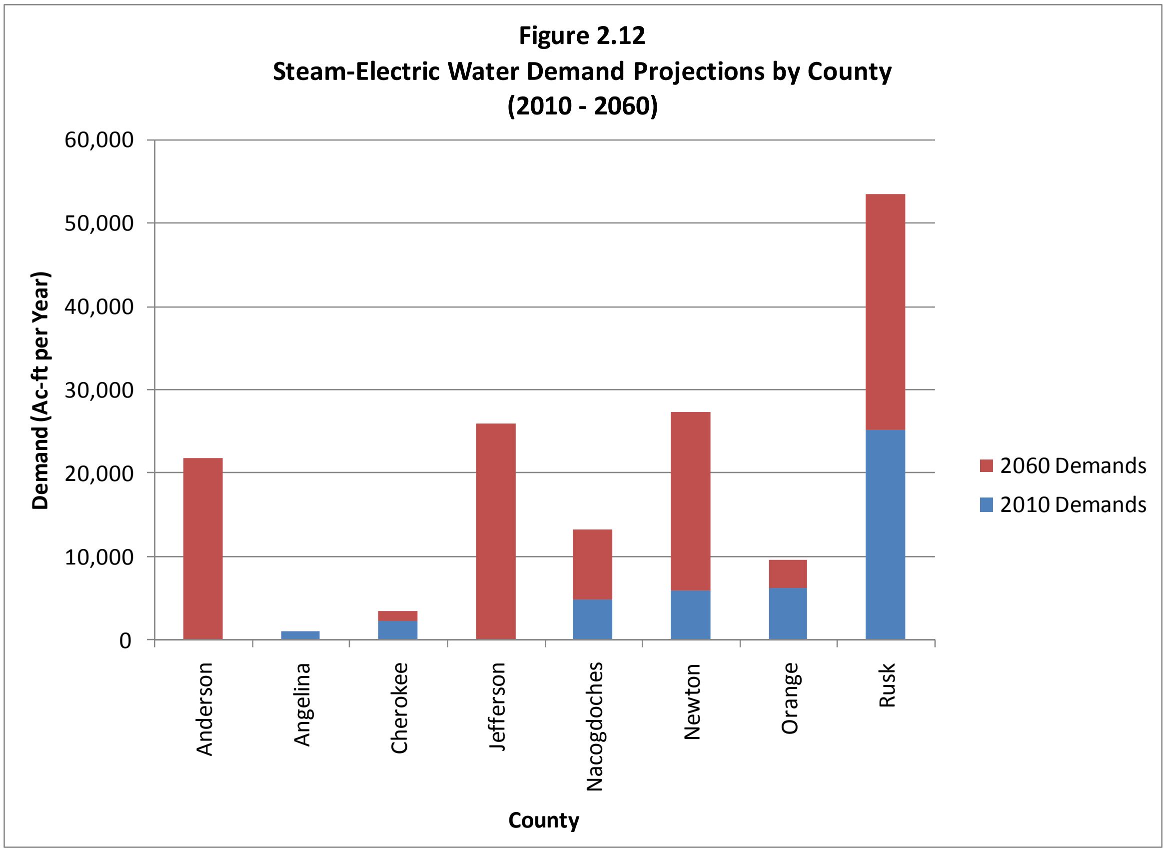
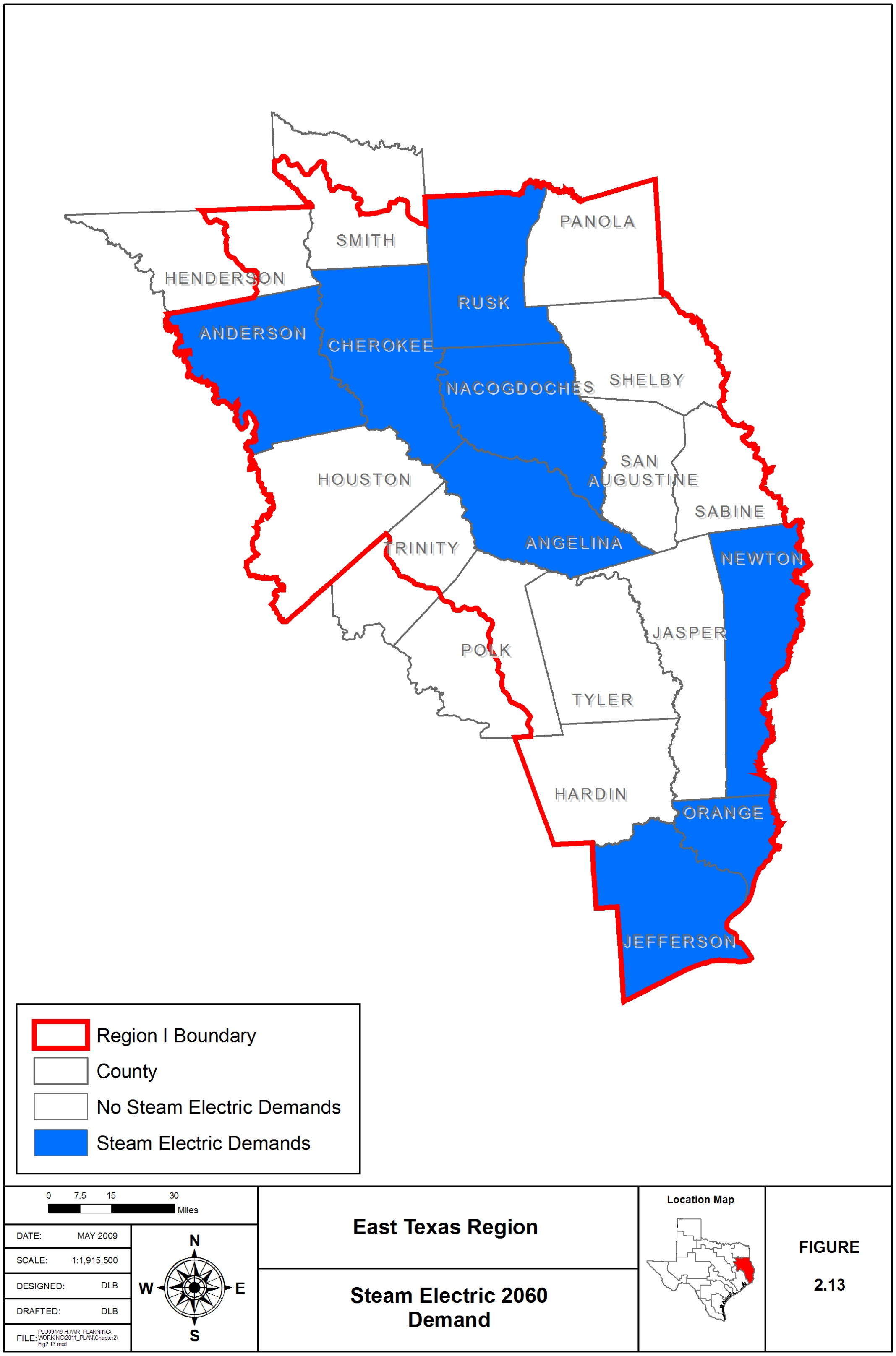


Figure 2.12
Steam-Electric Water Demand Projections by County
(2010 - 2060)
60,000
50,000
40,000
30,000
20,000
10,000
0
Demand (Ac-ft per Year)
Anderson
Angelina
Cherokee
Jefferson
Nacogdoches
Newton
Orange
Rusk
County
2060 Demands
2010 Demands


SMITH
PANOLA
HENDERSON
RUSK
ANDERSON
CHEROKEE
NACOGDOCHES
SHELBY
HOUSTON
SAN
AUGUSTINE
SABINE
TRINITY
ANGELINA
NEWTON
JASPER
POLK
TYLER
HARDIN
ORANGE
JEFFERSON
Region I Boundary
County
No Steam Electric Demands
Steam Electric Demands
0 7.5 15 30
Miles
DATE: MAY 2009
SCALE: 1:1,915,500
DESIGNED: DLB
DRAFTED: DLB
FILE: PLU09149 H:\WR_PLANNING\WORKING\2011_PLAN\Chapter2\Fig2.13.mxd
N
W
E
S
East Texas Region
Steam Electric 2060 Demand
Location Map
FIGURE
2.13

2.3.5 Livestock Demands. Shelby County presently accounts for 18% of the livestock usage and is expected to account for 33% of the livestock usage by the end of the planning period. Other major livestock counties include Anderson, Cherokee, Henderson, Houston, Nacogdoches, Panola, Rusk and San Augustine, and account for approximately 60% of usage during the planning period. The total usage is expected to increase from 23,613 ac-ft per year to 34,533 ac-ft per year. The projected usage by county during the planning period is presented in Table 2.7. Figures 2.14 and 2.15 show the livestock demand by major and minor counties. The largest percentage change in growth, as well as total demand, is expected to occur in Nacogdoches, San Augustine, and Shelby Counties. Figure 2.16 illustrates the average annual projected growth by county in the ETRWPA during the planning period.

2.3.6 Mining Demands. Historically, most of the demand for mining water for the ETRWPA has been concentrated in Hardin, Panola, and Rusk Counties. This water has been used in aggregate mining operations, for the most part.

Beginning in the 2010 decade, however, a projected demand for mining water use has developed to support the growing natural gas production industry in Angelina, Cherokee, Nacogdoches, Shelby and San Augustine Counties. This demand is projected through 2020, but not beyond that decade. Therefore, mining water demand shows a spike at the outset of the planning period, but drops off to levels projected in the previous plan.

Table 2.8 provides mining water projections for each county in the ETRWPA. Demands for counties with major projections (greater than 2,000 ac-ft per year) are depicted on Figure 2.17. Those counties with lower projected demands are shown on Figure 2.18. Figure 2.19 illustrates the annual percent change for mining water in each county in the ETRWPA.

Table 2.7 Historical and Projected Livestock Water Demand by County (ac-ft per year)

County	Historical 2006	Projections 2010	2020	2030	2040	2050	2060
Anderson	1,537	1,708	1,708	1,708	1,708	1,708	1,708
Angelina	398	598	620	647	677	712	749
Cherokee	1,439	1,765	1,765	1,765	1,765	1,765	1,765
Hardin	161	156	156	156	156	156	156
Henderson	516	2,594	2,594	2,594	2,594	2,594	2,594
Houston	1,616	2,115	2,291	2,483	2,690	2,915	3,158
Jasper	473	317	317	317	317	317	317
Jefferson	1,047	807	807	807	807	807	807
Nacogdoches	1,338	1,719	1,954	2,227	2,544	2,911	3,332
Newton	139	110	110	110	110	110	110
Orange	205	210	210	210	210	210	210
Panola	3,329	3,096	3,096	3,096	3,096	3,096	3,096
Polk	197	202	202	202	202	202	202
Rusk	1,008	1,171	1,188	1,207	1,231	1,257	1,283
Sabine	829	667	710	759	816	882	954
San Augustine	1,025	1,004	1,082	1,173	1,278	1,400	1,534
Shelby	3,920	4,246	5,176	6,310	7,691	9,376	11,430
Smith	839	660	660	660	660	660	660
Trinity	273	194	194	194	194	194	194
Tyler	282	274	274	274	274	274	274
Total for ETRWPA	**20,571**	**23,613**	**25,114**	**26,899**	**29,020**	**31,546**	**34,533**

Figure 2.14
Major Livestock Water Demand Projections (2010 - 2060)

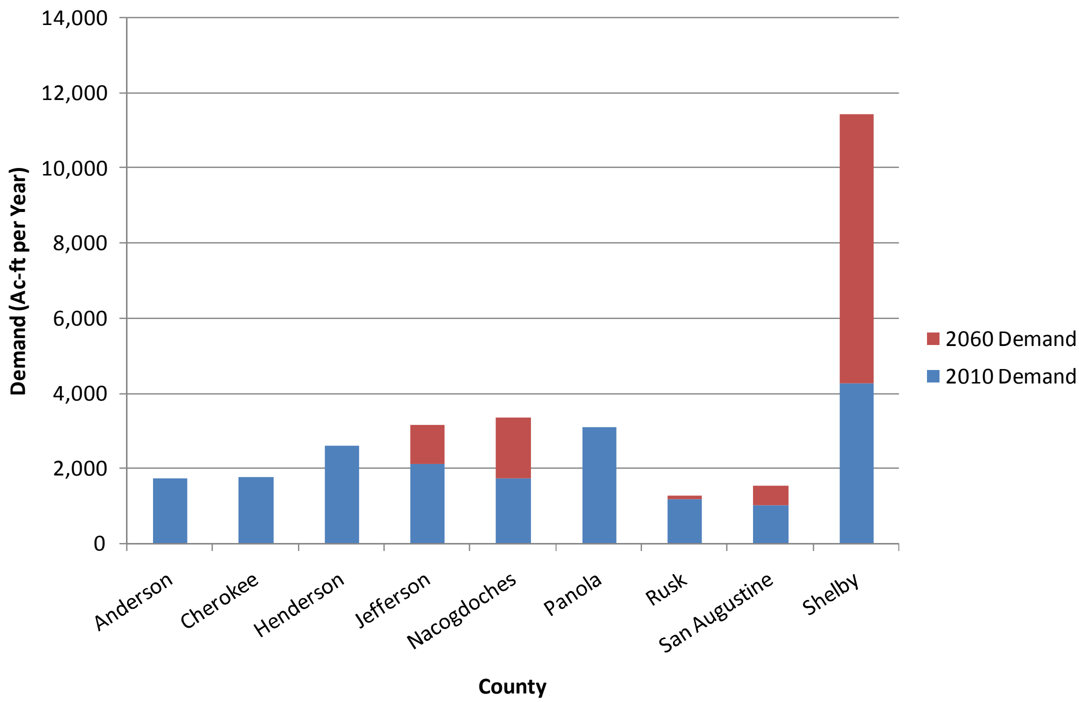
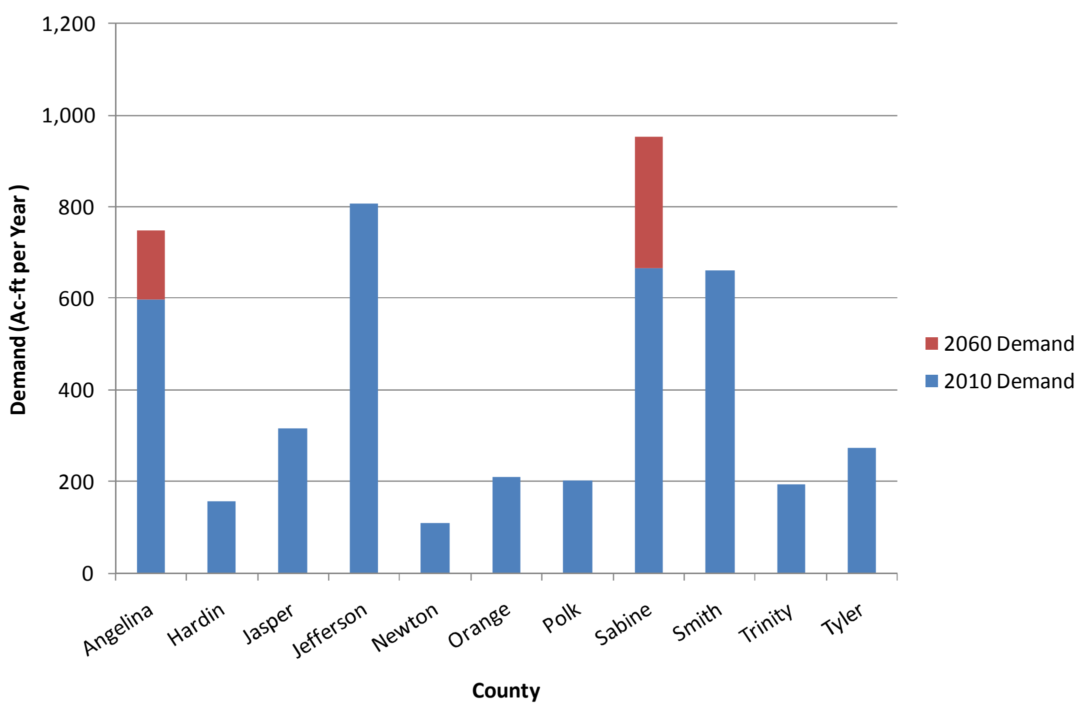
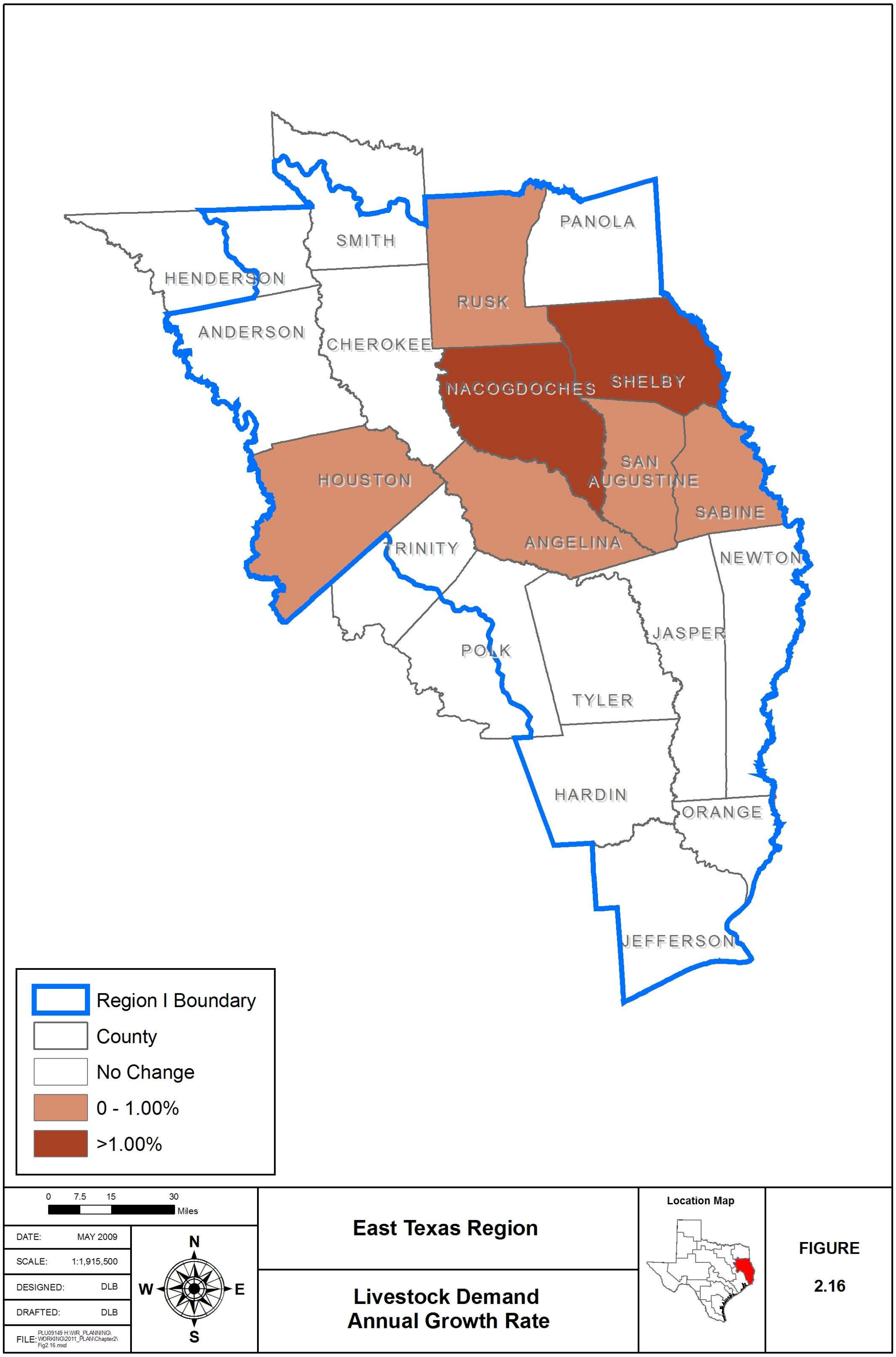


Figure 2.15
Minor Livestock Water Demand Projections (2010 - 2060)




SMITH
PANOLA
HENDERSON
RUSK
ANDERSON
CHEROKEE
NACOGDOCHES
SHELBY
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N
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E
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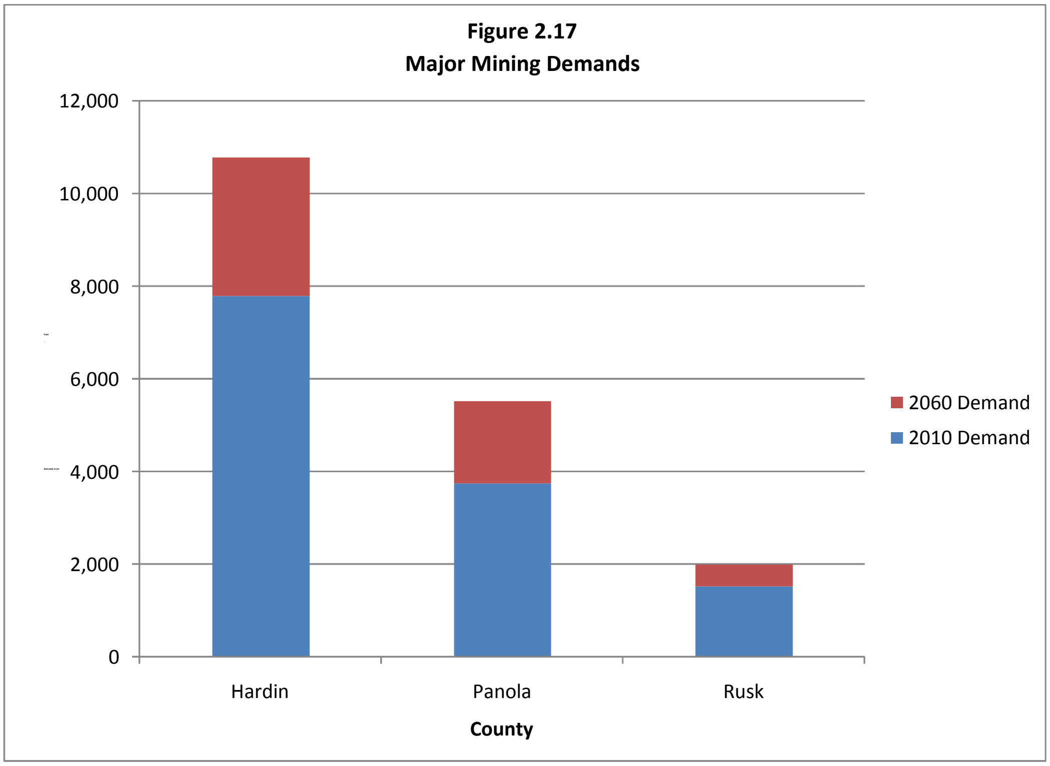
East Texas Region
Livestock Demand
Annual Growth Rate
Location Map
FIGURE
2.16

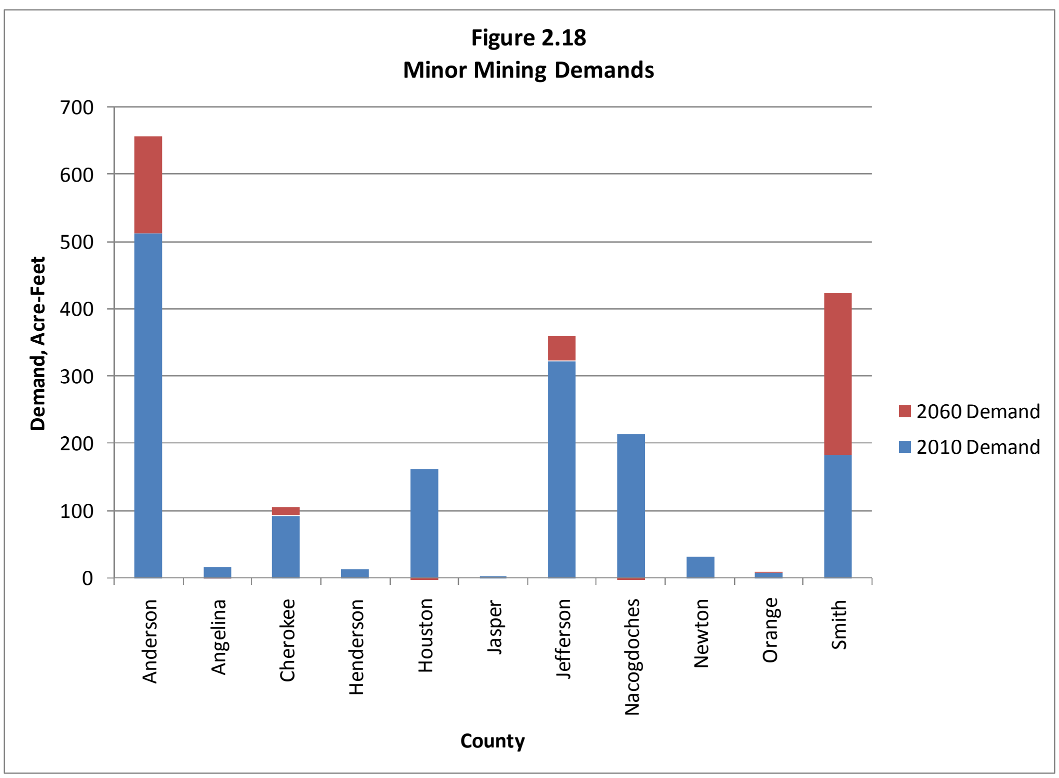
Table 2.8 Historical and Projected Mining Water Demand by County (ac-ft per year)

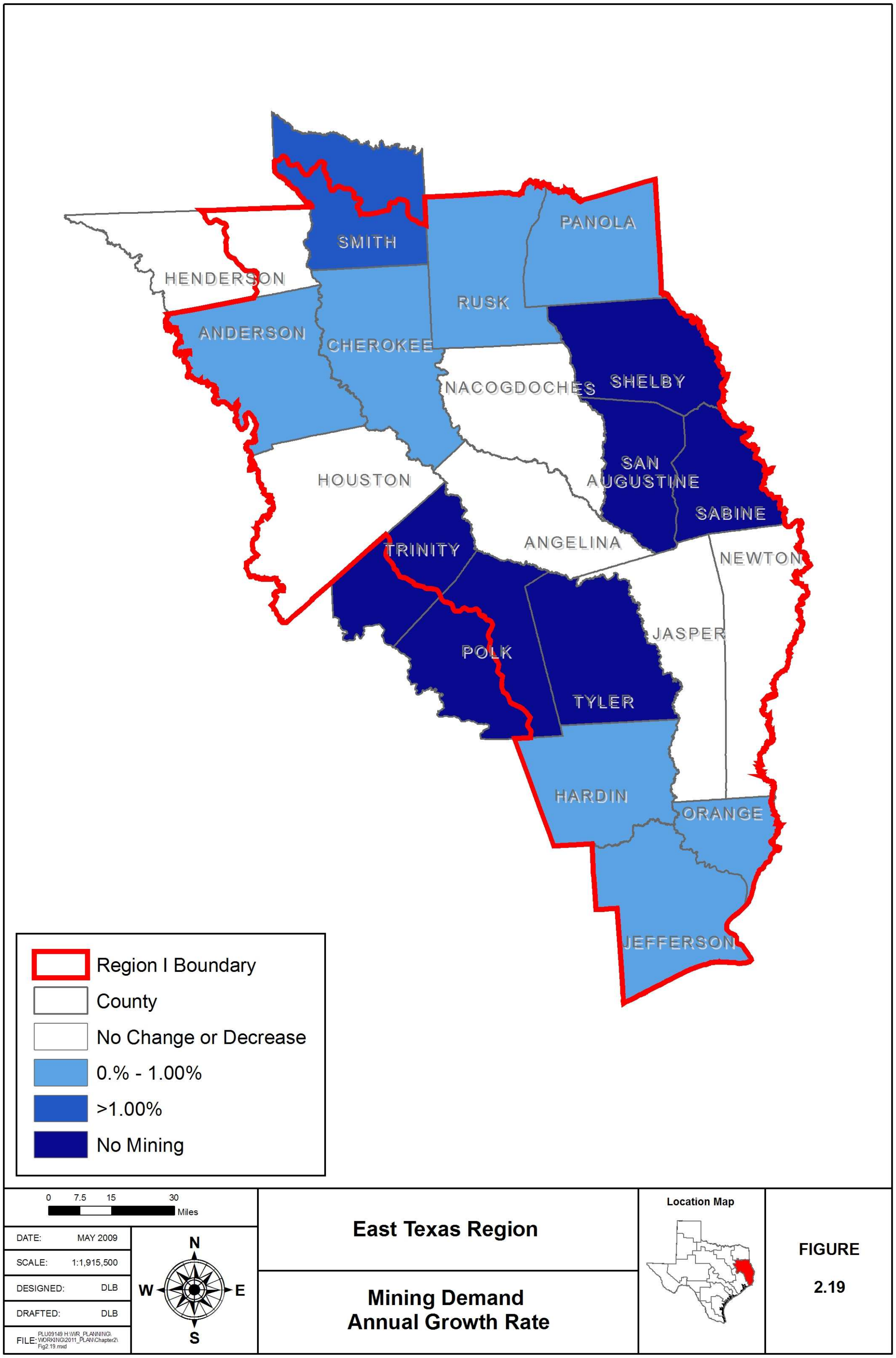
	Historical 2006	Projections 2010	2020	2030	2040	2050	2060
Anderson	424	513	557	583	608	633	657
Angelina	22	2,018	4,017	17	17	17	17
Cherokee	83	593	1,597	99	101	103	105
Hardin*	5,236	7,800	8,648	9,219	9,788	10,361	10,798
Henderson	21	14	14	14	14	14	14
Houston	177	163	160	158	156	154	153
Jasper	4	4	4	4	4	4	4
Jefferson	434	323	334	341	348	355	360
Nacogdoches	220	2,715	7,213	212	211	210	209
Newton	34	32	32	32	32	32	32
Orange	0	8	9	9	9	9	9
Panola	953	3,756	4,271	4,587	4,905	5,228	5,536
Polk	0	0	0	0	0	0	0
Rusk	633	1,540	1,679	1,761	1,841	1,921	1,996
Sabine	0	0	0	0	0	0	0
San Augustine	0	1,500	7,000	0	0	0	0
Shelby	0	500	1,500	0	0	0	0
Smith	116	183	262	295	351	391	424
Trinity	0	0	0	0	0	0	0
Tyler	0	0	0	0	0	0	0
Total for ETRWPA	***8,357**	**21,660**	**37,297**	**17,331**	**18,385**	**19,432**	**20,314**

*Historical data for mining are reported for 2005. In 2006, the TWDB changed the methodology of reporting mining use to include only data provided to the TWDB through the annual survey and other mining use that can be confirmed. This resulted in significantly lower estimates of mining water use across the state.



* Footnote: Angelina, San Augustine, Cherokee, Nacogdoches, Shelby





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East Texas Region

Mining Demand Annual Growth Rate

FIGURE 2.19

2.4 Demands for Wholesale Water Providers

As part of the development of the regional water plan, current water demands were identified for the WWPs in the ETRWPA. The WWPs are as follows:

- Angelina and Neches River Authority,
- Angelina-Nacogdoches Water Control and Improvements District No. 1,
- Athens Municipal Water Authority,
- City of Beaumont,
- City of Carthage,
- City of Center,
- City of Jacksonville,
- City of Lufkin,
- City of Nacogdoches,
- City of Port Arthur,
- City of Tyler,
- Houston County WCID No. 1,
- Lower Neches Valley Authority,
- Panola County Freshwater Supply District No. 1,
- Sabine River Authority, and
- Upper Neches River Municipal Water Authority.

Chapter 1 provides a description of each WWP in the ETRWPA.

2.4.1 Angelina and Neches River Authority. ANRA is currently pursuing developing Lake Columbia, a new lake on Mud Creek, and has 17 participants that have committed to taking water on a wholesale basis from the project. In addition, ANRA currently provides retail water service to Holmwood Utility located in Jasper County. The demands shown in Table 2.9 represent the contract amounts for the Lake Columbia participants and the expected demands from Holmwood Utility.

Table 2.9 Expected Demands for the Angelina and Neches River Authority (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
Angelina County Manufacturing (Temple Inland)	8,551	8,551	8,551	8,551	8,551	8,551
Cherokee County-Other	3,848	3,848	3,848	3,848	3,848	3,848
City of Jacksonville	4,275	4,275	4,275	4,275	4,275	4,275
City of New Summerfield	2,565	2,565	2,565	2,565	2,565	2,565
North Cherokee WSC	4,275	4,275	4,275	4,275	4,275	4,275
City of Rusk	4,275	4,275	4,275	4,275	4,275	4,275
Rusk Rural WSC	855	855	855	855	855	855
Nacogdoches County-Other	428	428	428	428	428	428
City of Nacogdoches	8,551	8,551	8,551	8,551	8,551	8,551
City of New London	855	855	855	855	855	855
City of Troup	4,275	4,275	4,275	4,275	4,275	4,275
City of Arp	428	428	428	428	428	428
City of Alto	428	428	428	428	428	428
Smith County-Other	855	855	855	855	855	855
Jackson WSC	855	855	855	855	855	855
City of Whitehouse	8,551	8,551	8,551	8,551	8,551	8,551
Total Demand – Lake Columbia	*53,870*	*53,870*	*53,870*	*53,870*	*53,870*	*53,870*
Holmwood Utility	60	65	70	70	70	70
Total Demand	**53,930**	**53,935**	**53,940**	**53,940**	**53,940**	**53,940**

2.4.2. Angelina-Nacogdoches Water Control and Improvement District No. 1. The A-NWCID No. 1 provides water for cooling for Luminant Energy's natural gas fired electrical plant located on the shoreline of Lake Striker. Luminant has a contract for 5,000 ac-ft per year of raw water. Luminant's current contract expires on April 30, 2031, with an option of 10 year extensions beyond the 2031 date.

The District has a wholesale contract with Nacogdoches Power LLC, to provide cooling water for their biomass fired electrical power plant that is soon to be under construction near Sacul. Nacogdoches Power has a contract for 2,240 ac-ft per year and an option for an additional 4,481 ac-ft per year. This water will be re-circulated through a cooling tower. Their contract began January 1, 2008, and is scheduled for a primary term of 25 years with an option of a 15-year extension.

The Cities of Henderson and Whitehouse have options for water from Lake Striker for their potential future needs. Each of these options expires on September 30, 2016. Table 2.10 depicts expected demands for the A-NWCID No. 1.

Table 2.10 Expected Demands for the Angelina-Nacogdoches Water Control and Improvement District No. 1(ac-ft per year)

WUGs	2010	2020	2030	2040	2050	2060
Luminant Energy	2,245	1,790	2,093	2,462	2,912	3,460
Nacogdoches Power	2,240	6,721	6,721	6,721	0	0
City of Whitehouse	2,186	0	0	0	0	0
Henderson	2,242	0	0	0	0	0
Total Demand	**8,913**	**8,511**	**8,814**	**9,183**	**2,912**	**3,460**

2.4.3. Athens Municipal Water Authority. The Athens MWA provides wholesale water to the City of Athens, which is located in Regions C and I. The City of Athens also provides water to manufacturing in Henderson County in Region C. In addition, Athens MWA supplies a small amount of water for local irrigation around the lake and has a contract with the Athens Fish Hatchery for 3,023 ac-ft per year of raw water. Table 2.11 depicts expected demands on Athens MWA.

Table 2.11 Expected Demands for the Athens Municipal Water Authority and Lake Athens (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
City of Athens (less groundwater supplies)	2,085	2,591	3,190	3,870	4,762	5,867
Henderson Co. Irrigation	159	164	169	174	179	185
Athens Fish Hatchery	3,023	3,023	3,023	3,023	3,023	3,023
Henderson County Manufacturing	100	106	120	136	155	176
Total Demand	**5,367**	**5,884**	**6,502**	**7,203**	**8,119**	**9,251**

2.4.4 City of Beaumont. In addition to retail municipal water for its own customers, the City of Beaumont provides wholesale water to numerous industries in Jefferson County. The City also provides treated water to most of the County-Other demands in Jefferson County, including Jefferson County Water Improvement District No. 1, Northwest Forest Municipal Utility District, and prison complexes. The City also provides retail municipal water to its residents. Table 2.12 depicts expected demands for the City of Beaumont.

Table 2.12 Expected Demands for the City of Beaumont (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
City of Beaumont*	27,040	26,657	26,275	25,892	25,636	25,636
Jefferson County-Other	1,692	2,194	2,615	2,945	3,311	4,004
Jefferson County Manufacturing	1,000	1,105	1,221	1,349	1,490	1,646
Meeker MUD	3	4	4	5	5	8
Total Demand	**29,735**	**29,960**	**30,116**	**30,190**	**30,442**	**31,294**

*Municipal (not wholesale) demand

2.4.5 City of Carthage. In addition to providing municipal water on a retail basis to its own customers, the City of Carthage provides wholesale water to County-Other and manufacturing customers in Panola County. Expected demands on the City are expected to increase from 4,779 ac-ft per year in 2010 to 5,120 ac-ft per year in 2060. Table 2.13 depicts expected demands for the City of Carthage.

Table 2.13 Expected Demands for the City of Carthage (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
City of Carthage*	2,274	2,297	2,311	2,317	2,326	2,343
Panola County-Other	1,487	1,487	1,487	1,487	1,487	1,487
Panola County Manufacturing	1,018	1,078	1,125	1,171	1,211	1,290
Total Demand	**4,779**	**4,862**	**4,923**	**4,975**	**5,024**	**5,120**

*Municipal (not wholesale) demand.

2.4.6 City of Center. The City of Center provides municipal water on a retail basis for its own customers, and wholesale water to Shelby County Manufacturing and Shelby County-Other. The City's municipal customers include Sand Hills WSC and Shelbyville WSC. The primary customer for manufacturing water is Tyson Foods, Inc. Table 2.14 depicts expected demands for the City of Center.

Table 2.14 Expected Demands for the City of Center (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
Sand Hills WSC	167	174	179	180	184	190
Shelbyville WSC	21	22	22	23	23	24
Manufacturing	1,156	1,282	1,391	1,501	1,598	1,716
City of Center*	1,633	1,718	1,785	1,823	1,867	1,923
Total Demand	**2,977**	**3,195**	**3,378**	**3,527**	**3,672**	**3,853**

*Municipal (not wholesale) demand.

2.4.7 City of Jacksonville. The City of Jacksonville currently provides treated water to several water supply corporations in Cherokee County as well as nearly all of the manufacturing needs in the county. The expected demand on Jacksonville is over 5,300 ac-ft per year in 2010, increasing to nearly 6,900 ac-ft per year by 2060. Table 2.15 depicts expected demands for the City of Jacksonville.

Table 2.15 Expected Demands for the City of Jacksonville (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
City of Jacksonville*	3,502	3,637	3,741	3,827	3,948	4,111
Cherokee County Manufacturing	718	784	839	891	934	1,007
Cherokee County-Other	226	198	154	95	68	55
North Cherokee WSC	387	439	482	519	560	616
Bullard	10	10	10	10	10	10
Craft-Turney WSC	515	614	742	908	995	1,078
Total Demand	**5,358**	**5,682**	**5,968**	**6,250**	**6,515**	**6,877**

*Municipal (not wholesale) demand.

2.4.8 City of Lufkin. The City of Lufkin provides municipal water on a retail basis to its own customers, as well as wholesale water to several industries in Angelina County and municipal water to the Angelina Fresh Water Authority, Redland WSC and the City of Huntington. The City has recently contracted with the City of Diboll for 632 MGY and has a contract with Abitibi for 5 MGD, if needed. Neither of these customers is currently receiving water. The City's largest industrial customer is Pilgrim's Pride. With the recent acquisition of the Abitibi well field and Lake Kurth water rights, there is the potential for the City to provide wholesale water to other entities in Angelina and Nacogdoches Counties. Table 2.16 depicts expected demands for the City of Lufkin.

Table 2.16 Expected Demands for the City of Lufkin (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
City of Lufkin*	7,546	8,444	9,446	10,565	11,951	13,599
Angelina County-Other	91	94	99	104	115	131
Angelina County Manufacturing	9,550	17,255	18,981	20,879	22,966	25,263
Redland WSC	107	104	101	98	97	97
Angelina Fresh Water Authority	40	54	66	72	80	88
Huntington	20	27	33	36	40	44
City of Diboll	1,940	1,940	1,940	1,940	1,940	1,940
Total Demand	**19,294**	**27,918**	**30,664**	**33,694**	**37,189**	**41,162**

*Municipal (not wholesale) demand.

2.4.9 City of Nacogdoches. The City currently provides retail municipal water to its own customers and wholesale water to County-Other in Nacogdoches County, including Central Heights WSC, Lilly Grove WSC, Nacogdoches County MUD No. 1, and Timber Ridge East. The city also supplies water to Appleby WSC, D&M Water Supply, and nearly all of the manufacturing demands in Nacogdoches County. For this plan it is assumed that Nacogdoches will continue to meet the projected manufacturing demands for Nacogdoches County. Table 2.17 depicts expected demands for the City of Nacogdoches.

Table 2.17 Expected Demands for the City of Nacogdoches (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
City of Nacogdoches*	7,625	8,423	9,218	9,939	11,352	12,540
Manufacturing	2,288	2,553	2,786	3,016	3,214	3,468
Appleby WSC	25	145	317	511	878	1,274
D&M Water Supply	406	452	491	540	652	780
Total Demand	**10,344**	**11,573**	**12,812**	**14,006**	**16,096**	**18,062**

*Municipal (not wholesale) demand.

2.4.10 City of Port Arthur. The City of Port Arthur provides retail municipal water to its customers as well as treated wholesale water to industrial users in Jefferson County. The City of Port Arthur receives raw water supply from the LNVA. The City also provides a small amount of reuse water to one industrial customer. Table 2.18 depicts expected demands for the City of Port Arthur.

Table 2.18 Expected Demands for the City of Port Arthur (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
City of Port Arthur*	9,704	9,510	9,315	9,122	8,993	8,993
Jefferson County-Other	5	5	5	5	5	5
Jefferson County Manufacturing	6,140	6,862	7,584	8,306	9,028	9,752
Total Demand	**15,849**	**16,377**	**16,904**	**17,433**	**18,026**	**18,750**

*Municipal (not wholesale) demand.

2.4.11 City of Tyler. The City of Tyler provides municipal water on a retail basis to its own customers and wholesale water to local industries, Walnut Grove Water System, Southern Utilities Company, and the City of Whitehouse. It also provides a small amount of water for golf course irrigation. It is assumed that Tyler will continue to provide about 75 percent of the manufacturing demand in Smith County and 70 percent of the demands for Whitehouse. Table 2.19 depicts expected demands for the City of Tyler.

Table 2.19 Expected Demands for the City of Tyler (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
City of Tyler	25,886	26,849	27,778	28,675	30,615	33,334
Smith County Irrigation	300	300	300	300	300	300
Smith County Manufacturing	2,885	3,223	3,523	3,811	4,055	4,391
City of Whitehouse	687	749	807	868	984	1,145
Walnut Grove Water System	445	467	491	515	541	568
Southern Utilities Company	303	315	325	338	370	918
Total Demand	**30,506**	**31,903**	**33,224**	**34,506**	**36,865**	**40,656**

2.4.12 Houston County Water Control and Improvement District No. 1. HCWCID No. 1 provides wholesale raw water to municipal and manufacturing customers. HCWCID No. 1 presently serves Houston County-Other, Consolidated WSC, City of Crockett, City of Grapeland, City of Lovelady, and manufacturing water to AMPACET. Table 2.20 depicts expected demands for the HCWCID No. 1.

Table 2.20 Expected Demands for the Houston County Water Control and Improvement District No. 1 (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
City of Grapeland	405	405	405	405	405	405
Houston County-Other	89	90	91	93	96	100
Houston County Manufacturing	169	190	209	227	243	263
City of Crockett	1,841	1,841	1,841	1,841	1,841	1,841
City of Lovelady	77	77	77	77	77	77
Consolidated WSC	1,031	1,031	1,031	1,031	1,031	1,031
Total Demand	**3,612**	**3,634**	**3,654**	**3,674**	**3,693**	**3,717**

2.4.13 Lower Neches Valley Authority. The LNVA provides wholesale raw water for municipal, industrial, and irrigation uses. The LNVA currently serves municipal customers in Jefferson County in the ETRWPA, and Chambers and Galveston Counties in Region H. LNVA provides a significant portion of water for industrial use in Jefferson County (directly and indirectly through the City of Port Arthur) and Jasper County. It is expected that LNVA will provide water to Liquid Natural Gas (LNG) facilities that are currently planned within the ETRWPA. The LNVA also provides irrigation water through its canal system to farmers in Jefferson County in the ETRWPA and Chambers and Liberty Counties in Region H.

The LNVA has recently entered into contracts with the City of Beaumont, West Vaco and the City of Woodville for future water supplies. The total expected demand on LNVA, including these contractual obligations, is 530,800 ac-ft per year in 2010 and increasing to over 1 million ac-ft per year by 2060. Table 2.21 depicts expected demands for the LNVA.

Table 2.21 Expected Demands for the Lower Neches Valley Authority (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
Jasper County Manufacturing	20,189	23,571	26,084	28,281	29,928	29,991
Groves	3,190	3,137	3,085	3,031	2,996	2,996
Nederland	4,125	4,268	4,387	4,456	4,573	4,834
Port Arthur	15,849	16,377	16,904	17,433	18,026	18,750
Port Neches	1,782	1,782	1,789	1,780	1,804	1,882
Jefferson County - Other	188	244	291	327	368	445
Jefferson County Manufacturing	144,032	235,566	235,566	260,566	285,566	310,566
Jefferson County LNG	0	179,225	358,450	358,450	358,450	358,450
Jefferson County - Irrigation	140,000	140,000	140,000	140,000	140,000	140,000
West Jefferson County MWD	1,029	1,148	1,264	1,345	1,436	1,631
Jefferson County WCID #10	640	700	750	787	832	929
Nome	127	136	144	150	157	172
Region H						
Trinity Bay Conservation District	2,688	2,688	2,688	2,688	2,688	2,688
Bolivar Peninsula SUD	6,000	6,000	6,000	6,000	6,000	6,000
Chambers County - Irrigation	37,000	37,000	37,000	37,000	37,000	37,000
Liberty County - Irrigation	23,000	23,000	23,000	23,000	23,000	23,000
Delivery Losses	43,982	67,484	77,166	70,824	63,898	56,360
Total Demand	**443,822**	**742,326**	**934,568**	**956,117**	**976,721**	**995,694**
Other Obligations						
City of Beaumont - Reserve	31,360	31,360	31,360	31,360	31,360	31,360
West Vaco - Contract	50,000	50,000	50,000	50,000	50,000	50,000
City of Woodville - Contract	5,600	5,600	5,600	5,600	5,600	5,600
Obligation sub-total	**86,960**	**86,960**	**86,960**	**86,960**	**86,960**	**86,960**
Total Demands & Obligations	**530,782**	**829,286**	**1,021,528**	**1,043,077**	**1,063,681**	**1,082,654**

2.4.14 Panola County Freshwater Supply District No. 1. PCFWSD No. 1 provides raw water to the City of Carthage from its water right of 21,400 acre-feet in Lake Murvaul. Water is also provided for mining operations, Panola County manufacturing, and Panola County-Other. Table 2.22 depicts expected demands for the PCFWSD No.1.

Table 2.22 Expected Demands for the Panola County Freshwater Supply District No. 1 (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
City of Carthage	2,274	2,297	2,311	2,317	2,326	2,343
Panola County-Other	1,487	1,487	1,487	1,487	1,487	1,487
Panola County Manufacturing	1,018	1,078	1,125	1,171	1,211	1,290
Panola County Mining	2,254	2,563	2,752	2,943	3,137	3,322
Total Demand	**7,032**	**7,424**	**7,675**	**7,918**	**8,160**	**8,442**

2.4.15 Sabine River Authority. SRA owns and operates several reservoirs and run-of-the-river water rights. The SRA system consists of an Upper Basin System (Lake Fork and Lake Tawakoni) and Lower Basin System (Toledo Bend Reservoir and Canal System). The SRA provides wholesale water to municipal and industrial customers in Regions C and D from the Upper Basin System, located outside of the ETRWPA.

The SRA provides wholesale water to customers in the ETRWPA from its Toledo Bend Reservoir and Canal System. Municipal customers include the Cities of Hemphill, Huxley, and Rose City; Beechwood WSC, El Camino Bay Property Owners Association, and Pendleton Utility Corporation. The largest manufacturing demands are for E.I. Dupont de Nemours Company, Inc., and Temple-Inland Paperboard and Packaging. Water from SRA's Canal System also provides irrigation water in Orange County. Table 2.23 depicts expected demands for SRA.

Table 2.23 Expected Demands for the Sabine River Authority (ac-ft per year)

Lower Basin Customer	2010	2020	2030	2040	2050	2060
Toledo Bend:						
Hemphill	1,841	1,841	1,841	1,841	1,841	1,841
Huxley	280	280	280	280	280	280
Tenaska	17,922	17,922	17,922	17,922	17,922	17,922
Beechwood WSC	190	190	190	190	190	190
El Camino WS	18	18	18	18	18	18
Pendleton Utility Corp	28	28	28	28	28	28
Canal (Gulf Coast Division)						
Honeywell	1,120	1,120	1,120	1,120	1,120	1,120
Bayer	1,120	1,120	1,120	1,120	1,120	1,120
Chevron Phillips	2,240	2,240	2,240	2,240	2,240	2,240
E.I. DuPont	24,643	24,643	24,643	24,643	24,643	24,643
Entergy	4,481	4,481	4,481	4,481	4,481	4,481
Firestone	737	737	737	737	737	737
Temple-Inland Paper	22,403	22,403	22,403	22,403	22,403	22,403
Gerdau Ameristeel US Inc.	1,120	1,120	1,120	1,120	1,120	1,120
North Star Steel/Lanxess	1,120	1,120	1,120	1,120	1,120	1,120
A. Schulman, Inc.	224	224	224	224	224	224
Cottonwood Energy	13,442	13,442	13,442	13,442	13,442	13,442
Rose City	478	478	478	478	478	478
Orange County Irrigation	2,500	2,500	2,500	2,500	2,500	2,500
Total Demands - Lower Basin	**95,907**	**95,907**	**95,907**	**95,907**	**95,907**	**95,907**

2.4.16 Upper Neches River Municipal Water Authority. The UNRMWA owns and operates Lake Palestine and water rights on the Neches River. It has existing wholesale water supply contracts with the cities of Dallas, Tyler, and Palestine, and provides a small amount to other local water users.

Presently, the City of Dallas has a contract for 114,337 ac-ft per year, but there are no transmission facilities to transport water from Lake Palestine. Dallas is expected to begin using water from Lake Palestine by 2015. The City of Tyler has a contract for 67,200 ac-ft per year, from Lake Palestine. Tyler has completed a 30 MGD treatment and transmission facility from the lake that can provide half of the contract amount. The City of Palestine has a contract for 28,000 ac-ft per year and takes this water from a diversion point on the Neches River. UNRMWA also provides water to Super Tree Farm, the Emerald Bay golf course, and TECON. It expects to provide a small amount of water to local County-Other in Smith County. Table 2.24 depicts the expected demands for the UNRMWA.

Table 2.24 Expected Demands for the Upper Neches River Municipal Water Authority (ac-ft per year)

Customer	2010	2020	2030	2040	2050	2060
City of Dallas (not connected)	114,337	114,337	114,337	114,337	114,337	114,337
City of Tyler	67,200	67,200	67,200	67,200	67,200	67,200
City of Palestine	28,000	28,000	28,000	28,000	28,000	28,000
Smith County-Other (1%)	93	82	73	64	57	51
Super Tree Farm for International Paper (Cherokee County Irrigation)	300	300	300	300	300	300
TECON (Henderson County-Other)	100	100	100	100	100	100
Emerald Bay Golf Course (Smith County Irrigation)	105	105	105	105	105	105
Total Demand	**210,135**	**210,124**	**210,115**	**210,106**	**210,099**	**210,093**

Chapter 3

Evaluation of Current Water Supplies in the Region

Under SB1 planning guidelines, each region is to identify currently available water supplies to the region by 1) source and 2) user. The supplies available by source are based on the supply available during drought of record conditions. Surface water and groundwater represent the primary types of sources of water supply, although, there are other potentially significant types of sources as well.

Surface water includes reservoirs and run-of-river supplies. For surface water reservoirs, this is the equivalent of firm yield supply or permitted amount (whichever is lower). For run-of-the-river supplies, this is the minimum supply available in a year over the historical record.

Texas is currently in the process of a groundwater joint planning initiative. Joint planning is conducted by the GCDs in the GMAs and is sometimes referred to as GMA planning. The counties in the ETRWPA fall in GMA-11 or GMA-14. The Texas Water Code now requires that RWPGs rely on the MAG estimates that are determined from the DFCs in each GMA. Neither of the GMAs in the ETRWPA had DFCs or MAGs prior to the deadline set by TWDB for inclusion in the 2011 Plan, therefore, groundwater supplies have not been modified.

Other water supplies considered for planning purposes include reuse of treated wastewater, saline sources, and local supplies. Local supplies generally include stock ponds that do not require water rights permits, and local mining supplies. These supplies are assessed based on historical and current use.

Currently, water supplies available to each user are those that have been permitted or contracted with infrastructure in place to transport and treat (if necessary) water. Some water supplies are permitted or are contracted for use, but the infrastructure is not yet in place. Connecting such supplies is considered a water management strategy for future use. Water supply limitations considered in this analysis include raw water source availability, well field production capacities, permit limits, contract amounts, water quality, transmission infrastructure, and water treatment capacities.

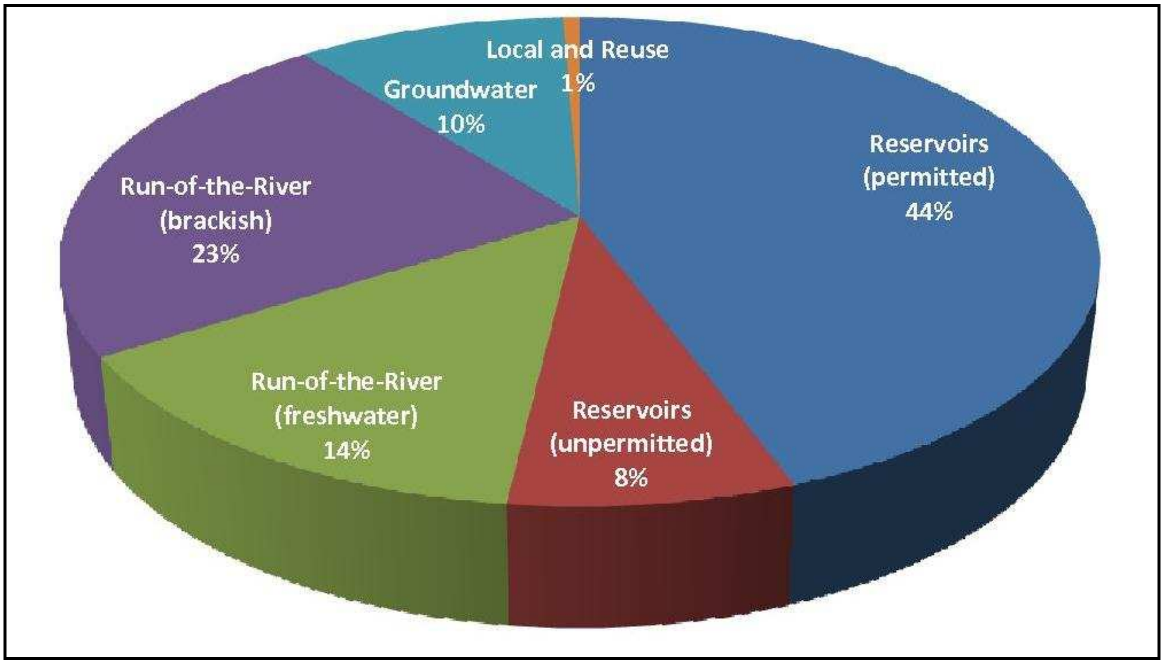
3.1 Regional Water Supply Availability

Table 3.1 and Figure 3.1 summarize overall water supply availability in the ETRWPA. Approximately 4.4 million ac-ft per year of permitted supplies are available in the region. Of this amount, about 3.4 million ac-ft per year are freshwater supplies. Most of the available water in the ETRWPA is associated with surface water sources. Approximately 15 percent of the total freshwater supply is groundwater. However, groundwater is a very important resource in the region and is used to supply much of the municipal and rural water needs of the region.

Table 3.1 Summary of Currently Available Water Supplies in the ETRWPA (ac-ft per year)

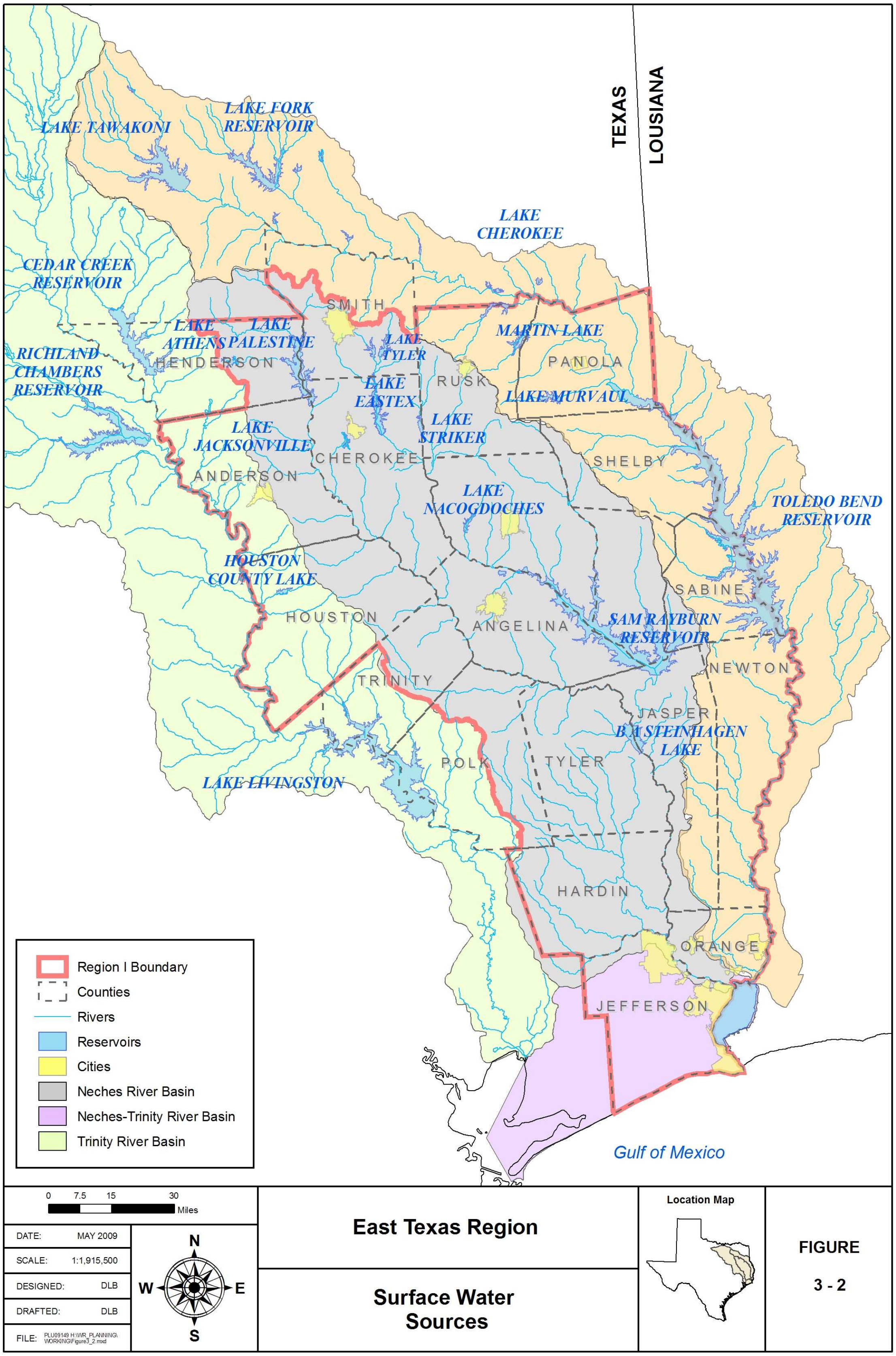
Source of Supply	2000	2010	2020	2030	2040	2050	2060
Reservoirs (permitted)	1,966,474	1,962,698	1,958,512	1,954,328	1,950,141	1,945,955	1,941,769
Reservoirs (unpermitted)	340,300	330,874	321,857	312,841	303,825	294,808	285,790
Run-of-the-River (freshwater)	623,004	623,004	623,004	623,004	623,004	623,004	623,004
Run-of-the-River (brackish)	1,035,982	1,035,982	1,035,982	1,035,982	1,035,982	1,035,982	1,035,982
Groundwater	446,043	446,043	446,043	446,043	446,043	446,043	446,043
Local Supplies	13,094	13,094	13,094	13,094	13,094	13,094	13,094
Direct Reuse	1,518	1,518	1,518	1,518	1,518	1,518	1,518
Indirect Reuse	16,559	16,559	13,687	13,687	13,687	13,687	13,687
Total	**4,442,974**	**4,429,772**	**4,413,697**	**4,400,497**	**4,387,294**	**4,374,091**	**4,360,887**

Figure 3.1 Year 2010 Available Supplies by Source Type



3.1.1 Surface Water Availability. In accordance with established procedures of the TWDB, the surface water supplies for the regional water plans were determined using the TCEQ-approved Water Availability Models (WAM). In the ETRWPA, four basins were evaluated: Neches, Neches-Trinity, Trinity, and Sabine. Figure 3.2 shows the river basins and major reservoirs.

The WAMs were developed for the purpose of reviewing and granting new surface water rights permits using a hypothetical repetition of historical hydrology. The results from the modeling for regional water planning are used for planning purposes only and do not affect the right of an existing water right holder to divert and use the full amount of water authorized by its permit. The assumptions in the WAMs are based in part on the legal interpretation of water rights, and in some cases do not accurately reflect current operations. For planning purposes, adjustments were made to the TCEQ-


LAKE TAWAKONI
LAKE FORK RESERVOIR
LAKE CHEROKEE
TEXAS
LOUSIANA
CEDAR CREEK RESERVOIR
RICHLAND CHAMBERS RESERVOIR
LAKE ATHENS
LAKE PALESTINE
LAKE TYLER
MARTIN LAKE
LAKE EASTEX
LAKE MURVAUL
LAKE JACKSONVILLE
LAKE STRIKER
LAKE NACOGDOCHES
TOLEDO BEND RESERVOIR
HOUSTON COUNTY LAKE
SAM RAYBURN RESERVOIR
B A STEINHAGEN LAKE
LAKE LIVINGSTON
SMITH
HENDERSON
PANOLA
RUSK
CHEROKEE
ANDERSON
SHELBY
SABINE
HOUSTON
ANGELINA
NEWTON
TRINITY
JASPER
POLK
TYLER
HARDIN
ORANGE
JEFFERSON
Gulf of Mexico
Region I Boundary
Counties
Rivers
Reservoirs
Cities
Neches River Basin
Neches-Trinity River Basin
Trinity River Basin
0 7.5 15 30
Miles
DATE: MAY 2009
SCALE: 1:1,915,500
DESIGNED: DLB
DRAFTED: DLB
N
W
E
S
East Texas Region
Surface Water Sources
Location Map
FIGURE
3 - 2

approved WAMs to better reflect current and future surface water conditions in the region. WAM Run 3, as modified below, was used to assess surface water supplies. The principal assumptions of Run 3 are that all water right holders divert the full permitted amount of their right by priority date order and do not return any of the diversion to the watershed unless an amount is specified in the permit. This assumption provides a conservative estimate of water supplies in the ETRWPA. Generally, changes to the WAMs include the following:

- Assessment of reservoir sedimentation rates, and the calculation of area-capacity conditions for current (2000) and future (2060) conditions. Since the 2006 regional water plan there have been three new volumetric surveys completed: Lake Jacksonville, Lake Palestine, and Sam Rayburn Reservoir. New sedimentation rates were calculated and estimates of the current storage volumes were updated.
- Inclusion of subordination agreements that are currently in place
- Inclusion of system operations where appropriate
- Basin-specific modifications

The specific changes to each river basin are described below. The modified Trinity WAM for Region C was used to assess the supplies in the ETRWPA from the Trinity Basin. There were no changes specific to the region's sources. Also, no changes were made to the Neches-Trinity WAM.

Neches River Basin WAM. Changes made to the Neches WAM include the following:

- Modeled the UNRMWA's water rights as a system (Lake Palestine and Rocky Point dam).
- Sam Rayburn/Steinhagen water right was modeled subordinate to flow upstream above the Ponta Dam site (which is now Lake Columbia) and

Weches Dam site (special condition (d) of Certificate of Adjudication 4411)[1.

- Sam Rayburn/Steinhagen industrial and irrigation water use was modeled subordinate to municipal rights located below the Ponta and Weches dam sites and above the reservoirs. This included Lake Nacogdoches, Pinkston Reservoir and the water rights for San Augustine Lake that are junior to 1963.
- The TCEQ input file did not consider hydropower use in Sam Rayburn. Hydropower was included in the model.
- The operation of LNVA's water rights was modeled as a system by including backup of LNVA's Pine Island water rights with storage from Sam Rayburn.
- The firm yield of Sam Rayburn/Steinhagen included a minimum elevation in Sam Rayburn of 149 ft. msl., and all storage available in Sam Rayburn up to elevation 164.4 ft. msl.

Sabine River Basin WAM. The Sabine WAM that was developed for the 2006 Plan was used to assess surface water supplies for the 2011 Plan update. The changes made to TCEQ-approved Sabine WAM include the following:

- Adjusted the sedimentation rate for Lake Fork to equal the rate determined for Lake Tawakoni. Based on soil types and watershed characteristics of the two lakes, sedimentation for Lake Fork should be less than Lake Tawakoni. This rate will be re-assessed after a new volumetric survey is completed for Lake Fork.
- The SRA's water rights in the lower basin were modeled as a system by backing up the Authority's canal water rights with releases from Toledo Bend Reservoir.

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[1]Lake Columbia and the Weches Dam have not been constructed to date. Lake Columbia has a water right permit for 85,507 ac-ft per year.

- The remainder of the yield of Toledo Bend was evaluated assuming all diversions were taken lakeside.
- The TCEQ Sabine WAM models Toledo Bend with hydropower. For purposes of finding total available supply for Toledo Bend, hydropower was excluded. Hydropower was included in the evaluation of supplies for all other reservoirs and run-of-the-river supplies.

Reservoirs. Reservoirs in the ETRWPA with over 5,000 ac-ft of conservation storage (i.e., major reservoirs) were evaluated, as were some smaller reservoirs that are used for municipal supply. The available water supply is limited to currently permitted diversions or firm yield. The firm yield is the greatest amount of water a reservoir could have supplied on an annual basis without shortage during a repeat of historical hydrologic conditions, particularly the drought of record. Both Sam Rayburn and Toledo Bend Reservoirs were constructed for multiple purposes, and include hydropower generation. Hydropower is not considered a consumptive use of water, but it is an operational consideration. The inclusion of hydropower in the firm yield analyses was an operating decision by the reservoir owner. For this plan, hydropower is not considered in the yield determination of Toledo Bend Reservoir. Hydropower is included for the Sam Rayburn/Lake B. A. Steinhagen System; however, the actual operation of hydropower may differ from the assumptions in the WAM models. A summary of the available supplies for reservoirs in the ETRWPA is shown in Table 3.2.

Unpermitted Reservoir Yields. Table 3.3 includes information on "unpermitted reservoir yields". This provides an estimate of available supply that could be permitted for future use. The largest unpermitted reservoir yield in the ETRWPA is Texas' share of the yield of Toledo Bend Reservoir, which is nearly 225,000 ac-ft per year. Other unpermitted yields are located in the Lake Sam Rayburn/B.A. Steinhagen System, Houston County Lake, San Augustine City Lake, and Lake Jacksonville.

Table 3.2 Currently Available Supplies from Permitted Reservoirs Serving the ETRWPA (ac-ft per year)

Reservoir	Basin	County	Permitted Diversion	Currently Available Supply[1]						
				2000	2010	2020	2030	2040	2050	2060
Lake Athens	Neches	Henderson	8,500	6,145	6,064	5,983	5,903	5,822	5,741	5,660
Bellwood Lake	Neches	Smith	2,200	950	950	950	950	950	950	950
Lake Kurth	Neches	Angelina	19,100	18,425	18,421	18,417	18,413	18,408	18,404	18,400
Lake Columbia	Neches	Cherokee	85,507	0	0	0	0	0	0	0
Lake Jacksonville	Neches	Cherokee	6,200	6,200	6,200	6,200	6,200	6,200	6,200	6,200
Lake Nacogdoches	Neches	Nacogdoches	22,000	17,450	17,067	16,683	16,300	15,917	15,533	15,150
Lake Palestine system	Neches	Anderson	238,110	209,500	207,458	205,417	203,375	201,333	199,292	197,250
Lake Tyler/Tyler East	Neches	Smith	40,325	30,950	30,925	30,900	30,875	30,850	30,825	30,800
Pinkston Reservoir	Neches	Shelby	3,800	3,800	3,800	3,800	3,800	3,800	3,800	3,800
Rusk City Lake	Neches	Cherokee	160	65	64	63	63	62	61	60
San Augustine City Lake	Neches	San Augustine	1,285	1,285	1,285	1,285	1,285	1,285	1,285	1,285
Sam Rayburn & Steinhagen System	Neches	Jasper	820,000	820,000	820,000	820,000	820,000	820,000	820,000	820,000
Striker Lake	Neches	Rusk	20,600	20,600	20,183	19,357	18,530	17,703	16,877	16,050
Lake Timpson	Neches	Shelby	350	350	350	350	350	350	350	350
Lake Cherokee[2]	Sabine	Cherokee/ Gregg	62,400	29,120	28,885	28,650	28,415	28,180	27,945	27,710
Lake Center	Sabine	Shelby	1,460	754	754	754	754	754	754	754
Lake Murvaul	Sabine	Panola	22,400	22,380	21,792	21,203	20,615	20,027	19,438	18,850
Martin Lake	Sabine	Rusk	25,000	25,000	25,000	25,000	25,000	25,000	25,000	25,000
Toledo Bend	Sabine	Sabine	750,000	750,000	750,000	750,000	750,000	750,000	750,000	750,000
Houston County Lake	Trinity	Houston	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
Total – Permitted Reservoirs				**1,966,474**	**1,962,698**	**1,958,512**	**1,954,328**	**1,950,141**	**1,945,955**	**1,941,769**

1. Supplies are determined by modified WAM Run 3. Supply for Lake Columbia is shown as “0” because the lake has not been constructed to date.
2. Lake Cherokee is located in both ETRWPA and Northeast Texas region. Most of the water from this source is used in Northeast Texas region.

Table 3.3 Unpermitted Supply from Existing Reservoirs (ac-ft per year)

Reservoir	Basin	County	2000	2010	2020	2030	2040	2050	2060
Houston County Lake	Trinity	Houston	3,100	2,967	2,834	2,701	2,568	2,435	2,300
Lake Jacksonville	Neches	Cherokee	3,000	2,768	2,537	2,305	2,073	1,842	1,610
Sam Rayburn & B.A. Steinhagen System	Neches	Jasper	108,290	104,222	100,153	96,085	92,017	87,948	83,880
San Augustine City Lake	Neches	San Augustine	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Striker Lake	Neches	Rusk	410	0	0	0	0	0	0
Toledo Bend	Sabine	Sabine, Shelby	224,500	219,917	215,333	210,750	206,167	201,583	197,000
Total - Unpermitted Supply			**340,300**	**330,874**	**321,857**	**312,841**	**303,825**	**294,808**	**285,790**

Run-of-the-River Diversion. Table 3.4 presents the run-of-the-river supplies by county and basin. Some of the projected demands include industries that currently use these brackish supplies. Generally, brackish run-of-the-river water supplies are located in tidally influenced river segments and are not expected to be developed beyond current levels of use. These supplies are shown in red italics on Table 3.4.

Table 3.4 Summary of the Available Supply from Run-of-the-River Diversions (ac-ft per year)

County	Basin	Use	Owner	2000	2010	2020	2030	2040	2050	2060
Anderson	Neches	Irrigation		197	197	197	197	197	197	197
Anderson	Trinity	Irrigation		1,060	1,060	1,060	1,060	1,060	1,060	1,060
Angelina	Neches	Industrial	Temple Inland	57	57	57	57	57	57	57
Angelina	Neches	Irrigation		17	17	17	17	17	17	17
Cherokee	Neches	Irrigation		182	182	182	182	182	182	182
Hardin	Neches	Irrigation		57	57	57	57	57	57	57
Henderson	Neches	Irrigation		0	0	0	0	0	0	0
Houston	Neches	Irrigation		287	287	287	287	287	287	287
Houston	Trinity	Irrigation		1,783	1,783	1,783	1,783	1,783	1,783	1,783
Jasper	Neches	Industrial	TPWD (hatchery)	604	604	604	604	604	604	604
Jasper	Neches	Industrial	Louisiana Pacific	12	12	12	12	12	12	12
Jasper	Neches	Irrigation		127	127	127	127	127	127	127
Jefferson	Neches	Multi-use	LNVA	381,876	381,876	381,876	381,876	381,876	381,876	381,876
Jefferson	Neches	Industrial	Huntsman Corp.	434,400	434,400	434,400	434,400	434,400	434,400	434,400
Jefferson	Neches	Industrial	Independent Refining	2,700	2,700	2,700	2,700	2,700	2,700	2,700
Jefferson	Neches	Industrial	Union Oil	4,300	4,300	4,300	4,300	4,300	4,300	4,300
Jefferson	Neches	Industrial	Mobil Oil	17,922	17,922	17,922	17,922	17,922	17,922	17,922
Jefferson	Neches	Industrial		319	319	319	319	319	319	319
Jefferson	Neches	Industrial	Beaumont	2,806	2,806	2,806	2,806	2,806	2,806	2,806
Jefferson	Neches	Industrial	Motiva	12,900	12,900	12,900	12,900	12,900	12,900	12,900
Jefferson	Neches	Industrial	Gulf States Utilities	279,131	279,131	279,131	279,131	279,131	279,131	279,131
Jefferson	Neches-Trinity	Industrial	Premcor Refining	480	480	480	480	480	480	480
Jefferson	Neches-Trinity	Irrigation		54,746	54,746	54,746	54,746	54,746	54,746	54,746
Jefferson	Neches-Trinity	Industrial		680	680	680	680	680	680	680
Jefferson	Neches-Trinity	Mining		34	34	34	34	34	34	34
Jefferson	Neches	Municipal	Beaumont	25,160	25,160	25,160	25,160	25,160	25,160	25,160

Table 3.4 Summary of the Available Supply from Run-of-the-River Diversions (Cont.)

County	Basin	Use	Owner	2000	2010	2020	2030	2040	2050	2060
Jefferson	Neches	Municipal	Beaumont	4,145	4,145	4,145	4,145	4,145	4,145	4,145
Nacogdoches	Neches	Industrial		2	2	2	2	2	2	2
Nacogdoches	Neches	Irrigation		136	136	136	136	136	136	136
Orange	Neches	Industrial	TE Products	*100*	*100*	*100*	*100*	*100*	*100*	*100*
Orange	Neches	Industrial	Gulf States Utilities	*17,210*	*17,210*	*17,210*	*17,210*	*17,210*	*17,210*	*17,210*
Rusk	Neches	Irrigation		86	86	86	86	86	86	86
Rusk	Neches	Industrial		2	2	2	2	2	2	2
Sabine	Neches	Industrial	Temple Inland	182	182	182	182	182	182	182
Smith	Neches	Irrigation		50	50	50	50	50	50	50
Smith	Neches	Mining		0	0	0	0	0	0	0
Trinity	Neches	Irrigation	Temple Inland	62	62	62	62	62	62	62
Tyler	Neches	Irrigation		123	123	123	123	123	123	123
Newton	Sabine	Industrial	Weirgate Lumber	135	135	135	135	135	135	135
Newton	Sabine	Irrigation	SRA	46,700	46,700	46,700	46,700	46,700	46,700	46,700
Newton	Sabine	Irrigation		50	50	50	50	50	50	50
Newton	Sabine	Industrial	SRA	100,400	100,400	100,400	100,400	100,400	100,400	100,400
Orange	Sabine	Industrial	E.I. Dupont Nemours	*267,000*	*267,000*	*267,000*	*267,000*	*267,000*	*267,000*	*267,000*
Orange	Sabine	Irrigation		28	28	28	28	28	28	28
Panola	Sabine	Industrial	Hills Lake Fishing Club	114	114	114	114	114	114	114
Panola	Sabine	Industrial	TXU	129	129	129	129	129	129	129
Panola	Sabine	Irrigation		191	191	191	191	191	191	191
Panola	Sabine	Mining	TXU	167	167	167	167	167	167	167
Rusk	Sabine	Irrigation		127	127	127	127	127	127	127
Rusk	Sabine	Municipal	Henderson	10	10	10	10	10	10	10
TOTAL				**1,658,986**	**1,658,986**	**1,658,986**	**1,658,986**	**1,658,986**	**1,658,986**	**1,658,986**
Subtotal Freshwater				**623,004**	**623,004**	**623,004**	**623,004**	**623,004**	**623,004**	**623,004**
Subtotal Brackish water				***1,035,982***	***1,035,982***	***1,035,982***	***1,035,982***	***1,035,982***	***1,035,982***	***1,035,982***

Supplies shown in red are brackish water supplies and are generally not considered to meet the projected demands.

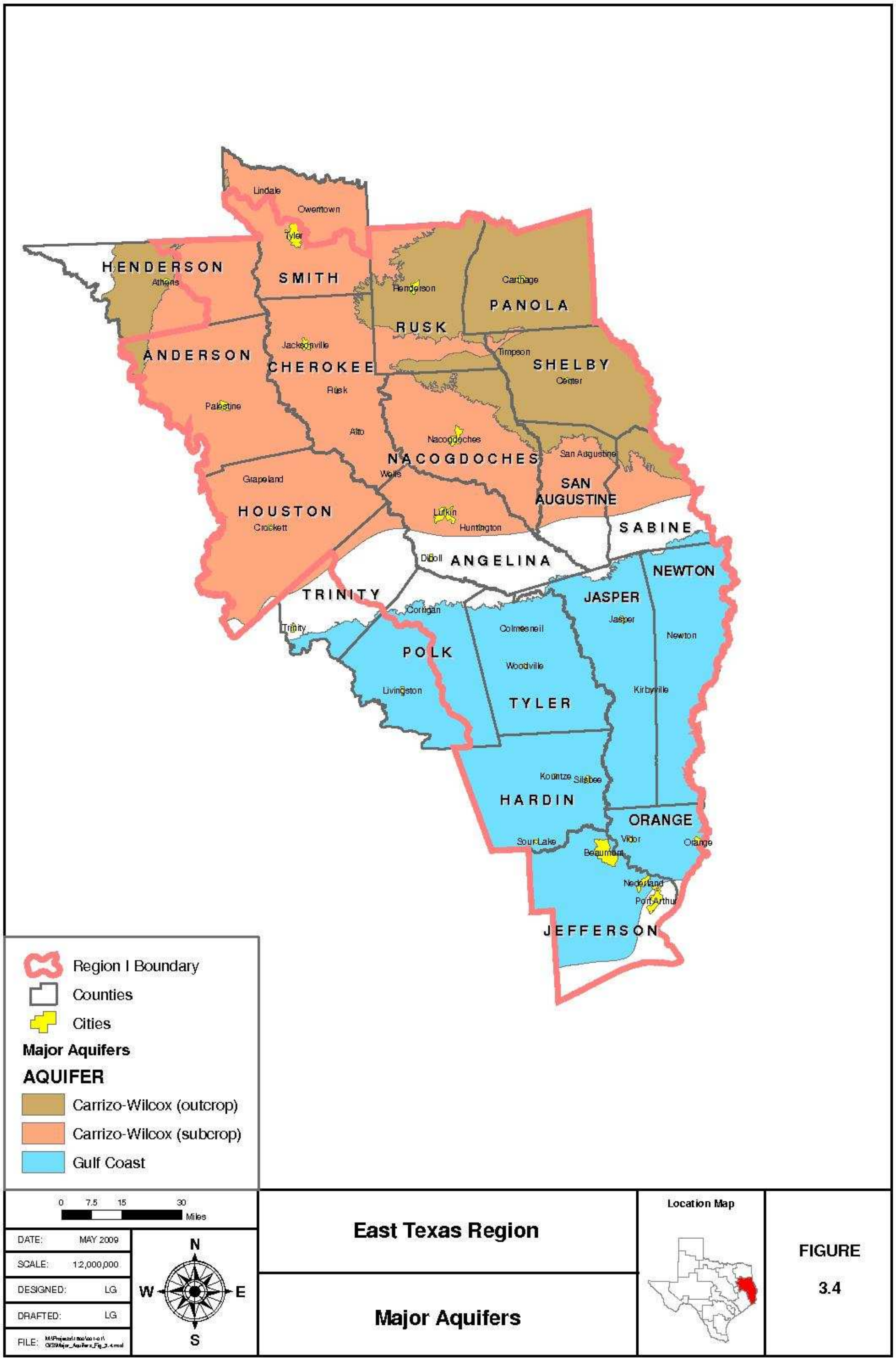
3.1.2 Groundwater Availability. As indicated in the introduction to this chapter, neither GMS-11 nor GMS-14 determined DFCs or MAGs before the TWDB deadline for inclusion in the 2011 Plan. However, on April 13, 2010, GMA-11 adopted initial DFCs intended to protect and conserve groundwater resources within the GMA, while allowing for anticipated growth in the area. The Yegua-Jackson, Sparta, Weches, Queen City, Reklaw, and Carrizo-Wilcox aquifers within GMA-11 now have a defined DFC of 17 feet of drawdown. The Trinity, Nacatoch, and Gulf Coast aquifers are not included in GMA-11 DFCs. As of September 1, 2010, GMA-14 has not adopted DFCs for aquifers within its designated area.

The Southeast Texas GCD had expressed interest in providing the ETRWPA with preliminary estimates of groundwater availability based on a GAM run completed by TWDB, but these numbers were not available when groundwater supplies were evaluated. The rest of the groundwater supplies were based on the previous ETRWPA plan. Those supply estimates were based on region-approved acceptable levels of drawdown.

The TWDB planning guidelines require that regional planning groups "Calculate the largest annual amount of water that can be pumped from a given aquifer without violating the most restrictive physical or regulatory or policy conditions limiting withdrawals, under drought-of-record conditions. Regulatory conditions refer specifically to any limitations on pumping withdrawals imposed by GCDs through their rules and permitting programs." This guideline requires that planning groups make a policy decision as to the interpretation of the term "most restrictive" as it relates to long-term groundwater availability. In addition, TWDB guidelines further require that, "Once GAM (Groundwater Availability Model) information is accessible for an area within a region, the planning group shall incorporate this information in its next planning cycle unless better site-specific information is developed."

Groundwater supplies in the ETRWPA can be divided into the northern and southern regions. The northern region is generally consistent with GMA-11 and the southern region is generally consistent with GMA-14. The conditions and available information for each region are presented separately.

Northern Region. The Carrizo-Wilcox Aquifer provides the majority of the groundwater supply in the northern region. Minor aquifers in the northern region include the Queen City, Sparta and Yegua-Jackson. In some areas, the Queen City aquifer provides a significant quantity of water, although the well yields are typically smaller than in the underlying Carrizo-Wilcox aquifer. Because it has a relatively large surface area, the Queen City aquifer also receives a significant volume of recharge from precipitation and thus provides significant baseflow to creeks and rivers in the region. The Yegua-Jackson aquifer provides water in the area between the downdip extent of the Carrizo-Wilcox and the outcrop area of the Gulf Coast aquifer. Figures 3.4 and 3.5 provide an overview of the location of the aquifers. Five GCDs are located in the northern region: Anderson County Underground Water Conservation District (UWCD), which is part of Anderson County, Neches and Trinity Valleys GCD (Anderson, Henderson and Cherokee Counties), Pineywoods GCD (Angelina and Nacogdoches Counties), Rusk County GCD (Rusk County), and Panola County GCD. All the districts have management plans, and some are beginning to register new and existing wells and monitor water levels. In the absence of specific production restrictions during the last round of planning, the ETRWPG selected a reasonably sustainable planning goal for the groundwater during the 50-year planning window as well as for future generations beyond the 50-year window. With that goal in mind, groundwater availability for the planning period was defined as the amount of groundwater that could be withdrawn from aquifers over the next 50 years that will not cause more than 50 feet of water level decline or 10% decrease in saturated thickness (in unconfined portions of the aquifer) whichever is less in the aquifers of the Northern Region.


HENDERSON
Athens
SMITH
Lindale
Overtown
Tyler
RUSK
Henderson
PANOLA
Carthage
ANDERSON
Palestine
CHEROKEE
Jacksonville
Rusk
Alto
SHELBY
Timpson
Center
NACOGDOCHES
Nacogdoches
Wells
Lufkin
Huntington
SAN AUGUSTINE
San Augustine
HOUSTON
Grapeland
Crockett
SABINE
ANGELINA
Diboll
TRINITY
Trinity
Corrigan
NEWTON
Newton
JASPER
Jasper
Kirbyville
POLK
Livingston
Colmesneil
Woodville
TYLER
HARDIN
Kountze
Silsbee
Sour Lake
ORANGE
Vidor
Orange
Beaumont
Nederland
Port Arthur
JEFFERSON
Region I Boundary
Counties
Cities
Major Aquifers
AQUIFER
Carrizo-Wilcox (outcrop)
Carrizo-Wilcox (subcrop)
Gulf Coast
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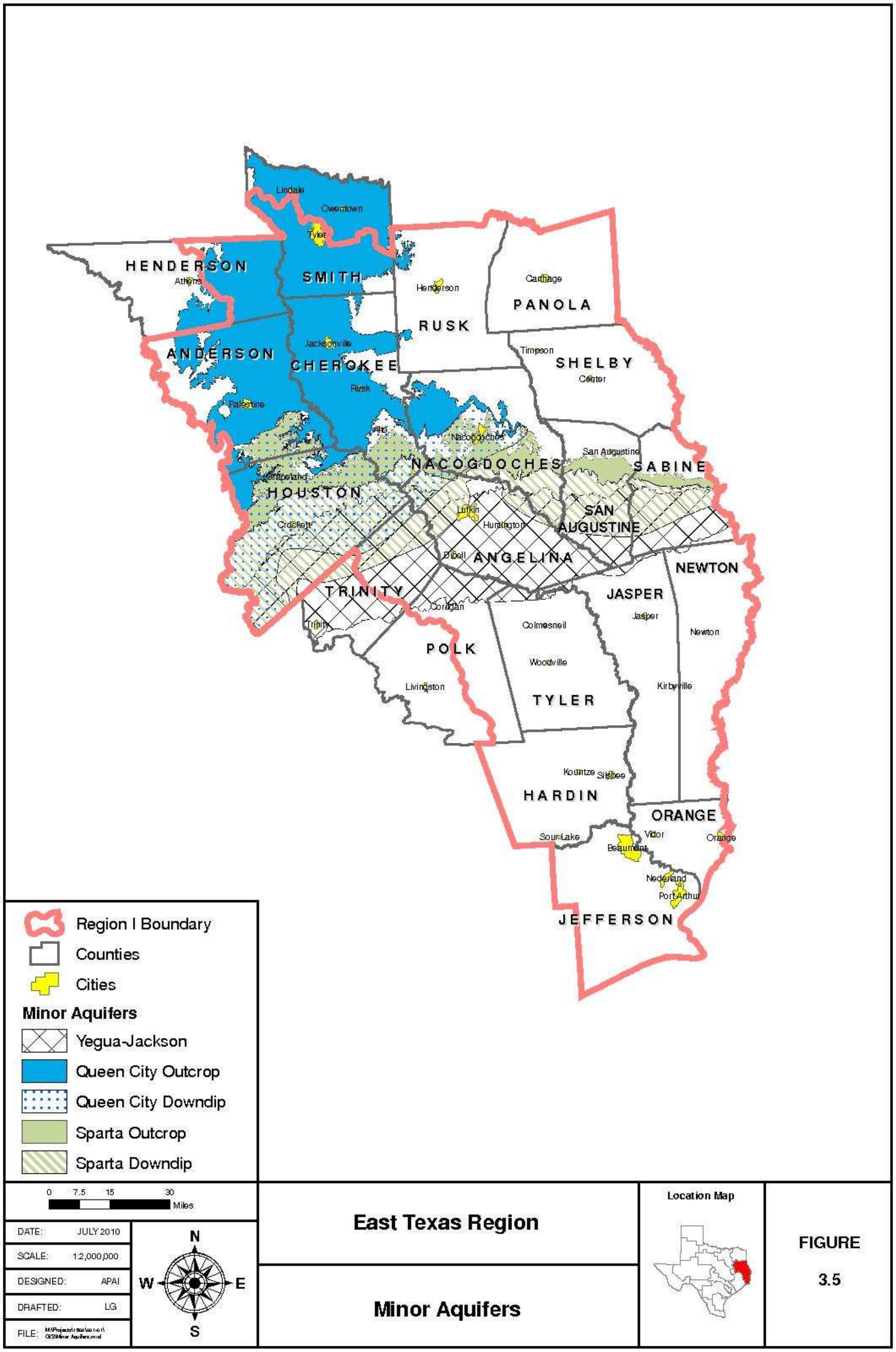
East Texas Region
Major Aquifers
Location Map
FIGURE
3.4


HENDERSON
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ANGELINA
NEWTON
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Henderson
Carthage
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Timpson
Center
Palestine
Rusk
Nacogdoches
San Augustine
Crockett
Lufkin
Huntington
Diboll
Corrigan
Trinity
Jasper
Newton
Colmesneil
Woodville
Livingston
Kirbyville
Kountze
Silsbee
Sour Lake
Vidor
Orange
Beaumont
Nederland
Port Arthur
Region I Boundary
Counties
Cities
Minor Aquifers
Yegua-Jackson
Queen City Outcrop
Queen City Downdip
Sparta Outcrop
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0 7.5 15 30 Miles
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East Texas Region
Minor Aquifers
Location Map
FIGURE
3.5

The Queen City/Sparta/Carrizo Wilcox GAM was available to analyze the availability of groundwater in each county based on the above criteria. The only county not meeting the criteria was Smith County. In Smith County, the GAM indicated that current demands could not be met with available supplies based on the above criteria. Average water-level decline was over 80 feet during the 50-year period. In this case, the groundwater supply was set equal to the demand because there is currently no GCD to limit pumping in that county. The ETRWPG acknowledges that additional water does occur in storage within the aquifers and that a portion of that water (above than the estimated supply) could be pumped if there is not a GCD in place to prevent such withdrawals. The groundwater availability for the counties in the Northern Region are provided in Table 3.5.

Southern Region. The Gulf Coast Aquifer provides most of the groundwater supply in the southern region. One GCD, the Southeast Texas GCD (Jasper, Newton, Tyler, and Hardin Counties), is located in the Southern Region. In the last round of planning, a predictive Gulf Coast GAM was not available to assess supplies for the Gulf Coast Aquifer, but since then, a predictive GAM has been developed and approved by the TWDB. The Southeast Texas GCD has worked with TWDB to complete several GAM runs to assess supplies, but these numbers were not available when groundwater supplies were estimated for this round of planning. Therefore, the supplies for the Southern Region were not modified, and were based on published information such as Baker (1986),[2] available well and water level records, and the knowledge base of the consultant team. Table 3.5 contains a summary of groundwater availability in the Southern Region.

Table 3.5 Total Available Groundwater by Aquifer (ac-ft per year)

County	Yegua Jackson	Queen City	Sparta	Carrizo Wilcox	Gulf Coast	Other
Northern Region						
Anderson		18,320	600	9,830		280
Angelina	6,472	1,060	670	28,330		1,450
Cherokee		21,850	350	10,870		
Henderson (P)		14,870		4,200		
Houston	1,380	400	870	5,220		1,380
Nacogdoches	60	4,860	400	31,140		80
Panola				10,370		
Rusk		4,250		20,290		
Sabine	1,100		290	6,710	1,100	200
San Augustine	540		200	1,690		60
Shelby				12,750		
Smith (P)		17,280		18,400		80
Trinity (P)	740		600	2,161	100	280
Northern Region Subtotal	**10,292**	**82,890**	**3,980**	**161,961**	**1,200**	**3,810**
Southern Region						
Hardin					23,500	
Jasper					52,000	6,000
Jefferson					2,500	
Newton					29,000	1,500
Orange					20,000	
Polk (P)	360				13,500	1,450
Tyler	180				30,300	1,620
Southern Region Subtotal	**540**	**–**	**–**	**–**	**170,800**	**10,570**
Aquifer Totals	**10,832**	**82,890**	**3,980**	**161,961**	**172,000**	**14,380**
Grand Total						**446,043**

Note: The above values are total supply available to meet both existing and projected demands and are available for each decade of the 50-year planning cycle.
(P) denotes Partial County

3.1.3 Local Supply. Local supply generally includes small surface water supplies that are not associated with a water right. Most of the local supply is surface water used from livestock ponds. A small amount of local supply is for mining purposes. This generally represents recycled water captured from surface flow that has not entered the waters of the State. The maximum recent historical use from these sources (according to TWDB records) is assumed to be available in the future. Local supplies are listed on Table 3.6.

Table 3.6 Summary of Available Local Supply (ac-ft per year)

County	Basin	Use	Supply (ac-ft per year)
Local Supplies			
Anderson	Neches	Livestock	599
Anderson	Trinity	Livestock	684
Angelina	Neches	Livestock	347
Cherokee	Neches	Livestock	1,059
Cherokee	Neches	Mining	2
Hardin	Neches	Livestock	139
Hardin	Trinity	Livestock	2
Henderson	Neches	Livestock	279
Houston	Neches	Livestock	388
Houston	Trinity	Livestock	783
Jasper	Neches	Livestock	115
Jasper	Sabine	Livestock	75
Jefferson	Neches	Livestock	43
Jefferson	Neches-Trinity	Livestock	280
Jefferson	Neches	Mining	242
Nacogdoches	Neches	Livestock	910
Nacogdoches	Neches	Mining	220
Newton	Sabine	Livestock	66
Newton	Sabine	Mining	28
Orange	Neches	Livestock	56
Orange	Sabine	Livestock	70
Orange	Sabine	Mining	1
Panola	Cypress	Livestock	30
Panola	Sabine	Livestock	1,828
Polk	Neches	Livestock	122
Rusk	Neches	Livestock	386
Rusk	Sabine	Livestock	308
Rusk	Sabine	Mining	287
Sabine	Neches	Livestock	59
Sabine	Sabine	Livestock	320
San Augustine	Neches	Livestock	490
San Augustine	Sabine	Livestock	71
Shelby	Neches	Livestock	334
Shelby	Sabine	Livestock	1,755
Smith	Neches	Livestock	416
Trinity	Neches	Livestock	135
Tyler	Neches	Livestock	165
Total Local Supply			**13,094**

3.1.4 Reuse. The reuse listed as available to the region is for existing projects based on current permits and authorizations. Categories of reuse include (1) currently permitted and operating indirect reuse projects for non-industrial purposes, in which water is reused after being returned to the stream; (2) existing indirect reuse for industrial purposes; and (3) authorized direct reuse projects for which facilities are already developed. The specific reuse projects are listed in Table 3.7.

Table 3.7 Summary of Available Reuse Supply (ac-ft per year)

County	Basin	Use	Supply
Direct Reuse Supplies			
Angelina	Neches	Manufacturing	1,265
Sabine	Neches	Manufacturing	20
Orange	Sabine	Irrigation	15
Shelby	Sabine	Irrigation	82
Shelby	Sabine	Manufacturing	136
Indirect Reuse Supplies			
Henderson	Neches	Livestock	2,872
Jefferson	Neches-Trinity	Irrigation	13,687
Total Reuse Supply			**18,077**

3.1.5 Imports and Exports. There are several small imported supplies to the ETRWPA from adjoining regions and Louisiana. Water from Lake Fork in the Northeast Region is used by the Cities of Henderson and Kilgore and their customers. Other surface water imports include water from Lake Livingston to Groveton and surface water for the City of Joaquin from the City of Logansport, Louisiana. The specific source for this import is the Louisiana portion of the Toledo Bend Reservoir.

There are also uses of groundwater from sources located outside of the ETRWPA. Most are associated with entities that extend over multiple regions. Groundwater from the Northeast Region is provided to Crystal Water System, Kilgore, Elderville WSC, and West Gregg WSC. Groundwater in the Region C portion of Henderson County is provided to the small portion of the City of Athens that lies in the ETRWPA.

Water from the ETRWPA is used to supply the City of Tyler's customers in the Northeast Region, City of Athens in Region C and several customers of the LNVA in Region H. Water from Lake Cherokee is provided to customers in both the Northeast Region and ETRWPA through the Cherokee Water Company and the City of Longview. There is also an existing contract to supply water to Dallas from Lake Palestine. The infrastructure for this supply has not been constructed. A summary of exports and imports is provided in Table 3.8.

Table 3.8 Summary of Exports and Imports in ETRWPA (ac-ft per year)

Source	2010	2020	2030	2040	2050	2060
Exports						
Lake Athens	1,581	1,706	1,826	1,935	2,046	2,147
Sam Rayburn/B.A. Steinhagen	63,863	63,863	63,863	63,863	63,863	63,863
Lake Cherokee	25,675	25,675	25,675	25,675	25,675	25,675
Lake Tyler	358	464	567	668	844	1,081
Total	**91,477**	**91,743**	**92,014**	**92,285**	**92,648**	**93,080**
Imports						
Carrizo-Wilcox Aquifer (Henderson, Smith and Gregg Counties)	659	649	638	624	613	602
Lake Fork	3,413	3,413	3,413	3,413	3,413	3,413
Lake Livingston	114	121	122	118	113	109
Toledo Bend - Louisiana	235	235	235	235	235	235
Sabine River	303	290	278	266	251	233
Total	**4,724**	**4,708**	**4,686**	**4,656**	**4,625**	**4,592**

3.2 Impacts of Water Quality on Supplies

The quality of a surface water body or groundwater aquifer can be a significant factor in the determination of water supply availability. Water quality can dictate the level of treatment necessary to render a water body available for its intended use, which can affect the quantity of produced water. In cases of severe contamination, it is possible that a water supply source could be considered untreatable and, hence, unusable. The ETRWPA is fortunate in that water quality impacts are generally minor with respect to their effect on availability and treatability.

Key water quality parameters for the ETRWPA are identified and discussed in Chapter 5. These parameters are generally a consideration for surface waters. Some of these parameters could be an issue for groundwater as well. The key water quality parameters identified include the following:

- Total Dissolved Solids
- Dissolved Oxygen
- Nutrients
- Metals
- Turbidity

In general, these parameters potentially affect some aspect of aquatic life or the use of the water for recreation. However, in some cases they could affect its availability for water supply as well. Water quality impacts for surface water and groundwater are discussed as they relate to availability, and treatment requirements are discussed in the following subsections.

3.2.1 Water Quality Impacts on Surface Water Availability. Surface water quality in the ETRWPA is addressed in Chapter 1, Appendix 1-B, where it is noted that a total of 69 water quality impairments have been identified in the Draft 2008 303(d) List. These impairments are found on 48 classified segments within the ETRWPA. The specific impairments include the following:

- Bacteria (28 impairments)
- Dissolved Oxygen (18)
- Toxicity in water or sediment (4)
- Metals in water (4)
- Mercury in fish/shellfish (9)
- pH (3)
- Biological (3)

In comparing surface quality impairments with the key water quality parameters identified in Chapter 5, it is seen that metals and dissolved solids are common to both lists. The metals identified include mercury in fish tissue in nine segments, lead in two segments, aluminum in one segment, and zinc in one segment.

Mercury in fish tissue is a human health concern (through ingestion), but is not considered a limiting factor to either water supply availability or the treatability of the water. Mercury has not been demonstrated to be a concern in the water in any segment in the ETRWPA.

Lead in water can be either a human health protection concern or an aquatic life protection concern. Lead levels in the two segments identified as impaired in the ETRWPA are not identified in the Draft 2008 303(d) List. However, the water quality inventory on which the list is based indicates that the data for lead are inadequate or limited. It is unlikely that levels exceed the Primary Drinking Water Standard action level of 0.015 mg/L. Furthermore, lead can be readily removed in the water treatment process. Therefore, lead is not anticipated to be a limiting factor in water supply availability or treatment for the ETRWPA.

Excessive aluminum in water is an aquatic life protection concern for surface water bodies, but is generally not considered to affect water supply availability or treatability. Aluminum is a secondary drinking water contaminant. Conventional water treatment processes readily remove aluminum. Therefore, aluminum is not considered to be a limiting factor in water supply availability or treatment for the ETRWPA.

Excessive zinc in water is also an aquatic life protection concern for surface water bodies. Zinc is a secondary drinking water contaminant. It is not generally considered to affect water supply availability or treatability. Conventional water treatment processes also readily remove zinc. In the case of zinc found in the one segment in the ETRWPA (Segment 0606, Neches River above Lake Palestine), the average concentrations observed in the water are only slightly above the surface water quality standard and well below the secondary drinking water standard. Therefore, zinc is not considered to be a concern for water supply availability or treatment in the ETRWPA.

Of the remaining listed impairments, none are considered to limit the availability of water supply or treatability of the water.

3.2.2 Water Quality Impacts on Groundwater Availability. Appendix 1-C provides a detailed discussion of water quality in four water supply aquifers in the ETRWPA. The four aquifers evaluated were the Carrizo-Wilcox, the Gulf Coast, the Queen City-Sparta, and the Yegua-Jackson. In the evaluation, a range of primary and secondary drinking water contaminants was evaluated. Water quality data for wells within the TWDB database were reviewed and summarized. Based on this evaluation, it may be stated that limitations on water supply availability or treatability are rare for groundwater supplies in the ETRWPA.

Primary drinking water contaminants evaluated included alpha particles, arsenic, barium, cadmium, chromium, lead, nitrate (as nitrogen), and selenium. Although individual wells sometimes detect concentrations of contaminants, none are considered to be widespread in any of the aquifers at levels of concern. The most prevalent of the primary drinking water contaminants was found to be nitrate (as nitrogen), which exceeded the primary standard of 10 mg/L in about 4% of samples from all aquifers. However, the median concentration of nitrate (as nitrogen) was less than 0.25 mg/L and the average less than 3 mg/L. Nitrate can be removed from water using advanced treatment processes such as reverse osmosis or ion exchange. This would result in a reduced availability as a significant portion of the supply becomes the reject or waste stream. Given the low incidence of nitrate contamination, it is unlikely that it would become a significant issue for the ETRWPA.

Secondary drinking water contaminants evaluated included copper, fluoride, chloride, iron, manganese, pH, sulfate, and TDS. Of these, iron, manganese, and pH were commonly found in excess of secondary standards in all aquifers. TDS was found to exceed the Texas secondary standard of 1,000 mg/L in only the Yegua-Jackson Aquifer.

Iron and manganese are naturally occurring constituents in groundwater. In excess, they can cause taste and odor problems in drinking water, but not significant health problems. A common means of managing iron and manganese concentrations in drinking water is through aeration of the groundwater as it is pumped from the ground and to a storage tank. The aeration causes the iron and manganese to precipitate and settle to the bottom of the storage tank. The drinking water then distributed to customers, therefore, contains lower concentrations of the constituents. Industrial users of water with excessive levels of iron or manganese may require significant removal prior to using the water in industrial processes.

In the ETRWPA, approximately 26% of all wells evaluated exceeded the secondary standard for iron (i.e., 0.3 mg/L). Median values for iron were within the secondary standard, but averages exceeded the standard by over four times in some cases. Approximately 16% of all wells exceeded the secondary standard for manganese (i.e., 0.05 mg/L). Median values for manganese were well within the standard. The average manganese level exceeded the standard in only Gulf Coast Aquifer wells, at a concentration of 0.065 mg/L.

Although it is not known whether any existing public water supply system or industrial user is currently contending with excessive iron or manganese in its groundwater source, these results indicate that iron and manganese could be a significant issue in groundwater in some parts of the ETRWPA. As indicated above, treatment may be relatively simple and would not generally result in a reduction of water supply availability or treatability. In extreme cases of excessive iron or where the water is desired for industrial uses, it is possible that more comprehensive treatment could be necessary to remove a sufficient amount of the constituent to enable its use.

It was found to be relatively common for pH concentrations in groundwater to be outside the allowable range (i.e., 6.5 to 8.5 standard units) for the four aquifers evaluated. The pH was outside the range in approximately 33% of the groundwater samples. However, neither the median nor the average values were found outside the range for any of the aquifers. This indicates that the pH concerns for groundwater in the ETRWPA may be a minimal issue.

Control of pH, if necessary, could be accomplished by the addition of pH adjusting chemicals, such as soda ash (to raise pH), or sulfuric acid (to lower pH). Treatment would not result in a significant reduction of the source availability. Therefore, pH is not considered to be a significant limiting factor in availability or treatability.

The concentration of TDS in the Yegua-Jackson Aquifer was found to exceed the Texas secondary standard in approximately 18% of the groundwater samples evaluated. However, the average concentration for all wells in the aquifer was only approximately 672 mg/L. This indicates that TDS concerns for the Yegua-Jackson Aquifer are probably minimal.

Treatment for TDS, if necessary, could include processes such as reverse osmosis or ion exchange. This would result in reduced availability as a significant portion of the supply becomes the reject or waste stream. Given the low incidence of TDS contamination in most of the region, it is unlikely that it would become a significant issue for groundwater availability for the ETRWPA.

3.3 Impact of Environmental Flow Policies on Water Rights, Water Availability, and Water Planning

The objective of this section of the 2011 Plan is to provide an evaluation of the effect of environmental flow policies on water rights, water availability, and water planning in the ETRWPA. Much has occurred in the area of environmental flow recommendations since the 2006 Plan was adopted, including the development of new recommendations for the Sabine and Neches watersheds. However, it is not clear how much effect these recommendations will have in the short-term.

The Legislature passed Senate Bill 3 (SB3) in the 2007 80th Regular Session. SB3 is the third in a series of three omnibus water bills related to the State of Texas' meeting the future needs for water. SB3 created a basin-by-basin process for developing recommendations to meet the instream flow needs of rivers as well as freshwater inflow needs of affected bays and estuaries and required TCEQ to adopt the recommendations in the form of environmental flow standards. Such standards will be utilized in the decision-making process for new water right applications and in establishing an amount of unappropriated water to be set aside for the environment.

Prior to SB3, Texas law recognized the importance of balancing the biological soundness of the state's rivers, lakes, bays, and estuaries with the public's economic health and general well-being. The Texas Water Code (TWC) requires the TCEQ, while balancing all other interests, to consider and provide for the freshwater inflows necessary to maintain the viability of Texas' bay and estuary systems in TCEQ's regular granting of permits for the use of state water. Balancing the effect of authorizing a new use of water with the need for that water to maintain a sound ecological system was done on a case-by-case basis as part of the water rights permitting process.

SB3 called for the appointment of stakeholder committees for the various watersheds feeding bays and estuaries for the Texas coast. For that portion of the Texas coast within the ETRWPA, the primary basins of interest were the Sabine and Neches Rivers, and part of the Neches-Trinity Coastal basin. These basins feed fresh water to Sabine Lake and the upper Texas coast. Since a portion of the Trinity River basin is in the region and the Trinity River forms a portion of the western boundary of the region, another stakeholder group for the Trinity-San Jacinto-Galveston Bay area is also of potential interest. Stakeholder committees for both areas were appointed in 2008. Each stakeholder committee then appointed a "bay and basin expert science team" (BBEST) in the fall of 2008 to address the development of environmental flow recommendations in accordance with SB3. The BBESTs met individually over the course of 12 months to develop environmental flow recommendations for their respective areas. Appendix 3-A contains the Sabine and Neches Executive Summary (ES), which is the primary area of interest to the ETRWPA. The ES describes, generally, the process undertaken and the recommendations made by the BBEST.

The Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Area Stakeholder's Committee (Sabine-Neches Bay and Basin Area Stakeholder Committee [BBASC]) evaluated the recommendations of the BBEST and prepared its own report. The report, dated May 4, 2010, has been presented to the TCEQ for its review. A copy of the report is provided in Appendix 3-A.

Environmental flow recommendations will impact the procurement of water rights in the future by creating a comprehensive process of evaluating environmental flow needs whenever a new water right application is processed. The process of approving water rights is likely to become more complex under the new environmental flow policies that will be implemented by the TCEQ. However, it should result in more clarity in how diversions can be made, and better ensure that sufficient water is available in the streams of the Sabine and Neches basins.

As a result of the implementation of new environmental flow recommendations, the operation of reservoirs will become more dependent on the development of an "accounting plan," which is a feature that the TCEQ is already implementing within the State. Whether such accounting plans will have a significant impact on the availability of water is not known at this time.

The implementation of environmental flow recommendations will result in a need to more carefully consider environmental flow needs during the process of water planning in the ETRWPA. In future planning cycles, the ETRWPG will need to analyze new water rights in light of these recommendations to determine how the new environmental flow requirements are consistent with the long-term protection of the region's water resources.

3.4 Water Availability by Water User Group

The water availability by WUG is limited by the ability to deliver and/or use the water. These limitations include firm yield of reservoirs, well field capacity, aquifer characteristics, water quality, water rights, permits, contracts, regulatory restrictions, raw water delivery infrastructure and water treatment capacities where appropriate. Appendix 3-B presents the current water available for each WUG by county. (WUGs are cities, water supply corporations, county-other municipal users and countywide manufacturing, irrigation, mining, livestock, and steam electric uses.) For county-wide user groups, historical use was considered in the determination of currently available supplies.

The table in Appendix 3-B shows the amount of supply available to each user group from each source by decade based on existing facilities. The total supply to water users by use type is shown on Figure 3.6. These developed supplies represent about one third of the currently available supply to the region. The supplies by county are shown in Table 3.9.

Figure 3.6 Currently Available Supply to Water User Groups

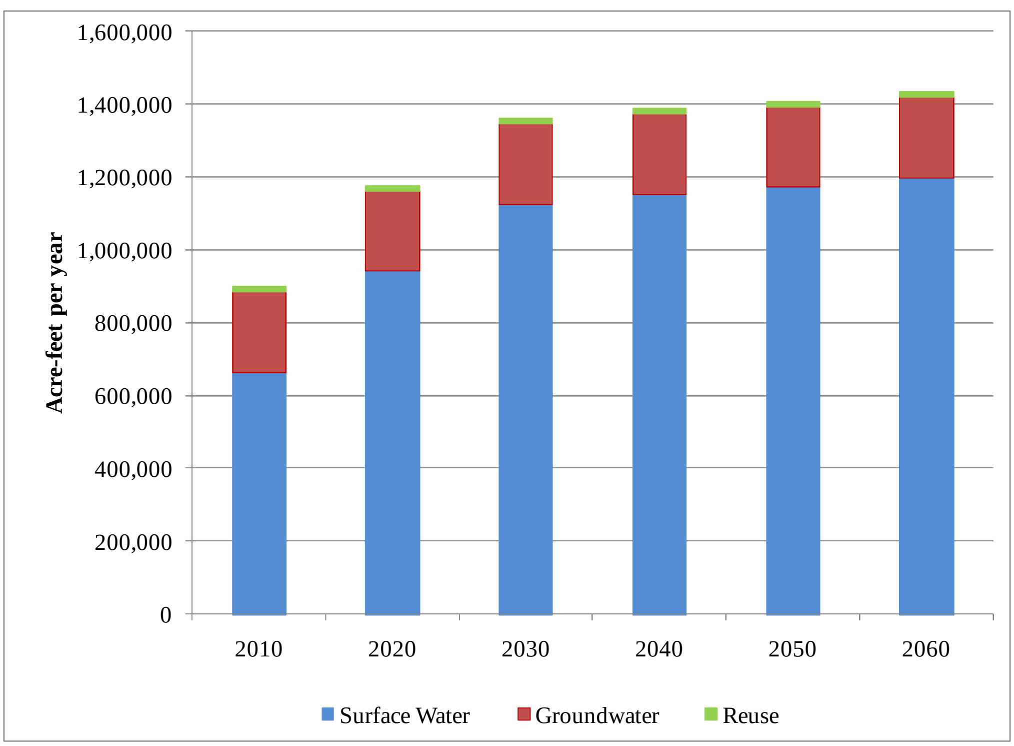

Table 3.9 Summary of Available Supply to Water Users by County (ac-ft per year)

County	Available Supply					
	2010	2020	2030	2040	2050	2060
Anderson	17,649	17,649	17,649	17,649	17,649	17,649
Angelina	25,957	26,321	26,392	26,458	26,521	26,579
Cherokee	18,684	18,273	18,625	19,046	19,539	20,126
Hardin	14,296	14,296	14,296	14,296	14,296	14,271
Henderson (P)	9,509	7,890	7,705	7,538	7,365	7,205
Houston	10,248	10,246	10,246	10,247	10,246	10,246
Jasper	72,835	76,218	78,731	80,928	82,575	82,638
Jefferson	414,903	686,525	866,571	892,088	918,150	944,597
Nacogdoches	33,596	37,693	37,289	36,856	29,640	29,129
Newton	19,908	19,908	19,908	19,908	19,908	19,908
Orange	98,484	98,484	98,484	98,484	98,484	98,484
Panola	16,758	17,067	17,256	17,448	17,641	17,826
Polk (P)	2,626	2,626	2,626	2,626	2,626	2,626
Rusk	60,725	60,732	60,732	60,722	60,719	60,729
Sabine	4,101	4,101	4,101	4,101	4,101	4,101
San Augustine	2,933	2,933	2,933	2,933	2,933	2,933
Shelby	11,430	11,445	11,458	11,471	11,482	11,496
Smith (P)	59,273	58,953	58,711	58,484	58,186	57,842
Trinity (P)	1,021	1,028	1,029	1,025	1,020	1,016
Tyler	5,328	5,328	5,328	5,328	5,328	5,328
TOTAL	**900,264**	**1,177,716**	**1,360,070**	**1,387,636**	**1,408,409**	**1,434,729**

Note: (P) denotes Partial County

3.5 Water Availability by Wholesale Water Provider

There are 16 designated WWPs in the ETRWP area. A WWP is a provider that has wholesale water contracts for 1,000 ac-ft per year or is expected to contract for 1,000 ac-ft per year or more during the planning period. Similar to the available supply to WUGs, the water availability for each WWP is limited by the ability to deliver the raw water. These limitations include firm yield of reservoirs, well field capacity, aquifer characteristics, water quality, water rights, permits, contracts, regulatory restrictions and infrastructure. A summary of supplies of each WWP is included in Appendix 3-B. Total available supply by decade for each wholesale provider is shown in Table 3.10.

Table 3.10 Summary of Currently Available Supplies for Wholesale Water Provider (ac-ft per year)

Water Provider	Currently Available Supply					
	2010	2020	2030	2040	2050	2060
ANRA	60	65	70	70	70	70
A-N WCID 1	20,183	19,357	18,530	17,703	16,877	16,050
Athens MWA	5,772	2,900	2,900	2,900	2,900	2,900
Beaumont	31,420	31,420	31,420	31,420	31,420	31,420
Carthage	6,461	6,461	6,461	6,461	6,461	6,461
Center	4,554	4,554	4,554	4,554	4,554	4,554
Houston Co. WCID 1	3,500	3,500	3,500	3,500	3,500	3,500
Jacksonville	7,391	7,391	7,391	7,391	7,391	7,391
LNVA	1,173,876	1,173,876	1,173,876	1,173,876	1,173,876	1,173,876
Lufkin	11,000	11,000	11,000	11,000	11,000	11,000
Nacogdoches	20,167	19,783	19,400	19,017	18,633	18,250
Panola Co. FWSD 1	21,792	21,203	20,615	20,027	19,438	18,850
Port Arthur	15,852	16,380	16,907	17,436	18,029	18,753
SRA	1,300,726	1,297,888	1,295,045	1,292,194	1,289,323	1,286,456
Tyler	44,996	44,996	44,996	44,996	44,996	44,996
UNRMWA	207,458	205,417	203,375	201,333	199,292	197,250
Wholesale Water Provider Totals	**2,875,208**	**2,866,191**	**2,860,040**	**2,853,878**	**2,847,760**	**2,841,777**

A brief description of the supply sources is presented below. As previously discussed, the analyses of the available supplies by source were determined using the assumptions outlined in Sections 3.2.1 and 3.2.2. The results of these analyses are for planning purposes and do not affect the right of a water holder to divert and use the full amount of water authorized by its permit.

3.5.1 Angelina and Neches River Authority. ANRA has a state water right permit to construct Lake Columbia on Mud Creek in the Neches River Basin and divert 85,507 ac-ft per year. ANRA estimates that development of the lake could be complete by the year 2015. No currently available supply is shown since the reservoir is not constructed. The estimated firm yield using the modified Neches WAM Run 3 is 75,700 ac-ft per year.

3.5.2 Angelina-Nacogdoches Water Control Improvement District No 1. The A-N WCID No. 1 owns and operates Lake Striker in Rusk and Cherokee Counties. The firm yield from Lake Striker in 2010 is estimated at 20,183 ac-ft per year, which is expected to decrease to 16,050 ac-ft per year by 2060.

3.5.3 Athens Municipal Water Authority. Athens MWA has 8,500 ac-ft per year of water rights in Lake Athens. The firm yield of the lake using the modified Neches WAM Run 3 was estimated at 6,145 ac-ft per year in 2000. However, the intake structure for the fish hatchery does not allow the water level to drop below 431 feet msl and maintain inflow to hatchery. Using this operational constraint, the yield of Lake Athens is 2,900 ac-ft per year. The Athens MWA also has a wastewater reuse permit for 2,677 ac-ft per year, but the infrastructure is not in place to utilize this source. The City of Athens and Athens MWA continue to study indirect reuse as a supplement to the yield of Lake Athens.

3.5.4 City of Beaumont. The City of Beaumont obtains water from the Neches River and groundwater wells from the Gulf Coast Aquifer in Hardin County. The reliable surface water supplies are estimated at 32,111 ac-ft per year (ac-ft per year) based on the firm yield of the City's run-of-the-river water rights. The City's current water treatment system is rated for 40 MGD, limiting the available treated surface water to 22,420 ac-ft per year. The City currently uses about 10,000 ac-ft per year of groundwater with a current well capacity of about 23 MGD. However, due to limited aquifer availability, the estimated reliable groundwater supply for Beaumont is limited to 9,000 ac-ft per year. Considering both its groundwater and surface water sources the City's currently available treated water supplies total 31,420 ac-ft per year.

3.5.5 City of Carthage. The City of Carthage obtains its water from groundwater from the Carrizo-Wilcox Aquifer and surface water from Panola County FWSD. The City has a contract with Panola County FWSD for 12 MGD of water from Lake Murvaul. Considering its current water system capacities, the city of Carthage has approximately 6,400 ac-ft per year of reliable supply.

3.5.6 City of Center. The City of Center currently obtains water from Lake Center and Lake Pinkston for use within the City and for distribution to its municipal and industrial customers. The City owns and operates Lake Center, with a firm yield of 754 ac-ft of municipal water. Water from Lake Pinkston is pumped from the Neches River Basin to the City, located in the Sabine River Basin. The City holds rights to 3,800 ac-ft of water in Lake Pinkston. The total available supply for the City of Center is 4,554 ac-ft per year.

3.5.7 Houston County WCID No. 1. Houston County WCID No. 1's water rights to Houston County Lake include a right to divert 3,500 ac-ft per year at a rate not to exceed 6,300 gpm. Supplies to Houston County WCID No. 1 are limited to its permitted diversions.

3.5.8 City of Jacksonville. The City of Jacksonville obtains water supplies from Lake Jacksonville and the Carrizo-Wilcox Aquifer. The city holds 6,200 ac-ft per year in water rights in Lake Jacksonville. The firm yield of the lake exceeds the permitted diversions. The ability to use this water for municipal purposes is limited by the city's water treatment capacity (estimated at 5,173 ac-ft per year). The groundwater supplies are based on current well field production. The total supply available to Jacksonville is estimated at 7,391 ac-ft per year.

3.5.9 Lower Neches Valley Authority. The LNVA maintains water rights from Lake Sam Rayburn, Lake B.A. Steinhagen and Run-of-the-River diversion from the Neches River. LNVA's water rights total 1,173,876 ac-ft per year. The firm yield analyses using the modified Neches WAM Run 3 show that the full permitted amount is available, and there are also unpermitted supplies associated with the Sam Rayburn/ B.A. Steinhagen system. The LNVA currently possesses the infrastructure to divert these water rights to its municipal, manufacturing, mining and irrigation users.

3.5.10 City of Lufkin. The City of Lufkin presently obtains groundwater from the Carrizo-Aquifer in Angelina County. Supplies for the City of Lufkin are based on its present well field pumping capacity.

The City has recently purchased additional groundwater rights in the Carrizo-Wilcox Aquifer and the surface water rights in Lake Kurth that were held by Abitibi Bowater. The City is currently evaluating the infrastructure improvements needed to utilize these sources. Lufkin also has a water right for 28,000 ac-ft per year of water from Lake Sam Rayburn. Currently there are no transmission facilities to use this water.

3.5.11 City of Nacogdoches. The City of Nacogdoches obtains groundwater from the Carrizo-Wilcox aquifer and Lake Nacogdoches. The groundwater supply is based on the average annual current well field pumping capacity. The City currently has water rights to divert 22,000 ac-ft per year of water from Lake Nacogdoches. The modified Neches WAM Run 3 shows the current firm yield of this lake to be 17,450 ac-ft per year, and reducing to 15,150 ac-ft per year by 2060.

3.5.12 Panola County Freshwater Supply District No. 1. The Panola County FWSD 1 owns and operates Lake Murvaul in the ETRWPA. The estimated firm yield of Lake Murvaul using the modified Sabine WAM Run 3 is 22,380 ac-ft per year in year 2000, decreasing to 18,850 ac-ft per year by 2060.

3.5.13 City of Port Arthur. The City of Port Arthur receives raw water supply from the LNVA. Treated water is supplied to industrial users in addition to its citizens. It is assumed that LNVA will provide for 100% of the City's demands. The projected supply from LNVA is 15,846 ac-ft per year in 2010, increasing to 18,747 ac-ft per year by 2060.

3.5.14 Sabine River Authority. The SRA owns and operates Lake Tawakoni, Lake Fork, and the Toledo Bend Reservoir. In addition, the SRA maintains run-of-the-river rights from the Sabine in Newton and Orange County. The SRA provides water to municipal and industrial customers in Region C and Region D from Lake Fork and Lake Tawakoni, located outside of the ETRWPA. Water in the ETRWPA is provided from Toledo Bend Reservoir and diversions from the Sabine River through the SRA Canal System. SRA holds water rights of 238,100 ac-ft per year from Lake Tawakoni, 188,660 ac-ft per year from Lake Fork, 750,000 ac-ft per year from Toledo Bend Reservoir and

147,100 ac-ft per year from the Sabine River. The reliable supply from SRA's Lower basin sources (Toledo Bend Reservoir and Canal System) is approximately 1.3 million ac-ft per year.

3.5.15 City of Tyler. The City of Tyler receives raw water supply from Lake Tyler and Tyler East with a firm yield of 30,950 ac-ft per year. Supply from these reservoirs is limited to 23,541 ac-ft per year by the water treatment plant capacity. The City also has a contract with the Upper Neches River Municipal Water Authority for 60 MGD from Lake Palestine. The City of Tyler has constructed a 30 MGD treatment facility at the lake and currently can use 16,815 ac-ft per year from Lake Palestine. The City possesses water rights to Lake Bellwood; however, the raw water from this source is used directly by industry or for irrigation. Water is not treated by the City from this source. The City also obtains water from the Carrizo-Wilcox aquifer. The estimated reliable supply from groundwater is 4,340 ac-ft per year, which was reduced from its production capacity due to limited aquifer availability. Collectively, the City has a total of 44,696 ac-ft per year of treated water and an additional 950 ac-ft per year of raw water from Lake Bellwood.

3.5.16 Upper Neches River Municipal Water Authority. The UNRMWA maintains a total water right of 238,110 ac-ft per year for diversions from Lake Palestine and a downstream location at Rocky Point Dam. The UNRMWA operates these rights as a system. Available supply using the modified Neches WAM Run 3 is estimated at 209,500 ac-ft per year in year 2000, decreasing to 197,250 ac-ft per year by 2060.

3.6 Summary of Current Water Supply in East Texas Regional Water Planning Area

The projected overall reliable fresh water supply to the ETRWPA from current sources will be about 3 million ac-ft per year in 2060. (This figure does not consider supply limitations due to the capacities of current raw water transmission facilities and wells nor does it include brackish water sources). Approximately 85% of the supply is associated with in-region reservoirs and run-of-the river diversions. Nearly 15% of the supply is from groundwater. Very little supply is currently obtained from reuse.

There are some sources of supply that will not be utilized fully during the period covered by this plan. Others are fully utilized today, including groundwater from the Carrizo-Wilcox aquifer in Smith County and several smaller reservoirs.

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Chapter 4A

Comparison of Water Demands with Water Supplies to Determine Needs

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This report describes the comparison of estimated current water supply for drought of record conditions (from Chapter 3) and projected water demand (from Chapter 2). From this comparison, water shortages or surpluses under drought of record conditions have been estimated.

As discussed in Chapter 3, allocations of existing supplies were based on the most restrictive of current water rights, contracts, water treatment capacities, available yields for surface water, and production capacities for groundwater. The allocation process did not directly address water quality issues, which may impact the desirability or continued use of some water sources.

The comparison of current water supply and projected water demand in the ETRWPA is evaluated on a regional basis, by county, by WUG and by WWP. Section 4A.1 presents a regional comparison of current supply and projected demand. Section 4A.2 presents a county-by-county comparison of current supply and projected demand. Section 4A.3 presents the comparison of current supply and projected demand for each WUG. Section 4A.4 discusses shortages for the WWPs in the region. Analysis of demands related to future potential users or to demands on supplies located in the ETRWPA, to meet water management strategies outside the region are not discussed in this section of the report. The discussion of these items is included in Chapter 4C, specifically for the LNVA, UNRMWA, and SRA.

4A.1 Regional Comparison of Supply and Demand

Table 4A.1 and Figure 4A.1 summarize the comparison of total currently available water supply and total projected water demand for the ETRWPA. The region as a whole has a currently available surplus of 169,352 acre-feet per year (ac-ft per year) in 2010, changing to a shortage of nearly 3,000 ac-ft per year by 2050, and increasing to a shortage of 55,867 by 2060. The actual total shortages of individual WUGs are greater, totaling 182,145 ac-ft per year by 2060. The individual shortages by water user are discussed in Section 4A.3.

As shown on Figure 4A.1, the region has supplies available to meet these needs. Unconnected water supplies are identified by comparing the supplies available to each city and category to the current regional water supply sources. Excluding unpermitted reservoir yields and brackish water, the difference between the total supply reported in Chapter 3 and the supply available to WUGs is between 2.1 and 1.5 million ac-ft per year in each decade of the planning period (Figure 4A.1). Additional infrastructure and/or contracts are needed to utilize these sources.

Table 4A.1 Summary of Supply and Demand for the ETRWPA (ac-ft per year)

	2010	2020	2030	2040	2050	2060
Demands	730,912	1,083,549	1,277,416	1,340,598	1,411,268	1,490,596
Developed Supplies	900,264	1,177,716	1,360,070	1,387,636	1,408,409	1,434,729
Difference	169,352	94,167	82,654	47,038	-2,859	-55,867

Figure 4A.1 Comparison of Regional Water Supplies to Demands

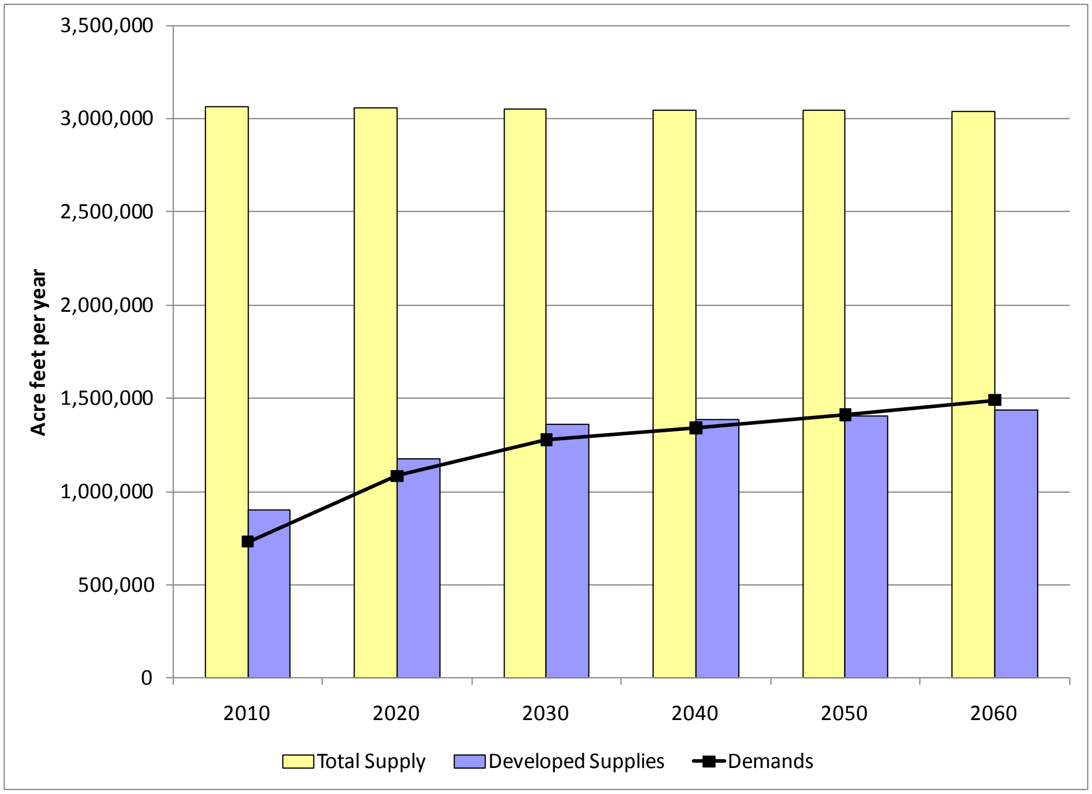
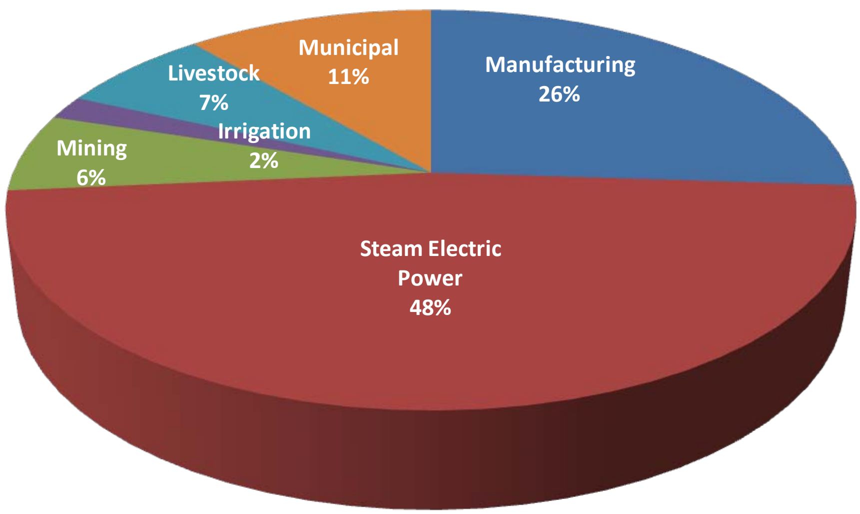


Table 4A.2 summarizes regional surpluses and shortages by category of water use. Figure 4A.2 summarizes regional surpluses and shortages by categoy of water use in 2060. On a regional basis, sufficient supplies exist for municipal and irrigation water uses. Regional shortages are identified for manufacturing, steam-electric power, mining and livestock. Most of the manufacturing shortages are the result of considerable growth in demands and supplies that are limited to existing contract amounts. The steam-electric power shortages are for projected growth that currently does not have an identified source or infrastructure. Mining shortages are largely associated with new mining demands associated with natural gas development and mining demands in Hardin County that are no longer substantiated based on current use. Livestock water use is also expected to grow in some counties, which will require the development of additional resources and/or infrastructure. Even though the municipal water use shows a net surplus in every decade of the planning period, there are individual cities that are projected to have shortages during the planning period.

Table 4A.2 Summary of Projected Surpluses or Shortages by Water Use Type (ac-ft per year)

Water Use Type	2010	2020	2030	2040	2050	2060
Municipal	68,710	58,979	51,784	44,944	33,189	17,291
Manufacturing	3,721	-11,014	-19,925	-29,031	-36,815	-45,647
Steam- Electric Power	35,136	3,158	-10,065	-26,187	-52,560	-76,515
Mining	-13,351	-28,677	-8,522	-9,385	-10,238	-10,935
Irrigation	72,533	72,135	71,769	71,376	70,943	70,467
Livestock	2,604	-414	-2,388	-4,679	-7,378	-10,528

Figure 4A.2 Distribution of Regional Shortages by Water Use in 2060



4A.2 Comparison of Supply and Demand by County

Table 4A.3 shows the projected surpluses and shortages by county for each decade of the planning period. In general, some shortages exist throughout the region. Twelve counties are identified with shortages over the planning horizon, with Anderson, Jefferson, Orange and Rusk Counties having the largest projected shortages by 2060. Table 4A.4 shows the projected surpluses or shortages as a percentage of demand. Anderson and Angelina Counties are expected to have the largest percent shortages (52 and 56 percent) in 2060, and Tyler County is expected to have the largest percentage surplus (48 percent) in 2060.

Table 4A.3 Comparison of Supply and Demand by County (ac-ft per year)

County	2010	2020	2030	2040	2050	2060
Anderson	4,230	-7,508	-9,688	-12,284	-15,428	-19,218
Angelina	-6,089	-18,070	-18,362	-23,058	-28,317	-34,632
Cherokee	4,788	3,373	4,595	4,393	4,065	3,532
Hardin	-5,080	-6,417	-7,120	-7,830	-8,645	-9,434
Henderson (P)	2,818	876	387	-89	-700	-1,455
Houston	2,012	1,536	973	370	-339	-1,154
Jasper	2,932	2,728	2,670	2,762	2,808	2,808
Jefferson	71,958	58,255	55,789	52,733	49,251	44,206
Nacogdoches	9,720	5,385	9,013	5,305	-6,827	-12,638
Newton	10,895	2,551	96	-2,930	-6,615	-11,096
Orange	19,110	13,537	6,890	141	-6,391	-13,947
Panola	4,321	4,028	3,849	3,686	3,512	3,252
Polk (P)	290	-75	-374	-602	-773	-959
Rusk	26,188	23,243	18,482	12,802	5,672	-3,305
Sabine	1,369	1,226	1,103	971	814	637
San Augustine	-1,419	-7,004	-104	-224	-380	-549
Shelby	1,059	-1,182	-1,072	-2,621	-4,504	-6,827
Smith (P)	17,874	15,669	13,707	11,744	8,163	3,167
Trinity (P)	128	94	90	73	50	25
Tyler	2,249	1,922	1,729	1,696	1,725	1,720

Note: The sum of needs by county shown in Table 4A.3 is based on total supplies to the county less the total county demands. The sum of the individual needs of water user groups within a county will differ. These needs are shown in Table 4A.5.

Table 4A.4 Surplus or Shortage as Percent of Demand by County (ac-ft per year)

County	2010	2020	2030	2040	2050	2060
Anderson	32%	-30%	-35%	-41%	-47%	-52%
Angelina	-19%	-41%	-41%	-47%	-52%	-57%
Cherokee	34%	23%	33%	30%	26%	21%
Hardin	-26%	-31%	-33%	-35%	-38%	-40%
Henderson (P)	42%	12%	5%	-1%	-9%	-17%
Houston	24%	18%	11%	4%	-3%	-10%
Jasper	4%	4%	4%	4%	4%	4%
Jefferson	21%	9%	7%	6%	6%	5%
Nacogdoches	41%	17%	32%	17%	-19%	-30%
Newton	121%	15%	0%	-13%	-25%	-36%
Orange	24%	16%	8%	0%	-6%	-12%
Panola	35%	31%	29%	27%	25%	22%
Polk (P)	12%	-3%	-12%	-19%	-23%	-27%
Rusk	76%	62%	44%	27%	10%	-5%
Sabine	50%	43%	37%	31%	25%	18%
San Augustine	-33%	-70%	-3%	-7%	-11%	-16%
Shelby	10%	-9%	-9%	-19%	-28%	-37%
Smith (P)	43%	36%	30%	25%	16%	6%
Trinity (P)	14%	10%	10%	8%	5%	3%
Tyler	73%	56%	48%	47%	48%	48%

4A.3 Comparison of Supply and Demand by Water User Group

The comparison of supply versus demands by user group for entities with shortages is presented in Table 4A.5. There are 68 WUGs with identified shortages that cannot be met by existing infrastructure and supply. These shortages total nearly 179,300 acre-feet per year by 2060.

Of the entities with shortages greater than 5,000 ac-ft per year, five are steam-electric power uses (Anderson, Jefferson, Nacogdoches, Newton and Rusk), one municipal user (Lufkin), manufacturing in Angelina and Orange County, mining in Hardin County and livestock in Shelby County.

Table 4A.5 Water User Groups with Projected Shortage (ac-ft per year)

Water User Group	2010	2020	2030	2040	2050	2060
Anderson County	**-18**	**-11,328**	**-13,269**	**-15,653**	**-18,556**	**-22,158**
County-Other	0	0	0	-10	-31	-132
Frankston	0	0	-6	-24	-40	-54
Mining	-18	-22	-45	-70	-95	-119
Steam Electric	0	-11,306	-13,218	-15,549	-18,390	-21,853
Angelina	**-9,383**	**-20,806**	**-20,557**	**-24,836**	**-29,598**	**-35,451**
County-Other	0	0	-20	-135	-349	-661
Diboll	-32	-187	-374	-618	-965	-1,441
Four Way WSC	0	0	0	0	0	-225
Hudson	0	0	-123	-360	-710	-1,174
Hudson WSC	0	0	0	-104	-367	-735
Livestock	0	0	0	-17	-52	-89
Lufkin	-3,244	-5,117	-6,057	-7,116	-8,416	-9,965
Manufacturing	-3,117	-10,513	-12,983	-15,486	-17,739	-20,161
Mining	-1,990	-3,989	0	0	0	0
Steam Electric	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000
Cherokee	**-490**	**-1,494**	**-40**	**-118**	**-233**	**-379**
Mining	-490	-1,494	0	0	0	-2
New Summerfield	0	0	-40	-76	-117	-165
Rusk	0	0	0	-42	-116	-212
Hardin	**-8,955**	**-9,931**	**-10,540**	**-11,148**	**-11,790**	**-12,317**
County-Other	-154	-263	-284	-305	-358	-431
Irrigation	-1,002	-1,002	-1,002	-1,002	-1,002	-1,002
Manufacturing	-27	-46	-63	-81	-97	-114
Mining	-7,772	-8,620	-9,191	-9,760	-10,333	-10,770
Henderson	**-75**	**-297**	**-636**	**-955**	**-1,361**	**-1,847**
Athens	0	-52	-70	-88	-117	-155
Brownsboro	0	0	0	0	0	-4
County-Other	-75	-216	-348	-479	-683	-964
Livestock	0	-29	-218	-388	-561	-724
Houston	**-642**	**-883**	**-1,396**	**-1,953**	**-2,567**	**-3,239**
Irrigation	-567	-667	-986	-1,334	-1,720	-2,146
Livestock	-72	-211	-403	-610	-835	-1,078
Manufacturing	-3	-5	-7	-9	-12	-15
Jasper	**-374**	**-470**	**-488**	**-430**	**-403**	**-403**
County-Other	-374	-470	-488	-430	-403	-403

Table 4A.5 Water User Groups with Projected Shortage (ac-ft per year)(cont'd)

Water User Group	2010	2020	2030	2040	2050	2060
Jefferson	**0**	**-13,426**	**-15,696**	**-18,464**	**-21,843**	**-25,960**
Mining	0	0	0	0	-5	-9
Steam Electric Power	0	-13,426	-15,696	-18,464	-21,838	-25,951
Nacogdoches	**-5,083**	**-7,183**	**-1,621**	**-3,476**	**-12,807**	**-15,905**
D&M WSC	0	0	-21	-70	-182	-310
Lilly Grove SUD	0	0	0	0	-221	-463
Livestock	0	0	-242	-559	-926	-1,347
Mining	-2,495	-6,993	0	0	0	0
Steam Electric Power	-2,588	-190	-1,358	-2,783	-11,241	-13,358
Swift WSC	0	0	0	-64	-237	-427
Newton	**-149**	**-264**	**-2,713**	**-5,734**	**-9,382**	**-13,805**
Manufacturing	-149	-264	-370	-477	-574	-667
Steam Electric Power	0	0	-2,343	-5,257	-8,808	-13,138
Orange	**-132**	**-5,136**	**-10,989**	**-16,789**	**-22,021**	**-27,894**
County-Other	-132	-93	-53	-7	0	-6
Manufacturing	0	-5,006	-10,855	-16,686	-21,863	-27,686
Mauriceville SUD	0	-37	-81	-96	-158	-202
Panola	**-96**	**-116**	**-132**	**-147**	**-161**	**-187**
Manufacturing	-96	-116	-132	-147	-161	-187
Polk	**-208**	**-481**	**-742**	**-950**	**-1,110**	**-1,277**
County-Other	-208	-417	-578	-681	-745	-828
Manufacturing	0	-64	-164	-269	-365	-449
Rusk	**0**	**0**	**0**	**-30**	**-1,561**	**-10,000**
Mining	0	0	0	-30	-60	-88
Steam Electric Power	0	0	0	0	-1,501	-9,912
Sabine	**-40**	**-92**	**-147**	**-210**	**-283**	**-367**
County-Other	-3	-12	-18	-24	-31	-43
Livestock	-37	-80	-129	-186	-252	-324
San Augustine	**-1,691**	**-7,269**	**-360**	**-465**	**-588**	**-723**
Irrigation	-100	-100	-100	-100	-100	-100
Livestock	-91	-169	-260	-365	-487	-621
Manufacturing	0	0	0	0	-1	-2
Mining	-1,500	-7,000	0	0	0	0

Table 4A.5 Water User Groups with Projected Shortage (ac-ft per year) (cont'd)

Water User Group	2010	2020	2030	2040	2050	2060
Shelby	**-1,403**	**-3,397**	**-3,085**	**-4,475**	**-6,200**	**-8,317**
County-Other	-126	-190	-244	-253	-288	-344
Livestock	-777	-1,707	-2,841	-4,222	-5,907	-7,961
Manufacturing	0	0	0	0	-5	-12
Mining	-500	-1,500	0	0	0	0
Smith	**-117**	**-317**	**-503**	**-807**	**-1,138**	**-1,627**
Bullard	0	-13	-42	-71	-124	-195
Community Water Company	-37	-88	-111	-132	-171	-227
Irrigation	-6	-36	-68	-100	-133	-168
Jackson WSC	0	0	-38	-83	-118	-157
Lindale Rural WSC	0	0	0	0	0	-73
Manufacturing	0	0	-6	-101	-182	-295
Mining	-47	-126	-159	-215	-255	-288
Whitehouse	-27	-54	-79	-105	-155	-224
Trinity	**0**	**0**	**0**	**-9**	**-32**	**-57**
County-Other	0	0	0	-9	-32	-57
Tyler	**0**	**-142**	**-239**	**-251**	**-232**	**-232**
County-Other	0	-142	-239	-251	-232	-232
Total	**-28,856**	**-83,032**	**-83,153**	**-106,900**	**-141,866**	**-182,145**

The steam-electric power shortages are due to increases in demand above current facilities generation capacities. Some of this demand is predicated on power facilities that are not going forward at this time, but have the potential for development in the future. The manufacturing shortages in Angelina and Orange Counties and livestock shortages in Shelby County are also due to increased demands above current facilities' supplies. The city of Lufkin shows a deficit beginning in 2010, which is due to the production capacities of their existing groundwater wells. The City has purchased additional groundwater rights and is also planning on developing surface water supplies from their water rights in Lake Kurth and Sam Rayburn Reservoir. These supplies will also be used to meet the manufacturing shortages in Angelina County.

In addition to these shortages, there are several near-term mining shortages associated with renewed interest in natural gas exploration in the Haynesville/ Bossier Shale in East Texas.

4A.4 Comparison of Supply and Demand by Wholesale Water Provider

The comparison of supply versus demands for each WWP is presented in Appendix 4A-A. Of these providers, five were identified with projected shortages in the ETRWPA over the planning cycle. The SRA will need to implement strategies to meet demands outside the region. The WWPs with shortages are shown in Table 4A.6 and discussed below.

In addition to these providers, there are several WWPs that are planning WMSs to increase the reliability of their supplies and to meet the needs of potential future customers. These providers and the recommended strategies are discussed in Chapter 4C.

Table 4A.6 Wholesale Water Providers with Projected Shortages for Current Customers (ac-ft per year)

Water Provider	2010	2020	2030	2040	2050	2060
ANRA	-53,870	-53,870	-53,870	-53,870	-53,870	-53,870
Athens MWA	0	-2,984	-3,602	-4,303	-5,219	-6,351
Houston County WCID 1	-194	-218	-238	-257	-277	-301
Lufkin	-8,294	-16,918	-19,664	-22,694	-26,189	-30,162
UNRMWA	-2,677	-4,708	-6,740	-8,773	-10,808	-12,843

Note: The shortages shown above are for current customers only. Potential future customers may place additional demands on these providers.

4A.4.1 Angelina and Neches River Authority. ANRA is projected to have a shortage of 53,870 ac-ft per year. ANRA has contractual demands for water from Lake Columbia that are estimated to begin by 2020 (assuming that Lake Columbia is completed by 2020). ANRA has no currently available water supply to meet these contractual demands. The potential management strategy to meet this shortage is the construction of Lake Columbia.

4A.4.2 Athens Municipal Water Authority. The maximum projected shortage for Athens MWA is 6,351 ac-ft per year. Most of this shortage is associated with operational constraints of Lake Athens for the Athens Fish Hatchery. Several water management strategies are being considered for Athens MWA to meet this need, including reuse from return flows from the Athens Fish Hatchery, obtaining water from Forest Grove Reservoir and developing groundwater supplies from the Carrizo-Wilcox aquifer.

4A.4.3 City of Lufkin. The City of Lufkin is projected to have a water shortage under drought of record conditions of 8,294 ac-ft per year beginning in Year 2010, growing to 30,162 ac-ft per year for Year 2060. Much of the projected shortages are associated with increased demands for manufacturing needs and local growth. The City currently has a three-part plan to address these needs.

4A.4.4 Houston County Water Control and Improvement District No. 1. Houston County WCID 1 has contractual demands that exceed its permitted supply from Houston County Lake. Houston County WCID 1 is currently seeking a permit amendment to increase the permitted diversions from this source.

4A.4.5 Upper Neches River Municipal Water Authority. The UNRMWA has contractual demands that exceed the reliable supply from its Lake Palestine system. The long-term strategy to meet these demands and other potential future demands is to develop additional supplies in the Neches River basin.

4A.5 Socioeconomic Impacts of Not Meeting Needs

Administrative Rules in 31 TAC §357.7 require regional planning groups to evaluate socioeconomic impacts of not meeting water needs as part of the regional planning process. Rules direct the TWDB to provide technical assistance upon request for water supply and demand analysis, including methods to evaluate the social and economic impacts of not meeting needs. The ETRWPG convened February 17, 2010, and directed Chairman Kelley Holcomb to write an official request for technical assistance from the TWDB. The official request was sent to the TWDB February 26, 2010, and is provided as correspondence in Appendix 2-A.

The TWDB prepared a report entitled *Socioeconomic Impacts of Projected Water Shortages for the East Texas Regional Water Planning Area (Region I).* The report assessed the economic impacts of not meeting water demands for agricultural, municipal, and industrial users, and assessed the social impacts of water shortages. The TWDB implemented a methodology consistent between all planning regions. The report is presented in Appendix 4A-B.

Economic impact was primarily gauged by change in gross state product, which is income plus state and local business taxes. The following is a summary of economic impacts of not meeting water demands in the ETRWPA.

- Agricultural Shortages Impacts – Irrigation
  - Shortages in Hardin, Houston, San Augustine, and Smith Counties.
  - Shortages amount to a reduction in gross state product of less than $1 million per year for each decade throughout planning horizon.
- Agricultural Shortages Impacts – Livestock
  - Shortages in Angelina, Henderson, Houston, Nacogdoches, Sabine, San Augustine, & Shelby Counties.
  - Shortages amount to a reduction in gross state product of $14 million per year in 2010, and $551 million in 2060.
- Municipal Shortages Impacts:

- Estimated economic value of domestic water shortages total $19 million in 2010 and $157 million in 2060.
- Shortages would reduce gross state product by $34 million in 2020, and $162 million in 2060.

- Manufacturing Shortages Impacts:
  - Shortages expected in Angelina, Henderson, Nacogdoches, Sabine, San Augustine, and Shelby Counties.
  - Reduction in gross state product by an estimated $41 million in 2010 and $1.2 billion in 2060.
- Mining Shortages Impacts:
  - Shortages in Angelina, Jefferson, Nacogdoches, Newton, San Augustine, & Rusk Counties
  - Reduction in gross state product by an estimated $1.2 billion in 2010, and $900 million in 2060.
- Steam-Electric Shortages Impacts:
  - Shortages in Anderson, Angelina, Jefferson, Nacogdoches, Newton, and Rusk Counties
  - Reduction in gross state product by an estimated $119 million in 2020, and $3.7 billion in 2060.

The TWDB also analyzed the social impacts of water shortages. Examples of social effects associated with drought or water shortages include changes in population and consequently school enrollment, loss of jobs, conflicts between water users, health-related low-flow problems, public safety issues, and loss of aesthetic property values.

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Chapter 4B

Types of Water Management Strategies

This section provides a review of the types of water management strategies considered for the ETRWPA. Included is a summary of the application of each strategy to meet the needs during the planning period. Chapter 4C provides a summary of the strategies considered for each WUG on a county basis and provides the costs for the strategies. WMSs considered include water conservation and drought management, wastewater reuse, expanded use of existing supplies, new supply development and interbasin transfers. WMSs to meet potential future demands, not presently approved by the TWDB, or those that require supply strategies within the ETRWPA to meet demands in other regions are not included. Details of these strategies are included under the discussion for wholesale water providers in Chapter 4C, specifically for the LNVA, UNRMWA, and SRA.

The ETRWPG evaluated WMSs available to meet the demands in the ETRWPA. The strategies considered include the following:

- Water conservation and drought management
- Wastewater reuse
- Expanded use of existing supplies
  - System operation,
  - Conjunctive use of groundwater and surface water,
  - Reallocation of reservoir storage
  - Voluntary redistribution of water resources
  - Voluntary subordination of water rights
  - Yield enhancement
  - Water quality improvements

- New supply development
  - Surface water resources
  - Groundwater resources
  - Brush control
  - Precipitation enhancement
  - Desalination
  - Water right cancellation
  - Aquifer storage and recovery
- Interbasin transfers

The screening criteria developed by the ETRWPG is provided in Appendix 4B-A.

4B.1 Water Conservation and Drought Management

Water conservation is defined as methods and practices that either reduce the demand for water supply or increase the efficiency of the supply or use so that available supply is conserved and made available for future use. Water conservation is typically a non-capital intensive alternative, although costs to individual customers can be significant (e.g., purchase costs for water-efficient appliances). All water supply entities and some major water right holders are required by regulations to have a Drought Contingency and Water Conservation Plan. These plans must detail the entity's procedures for reducing water demand at times when the demand threatens the total capacity of the water supply delivery system or when overall supplies are low.

If strong conservation measures are taken early in a drought and assumed in the planning stages, there is little or no flexibility remaining, should the drought exceed the conservation assumed during planning. The ability to adopt measures more stringent than planned could be limited in times of emergency.

4B.1.1 Regional Considerations. The water demand projections developed in Chapter 2 assume that approved conservation plans are in place and effective for all entities. The savings in water, associated with reduction in per capita usage attributed to the conservation measures, is estimated to be 20,600 ac-ft per year in 2060. Each entity has varying amounts of additional demand reduction included in the future demand projections described in Chapter 2. The assumed reductions tended to increase for future projections. Conservation activities that were assumed to be in place for the projections included:

- Water-efficient plumbing fixtures consistent with the State Water Efficient Plumbing Act of 1991;
- More thorough use of leak detection processes;
- More widespread use of water efficient appliances;

Water conservation actions implemented as strategies would result in savings above that assumed for the TWDB projections. The Texas Water Development Board Report 362, published by the Water Conservation Implementation Task Force in November 2004, provides a review of best management practices for water conservation for municipal, industrial and agricultural water users. Water conservation strategies, using the guidelines in TWDB Report 362, were evaluated for water users that demonstrated needs in the planning period and met the following conditions:

- Municipal users with current per capita water use greater than 140 gpcd,
- Municipal users that have industrial, commercial and institutional customers that account for more than 20% of the city's total water use,
- Manufacturing users located in counties where manufacturing use is greater than 1,000 ac-ft per year or with an identifiable industry with water use greater than 500 ac-ft per year.

Water conservation strategies for other users (irrigation, steam-electric, livestock and mining) were not developed. These users comprise between 25% to 33% of the total water demand in the ETRWPA during the planning period. Water conservation has recently begun to be utilized in irrigation of rice in one area of the ETRWPA. The water conservation efforts were driven by economic reasons (i.e., billing of water used from metered flow as opposed to acreage farmed). The financial incentive has led to four conservation measures being implemented; irrigation scheduling, field maintenance, land leveling and tailwater recovery. Metering began in 2004, however, it was not until 2005 that billing on the amount metered was implemented. Comparison of the two years indicated average water consumption to be reduced from 3.79 ac-ft per acre farmed to 2.84 ac-ft per acre farmed. The demand for steam-electric use is projected to grow from 4% to 12% of the demand during the 50-year period. The projections for steam-electric use were provided by the TWDB. Most of the demand will be consumed by new projects, which include conservation in the projected water use. Livestock and mining comprise a total of 4% to 5% of the demand. The cost of water in these industries comprises a small percentage of the overall business cost and it is not expected these industries will see an economic benefit to water conservation

4B.1.2 Selected Water Conservation Strategies. The following are selected water conservation strategies for municipal and manufacturing users.

Municipal Water Conservation Strategies. Water conservation strategies were evaluated for those municipal users showing a need during the planning period and have a per capita water use greater than 140 gpcd. Entities with this type of use customarily have larger commercial and industrial users in relation to the general population. Water conservation practices evaluated included public and school education, water conservation pricing, and passive implementation of new water conserving clothes washing machines. Public and school education would involve providing formal and indirect means of information on how to conserve water. Water conservation pricing requires an increasing rate structure with increasing use. The effectiveness of this measure is, in part, determined by whether water conservation pricing is currently implemented. The passive implementation of new water conserving clothes washing machines is the natural replacement of clothes washers with time.

Education costs were applied to all of the entities meeting the above criteria. Assumptions made in evaluating the efficiency of this measure included restrictions that the annual budget spent on education would be limited to approximately $1.00 per capita or per 1,000 gallons water conserved, whichever was most restrictive. The total budget available will be an indication as to the effectiveness of the program. Table 4B.1 indicated efficiencies assigned to various ranges of available budget.

Table 4B.1 Water Conservation Efficiencies

Budget		Efficiency of Conservation
Low	**High**	
$1,500 (minimum)	$9,999	1.5%
$10,000	$19,999	2.0%
$20,000	$29,999	2.5%
$30,000	$40,000 (maximum)	3.0%

Water conservation pricing will be most effective in areas where groundwater resources are becoming less available and requires high expenditures in capital projects to supply water. Only those entities meeting the above criteria and located in counties that are reaching the limits of groundwater were considered for this strategy. Where the recommended strategies were less than $1.00 per 1,000 gallons the efficiency achieved is assumed to be 1.0%. A 2.0% efficiency is assumed where the recommended strategy exceeds $1.00 per 1,000 gallons.

Implementation of the passive clothes washer strategy was limited to areas where the recommended strategy exceeds $1.00 per 1,000 gallons. The assumptions made in this strategy include a replacement rate of 7.7% per year with a total saving of 5.6 gpcd where installed. Details of municipal conservation strategies are provided in Appendix B. The total savings in water during the planning period for the selected entities is provided in Table 4B.2.

Table 4B.2 Water Conservation Savings for Selected Entities

Entity (County)	Amount Conserved (ac-ft per year)					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Frankston (Anderson)			6	7	8	9
Diboll (Angelina)	11	20	26	34	53	72
Lufkin (Angelina)	50	117	189	249	319	408
New Summerfield (Cherokee)		10	18	21	23	26
Rusk (Cherokee)				51	66	76
Lumberton/Lumberton MUD (Hardin)	76	116	146	167	190	215
Athens(Henderson)	1	6	12	17	22	30
County-Other (Henderson)	31	57	74	92	108	129
Kirbyville (Jasper)	3	4	5	6	7	7
Appleby WSC (Nacogdoches)				22	39	62
Nacogdoches (Nacogdoches)		229	425	514	654	787
Center (Shelby)	15	34	47	60	67	75
Bullard (Smith)		3	4	5	6	8
Lindale Rural WSC (Smith)			5	7	9	12
Tyler (Smith)	301	526	772	1,036	1,234	1,344
TOTAL	**488**	**1,122**	**1,729**	**2,288**	**2,805**	**3,260**

Water conservation strategies for municipal users that have industrial, commercial and institutional customers that account for more than 20% of the city's total water use were not considered individually. The water conservation strategies for this group are evaluated under conservation strategies considered for the manufacturing user group.

Manufacturing Water Conservation Strategies. The criteria for evaluating water conservation measures in manufacturing uses was limited to counties showing a need in this sector during the planning period with use greater than 1,000 ac-ft per year or with an identifiable industry with water use greater than 500 ac-ft per year. The counties meeting these criteria include Angelina, Nacogdoches, Newton, Orange and Polk. The distribution, by the general category of manufacturing use, on a county basis is provided in Table 4B.3.

Table 4B.3 Manufacturing Water Conservation

County	Manufacturing Type			
	Timber/Paper	Food	Manufacturing	Petrochemical
Angelina	90%	7%	3%	
Nacogdoches	7%	81%	12%	
Newton	100%			
Orange	40%		2%	58%
Polk	100%			

There are readily available supplies of water to meet manufacturing needs in Newton, Orange and Polk counties. Development of water management strategies for Angelina and Nacogdoches will require more intense planning. The timber and paper industries in Angelina County, for the most part, provide their own ground or surface water. Any conservation measures will more than likely be based on economic justification to expand plant capacity and will not affect water availability to the region as a whole. The remaining industries, food and manufacturing facilities in Angelina and Nacogdoches Counties, should be considered for water conservation. The majority of the water in these sectors is supplied by municipal suppliers that face the needs for major WMSs.

TWDB Report 362 lists fourteen best management practices for industrial users. Application of each of the practices to the food and manufacturing industries in Angelina and Nacogdoches Counties is not practical at this time. However, the industrial water audit practice is a feasible alternative to consider for implementation. The TWDB Report 362 determined that an audit should result in savings of 10 to 35 percent if an audit has not been performed. Table 4B.4 indicates the expected savings of implementation of this water conservation strategy is based on a savings of 10 percent.

Table 4B.4 Manufacturing Water Conservation Savings (ac-ft per year)

County	Demand or Savings					
	2010	2020	2030	2040	2050	2060
Angelina						
Total Demand	30,266	34,359	37,982	41,642	44,887	48,356
Food & Manufacturing Demand	3,066	7,159	10,782	14,442	17,687	21,156
Water Conservation Savings	307	716	1,088	1,444	1,769	2,116
Nacogdoches						
Total Demand	2,288	2,553	2,786	3,016	3,214	3,468
Food & Manufacturing Demand	2,118	2,383	2,616	2,846	3,044	3,298
Water Conservation Savings	212	239	262	285	304	330

Water Conservation Environmental Issues. No substantial environmental impacts are anticipated, as water conservation is typically a non-capital intensive alternative that is not associated with direct physical impacts to the natural environment. A summary of the few environmental issues that might arise for this alternative are presented in Table 4B.5.

Table 4B.5 Potential Environmental Issues Associated with Water Conservation

Environmental Issue	Evaluation Result
Implementation Measures	Voluntary reduction, water pricing, city drought contingency plans
Environmental Water Needs/Instream Flows	No substantial impact identified, assuming relatively low reduction in diversions and return flows: substantial reductions in municipal and industrial diversions from water conservation would result in possibly low to moderate positive impacts as more stream flow would be available for environmental water needs and instream flows.
Bays and Estuaries	No substantial impact identified, assuming relatively low reduction in diversions and return flows.
Fish and Wildlife Habitat	No substantial impact identified, assuming relatively low reductions in diversions and return flows; possible low to moderate positive impact to aquatic and riparian habitats with substantial reductions as more stream flow would be available to these habitats.

Table 4B.5 Potential Environmental Issues Associated With Water Conservation (Cont.)

Environmental Issue	Evaluation Result
Cultural Resources	No substantial impact anticipated
Threatened and Endangered Species	No substantial impact identified, assuming relatively low reduction in diversions and return flows; possible low to moderate positive impact to aquatic and riparian threatened and endangered species (where they occur) with substantial diversion reductions.
Comments	Assumes no substantial change in infrastructure

Water Conservation Cost Considerations. Since water conservation plans are required for each community, regular costs for implementing and enforcing a general conservation program were not estimated. Only the efforts needed to enforce a more stringent conservation plan over and above that assumed in the projections were studied. The only strategy that created a direct cost on the entity is school and public education.

Water Conservation Implementation Issues. Water conservation as a water supply option has been compared to the plan development criteria, as shown in Table 4B.6. Based on the table, it is evident that water conservation meets the evaluation criteria.

Table 4B.6 Water Conservation Evaluation

Impact Category	Comment(s)
A. Water Supply: 1. Quantity 2. Reliability 3. Cost	1. Limited. 2. Variable, dependent on public acceptance. 3. Reasonable.
B. Environmental Factors 1. Environmental Water Needs 2. Habitat 3. Cultural Resources 4. Bays and Estuaries	1. None or low impact. 2. No apparent negative impact. 3. None. 4. None or low impact.
C. Impact on Other State Water Resources	No apparent negative impacts on state water resources, no effect on navigation.
D. Threats to Agriculture and Natural Resources	None
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	Not applicable

4B.2 Wastewater Reuse

Wastewater reuse utilizes treated wastewater effluent as either a replacement for a potable water supply or involves the treatment of wastewater to parameters that allows it to be returned to the water supply resource.

There are no wastewater reuse strategies defined for the ETRWPA. While Athens MWA has received a reuse permit that allows the City of Athens to discharge its wastewater effluent to Lake Athens, the City and MWA have decided not to pursue this strategy at this time due to costs. Athens MWA is pursuing entering into a contract with the Athens Fish Hatchery to return water that is passed through its facility back to Lake Athens. Currently, the hatchery does return this water as part of its operations, but it is under no contractual obligations to do so.

4B.3 Expanded Use of Existing Supplies

Expanded use of existing supplies includes additional use from existing groundwater and local sources and voluntary redistribution of water resources.

4B.3.1 Expanded Use of Groundwater. Groundwater is still a viable and cost-effective supply of water for the ETRWPA. Approximately 60 percent of WUGs with a need during the planning period are expected to continue using groundwater as a source of new supplies. The supplies established in Chapter 3, Section 3.1 were used to evaluate the ability to meet demands for the ETRWPA. Where needs are shown for unspecified users such as irrigation and livestock, the expansion of groundwater use was evaluated on the same percentage usage of existing supplies. Counties that are near capacity in utilizing the groundwater resources are Angelina, Cherokee, Hardin, Nacogdoches, Orange, Shelby and Smith. Evaluation of the expanded use of groundwater is presented by aquifer and county in Tables 4B.7-11.

Table 4B.7 Water Management Strategies Utilizing Gulf Coast Aquifer

Entity	Projected Additional Groundwater Demand (ac-ft per year)					
	2010	2020	2030	2040	2050	2060
Hardin County						
County-Other	154	306	306	306	459	459
Manufacturing	114	114	114	114	114	114
Jasper County						
County-Other	632	632	632	632	632	632
Jefferson County						
Mining	0	0	0	0	5	9
Newton County						
Manufacturing	400	400	400	800	800	800
Orange County						
County-Other	140	140	140	140	140	140
Mauriceville WSC	0	203	203	203	203	203
Polk County						
County-Other	208	417	624	832	832	832
Tyler County						
County-Other	0	251	251	251	251	251
Woodville	0	300	300	300	300	300

Table 4B.8 Water Management Strategies Utilizing Carrizo-Wilcox Aquifer

Entity	Projected Additional Groundwater Demands (ac-ft per year)					
	2010	2020	2030	2040	2050	2060
Anderson County						
County-Other	0	0	0	100	100	100
Frankston	0	0	120	120	120	120
Mining	18	120	120	120	120	120
Angelina County						
Hudson WSC	0	0	600	600	2000	2000
Lufkin	4650	4650	4650	4650	4650	4650
Steam Electric	1000	1000	1000	1000	1000	1000
Cherokee County						
New Summerfield	0	0	121	242	242	242
Rusk	0	0	0	0	212	212
Henderson County						
County-Other	50	50	50	50	50	50
Athens MWA		1,400	1,400	1,400	1,400	1,400
Houston County						
Irrigation	766	1,149	1149	1,629	1915	2298
Livestock	211	211	422	633	844	1080
Nacogdoches County						
D&M WSC	0	0	310	310	310	310
Livestock	0	0	322	644	966	1350
Swift WSC	350	350	350	350	350	350
Rusk County						
Mining	0	0	0	158	158	158
Sabine County						
County-Other	32	32	32	64	64	64
Livestock	50	50	50	100	100	100
San Augustine County						
Irrigation	100	100	100	100	100	100
Livestock	150	150	250	300	400	400
Shelby County						
County-Other	100	200	300	300	350	350
Livestock	1500	2500	3000	3000	3500	3500
Smith County						
Bullard	0	100	100	100	200	200
Lindale Rural WSC	0	0	0	0	0	80

Table 4B.9 Water Management Strategies Utilizing Queen City Aquifer

Entity	Projected Additional Groundwater Demands (ac-ft per year)					
	2010	2020	2030	2040	2050	2060
Anderson County						
County-Other	0	0	0	0	0	100
Henderson County						
County-Other	50	50	50	100	200	500
Smith County						
Irrigation	40	40	80	120	168	168
Mining	47	141	188	235	282	329

Table 4B.10 Water Management Strategies Utilizing Yegua-Jackson Aquifer

Entity	Projected Additional Groundwater Demands (ac-ft per year)					
	2010	2020	2030	2040	2050	2060
Angelina County						
County-Other	0	0	150	150	300	300
Diboll	600	600	600	600	600	600
Trinity County						
County-Other	0	0	0	60	60	60

Expanded Use of Groundwater Environmental Issues. Consideration was given to limiting supply availability to the amount of groundwater that could be withdrawn from the aquifers over the planning period that will not cause more than 50 feet of water level declines, or 10% reduction in saturated thickness whichever is less.

Table 4B.11 Potential Environmental Issues Associated With Increased Use of Groundwater

Environmental Issue	Evaluation Result
Implementation Measures	Local impact resulting from development of well fields, storage facilities, pump stations and pipelines.
Environmental Water Needs/Instream Flows	Potential increase in return flows to streams.
Bays and Estuaries	No substantial impact identified
Fish and Wildlife Habitat	No substantial impact identified
Cultural Resources	No substantial impact anticipated
Threatened and Endangered Species	No substantial impact identified.

Expanded Use of Groundwater Cost Considerations. Cost considerations are affected by the distance from development of wells to the need for the water. Facilities requiring capital investment include wells, pipelines, pump stations and storage. Some wells may require minor treatment.

Expanded Use of Groundwater Implementation Issues. This water supply option has been compared to the plan development criteria, and how the option meets each criterion as shown in Table 4B.12.

Table 4B. 12 Comparison of Wastewater Reuse Option to Plan Development Criteria

Impact Category	Comment(s)
A. Water Supply: 1. Quantity 2. Reliability 3. Cost	 1. Sufficient to meet needs 2. High reliability 3. Moderate
B. Environmental Factors 1. Environmental Water Needs 2. Habitat 3. Cultural Resources 4. Bays and Estuaries	 1. Low impact 2. Low impact 3. Low impact 4. Negligible impact
C. Impact on Other State Water Resources	No apparent negative impacts; no effect on navigation.
D. Threats to Agriculture and Natural Resources	None
E. Equitable Comparison of Strategies Deemed Feasible	Option considered to meet demands of all user groups except Steam-Electric
F. Requirements for Interbasin Transfers	None
G. Third Party Social and Economic Impacts from Voluntary Redistribution	None

4B.3.2 Voluntary Redistribution For the purpose of the 2011 Plan, "voluntary redistribution" is defined as an entity in possession of water rights or water purchase contracts freely selling, leasing, giving, or otherwise providing water to another entity. Typically, the entity providing the water has determined that it does not need the water for the duration of the transfer. The transfer of water could be for a set period of years or a permanent transfer. Voluntary redistribution is essentially a water purchase.

Voluntary redistribution has many benefits over other supply options because it can be much easier than implementing a new reservoir project, it typically costs less than large capital projects, and it avoids implementation issues of new reservoir projects such as environmental and local impacts. Most importantly, redistribution of water makes use of existing resources and provides a more immediate source of water.

Entities that have the potential to meet demands through voluntary redistribution, either by having available supplies or currently providing needs through voluntary redistribution and having the ability to obtain new supplies were identified. It is important to remember that redistribution of water is voluntary. No group or individual is required to participate. Therefore, other strategies should be identified for groups relying on redistribution where the supply would place a burden on the distributor. A discussion of entities considered as potential suppliers of voluntary redistribution is provided below.

Voluntary Redistribution Strategies. Table 4B.13 includes a list of needs met by voluntary redistribution.

Table 4B.13 Needs Met by Voluntary Redistribution

Water Provider	Entity with Need	Water Supply (ac-ft per year)					
		2010	2020	2030	2040	2050	2060
City of Palestine (Lake Palestine)	Steam-Electric (Anderson County)		21,853	21,853	21,853	21,853	21,853
City of Lufkin (Lake Kurth, Sam Rayburn)	County-Other (Angelina County)	0	0	1,100	1,100	1,100	1,100
	Four Way WSC	0	0	0	0	0	225
	Diboll	800	800	800	800	1,600	1,600
	Manufacturing (Angelina County)	6,800	12,800	12,800	14,100	16,800	18,800
LNVA	Mining (San Augustine)	1,000	6,500	0	0	0	0
	Steam-Electric (Jefferson)	0	25,951	25951	25951	25951	25951
Athens MWA	City of Athens (Neches)	0	46	58	71	95	125
	Irrigation (Henderson)	0	70	83	95	108	121
UNRMWA	County-Other (Henderson County)	0	150	200	300	400	500
SRA	Steam-Electric (Newton)	0	0	15,000	15,000	15,000	15,000
	Manufacturing (Orange)	5,000	15,000	20,000	25,000	30,000	30,000
	Steam-Electric (Rusk)	0	0	0	0	1500	1500
	County-Other (Shelby)	150	150	150	150	150	150
	Livestock (Shelby)	0	0	0	4,000	4,000	4,000
	Mining (Shelby)	250	1250	0	0	0	0
City of Carthage	Manufacturing (Panola)	96	116	132	147	160	187
City of Tyler	Community Water Company	121	121	121	227	227	227
	Manufacturing (Smith)	0	0	294	294	294	294
	Whitehouse	27	0	0	0	0	0
City of Center	County-Other (Shelby County)	50	50	50	50	50	50
Houston County WCID	Manufacturing (Houston)	0	30	30	30	30	30
	Steam-Electric Power (Nacogdoches)	0	340	340	340	340	340
Hudson WSC	Hudson	0	0	125	400	800	1,200

*Alternative strategy

Voluntary Redistribution Environmental Issues. No significant environmental impacts are anticipated, as available water resources identified for this option are supplied through existing reservoirs or groundwater sources. A summary of the few environmental issues that might arise for this alternative are presented in Table 4B.14.

Table 4B.14 Potential Environmental Impacts Associated With Voluntary Redistribution

Environmental Issues	Evaluation Result
Implementation Measures	Terms of contract addressed on a case by case basis. Potential construction of treatment and distribution infrastructure.
Environmental Water Needs/Instream Flows	No substantial impact identified.
Bays and Estuaries	No substantial impact identified
Fish and Wildlife Habitat	Impact dependent on location and size of project.
Cultural Resources	Impact dependent on location and size of project.
Threatened and Endangered Species	Impact dependent on location and size of project.

Voluntary Redistribution Cost Considerations. Potential costs of purchasing and using water available from voluntary redistribution are listed below:

- Cost of raw water;
- Treatment costs;
- Conveyance costs;
- Additional costs required by water supplier.

Voluntary Redistribution Implementation Issues. This water supply option has been compared to the plan development criteria, as shown in Table 4B.15.

An issue facing redistribution is proper compensation for the entity or individual that owns the water right or contract for water. If an entity has arranged through contracts to have more water than they currently need or may need in the study period, they should be compensated for the expense and upkeep of any facilities already in place.

Table 4B.15 Comparison of Voluntary Redistribution Option to Plan Development Criteria

Impact Category	Comment(s)
A. Water Supply: 1. Quantity 2. Reliability 3. Cost	1. Significant quantity available in parts of the Region 2. High Reliability 3. Low to moderate
B. Environmental Factors 1. Environmental Water Needs 2. Habitat 3. Cultural Resources 4. Bays and Estuaries	1. No impact identified. 2. Low impact in areas of construction. 3. Possible low impact. 4. No substantial impact
C. Impact on Other State Water Resources	No apparent negative impacts, no effect on navigation.
D. Threats to Agriculture and Natural Resources	No impact identified.
E. Equitable Comparison of Strategies Deemed Feasible	Considered to meet the needs of all user groups.
F. Requirements for Interbasin Transfers	Not applicable
G. Third Party Social and Economic Impacts from Voluntary Redistribution	

The following issues should be considered when negotiating a voluntary redistribution agreement:

- Quantity of water to be redistributed;
- Location of excess water supply;
- Location of buyer with water need;
- Necessary water treatment and distribution facilities;
- Determination of fair market value;
- Consideration of how existing contracts will affect the sale or lease;

- Length of agreement;
- Expiration dates of agreement;
- Drought contingencies;
- Protections needed by entity providing water;
- Protections needed by entity needing water;
- Enforcement of protections, and
- Other conditions specific to buyer and seller.

4B.3.3 Expanded Local Supplies. Expansion of existing supplies involves the development of supplies currently being used near the source of demand, usually groundwater or local supplies (supply ponds). The WUGs that would implement this strategy are limited to irrigation, livestock and mining. The implementation of this strategy involves the assumption that the future needs will be filled by the same percentage usage of current supplies. Where groundwater is being used as a current supply, the additional usage has been included with the increase in use of groundwater. The analysis contained in this section is limited to sources other than groundwater. The WUGs that would implement this strategy are included in Table 4B.16.

Table 4B.16 Water User Groups Utilizing Expanded Local Supplies

Entity	Project Supply Demand (ac-ft per year)					
	2010	2020	2030	2040	2050	2060
Livestock – Sabine County	50	100	107	200	210	300
Livestock – San Augustine County	0	0	0	0	0	300
Livestock – Shelby County (Sabine Basin)	0	0	500	500	500	500

Expanded Local Supplies Environmental Issues. The expansion of local supplies is very limited in volume and geographic area. Impacts of this WMS on the environment are expected to be negligible.

Expanded Local Supplies Cost Consideration. Costs will vary with each project. This strategy involves development of additional stock ponds for livestock and costs are generally low.

Expanded Local Supplies Implementation Issues. Implementation issues associated with expansion of local supplies are not anticipated.

4B.4 New Reservoirs

Major water providers in the ETRWPA have performed numerous studies on locations of reservoir sites. The ETRWPA possesses many features attractive to reservoir construction. The process of implementing a new reservoir is a multi-decade task of identifying, evaluating, and resolving environmental impacts associated with the reservoir, and evaluating the economic feasibility of the project. These studies are beyond the scope of regional water planning. The process of implementation can go beyond the 50-year planning cycle in the current water planning process. The consideration of reservoir projects in the ETRWPA is based on major water providers located in the ETRWPA presenting information to the ETRWPG that demonstrates their ability and willingness to serve needs in the 50-year planning cycle. For proposed reservoirs, justification and environmental impacts analyses are the responsibility of the sponsoring major water provider.

One new reservoir is recommended as potential strategies for the needs in the current planning cycle: Lake Columbia is located predominantly in Cherokee County but extends into the southern portion of Smith County. The reservoir would be formed by construction of a dam on Mud Creek approximately 2.5 miles downstream of U.S. Highway 79 crossing. The dam is expected to impound water approximately 14 miles upstream with an estimated surface of 10,133 acres. The firm yield for the reservoir site is 75,700 ac-ft with a total storage volume at normal pool elevation of 315 feet, msl or 195,500 ac-ft.

Lake Fastrill was a recommended strategy in the 2007 State Water Plan; however, due to the designation of the Neches River National Wildlife Refuge the sponsors of this project are considering alternative strategies. One alternative is the Neches River Run-of-the-River Diversion. This strategy would include the construction of several off-channel storage reservoirs, which would be located on tributaries of the Neches River in Anderson and Cherokee Counties downstream of Lake Palestine and upstream of the Weches Dam Site. With a total storage capacity of about 540,000 ac-ft, the firm yield of the strategy is estimated at 134,500 ac-ft per year. Of this amount, 112,100 ac-ft per year would be provided to Dallas Water Utilities in Region C. The evaluation of this strategy is discussed in more detail in the 2011 Region C Water Plan.

Needs that would potentially be met by the development of Lake Columbia are provided in Table 4B.17. In addition, Lake Columbia is a recommended strategy for all participants in the project. Some participants intend to replace existing groundwater supplies with water from Lake Columbia. These users may or may not show a need in the 2011 Plan.

Table 4B.17 Demands Supplied by Lake Columbia

Entity	Projected Supply Demand (ac-ft per year)					
	2010	2020	2030	2040	2050	2060
Manufacturing (Angelina)	0	8,551	8,551	8,551	8,551	8,551
Mining (Angelina)	2,000	4,000	0	0	0	0
New Summerfield	0	1,000	1,000	1,000	1,000	1,000
Rusk	0	3,000	3,000	3,000	3,000	3,000
Mining (Cherokee)	500	1,500	0	0	0	0
Mining (Nacogdoches)	2,500	7,000	0	0	0	0
Steam Electric (Nacogdoches)	0	5,000	5,000	5,000	13,400	13,400
Steam Electric (Rusk)	0	0	0	0	0	8,500
Jackson WSC	0	600	600	600	600	600
Whitehouse	0	1,200	1,200	1,200	1,200	1,200

Water demands that would be satisfied by the development of the Lake Fastrill Replacement Project are indicated in Table 4B.18.

Table 4B.18 Demands Supplied by Lake Fastrill Replacement Project

Entity	Projected Supply Demand (ac-ft per year)					
	2010	2020	2030	2040	2050	2060
UNRMWA	0	0	0	134,500	134,500	134,500
City of Dallas				112,100	112,100	112,100
Steam-Electric Power (Anderson County)*				21,853	21,853	21,853
TOTAL				**134,500**	**134,500**	**134,500**

* Alternative Strategy

New Reservoirs Environmental Issues. Environmental impacts associated with the development of a new reservoir can be significant. Evaluation of such impacts is generally beyond the scope of water planning. Table 4B.19 provides a basic evaluation of issues. Environmental impacts for off-channel reservoirs may be less than on-channel reservoirs due to flexibility in locating these facilities.

Table 4B.19 Environmental Issues Associated with Development of New Reservoirs

Environmental Issues	Evaluation Result
Implementation Measures	Dam and reservoir covering 10,000 acres.
Environmental Water Needs/Instream Flows	Probable moderate impact
Bays and Estuaries	Possible cumulative impact to limited areas of coastal marsh
Fish and Wildlife Habitat	Possible high to moderate impact to species in general. Possible moderate impact on State-listed species.
Cultural Resources	Probable moderate impact.
Threatened and Endangered Species	Possible moderate to low impact pending identification of such species in the project area.

New Reservoirs Cost Consideration. As with any major reservoir project, the project costs are large. Based on comparison with other projects of similar size, it is estimated the proposed Lake Columbia project has an annualized cost of $16,280,500. This figure is an annualized estimate of cost that includes the construction of the dam, land acquisition, resolution of conflicts, environmental permitting and mitigation, and technical services.

Capital costs for the Neches River Run-of-the-River strategy are estimated at nearly $2 billion. Annualized costs are $193,301,000.

New Reservoirs Implementation Issues. This water supply option has been compared to the plan development criteria, as shown in Table 4B.20. The option meets each criterion.

Table 4B.20 Comparison of Development of New Reservoirs to Plan Development Criteria

Impact Category	Comment(s)
A. Water Supply: 1. Quantity 2. Reliability 3. Cost	1. Sufficient to meet needs 2. High reliability (Moderate reliability for river diversion) 3. Reasonable to High
B. Environmental Factors 1. Environmental Water Needs 2. Habitat 3. Cultural Resources 4. Bays and Estuaries	1. Moderate impact 2. High impact 3. High impact 4. Negligible impact
C. Impact on Other State Water Resources	Moderate impacts on state water resources (available water); moderate effect on navigation
D. Threats to Agriculture and Natural Resources	Moderate to high impact on bottomland hardwoods and habitat in reservoir area
E. Equitable Comparison of Strategies Deemed Feasible	Option is considered to meet shortages
F. Requirements for Interbasin Transfers	Potential interbasin transfer to Trinity Basin
G. Third Party Social and Economic Impacts from New Reservoirs	Varies: Potential for positive economic impacts

Chapter 4C

Water Management Strategies for Entities with an Identified Need

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The strategies are outlined for each WUG, by county, with a need identified in Chapter 4A. For each WUG with a defined shortage, a summary table is provided to review the projected need and the supply delivered by the strategy(ies). A second summary table provides an evaluation of the cost (capital, annual and unit) to deliver treated water to the user for the various strategies that were considered. Appendix 4C-A provides a summary of the unit prices and general description of the project scope and cost for each strategy.

Four major categories of WMS are recommended: water conservation and drought management, wastewater reuse, expanded use of existing supplies (voluntary redistribution, groundwater, local supplies) and new development. Further discussion of how the strategies were implemented in the ETRWPA is provided in Chapter 4B.

4C.1 Water User Groups with Needs

Due to the level of uncertainty in the water supply allocation and projected water demands, WMS are only developed for WUGs with projected needs that are greater than 5 ac-ft per year.

4C.1.1 Anderson County. WMS for Anderson County include expanding groundwater resources. There is adequate aquifer capacity to allow for the projected expansions of groundwater supplies. However, development of future steam-electric facilities will be dependent on the development of surface water supply from Lake Palestine through a contract with the City of Palestine.

County-Other. Current supplies are from the Carrizo-Wilcox aquifer, Queen City aquifer, and Sparta aquifer. The recommended strategy for meeting the projected need in 2060 is to increase supply from the Queen City and Carrizo-Wilcox aquifers. For planning purposes, these strategies assume that two new wells will be drilled in the Queen City aquifer and one well in the Carrizo-Wilcox aquifer. The actual number and location of the wells will be determined by the user.

Anderson County-Other	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	0	0	-31	-132
Recommended Strategy ADC-1: Increase Supply from Queen City						100
Recommended Strategy ADC-2: Increase Supply from Carrizo-Wilcox				100	100	100

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
ADC-1: Increase Supply from Queen City	100	$212,732	$32,110	$321	$0.99
ADC-2: Increase Supply from Carrizo-Wilcox	100	$262,189	$40,631	$406	$1.25

Frankston. The City of Frankston's water supply is currently from groundwater wells in the Carrizo-Wilcox aquifer. The strategy selected to meet the future demands is to increase additional supplies from the Carrizo-Wilcox.

Frankston	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Supply(+)-Demand(-) (ac-ft per year)	0	0	-6	-24	-40	-54
Recommended Strategy FR-1: Increase Supply from Carrizo-Wilcox			121	121	121	121
Recommended Strategy FR-2: Water Conservation			6	7	8	9

Strategy	**Yield (ac-ft per year)**	**Total Capital Cost**	**Total Annualized Cost**	**Unit Cost ($/ac-ft)**	**Unit Cost ($/1000 gal)**
FR-1: Increase Supply from Carrizo-Wilcox	120	$255,951	$42,846	$357	$1.10
FR-2: Water Conservation	9		$ 1,910	$212	$0.65

Mining. Water for mining is supplied by the Carrizo-Wilcox aquifer. The recommended strategy is to increase supply from this aquifer. The following table displays the projected future needs for the mining use in Anderson County.

Anderson County Mining	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Supply(+)-Demand(-) (ac-ft per year)	-18	-22	-45	-70	-95	-119
Recommended Strategy ADN-1: Increase Supply from Carrizo-Wilcox	18	120	120	120	120	120

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
ADN-1: Increase Supply from Carrizo-Wilcox	120	$228,730	$28,233	$233	$0.72

Steam-Electric. Previous plans by Louisville Gas & Electric to construct a steam-electric power plant and contract with the City of Palestine for water were abandoned due to lack of funding. The current demand projections are based on a similar project being developed in the future, with plant operation beginning in 2020 and expected to require an annual average amount of 21,853 ac-ft per year by 2060. It is assumed that the future facility could contract with City of Palestine to use water from its existing 28,000 ac-ft per year from Lake Palestine. Construction of a pipeline and pump station would be required to supply the plant with water from Lake Palestine. Alternatively, water from Lake Fastrill Replacement Project could be used to supply some of the projected demands for steam-electric power. The following table displays the projected future needs for the steam-electric power use in Anderson County. The recommended strategy is to obtain water from Lake Palestine.

Anderson County Steam-Electric	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	-11,306	-13,218	-15,549	-18,390	-21,853
Recommended Strategy ADS-1: Water from Lake Palestine		21,853	21,853	21,853	21,853	21,853
Alternate Strategy ADS-1: Water from Lake Fastrill Replacement Project		21,853	21,853	21,853	21,853	21,853

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
ADS-1: Water from Lake Palestine	21,853	$24,917,400	$7,500,600	$343	$1.05
Alt. Strategy ADS 2: Water from Lake Fastrill Replacement Project	21,853	$24,917,400	$7,500,600	$343	$1.05

4C.1.2 Angelina County. Most of the WUGs in Angelina County are currently dependent on groundwater supplies. Both the Yegua aquifer and the Carrizo-Wilcox aquifer have limited capacity for expanded development. Although some communities will continue to rely on groundwater, the proposed construction of transmission lines and a surface water treatment plant at Lake Kurth by the City Lufkin is expected to supply water for Lufkin, Zavalla, Huntingdon, Four Way WSC, Angelina WSC, M&M WSC, and some manufacturing needs.

County-Other. Current supplies for County-Other water users are groundwater from the Carrizo-Wilcox and Yegua aquifers. Zavalla, Huntington, Angelina WSC and M&M WSC are expected to obtain water from the City of Lufkin as Lufkin develops additional supplies. Other users will likely increase self-supplied groundwater from the Yegua-Jackson aquifer. Two strategies are recommended to meet the projected needs of Angelina County-Other: 1) Purchase water from the City of Lufkin, and 2) increase supplies from the Yegua-Jackson aquifer.

Angelina County Other	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	-20	-135	-349	-661
ANC-1: Voluntary redistribution from City of Lufkin	0	0	1,100	1,100	1,100	1,100
ANC-2A: Increase Supply from Yegua-Jackson	0	0	150	150	300	300

For purposes of developing costs for purchasing water from Lufkin, costs were estimated at the current rates to wholesale customers. Actual costs will be determined during contract negotiations.

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
ANC-1: Voluntary redistribution from City of Lufkin(1)	1,100	$10,604,000	$1,790,000	$1,627	$4.99
ANC-2A: Increase Supply from Yegua-Jackson	300	$419,717	$64,285	$214	$0.66

(1)See Section 4C.21 , Wholesale Water Providers, City of Lufkin, for costs of strategies for City of Lufkin

Diboll. Current supplies are from the Yegua-Jackson aquifer. Total pumpage from the Yegua-Jackson aquifer is approaching the long-term aquifer capacity in Angelina County, but there is some available water in the near-term. The City of Diboll is currently planning to expand its groundwater system to increase the supplies from the Yegua-Jackson aquifer. The City recently signed a contract with the City of Lufkin for 632 MGY of treated water from the former Abitibi well field. At this time the City of Diboll is pursuing both options to increase its reliable supplies. The recommended strategies for the City of Diboll are to: 1) expand the City's groundwater sources and 2) purchase water from Lufkin and build a pipeline to Diboll.

Diboll	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-32	-187	-374	-618	-965	-1,441
Recommended Strategy DI-1: Purchase water from Lufkin	800	800	800	800	1,600	1,600
DI-2: Water Conservation	11	20	26	34	53	72
Recommended Strategy DI-3A: Increase Supply from Yegua-Jackson	600	600	600	600	600	600

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
DI-1: Purchase water from Lufkin – Each Phase	800	$6,195,000	$1,144,900	$1,431	$4.39
DI-2: Water Conservation	72	$0	$8,955	$124	$0.38
DI-3: Increase Supply from Yegua-Jackson	600	$576,576	$140,344	$234	$0.72

Four Way WSC. Current supplies are from the Yegua aquifer. The recommended strategy for meeting the need projected in 2060 is to obtain treated surface water from the City of Lufkin. The following table displays the projected future needs for this entity.

Four Way WSC	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	0	0	0	-225
FW-1: Obtain water from Lufkin	0	0	0	0	0	225

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
FW-1: Obtain water from Lufkin[(1)]	225	$669,192	$211,421	$940	$2.88

[(1)]See Section 4C.21 , Wholesale Water Providers, City of Lufkin, for costs of strategies for the City of Lufkin

Hudson. The City of Hudson currently purchases water from Hudson WSC, which obtains water from the Carrizo-Wilcox aquifer. It is assumed that Hudson WSC will expand its well fields and production capacity to meet the projected shortages for the City of Hudson. The recommended strategy for meeting the need projected in 2060 is to purchase water from Hudson WSC. For cost purposes, it is assumed that the water is purchased at $1.25 per thousand gallons. Actual costs will be negotiated between the buyer and seller. The following table displays the projected future needs for this entity**.**

Hudson	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	-123	-360	-710	-1,174
HU-1A: Purchase water from Hudson WSC	0	0	125	400	800	1,200

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
HU-1A: Purchase water from Hudson WSC	1,200	$0	$380,703	$317	$0.97

Hudson WSC. Current supplies are from the Carrizo-Wilcox aquifer, and current production capacity is 3.2 MGD. To meet the projected needs of Hudson WSC and the City of Hudson, Hudson WSC will need to develop an additional 2,000 ac-ft per year. The recommended strategy for meeting the need projected in 2060 is to increase supply from the Carrizo-Wilcox aquifer. A two-phased strategy was considered to meet the future water demands.

Hudson WSC	2010	2020	2030	2040	2050	2060
Hudson WSC Supply(+)-Demand(-) (ac-ft per year)	0	0	0	-104	-367	-735
City of Hudson Supply(+)-Demand(-) (ac-ft per year)	0	0	-123	-360	-710	-1,174
HW-1A: Increase Supply from Carrizo-Wilcox – Phase I			600	600	600	600
HW-1B: Increase Supply from Carrizo-Wilcox – Phase II					1,400	1,400

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
HW-1A: Increase Supply from Carrizo-Wilcox – Phase I	600	$974,482	$190,352	$317	$0.97
HW-1B: Increase Supply from Carrizo-Wilcox – Phase II	1,400	$2,299,710	$447,897	$320	$0.98
TOTAL	**2,000**	**$3,274,192**			

Lufkin. The City of Lufkin currently relies on groundwater from the Carrizo-Wilcox aquifer. The City recently purchased additional groundwater and surface water rights from Abitibi Bowater Corporation. The City plans to develop this supply for its near-term needs and plans to utilize its water rights in Sam Rayburn Reservoir for its long-term water needs. The timing of the development of the Sam Rayburn water rights will depend on the reliable supplies from the new groundwater supplies and Lake Kurth and future demands on the city. At this time, the development of the water rights in Sam Rayburn Reservoir is planned for 2040. The proposed strategies for the City of Lufkin are discussed in Section 4C.21, Wholesale Water Providers, City of Lufkin.

Manufacturing. Much of the manufacturing water supplies in Angelina County are obtained from groundwater. Some water is provided by reuse from Temple Inland. The City of Lufkin supplies approximately 35% of the current manufacturing needs; however, it would be expected that the City's percentage of the supply may increase with the acquisition of Lake Kurth and future development of surface water supply from Sam Rayburn. It is anticipated that growth in manufacturing will be supplied by the City of Lufkin and Temple-Inland, which is currently under contract with ANRA for supply from Lake Columbia. It is expected that Temple-Inland will use the Lake Columbia supply as it becomes available.

Two potentially feasible strategies were considered to meet the future water demands. The first strategy is purchase of water from the City of Lufkin. Raw surface water is currently available from Lake Kurth for manufacturing use but there is limited infrastructure. Costs to use this source were estimated based on a 10-mile transmission line. Treated water sales from Lufkin could be provided through the city's groundwater sources and/or new surface water from Lake Kurth and Sam Rayburn Reservoir. Costs for this strategy are based on treated water purchase costs for large industries with no additional transmission costs. The second strategy is Temple-Inland's participation in the Lake Columbia development. For this strategy it was assumed that water would be diverted from the Angelina River and transported to a facility within 3 miles of the diversion location. It was also assumed that no treatment was needed.

Angelina County Manufacturing	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-3,117	-10,513	-12,983	-15,486	-17,739	-20,161
ANM-1: Obtain water from City of Lufkin	6,800	12,800	12,800	14,100	16,800	18,800
ANM-2: Obtain raw water from Lake Columbia via contract with ANRA		8,551	8,551	8,551	8,551	8,551

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
ANM-1: Obtain water from City of Lufkin	18,800	$18,573,800[(1)]	$8,536,000	$454	$1.39
ANM-2: Obtain raw water from Lake Columbia via contract with ANRA	8,551	$7,603,000	$2,736,000	$320	$0.98

[(1)]See Section 4C.21 , Wholesale Water Providers, City of Lufkin, for costs of strategies for City of Lufkin. It was assumed that 6,800 ac-ft per year would be raw water and 12,000 ac-ft per year would be treated water.

Livestock. Demands are projected to increase over the planning period and will exceed the current supplies. It is recommended that these shortages (up to 90 ac-ft per year by 2060) be met with increases in local surface water supplies.

Angelina County Livestock	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	0	-17	-52	-89
Recommended Strategy ANL-1 (ac-ft per year): Increase local surface water supplies (stock ponds)				90	90	90

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
ANL-1 Stock ponds	90	$168,800	$14,700	$163	$0.50

Mining. There has been recent interest in natural gas exploration in the Haynesville/ Bossier Shale that has placed new mining demands in Angelina County. As a result, there are near-term projected mining shortages in Angelina County. To meet these demands, it is recommended to use water from Lake Columbia and/or run-of-the-river diversions from the Angelina River. It is assumed that ANRA would be the sponsor for this water. Alternatively, water could be obtained from Lake Kurth through the City of Lufkin. The following tables show the projected mining shortages, recommended strategies and projected costs.

Angelina County Mining	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-1,990	-3,989	0	0	0	0
Recommended Strategy ANMi-1 (ac-ft per year): Obtain water from ANRA (Lake Columbia or Angelina River)	2,000	4,000	0	0	0	0
Alternate Strategy ANMi-2: Obtain water from Lufkin (Lake Kurth)	2,000	4,000	0	0	0	0

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
ANMI-1 Supply from ANRAs	4,000	$5,793,150	$1,527,000	$382	$1.17
ANMI-2 Supply from Lufkin	4,000	$5,793,150	$1,527,000	$382	$1.17

Steam-Electric. Steam electric power demands in Angelina County are based on the demands for the proposed Aspen Power facility, which are projected to be 1,000 acre-feet over the planning period. The facility is planning on using groundwater from the Carrizo-Wilcox aquifer to meet this shortage. There are existing wells at the project site, but it is uncertain whether these wells can meet all of the facilities water needs. For planning purposes, it is proposed that these shortages be met with new wells.

Angelina County Steam-Electric Power	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000
ANP -1: New wells in the Carrizo-Wilcox	1,000	1,000	1,000	1,000	1,000	1,000

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
ANP -1: New wells in the Carrizo-Wilcox	1,000	$1,724,909	$230,665	$1,538	$4.72

4C.1.3 Cherokee County. The Carrizo-Wilcox aquifer is almost fully allocated in Cherokee County. There is additional water available from the Queen City aquifer and a small amount available from the Sparta aquifer, but these aquifers do not cover the entire county. Where feasible, water from the Queen City or Sparta aquifers may be substituted for Carrizo-Wilcox water in the following potential WMS. However, the ETRWPG has made a policy decision that, for planning purposes, water from the Queen City and Sparta aquifers will be used primarily for livestock and irrigation uses because of the unreliable supply and quantity. No proposed management strategies for municipal water shortages involve the Queen City and Sparta aquifers.

Water obtained from the Queen City aquifer may be acidic and may have levels of iron and manganese greater than TCEQ secondary drinking water standards. Water obtained from the Sparta aquifer may have levels of sulfates greater than the TCEQ secondary drinking water standards, especially in far southern Cherokee County. Water quality in the Sparta aquifer is best on the outcrop.

New Summerfield. The City of New Summerfield currently obtains water supply from the Carrizo-Wilcox aquifer. Although near term needs are adequate, the City has a contract with ANRA for 2,565 ac-ft per year of water from Lake Columbia. Development of plant farms in the New Summerfield area, with the City being the supplier of the water, will increase the City's need for new sources. The selected strategy is to obtain water from Lake Columbia and implement water conservation. The first phase of this strategy would develop 1,000 ac-ft per year of supply, with expansions beyond 2060. An alternate strategy is to increase its supply from the Carrizo-Wilcox aquifer.

New Summerfield	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	-40	-76	-117	-165
NS-1: Obtain treated water from Lake Columbia via contract with ANRA		1,000	1,000	1,000	1,000	1,000
NS-2: Water Conservation		10	18	21	23	26
Alt. NS-3: Increase supply from Carrizo-Wilcox			121	242	242	242

Strategy	Contract Amount (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
NS-1: Obtain treated water from Lake Columbia via contract with ANRA	1,000	(1)	$1,140,479	$1,140	$3.50
NS-2: Water Conservation	26		$2,388	$92	$0.28
Alt. NS-3: Increase supply from Carrizo-Wilcox	242	$299,452	$63,329	$262	$0.80

(1)Capital costs are shown for ANRA. Costs for New Summerfield are based on the unit costs for the project.

Rusk. Current supplies are obtained from Carrizo-Wilcox aquifer and Rusk City Lake. The City presently has a contract with ANRA for 4,275 ac-ft per year of water from Lake Columbia, when constructed. The selected strategy is to obtain water from Lake Columbia. It is assumed that the City of Rusk will take raw water from Lake Columbia and develop water treatment facilities. It is also assumed that Rusk would provide treated water to other Lake Columbia participants located near the city (Rusk Rural WSC and the City of Alto). The transmission costs to these entities are not included in the costs below. An alternate strategy is to expand the City's well field and obtain additional water from the Carrizo-Wilcox aquifer. Future water needs are shown in the following table.

Rusk	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	0	-42	-116	-212
RU-1: Obtain treated water from Lake Columbia via contract with ANRA		3,000	3,000	3,000	3,000	3,000
RU-2: Water Conservation				51	66	76
Alternate Strategy RU-3: Increase supply from Carrizo Wilcox				212	212	212

Strategy	Contract Amount (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
RU-1: Obtain treated water from Lake Columbia via contract with ANRA	3,000	$28,435,800	$3,968,000	$1,323	$4.06
RU-2: Water Conservation	76		$9,552	$126	$0.39
Alternate RU-3: Increase supply from Carrizo Wilcox	212	$299,452	$60,386	$285	$0.87

Mining. Current mining water needs in Cherokee County are met through groundwater from the Carrizo-Wilcox aquifer and mining local supply. With the increased interest in natural gas exploration in East Texas, there are expected water shortages for mining in the near-term. To meet these demands, it is recommended to use water from Lake Columbia and/or run-of-the-river diversions from the Angelina River. It is assumed that ANRA would be the sponsor for this water. The small projected shortage in 2060 is below the 5 ac-ft per year threshold for developing strategies and can likely be met through existing supplies.

Cherokee County Mining	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-490	-1,494	0	0	0	-2
CHMi-1: Purchase water from ANRA (Lake Columbia or Angelina River)	500	1,500				0

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
CHMi-1: Purchase water from ANRA (Lake Columbia or Angelina River)	1,500	$3,619,300	$728,000	$485	$1.49

4C.1.4 Hardin County. The Gulf Coast aquifer supplies most users in Hardin County. The available supply for Hardin County from the Gulf Coast aquifer, based on the results of this plan, is limited to 23,500 ac-ft per year. The current supplies, associated with the Gulf Coast aquifer, total 23,164 ac-ft per year. The City of Beaumont accounts for 9,000 ac-ft per year of this current supply.

Due to the nearly full allocation of groundwater, surface water alternatives need to be considered. Municipal and manufacturing shortages are relatively small and will be supplied by continued use of the Gulf Coast aquifer.

County-Other. The current supply for County-Other is from the Gulf Coast aquifer. The selected strategy is to obtain additional supply from the Gulf Coast aquifer either through purchasing water from a water provider or developing new wells. For this plan, the costs were developed for new wells in the Gulf Coast aquifer with the understanding that water that is not being used by a provider (shown as a surplus in the supply-demand comparison) is available to meet the projected shortages without overdrafting the aquifer.

Hardin County Other	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-154	-263	-284	-305	-358	-431
Recommended Strategy HAC-1A (ac-ft/year): Use additional water from Gulf Coast Aquifer (Phases I-III).	154	306	306	306	459	459

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
HAC-1: Use additional water from Gulf Coast Aquifer. Each Phase (I-III)	154	$556,888	$65,857	$430	$1.32
Total for all phases	**459**	**$1,670,664**			

Manufacturing. Current supply is from the Gulf Coast aquifer. The selected strategy is to obtain additional supply from the Gulf Coast aquifer either from a local water provider or directly through new wells. As with the strategy for County-Other, the costs were determined based on drilling new wells, and it is assumed that the additional supplies from this strategy will not result in overdrafting the aquifer in Hardin County.

Hardin County Manufacturing	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-27	-46	-63	-81	-97	-114
Recommended StrategyHAM-1 (ac-ft/year): Use additional water from Gulf Coast Aquifer	114	114	114	114	114	114

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
HAM-1: Use additional water from Gulf Coast Aquifer	114	$429,542	$43,444	$381	$1.17

Irrigation. The needs for irrigation total approximately 1,000 ac-ft per year over the planning period. Due to the limitations of groundwater needs are shown to be met through the use of surface waters.

Hardin County Irrigation	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-1,002	-1,002	-1,002	-1,002	-1,002	-1,002
Recommended StrategyHAI-1 (ac-ft/year): Use surface water surfaces	1,002	1,002	1,002	1,002	1,002	1,002

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
HAI-1: Use surface water sources	1,002	$2,405,001	$296,920	$296	$0.91

Mining. The mining water demands in Hardin County are based on historical water usage that is no longer in place. The TWDB currently reports only a small amount of groundwater use for mining purposes. As a result the projected demands do not accurately reflect the current usage in Hardin County. The TWDB has commissioned a study on water use for mining purposes across the State. This study should be completed for the development of the projected water demands for the 2016 water plan. Since this demand does not appear to be valid at this time, no strategies have been developed to meet the projected shortages.

4C.1.5 Henderson County.

Henderson County is located in both Region C and the ETRWPA. The portion of the county in the Neches River Basin lies in the ETRWPA, and the portion in the Trinity River Basin lies in Region C. Much of the water supplies to users in the ETRWPA is obtained from groundwater with a small amount of surface water supplied from Lake Athens and Lake Palestine. Most of the needs in Henderson County are associated with shortages from Lake Athens.

Athens. The City of Athens receives treated surface water from the Athens MWA and groundwater from local wells. Most of the City is located in Region C with a small portion extending into the ETRWPA. The strategies to meet water shortages for Athens are to implement conservation and purchase water from the Athens MWA through the strategies identified for this wholesale water provider. Since most of Athens lies in Region C, conservation for the portion of Athens in the ETRWPA was estimated using the recommended conservation packages identified by Region C.

Athens	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	-52	-70	-88	-117	-155
AT-1: Conservation	1	6	12	17	22	30
AT-2: Overdraft Carrizo-Wilcox through Athens MWA	0	27	29	29	30	31
AT-3: Purchase water from Athens MWA	0	19	29	42	65	94

The costs of the strategies are presented in the following table.

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
AT-1: Conservation	30	NA	$5,223	$174	$0.53
AT-2: Develop additional groundwater (1)	31	NA	NA	NA	NA
AT-3: Water from Athens MWA(1)	94	NA	NA	NA	NA

(1) See Section 4C.21, Wholesale Water Providers, Athens MWA, for costs for strategies for Athens MWA.

County-Other. Current supplies are from the Carrizo-Wilcox aquifer and Queen City aquifer, with a small amount of water from Lake Palestine. The Carrizo-Wilcox aquifer is nearly fully allocated in the Neches basin part of the county. There is available water from the Queen City aquifer, but the quality of water from this source is variable. The recommended strategies to meet the projected shortage of 964 ac-ft per year are to purchase additional water from the UNRMWA (Lake Palestine), expand groundwater use of the Queen City aquifer, conservation, and use the available groundwater from the Carrizo-Wilcox aquifer.

Henderson County-Other	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-75	-216	-348	-479	-683	-964
Recommended Strategy HECo-1: Conservation	31	57	74	92	108	129
Recommended Strategy HECo-2: Expand use of Carrizo-Wilcox Aquifer	50	50	50	50	50	50
Recommended Strategy HECo-3: Expand use of Queen City Aquifer	50	50	50	100	200	500
Recommended Strategy HECo-4: Purchase water from UNRMWA		150	200	300	400	500

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
HECo-1: Conservation	129	$0	$17,911	$139	$0.43
HECo-2: Expand use of Carrizo-Wilcox	50	$609,900	$64,900	$1,298	$3.98
HECo-3: Expand use of Queen City	500	$4,420,100	$504,400	$1,009	$3.10
HECo-4: Water from UNRMWA	500	$8,937,350	$982,000	$1,964	$6.02

Brownsboro. There is a small shortage identified for Brownsboro in 2060 (less than 5 ac-ft per year). Since this shortage is below the 5 ac-ft per year threshold for developing strategies, no strategies were developed for Brownsboro. It is likely that this shortage can be met through existing supplies.

Irrigation. There is a small amount of irrigation demand in Henderson County. This demand is met with water from Lake Athens. The strategy is to continue to use water from Lake Athens through the Athens MWA strategies.

Henderson County Irrigation	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	0	0	0	0
Recommended Strategy HEI-1 (ac-ft/year): Obtain water from Lake Athens	0	70	83	95	108	121

Strategy	Yield (ac-ft per year))	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
HEI-1: Obtain water from Lake Athens	(1)	(1)	$29,490	$163	$ 0.50

(1) See Section 4C.21, Wholesale Water Providers, Athens MWA, for costs for strategies by Athens MWA.

Livestock. The livestock water demands in Henderson County include the Athens Fish Hatchery. This facility is located at Lake Athens and receives water directly from the lake. The intake structure for the hatchery is set at 9 feet below the normal pool elevation, which limits the available supply from this source. The hatchery has a water contract for 3,023 ac-ft per year from Lake Athens, which it intends to fully utilize. Currently, the Athens Fish Hatchery returns about 95 percent of the diverted water from Lake Athens back to Lake Athens. While this is the hatchery's current operation, it is under no contractual obligation to return water to the lake. To meet the projected needs, it is recommended that the hatchery continue to recycle its water through Lake Athens and participate with Athens MWA in obtaining additional water at Lake Athens.

Henderson County Livestock	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	-29	-218	-388	-561	-724
Recommended Strategy HEL-1 (ac-ft/year) Fish Hatchery Reuse	0	2,872	2,872	2,872	2,872	2,872

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
HEL-1: Fish Hatchery Reuse	2,872	$0	$0	$0	$0

(1) See Section 4C.21, Wholesale Water Providers, Athens MWA, for costs for strategies by Athens MWA.

4C.1.6 Houston County. Water supplies in Houston County include surface water from Houston County Lake (through Houston County WCID), run-of-the river supplies for irrigation and groundwater from the Carrizo-Wilcox, Yegua-Jackson, Sparta, Queen City and local aquifers. There are projected water shortages in Houston County are for irrigation and livestock uses, with small shortages for manufacturing water use. The Carrizo-Wilcox aquifer has adequate capacity for expanded development in this county.

Manufacturing. The current supply for manufacturing in Houston County is from Houston County Lake, and the projected shortages are associated with the wholesale water provider Houston County WCID. The demands on Houston County WCID exceed the permitted supply for Houston County Lake. The WCID is presently seeking a permit amendment for the full yield of the lake (7,000 ac-ft per year). When this amendment is granted, there would be sufficient supplies to meet all of the manufacturing demands in Houston County. It is assumed that there are no capital costs associated with this strategy.

Houston County Manufacturing	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-3	-5	-7	-9	-12	-15
Recommended Strategy HOMa-1 (ac-ft/year): Obtain water from Houston County WCID	30	30	30	30	30	30

Irrigation. Irrigation needs in Houston County are mostly supplied by run-of-river diversions from the Neches and Trinity Rivers. Based on available data from TWDB, roughly 10 to 15 percent of the irrigation needs in 1999 were supplied from groundwater sources. More recent data indicates an increased use of groundwater for irrigation. Consistent with this trend, it is recommended that the projected irrigation shortage be met with groundwater. The recommended strategy is to expand development of groundwater supplies.

Houston County Irrigation	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-567	-667	-986	-1,334	-1,720	-2,146
HOI-1: Increase Supply from Carrizo-Wilcox – Phase I-VI	766	1,149	1,149	1,629	1,915	2,298

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
HOI-1: Increase Supply from Carrizo-Wilcox – Phase I-VI	766	$1,068,520	$158,307	$207	$0.63
TOTAL	**2,298**	**$3,205,560**			

Livestock. Livestock demands are supplied by groundwater sources and local supply. If adequate local supplies are not available, expansion of groundwater sources may be required.

Houston County Livestock	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-72	-211	-403	-610	-835	-1,078
HOL-1: Increase Supply from Carrizo-Wilcox – Phase I-V	221	221	442	663	884	1,080

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
HOL-1: Increase Supply from Carrizo-Wilcox – Phase I-V	221	$534,260	$79,154	$375	$1.15
TOTAL	**1,080**	**$2,671,300**			

4C.1.7 Jasper County. Future needs will have minimal impact on existing supplies. The Gulf Coast aquifer will be capable of handling the increase in needs.

County-Other. Current supply is from the Gulf Coast aquifer. Future demands can be met by use of additional groundwater from Gulf Coast aquifer.

Jasper County-Other	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-374	-470	-488	-430	-403	-403
Recommended Strategy JAC-1 (ac-ft/year): Use of additional water from Gulf Coast Aquifer. (Neches)	550	550	550	550	550	550
Recommended Strategy JAC-2 (ac-ft/year): Use of additional water from Gulf Coast Aquifer. (Sabine)	82	82	82	82	82	82

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
JAC-1: Use additional supply from Gulf Coast Aquifer	632	$1,369,957	$410,551	$650	$1.99

4C.1.8 Jefferson County. Water supply is largely provided by the Lower Neches Valley Authority with the exceptions of water taken by the City of Beaumont from both the Neches River and groundwater wells in Hardin County and wells for Bevil Oaks.

Mining. Current supply is from the Gulf Coast aquifer. Future demands can be met by use of additional groundwater from Gulf Coast aquifer.

Mining	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	0	0	-5	-9
Recommended Strategy JEM-1 (ac-ft/year): Use additional supply from Gulf Coast Aquifer					5	9

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
JEM-1: Use additional supply from Gulf Coast Aquifer	9	$103,083	$12,746	$1,416	$4.35

Steam-Electric. The projected demands for steam-electric power are based on several proposed facilities in Jefferson County that have been delayed or temporarily cancelled. It is anticipated that as the need for electric power increases, these facilities will be constructed. Presently there is no infrastructure to supply water for steam-electric power. The proposed strategy to meet this need is to use surface water supplies in the Neches River Basin. There are sufficient supplies to meet these needs, which could be supplied from LNVA sources or directly from the Neches River. The actual source of water will be negotiated when the facilities are constructed.

Jefferson County Steam-Electric Power	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	-13,426	-15,696	-18,464	-21,838	-25,951
Recommended Strategy JESE-1 (ac-ft/year): Use water from the Neches River		25,951	25,951	25,951	25,951	25,951

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
JESE-1: Use additional water from the Neches River	25,951	$13,647,296	$2,240,124	$92	$0.28

4C.1.9 Nacogdoches County. Surface water, groundwater and local livestock supplies provide water to users in Nacogdoches County. Lake Nacogdoches and Striker Lake provide the majority of surface water, while groundwater is the primary source for rural water supplies. Lake Naconiche has recently been completed. This lake was built by NRCS for flood storage and recreation, but there are plans to develop water supply from the lake for rural communities. A study was completed in 1992 that evaluated a potential regional water system using water from Lake Naconiche. To provide water to Nacogdoches County-Other users and several rural WSCs, it is recommended to develop this source for water supply. A brief description of the proposed strategy is presented below.

Lake Naconiche Regional Water Supply System. Lake Naconiche is located in northeast Nacogdoches County on Naconiche Creek. It is permitted to store 9,072 acre-feet of water. To use water from Lake Naconiche for water supply, the County must seek a permit amendment for diversions for municipal use. According to the Neches WAM, the firm yield of the lake would be approximately 3,239 acre-feet per year. It is assumed that the regional water system would serve County-Other entities in Nacogdoches County (including Caro WSC, Lilbert-Looneyville, Libby and others), Appleby WSC, Lily Grove WSC and Swift WSC. At this time the primary sponsor of the system has not been confirmed. It could possibly be one of the entities served or a new water provider dedicated to the operation of this system.

The project is initially sized for 3 MGD. This includes a lake intake, new water treatment plant located near Lake Naconiche, pump station and a distribution system of pipelines in the northeast part of the county. Overall unit costs are estimated at $5.17 per 1,000 gallons during amortization. After amortization, costs will decrease to $1.30 per 1,000 gallons. The costs for each participant are based on the unit cost of water for the strategy and capital costs are proportioned by strategy amounts. Actual costs would be negotiated by each user.

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Nac-1: Develop Lake Naconiche	1,700	$24,890,000	$2,866,000	$1,686	$5.17

D&M WSC. D&M WSC currently relies on groundwater from the Carrizo-Wilcox. The recommended strategy is to expand development of supplies from Carrizo-Wilcox.

D & M WSC	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	-21	-70	-182	-310
DM-1: Increase Supply from Carrizo-Wilcox			310	310	310	310

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
DM-1: Increase Supply from Carrizo-Wilcox	310	$492,348	$100,361	$324	$0.99

Swift WSC. Swift WSC obtains water from the Carrizo-Wilcox aquifer in Nacogdoches County. Its current production capacity is limited to 1.2 MGD. The recommended strategy for Swift WSC is to initially expand its groundwater use in the Carrizo-Wilcox aquifer, and then participate in the Lake Naconiche regional water supply system. The groundwater strategy is based on one well being constructed in 2010. The Lake Naconich strategy is discussed above. An alternate strategy would be for Swift WSC to contract with ANRA for water from Lake Columbia.

Swift	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	0	-64	-237	-427
SW-1: Increase supply from Carrizo-Wilcox	350	350	350	350	350	350
SW-2: Lake Naconiche regional system			400	400	400	400
Alternate SW-3: Obtain water from Lake Columbia via contract with ANRA		688	688	688	688	688

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
SW-1: Increase supply from Carrizo-Wilcox	350	$498,171	$107,277	$307	$0.94
SW-2: Lake Naconiche regional system	400	$5,856,500	$674,370	$1,686	$5.17
SW-3: Obtain treated water from Lake Columbia via contract with ANRA	688	$0.00	$784,649	$1,140	$3.50

Lilly Grove Special Utility District. Water supplies for Lilly Grove Special Utility District (SUD**)** are from the Carrizo-Wilcox. The available water supply for the Lilly Grove SUD is affected by the impacts of oil and gas mining in the area on the water quality of the SUD's wells. The recommended strategy to supply projected shortages is to participate in the Lake Naconiche regional water supply system. As an alternate strategy, Lily Grove could develop a new well field that is not impacted by water quality and can sufficiently meet its needs.

Lilly Grove SUD	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	0	0	-221	-463
LG-1: Lake Naconiche regional system					500	500
Alt: LG-2: Increase Supply from Carrizo-Wilcox					500	500

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
LG-1: Lake Naconiche regional system	500	$7,320,600	$842,940	$1,686	$5.17
Alt: LG-2: Increase Supply from Carrizo-Wilcox	500	$580,504	$134,877	$270	$0.83

Appleby WSC. Appleby WSC does not show a shortage over the planning period. However, it is located close to the proposed Lake Naconiche regional water supply system. It is recommended that Appleby WSC participate with this project at a level of 300 ac-ft per year. The proportional estimated costs are shown below. Actual costs may be less due to the close proximity to the lake and infrastructure needed to deliver the water.

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
APL-1: Lake Naconiche regional system	300	$4,392,350	$505,765	$1,686	$5.17

County-Other. It is recommended that County-other entities participate in the Lake Naconiche regional water supply project. The estimated share of the costs is shown below.

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
NaCo-1: Lake Naconiche regional system	500	$7,320,600	$843,000	$1,686	$5.17

Livestock. Local supply provides over half of current livestock needs for Nacogdoches County, with the remainder supplied from groundwater sources. Local supplies may not be adequate to cover the projected shortages and further expansion of groundwater sources may be required.

Nacogdoches County Livestock	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	-242	-559	-926	-1,347
NCL-1: Increase Supply from Carrizo-Wilcox			322	644	966	1,350

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
NCL-1: Increase Supply from Carrizo-Wilcox	1,350	$1,969,392	$315,594	$234	$0.72

Mining. Current mining water needs in Nacogdoches County are met through local surface water supplies. As a result of increased interest in natural gas exploration in East Texas, there are projected water shortages for mining in Nacogdoches County. To meet these demands, it is recommended to use water from Lake Columbia and/or run-of-the-river diversions from the Angelina River. It is assumed that ANRA would be the sponsor for this water. Alternatively, some or all of this demand could be met through supplies from LNVA.

Nacogdoches County Mining	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Supply(+)-Demand(-) (ac-ft per year)	-2,495	-6,993	0	0	0	0
NCMI-1: Purchase water from ANRA (Lake Columbia or Angelina River)	2,500	7,000	0	0	0	0
Alternate NCMI-2: Purchase water from LNVA (Sam Rayburn)	2,500	7,000				

Strategy	**Yield (ac-ft per year)**	**Total Capital Cost**	**Total Annualized Cost**	**Unit Cost ($/ac-ft)**	**Unit Cost ($/1000 gal)**
NCMI-1: Purchase water from ANRA (Lake Columbia or Angelina River)	7,000	$9,593,450	$2,574,000	$368	$1.13
Alternate NCMI-2: Purchase water from LNVA	7,000				

Steam-Electric. No current supply exists. There have been discussions with Houston County WCID 1 regarding providing water for a new biomass power generation facility in Nacogdoches County. In addition to this facility, another plant was planned for Nacogdoches County. This would be a much larger facility with greater demands for cooling water. For planning purposes it is recommended that the projected need for steam-electric power be met with water from Houston County Lake and Lake Columbia. It is assumed that each of these sources would supply separate generating facilities.

Nacogdoches County Steam-Electric	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-2,588	-190	-1,358	-2,783	-11,241	-13,358
NCS-1: Obtain raw water from Lake Columbia	0	5,000	5,000	5,000	13,400	13,400
NCS-2: Obtain raw water from Houston County Lake	0	340	340	340	340	340

Strategy	Contract Amount (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
NCS-1: Obtain raw water from Lake Columbia	13,358	$10,718,000	$4,225,000	$315	$0.97
NCS-2: Obtain raw water from Houston County Lake	340	$2,012,400	$263,000	$774	$2.37

4C.1.10 Newton County. Most of the WUGs in Newton County use groundwater from the Gulf Coast aquifer. According to the groundwater availability estimates, there are 29,000 ac-ft per year of water available from the Gulf Coast aquifer in Newton County. Currently about 5,400 ac-ft per year is being used. There is also a significant amount of surface water available from the SRA system. Some of this water is contracted for steam-electric power. Based on the available groundwater and proximity of surface water to users in Newton County, there is substantial water available for development.

Manufacturing. Current manufacturing supply is from the Gulf Coast aquifer and a small run-of-the-river source. The projected demands for manufacturing are expected to double by 2060. The recommended strategy is to expand groundwater use. An alternative strategy would be to purchase surface water from SRA.

Newton County Manufacturing	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-149	-264	-370	-477	-574	-667
Recommended Strategy NWM-: Additional supply from Gulf Coast Aquifer	400	400	400	800	800	800
Alternative Strategy NWM-2: Purchase water from SRA	700	700	700	700	700	700

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
NWM-1: Additional Groundwater Well	800	$891,529	$203,045	$254	$0.78
NWM-2: Purchase water from SRA	700	$1,389,500	$199,600	$285	$0.87

Steam-Electric. The SRA supplies surface water to two facilities in Newton County. Current supplies are sufficient to need the needs for power generation through 2020. By 2030, there is a projected shortage due to expected increases in power demands. This shortage is estimated to be over 13,000 ac-ft per year by 2060. The recommended strategy to meet this demand is to purchase additional surface water from SRA.

Newton County Steam Electric	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	-2,343	-5,257	-8,808	-13,138
Alternative Strategy NWP-1: Purchase water from SRA	0	0	15,000	15,000	15,000	15,000

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
NWP-1: Purchase water from SRA	15,000	$12,515,350	$3,991,000	$266	$0.82

4C.1.11 Orange County. The majority of the water used in Orange County comes from the Gulf Coast Aquifer and the Sabine River, with a very small portion coming from the Neches River. The total long-term sustainable groundwater availability for Orange is estimated at 20,000 ac-ft per year. Substantial further development of groundwater in the county could result in subsidence and salt water intrusion into the aquifer. Current groundwater use in Orange County is nearly 20,000 ac-ft per year. Because the long-term sustainable availability of the aquifer has been reached, it is recommended that any new large-scale water needs be met with surface water. It is recommended that those entities currently on groundwater be allowed to remain on groundwater to meet their future growth until such a time that a salt water intrusion or subsidence problem is encountered.

There is a significant amount of surface water available in the Sabine River in Orange County. The SRA Canal, which is located in Orange County, has a conveyance capacity of 346,000 ac-ft per year. SRA has water rights of 147,100 ac-ft per year associated with the canal system (100,400 ac-ft per year for municipal and industrial and 46,700 ac-ft per year for irrigation). Currently, SRA has demands of approximately 75,000 ac-ft per year in the Canal System. This leaves approximately 72,000 ac-ft per year available to be contracted. SRA also has a large amount of uncontracted water in Toledo Bend Reservoir that could potentially be released through the dam and carried by the Sabine River for downstream use at the canal location.

County-Other. This category includes numerous small water supply entities. Their current supply is from the Gulf Coast aquifer. The Neches portion of the county shows a maximum shortage of 132 ac-ft per year in 2010, while the Sabine portion shows a corresponding surplus of 44 ac-ft per year. Since this is such a relatively small amount of shortage, it is assumed that it can be taken from the Gulf Coast aquifer with few problems. It is assumed that only four entities will need a small amount of additional supply and will need one well each. The cost estimate reflects the development of four wells.

County-Other (Neches Basin)	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-132	-93	-53	-7	0	-6
Recommended Strategy ORC-1 (ac-ft/year): Use additional supply from Gulf Coast Aquifer	140	140	140	140	140	140

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
ORC-1: Additional Wells	140	$432,222	$57,756	$413	$1.27

Mauriceville WSC. Mauriceville WSC serves customers in Orange, Jasper and Newton Counties. Their current supply is from wells in Orange County in the Gulf Coast aquifer. Since groundwater is fully allocated in Orange County and the WSC service area extends beyond Orange County, it is proposed that new wells be drilled in nearby Jasper County to meet the projected shortages.

Mauriceville WSC	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	-37	-81	-96	-158	-202
Recommended Strategy ORMa-1 : New well in Jasper County in Gulf Coast Aquifer		203	203	203	203	203

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
ORMa-1: New well in Jasper County	203	$550,848	$106,749	$526	$1.61

Manufacturing. Current supply is from the Gulf Coast aquifer, the Sabine River (SRA Canal), and the Neches River. Additional water is needed from 2010-2060. There is a shortage in the Sabine portion of the county and a surplus from the Neches Basin portion of the county. This surplus cannot fully meet the projected needs in the county. By year 2010, new supplies must be made available. The total 2060 unmet demand in the Sabine Basin is 34,127 ac-ft per year. The net shortage for both basins is 31,536 ac-ft per year.

To meet these shortages, it is recommended that additional supply from SRA's canal system and Toledo Bend Reservoir be used. It is assumed that the future facilities will be located along the SRA Canal and will require minimal transmission facilities. Water from Toledo Bend could be released downstream for diversion at the facilities. The only cost presented here is the cost of raw water purchase. It is assumed that no treatment of the water will be necessary.

Orange County Manufacturing	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	-5,006	-10,855	-16,686	-21,863	-27,686
Recommended Strategy OR-1SRA (ac-ft/year): Raw surface water supply from SRA Canal.	5,000	15,000	20,000	25,000	25,000	28,000
Recommended Strategy ORM-2 (ac-ft/year): Raw water from Toledo Bend Reservoir	-	-	-	-	5,000	8,000

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
OR-1SRA Surface Water Contract	36,000	$0.00	$2,932,700	$ 81.50	$ 0.25

4C.1.12 Panola County. Panola County has only one entity with projected water shortages. Generally, demands in Panola County are expected to increase slightly and can be met through existing supplies. Both groundwater from the Carrizo-Wilcox and surface water supplies, mostly from Lake Murvaul, are used in Panola County. The Carrizo-Wilcox aquifer has a long-term availability of approximately 5,800 ac-ft per year in Panola County. Based on historical use information and well capacities from entities in the county, the groundwater supply is fully developed. Because the long-term sustainable availability of the aquifer has been reached, it is recommended that any new (not currently identified) large-scale water needs be met with surface water. It is recommended that those entities currently on groundwater remain on groundwater to meet their future growth until such time as groundwater is no longer a reliable supply. Any entities that are willing to convert to surface water should be encouraged to do so.

Manufacturing. The City of Carthage currently provides approximately 75 percent of the manufacturing water needs in Panola County. It was assumed that Carthage would continue to provide this level of supply though the planning period. Based on the projected demands, shortages for manufacturing in Panola County are expected beginning in 2010. It is recommended that this shortage be met by purchasing additional water from the City of Carthage.

Panola County Manufacturing	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-96	-116	-132	-147	-160	-187
Purchase water from Carthage	96	116	132	147	160	187

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/acre-feet)	Unit Cost ($/1000 gal)
Strategy : Purchase Water from Carthage	187	$0	$182,802	$978	$3.00

4C.1.13 Polk County. Polk County is partially located in the ETRWPA and partially in Region H. The county uses water from the Gulf Coast aquifer and local surface water and groundwater supplies. Based on the groundwater availability estimates for this plan, the Gulf Coast aquifer is sufficient to provide future demands.

County-Other. Current supplies are from the Gulf Coast aquifer and local groundwater sources. The selected strategy is to obtain additional supply from the Gulf Coast aquifer.

Polk County-Other	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-208	-417	-578	-681	-745	-828
Recommended Strategy POC-1A (ac-ft/year): Use additional supply from Gulf Coast Aquifer (Phases I-IV).	208	417	624	832	832	832

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 Gal.)
POC-1: Use additional supply from Gulf Coast Aquifer. Phase I-IV	208	$747,785	$75,513	$363	$1.11
Total	**832**	**$2,991,140**			

Manufacturing. Supplies are from the Gulf Coast aquifer and Other Undifferentiated Groundwater Supply. The selected strategy is to obtain additional supply from the Gulf Coast aquifer.

Polk County Manufacturing	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	-64	-164	-269	-365	-449
Recommended Strategy POM-1 (ac-ft/year): Expand existing supplies (Phases I and II)		225	225	450	450	450

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
POM-1: Expand existing supplies Phase I-II	225	$290,672	$32,678	$884	$0.45
Total	**450**	**$581,344**			

4C.1.14 Rusk County. Rusk County uses both surface water and groundwater to meet the water needs in the county. There are projected shortages for mining and steam-electric power use in Rusk County. The Carrizo-Wilcox groundwater aquifer is sufficient to supply the mining needs of Rusk County, and it is assumed that steam-electric power demands will continue to be met with surface water.

Mining. Current supply is groundwater and surface water. It is recommended that additional groundwater from Carrizo-Wilcox aquifer be used to meet the projected shortage.

Rusk County Mining	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	0	-30	-60	-88
Recommended Strategy RUL-1 (ac-ft/year): Increase supply from Carrizo-Wilcox	0	0	0	158	158	158

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
RUL-1: Increase supply from Carrizo-Wilcox	158	$241,600	$27,550	$174	$0.54

Steam-Electric. The demands for steam-electric power are based on projected demands from two existing power plants that have existing supplies: Luminant's Martin Lake and Teneska Gateway facilities. Martin Lake is shown to have a firm yield of 25,000 ac-ft per year. The Teneska Gateway facility uses water from Toledo Bend and has a contract for 17,929 ac-ft per year. Based on the projected demands for steam-electric power in Rusk County, there is a projected shortage of 9,900 ac-ft per year in 2060. It is uncertain whether this demand will be placed on an existing facility or a new facility. For planning purposes, it is assumed that 1,500 ac-ft per year of this demand will be at the Tenaska facility and can be met through additional supplies from SRA with little to no infrastructure improvements. It is assumed that the additional demand for water will occur through a new facility, which does not have a specified location. As such, this demand could be met through supplies from Lake Columbia. Water could be released from Lake Columbia and diverted from the Angelina River at the location of use.

Rusk County Steam-Electric	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	0	0	-1,501	-9,912
Recommended Strategy RUSE-1 (ac-ft/year): Supply from SRA	0	0	0	0	1,501	1,500
Strategy RUSE-2: Supply from Lake Columbia					0	8,500

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
RUSE-1: Supply from SRA, Toledo Bend Reservoir	1,500	$1,318,500	$305,000	$203	$0.62
RUSE-2: Supply from ANRA (Lake Columbia)	8,500	$8,640,450	$2,396,000	$282	$0.86

4C.1.15 Sabine County. Water supply in Sabine County is comprised of water from the Carrizo-Wilcox aquifer, Sparta, Yegua-Jackson and other minor aquifers, Toledo Bend Reservoir, and local surface supplies. The total available supply from groundwater in Sabine County is 9,400 ac-ft per year. Of this amount, about 1,500 ac-ft per year is currently being used. This leaves considerable groundwater to meet projected shortages. In addition, Toledo Bend Reservoir, which is located along the eastern border of Sabine County, has available supply (through contracts with SRA).

County-Other. Sabine County-Other includes users in both the Sabine and Neches River basins. Supply is generally from groundwater with some surface water provided from the SRA in the Sabine Basin. Considering historical use there is a surplus of water in the Sabine Basin and a shortage in the Neches Basin. The maximum shortage in the Neches Basin is 193 ac-ft per year in year 2060. To meet this shortage it is recommended that additional wells be drilled in the Carrizo-Wilcox in the Neches Basin. Since there may be several users, the costs for the strategy were estimated based on two wells producing 50 ac-ft per year each. It was assumed that no additional transmission is needed since the demands remain fairly steady over the planning period. As an alternative, local users could purchase treated water from the City of Hemphill. For this strategy, a 5-mile pipeline was assumed from Hemphill.

Sabine County-Other	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-3	-12	-18	-24	-31	-43
Recommended Strategy SBC-1 (ac-ft/year): Increase supply from Carrizo-Wilcox (Neches Basin)	32	32	32	64	64	64
Alternative Strategy SBC-2: Purchase water from Hemphill	100	100	100	100	100	100

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
SBC-1: Additional Groundwater Phase I-II	64	$328,840	$35,300	$552	$1.69
SBC-2: Purchase water from Hemphill	100	$ 1,021,000	$ 148,200	$1,482	$4.55

Livestock. Supplies for livestock are from both groundwater (Carrizo-Wilcox, Sparta, and local aquifers) and local surface water (stock ponds). To meet the projected shortage by 2060 of 325 ac-ft per year, it is recommended that use from the existing supplies be expanded.

Sabine County Livestock	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-37	-80	-129	-186	-252	-324
Recommended Strategy SBL-1 (ac-ft/year): Expand Carrizo-Wilcox supplies (Sabine)	50	50	100	100	100	100
Recommended Strategy SBL-1 (ac-ft/year): Expand current surface water supplies (Neches and Sabine)	50	100	107	200	210	300

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
SBL-1: Expand Carrizo-Wilcox supplies (Sabine)	100	$226,430	$42,707	$427	$1.31
SBL-2: Stock Ponds	300	$562,700	$49,100	$164	$0.50

4C.1.16 San Augustine County. San Augustine County lies within both the Neches and Sabine River Basins. Current water supplies for the county include groundwater from the Carrizo-Wilcox, Sparta, and Yegua-Jackson, surface water from San Augustine Lake and other small local supplies. Available supplies to meet projected shortages include 1,400 ac-ft per year of unallocated groundwater and a small amount of surface water from San Augustine.

Irrigation. Current water supply for irrigation in San Augustine County is exclusively from groundwater. There are no surface water rights associated with irrigation. Pumpage data by basin appears to show that water pumped from the Sabine Basin portion of the County is being used to meet needs in the Neches portion of the County. It is assumed this will continue. Even with this use of water, there is a shortage for irrigation in the Neches Basin. It is recommended additional groundwater from the Carrizo-Wilcox be used to meet irrigation needs in the Neches Basin.

San Augustine County Irrigation	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-100	-100	-100	-100	-100	-100
Recommended Strategy SAI-1 (ac-ft/year): Obtain water from Carrizo-Wilcox aquifer	100	100	100	100	100	100

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
SAI-1: Carrizo-Wilcox aquifer	100	$224,690	$43,639	$485	$1.49

Livestock. Supplies for livestock are from both groundwater (Carrizo-Wilcox, Sparta and Yegua-Jackson) and local surface water stock ponds. Demands are projected to increase by about one third over the planning period. It is recommended that these shortages (up to 621 ac-ft per year by 2060) be met with increases in both the local groundwater and surface water supplies.

San Augustine County Livestock	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-91	-169	-260	-365	-487	-621
Recommended Strategy SAL-1 (ac-ft/year): Increase local surface water supplies (stock ponds) – Neches Basin		50	100	200	200	300
Recommended Strategy SAL-2 (ac-ft/year): Increase groundwater water supplies from Carrizo-Wilcox aquifer - Sabine Basin	50	50	50	100	100	100
Recommended Strategy SAL-3 (ac-ft/year): Increase groundwater water supplies from Carrizo-Wilcox aquifer- Neches Basin	100	100	200	200	300	300

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
SAL-1: Stock ponds	300	$562,700	$49,100	$164	$0.50
SAL-2: Carrizo-Wilcox (Sabine)	100	$ 189,570	$ 41,168	$528	$0.84
SAL-3 Carrizo-Wilcox (Neches)	300	$ 379,140	$ 82,336	$ 528	$ 0.840

Manufacturing. Manufacturing shortages in San Augustine County are estimated at 2 ac-ft per year by 2060. Since this shortage is below the 5 ac-ft per year threshold for developing strategies, no strategies were developed for San Augustine Manufacturing. It is likely that this shortage can be met through existing supplies.

Mining. There are little to no current mining activities in San Augustine County; however, with the increased interest in natural gas exploration in East Texas, there are new projected water demands for mining in San Augustine County. To meet these demands, it is recommended to use water from Sam Rayburn Reservoir or run-of-the-river diversions from the Attoyac Bayou. It is assumed that ANRA would be the sponsor for the run-of-the river water. This would require a new diversion right.

San Augustine County Mining	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-1,500	-7,000	0	0	0	0
SAMi-1: Purchase water from ANRA (Attoyac Bayou)	500	500	0	0	0	0
SAMi-2: Purchase water from LNVA (Sam Rayburn)	1,000	6,500	0	0	0	0

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
SAMi-1: Purchase water from ANRA (Angelina River)	500	$2,627,850	$363,000	$726	$2.23
SAMi-2: Purchase water from LNVA (Sam Rayburn)	6,500	$8,212,450	$1,993,000	$307	$0.94

4C.1.17 Shelby County. Shelby County, which is located in the northeastern part of the region, uses groundwater from the Carrizo-Wilcox aquifer and surface water from Toledo Bend Reservoir, Lake Pinkston, and Center Lake. The largest water user in the county is livestock, and this demand is expected to nearly triple by 2060. The other major demand center is the City of Center and its customers. The total projected shortage for the county is 8,215 ac-ft per year. The Carrizo-Wilcox aquifer has a long-term availability of 12,750 ac-ft per year, and its estimated current use is approximately 3,700 ac-ft per year. There is groundwater available for development, and there is considerable supply available from Toledo Bend Reservoir, which would require infrastructure development to the areas with needs. It is recommended that those entities currently on groundwater remain on groundwater to meet their future growth until such time as groundwater is no longer a reliable supply. Any entities that are willing to convert to surface water should be encouraged to do so.

County –Other. Water users that fall into the County-Other category receive water from the Carrizo-Wilcox aquifer, and sales from Center, Joaquin, SRA, and Shelby County FWSD #1. Based on current use and supply location, there is a surplus of water in the Neches Basin and a shortage in the Sabine Basin. The shortage in the Sabine Basin is 259 ac-ft per year in 2010 increasing to 478 ac-ft per year by 2060. These shortages will be met through expanded use of groundwater from the Carrizo-Wilcox and expanded use from Toledo Bend Reservoir through sales from SRA.

Shelby County-Other	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year) (Neches and Sabine Basins)	-126	-190	-244	-253	-288	-344
Recommended Strategy SHCo-1: Expand groundwater from the Carrizo-Wilcox (Sabine)	100	200	300	300	350	350
Recommended Strategy SHCo-2 (ac-ft/year): Purchase additional water from Center	50	50	50	50	50	50
Recommended Strategy SHCo-3 (ac-ft/year): Purchase water from SRA (Toledo Bend Reservoir)	150	150	150	150	150	150

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
SHCo-1: Carrizo-Wilcox wells	350	$2,278,400	$275,097	$786	$2.41
SHCo-2: Purchase from Center	50	$0	$48,878	$978	$3.00
SHCo-3: Purchase from SRA	150	$3,024,150	$347,400	$2,316	$7.10

Livestock. Livestock water demands are projected to increase significantly in Shelby County, partially due to the growing poultry industry. Current supply is from Carrizo-Wilcox aquifer and local surface water supplies. Some individual livestock water users may be able to drill individual wells or develop local stock ponds, but any large-scale user should obtain surface water from Toledo Bend Reservoir through a contract with SRA.

Shelby County Livestock	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-777	-1,707	-2,841	-4,222	-5,907	-7,961
Recommended Strategy SHL-1 (ac-ft/year): Increase Groundwater Supplies (Sabine Basin)	1,000	2,000	2,000	2,000	2,000	2,000
Recommended Strategy SHL-2 (ac-ft/year): Increase Groundwater Supplies (Neches Basin)	500	500	1,000	1,000	1,500	1,500
Recommended Strategy SHL-3 (ac-ft/year): Increase Local Supplies (Sabine Basin)			500	500	500	500
Long Term Scenario SHL-4 (ac-ft/year): Supplies from Toledo Bend (Sabine Basin)				4,000	4,000	4,000

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
SHL-1: Additional Groundwater Wells (Sabine Basin)	2,000	$1,387,600	$213,000	$107	$0.33
SHL-2: Additional groundwater wells (Neches Basin)	1,500	$1,040,800	$159,700	$106	$0.33
SHL-3: Increase local supplies	500	$689,600	$60,100	$120	$0.37
SHL-4: Purchase Raw Water from SRA (Toledo Bend)	4,000	$4,763,200	$1,177,000	$294	$0.90

Manufacturing. Current supply for manufacturing is from the Carrizo-Wilcox aquifer and sales from the City of Center. There is also a small amount of reuse water being used by local manufacturers. The majority of the use is from Center Lake and Pinkston Reservoir by manufacturing customers of Center, the largest of which is Tyson Foods. The projected shortage is associated with increased demands above the amount assumed to be supplied by the City of Center. This shortage can be met through existing supplies for the City of Center. It is recommended that any new manufacturing facility purchase water from the City of Center. No new infrastructure was assumed for cost purposes, but new industries may require additional transmission facilities, depending on their location.

Shelby County Manufacturing	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	0	0	-5	-12
Recommended Strategy SHM-1 (ac-ft/year): Purchase water from City of Center	0	0	0	0	5	12

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
SHM-1: Purchase surface water from City of Center	12	$0	$11,731	$978	$3.00

Mining. There are little to no current mining activities in Shelby County; however, with the increased interest in natural gas exploration in East Texas, there are new projected water demands for mining. To meet these demands, it is recommended to use water from Toledo Bend Reservoir and/or run-of-the-river diversions from the Attoyac Bayou. It is assumed that ANRA would be the sponsor for water from Attoyac Bayou and SRA would be the sponsor for water from Toledo Bend reservoir. Water from Attoyac Bayou would require a new diversion right.

Shelby County Mining	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-500	-1,500	0	0	0	0
SHMi-1: Purchase water from ANRA (Attoyac Bayou)	250	250	0	0	0	0
SHMi-2: Purchase water from SRA (Toledo Bend)	250	1,250	0	0	0	0

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
SHMi-1: Purchase water from ANRA (Attoyac Bayou)	250	$1,543,400	$209,000	$836	$2.56
SHMi-2: Purchase water from SRA (Toledo Bend)	1,250	$3,847,950	$619,000	$495	$1.52

4C.1.18 Smith County. Smith County is located partially in the ETRWPA and partially in Region D. Much of the water in Smith County in the ETRWPA comes from sources for the City of Tyler, with the remainder coming from groundwater. A small amount of water is supplied from Lake Jacksonville through the Cherokee WSC. The City of Tyler currently utilizes surface water from Lakes Tyler and Tyler East, Bellwood Lake and Lake Palestine. About 10 percent of Tyler's current supplies is from the Carrizo-Wilcox aquifer.

The groundwater in Smith County is heavily used by current users. The Carrizo-Wilcox aquifer, which is the reliable groundwater source is nearly fully allocated to water users (175 ac-ft per year of water that is not allocated to current users). There is water available from the Queen City aquifer, but water quality concerns limit its potential use. Due to the complexity of the available sources, the most likely sources for municipal water needs include surface water supplies from the City of Tyler and voluntary transfers from other users. Irrigation and mining needs are shown to be supplied by the Queen City aquifer.

Bullard. Bullard's current supply is from the Carrizo-Wilcox aquifer. Due to competition for water from this source, the City is projected to have a shortage of nearly 200 ac-ft per year by 2060. Based on its proximity to other sources is recommended that Bullard expand its groundwater supplies in the Carrizo-Wilcox aquifer.

Bullard	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	-13	-42	-71	-124	-195
Recommended Strategy BU-1 (ac-ft/year): Increase supply from Carrizo-Wilcox	0	100	100	100	100	100
Recommended Strategy BU-2 (ac-ft/year): Increase supply from Carrizo-Wilcox	0	0	0	0	100	100
BU-3: Water Conservation		3	4	5	6	8

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Strategy BU-1A: Increase supply from Carrizo-Wilcox	200	$305,674	$51,736	$517	$1.59
BU-3: Water Conservation	8		$2,388	$299	$0.92

Community Water Company. Community Water Company serves multiple counties in Regions C and D and Smith County in the ETRWPA. Water supplies to Smith County are from the Carrizo-Wilcox aquifer. Due to competition for this source, it is recommended that Community Water Company purchase water from a local provider. For planning purposes, it is assumed that the City of Tyler would supply Community Water Company.

Community Water Co.	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-37	-88	-111	-132	-171	-227
Recommended StrategyCWI-1A (ac-ft/year): Purchase water from the City of Tyler or other local water provider.	121	121	121	227	227	227

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Strategy CW-1A: Purchase water from the City of Tyler or other local water provider.	227	$1,640,776	$395,561	$1,743	$5.35

Jackson WSC. Current supplies for Jackson WSC are from Carrizo-Wilcox. Jackson WSC has a contract with ANRA for water from Lake Columbia. It is recommended that Jackson WSC participate with the ANRA treated water system project to meet its projected shortage (see Section 4C.21 for discussion of ANRA's strategies).

Jackson WSC	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	-38	-83	-118	-157
Recommended Strategy JA-1 (ac-ft/year): Purchase treated water from ANRA (Lake Columbia)	0	600	600	600	600	600

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Strategy JA-1 (ac-ft/year): Purchase water from ANRA (Lake Columbia)	600	(1)	$741,000	$1,235	$3.50

Lindale Rural WSC. Lindale Rural WSC is located in both Region D and the ETRWPA. The WSC obtains most of its water from the Carrizo-Wilcox aquifer. With the projected growth, Lindale WSC is projected to have a small shortage in 2060. This shortage can likely be met through additional groundwater from the Carrizo-Wilcox aquifer. Pending availability, some water may come from wells located in Region D. For planning purposes, it is assumed that the additional supply can be met with water in the ETRWPA.

Lindale Rural WSC	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	0	0	0	-73
Recommended Strategy LIR-1 (ac-ft/year): Increase supply from Carrizo-Wilcox	0	0	0	0	0	80
LIR-2: Water Conservation	0	0	5	7	9	12

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Strategy LIR-1: Increase supply from Carrizo-Wilcox	80	$347,259	$65,938	$824	$2.53
LIR-2: Water Conservation	12		$3,582	$299	$0.92

Whitehouse. Whitehouse has shortages which are expected to increase over the planning period from 27 acre-feet in 2010 to 224 acre-feet in 2060. The City of Whitehouse is a participant in the Lake Columbia project. It is recommended that the City of Whitehouse meet this shortage with the purchase of treated water from ANRA in 2020. In the interim, it is recommended that Whitehouse increase the amount of water it purchases from the City of Tyler.

Whitehouse	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-27	-54	-79	-105	-155	-224
Strategy WH-1: Purchase water from ANRA	0	1,200	1,200	1,200	1,200	1,200
Strategy WH-2: Purchase water from Tyler	27					

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Strategy WH-1: Purchase Water from ANRA	1,200	(1)	$1,368,000	$1,140	$3.50
Strategy WH-2: Purchase additional water from Tyler	27	$0			$3.00

Irrigation. There is little traditional irrigation water use in Smith County in the ETRWPA. Most of the irrigation demand is associated with the irrigation of golf courses, which is currently supplied by the City of Tyler and UNRMWA. Considering the unknown locations of the increased demands, it is recommended that the projected shortages be met by water from the Queen City aquifer. Alternatively, surface water could be used to meet these demands through increased sales from Tyler and/or UNRMWA.

Smith County Irrigation	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-6	-36	-68	-100	-133	-168
Recommended Strategy SMI-1 (ac-ft/year): Increase supply from the Queen City	40	40	80	120	168	168

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Strategy SMI-1: Increase supply from Queen City	168	$357,794	$39,333	$234	$0.72

Manufacturing. Manufacturing is expected to have shortages beginning in 2030 at 5 ac-ft per year and increasing to 294 ac-ft per year in 2060. It is recommended that the manufacturing shortage be met through the purchase of additional supplies from the City of Tyler.

Smith County Manufacturing	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	-6	-101	-182	-295
Strategy SMMa-1 (ac-ft/year): Purchase water from City of Tyler	0	0	6	101	183	295

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Strategy SMMa-1 (ac-ft/year): Purchase water from City of Tyler	295	$1,476,152	$438,811	$1,493	$4.58

Mining. The mining water demands in Smith County are based on historical water usage that appears to be no longer in place. The TWDB currently reports only a small amount of groundwater use in Smith County for mining purposes. As a result the projected demands do not accurately reflect the current usage. The TWDB has commissioned a study on water use for mining purposes across the State. This study should be completed for the development of the projected water demands for the 2016 water plan. Until such time as new mining demands are developed, it is assumed that any new mining water needs will be met from groundwater from the Queen City aquifer.

Smith County Mining	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	-47	-126	-159	-215	-255	-288
Recommended Strategy SMM-1 (ac-ft/year): Increase supply from the Queen City.	47	141	188	235	282	329

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Strategy SMM-1: Increase supply from Queen City	329	$655,416	$72,108	$219	$0.67

4C.1.19 Trinity County.

County-Other. Small water suppliers in Trinity County rely on the Yegua-Jackson, the Gulf Coast aquifer and other undifferentiated groundwater sources. The recommended strategy is to expand groundwater supplies. For planning purposes, it is assumed that this supply will come from the Yegua-Jackson aquifer.

Trinity County-Other	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	0	0	-9	-32	-57
TRC-1: Increase Supply from Yegua-Jackson				60	60	60

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
TRC-1: Increase Supply from Yegua-Jackson	60	$249,851	$36,990	$616	$1.89

4C.1.20 Tyler County.

County-Other. All of the municipal water supply in Tyler County is from the Gulf Coast aquifer. Increases in projected County-other demands result in a shortage beginning in 2020. The recommended strategy is to continue use of groundwater from Gulf Coast aquifer. The strategy assumes that four separate groundwater wells will be constructed to meet the needs of various entities.

Tyler County-Other	2010	2020	2030	2040	2050	2060
Supply(+)-Demand(-) (ac-ft per year)	0	-142	-239	-251	-232	-232
Recommended Strategy TYC-1 (ac-ft/year): Increase supply from Gulf Coast Aquifer.	0	251	251	251	251	251

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
TYC-1: Increase supply from Gulf Coast Aquifer.	251	$366,241	$49,441	$197	$0.60

Woodville. The City of Woodville obtains water from the Gulf Coast aquifer in Tyler. There is sufficient supply to meet the City's needs. However, the City also provides water to two prison facilities. Including these demands and considering the TCEQ's requirements to meet a maximum day demand equivalent to 0.6 gpm per connection, the City of Woodville will need a new water well. It is assumed that the City will drill one new well within one mile of its existing transmission system or the distribution point.

Strategy	Yield (ac-ft per year)	Total Capital Cost	Total Annualized Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
WDV-1: Increase supply from Gulf Coast Aquifer.	300	$511,400	$72,700	$242	$0.74

4C.2 Wholesale Water Providers with Needs

This section provides discussions for wholesale water providers (WWP) located in the ETRWPA that meet one of the following criteria:

- Has a projected shortage in supplies based on demands of current customers and current reliable supplies. These WWPs include ANRA, Athens MWA, City of Lufkin, Houston County WCID, SRA (Upper Basin) and the UNRMWA.
- Has supply sources in the ETRWPA that are listed as WMS for WUGs outside the Region. Both the UNRMWA and the SRA are included under this criterion.
- Are currently pursuing WMS to increase the reliability and/or distribution of their supplies. These include the cities of Nacogdoches, Tyler and Jacksonville, SRA and the LNVA.

4C.2.1 Angelina and Neches River Authority. ANRA is the sponsor for the Lake Columbia project on Mud Creek in Cherokee and Rusk Counties. ANRA currently has contracted customers for 63 percent of the 85,507 ac-ft per year permit of the proposed Lake Columbia reservoir. In addition, ANRA has been approached to supply water for mining purposes associated with the exploration of the Haynesville/ Bossier Shale. Some of this demand could be met through Lake Columbia, while some may be met with run-of-the-river diversions. The City of Dallas is also considering Lake Columbia as an alternative strategy.

Lake Columbia has a water right and is currently seeking a 404 permit for construction. An environmental impact study (EIS) has been prepared for Lake Columbia under the direction of the USACE. The draft EIS was published on January 29, 2010. As required, public and agency comments on the draft EIS are being received until March 30, 2010. Both ANRA and participating entities will share in the costs associated with the Lake Columbia water management strategy. Construction costs are divided into three separate categories: reservoir, water treatment plant and transmission system. For reservoir construction, unit costs are based on the WAM Run 3 yield estimate of 75,700 ac-ft per year. Costs for water treatment are shared among currently contracted entities that are assumed to buy treated water from ANRA. These include most of the municipal water users in Cherokee, Rusk and Smith Counties. The cities of Nacogdoches, Jacksonville, and Rusk and Temple Inland were assumed to purchase raw water and develop their own treatment facilities. Transmission system costs are shared among the contracted suppliers that receive treated water. The water suppliers currently under contract with ANRA are listed with the current participation percentage in the table below.

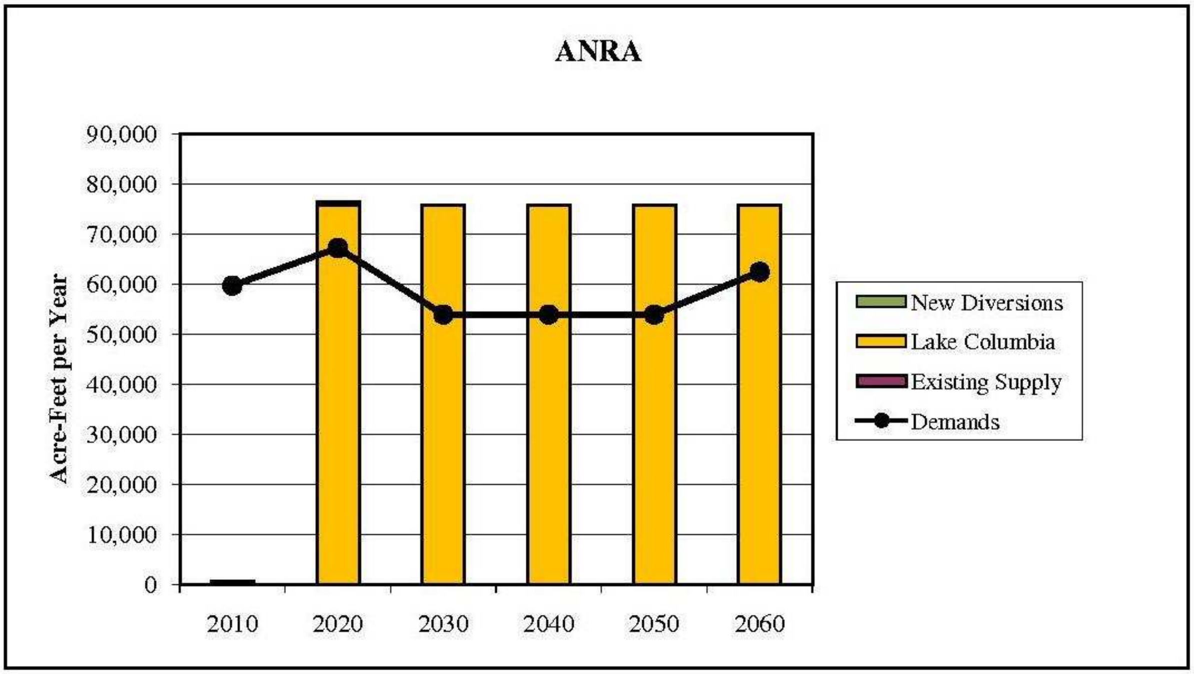
Current Participants in Lake Columbia

Recipient	County	Basin	Percent Participation	Contract Amount (ac-ft per year)
Temple Inland	Angelina	Neches	10.0%	8,551
Afton Grove WSC, Stryker Lake WSC, Cherokee County	Cherokee	Neches	4.5%	3,848
Jacksonville	Cherokee	Neches	5.0%	4,275
New Summerfield	Cherokee	Neches	3.0%	2,565
North Cherokee WSC	Cherokee	Neches	5.0%	4,275
Rusk	Cherokee	Neches	5.0%	4,275
Rusk Rural WSC	Cherokee	Neches	1.0%	855
Caro WSC	Nacogdoches	Neches	0.5%	428
Nacogdoches	Nacogdoches	Neches	10.0%	8,551
New London	Rusk	Sabine	1.0%	855
Troup	Smith	Neches	5.0%	4,275
Arp	Smith	Neches	0.5%	428
Blackjack WSC	Smith	Neches	1.0%	855
Jackson WSC	Smith	Neches	1.0%	855
Whitehouse	Smith	Neches	10.0%	8,551
City of Alto	Cherokee	Neches	0.5%	428

A comparison of the water supplies versus the demands and the recommended strategies to be implemented follows. A summary of the strategy costs is also provided.

Water Management Strategies

	2010	2020	2030	2040	2050	2060
Existing Supplies						
Jasper Aquifer	60	65	70	70	70	70
Water Management Strategies						
Lake Columbia	0	75,700	75,700	75,700	75,700	75,700
New Run-of River Diversions	750	750	0	0	0	0
Total Supplies from Strategies	0	76,450	75,700	75,700	75,700	75,700
Total Supplies	**810**	**77,265**	**75,770**	**75,770**	**75,770**	**75,770**
Demands (ac-ft per year)						
Demand (Current Customers)	53,929	53,934	53,939	53,939	53,939	53,939
Demand (Potential Future)	5,750	13,250	0	0	0	8,500
Potential Demand (Total)	59,679	67,184	53,939	53,939	53,939	62,439
Surplus or (Shortage)	**-58,869**	**10,081**	**21,831**	**21,831**	**21,831**	**13,331**



Strategy	Yield (ac-ft per year)	Capital cost	Annual Cost	Unit Cost ($/AF)	Unit Cost ($/1000 gal)
New River Diversions	750	$500,000	$0	$0	$0
Lake Columbia Reservoir	75,700	$231,865,000	$16,280,500	$215	$0.66
ANRA Treatment Plant and Distribution System	5,100	$35,127,250	$5,868,950	$1,151	$3.53

4C.2.2 Athens MWA. Athens MWA has a water right to divert 8,500 ac-ft per year from Lake Athens. Of this amount, 5,477 ac-ft per year can be used to meet projected municipal and manufacturing demands of the City of Athens. There is also a projected local demand of 155 ac-ft per year for lawn irrigation around the lake. This demand is expected to increase to 185 ac-ft per year by 2060. The Athens Fish Hatchery, located at the lake, has a contract with Athens MWA to divert 3,023 ac-ft per year from Lake Athens to serve the hatchery. Currently, approximately 95 percent of the diverted water is returned to Lake Athens; however, the Fish Hatchery is under no contractual obligations to continue this practice. Due to operational constraints of the hatchery's intake structure and the assumption that the hatchery's diversions will not be returned to the lake, the operational yield of Lake Athens is 2,900 ac-ft per year. The total projected shortages associated with Lake Athens for current customers are 5,521 ac-ft per year by 2060.

Recognizing the limitations of its existing supplies, Athens MWA has received a reuse permit that allows the City of Athens to discharge its wastewater effluent to Lake Athens, which can then be rediverted for use. The reuse permit is for 2,677 ac-ft per year. However, a recent study by Region C shows that this strategy is less economically feasible than other alternatives. At this time, Athens MWA and the City of Athens are not pursuing reuse to Lake Athens.

Other strategies considered include:

- Conservation for the city of Athens
- Continued reuse of diverted water by the Athens Fish Hatchery
- Develop groundwater from the Carrizo-Wilcox aquifer near Lake Athens and transport to Athens water treatment plant
- Temporary pumping facility for the fish hatchery to utilize water below its existing intake
- Water from Forest Grove Reservoir

Based on projected demands on Athens MWA, additional water treatment will be needed by 2040. The total treatment capacity needed by 2060 is estimated at 11 MGD. Existing treatment capacity is 6 MGD, with a 7.5 MGD treated water pipeline to the city of Athens.

With these considerations, it is recommended that Athens MWA implement the following strategies:

- Indirect reuse to Lake Athens from fish hatchery
- New groundwater from the Carrizo-Wilcox aquifer
- Water from Forest Grove Reservoir
- Construct new 4 MGD treatment plant near City of Athens, with a 4 MGD expansion in 2060.

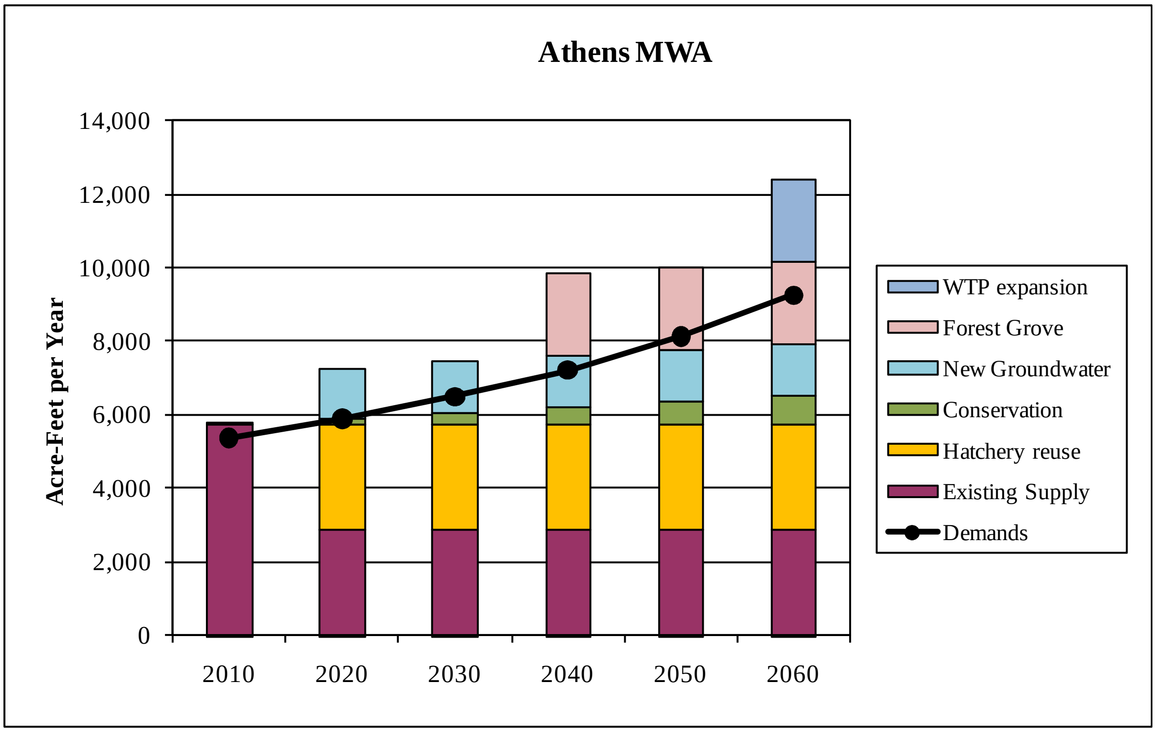
Indirect Reuse to Lake Athens from Fish Hatchery. To assure adequate supplies for the fish hatchery and other uses, Athens MWA should work with the fish hatchery to assure that the hatchery continues to return diverted water to Lake Athens for subsequent reuse. For purposes of this plan, it is assumed that 95 percent of the contracted water will be returned. This equates to 2,872 ac-ft per year of additional supply.

New Groundwater. Athens MWA is currently pursuing developing groundwater on property near Lake Athens. It is anticipated that four new wells would be drilled to provide a total of 2.5 mgd of groundwater supply. The water would be transported by pipeline to a storage facility near the existing city of Athens water treatment plant for subsequent distribution.

Forest Grove Reservoir and New Treatment Plant. This strategy assumes that up to 4,500 ac-ft per year would be diverted from Forest Grove Reservoir. This water would be treated at a new water treatment plant. The water treatment plant will be constructed for 4 mgd initially, supplying 2,240 ac-ft per year (2040), and be expanded to supply and additional 2,240 acre-feet per year by 2060. This strategy requires a change in permitted use from the lake and an agreement with Luminant to acquire the Forest Grove water rights.

In addition, conservation savings identified for the city of Athens will decrease the demands on the lake and Athens MWA. A summary of the amounts and timing of the proposed strategies is presented in the following table and figure.

	2010	2020	2030	2040	2050	2060
Existing Supplies						
Lake Athens	2,900	2,900	2,900	2,900	2,900	2,900
Fish Hatchery Reuse	2,872	0	0	0	0	0
Water Management Strategies						
Conservation (City of Athens)	47	111	298	451	589	765
Fish Hatchery Reuse	0	2,872	2,872	2,872	2,872	2,872
New groundwater (Carrizo-Wilcox)	0	1,400	1,400	1,400	1,400	1,400
Forest Grove w/ WTP at City	0	0	0	0	0	2240
WTP Expansion				2240	2240	2240
Total Supplies from Strategies	47	4,383	4,570	6,963	7,101	9,517
Total Supplies	5,819	7,283	7,470	9,863	10,001	12,417
Total from Conservation and Reuse	47	2,983	3,170	3,323	3,461	3,637
Percent of Strategy Supplies from Conservation and Reuse	100%	68%	69%	48%	49%	38%
Demands						
Demands (ac-ft per year)	5,367	5,884	6,502	7,203	8,119	9,251
Surplus or (Shortage)	**452**	**1,399**	**968**	**2,660**	**1,882**	**3,166**



Strategy	Yield (ac-ft per year)	Capital Cost	Annual Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Fish Hatchery Reuse	2,872	$ 0	$ 0	$ 0	$ 0
New Groundwater (Carrizo-Wilcox)	1,400	$3,799,000	$513,900	$367	$1.13
Forest Grove water with 4 MGD New WTP at City	2,240	$26,619,000	$2,628,600	$1,173	$3.60
4 MGD WTP Expansion	2,240	$16,575,556	$1,651,300	$ 843	$2.92

Alternative water management strategies for Athens MWA include:

- Reuse of City of Athens Discharges
- Developing additional yield from Lake Athens by building a new fish hatchery intake and expanding the existing water treatment plant.

4C.2.3 Houston County WCID 1. Houston County WCID 1 owns and operates Houston County Lake in the Trinity River Basin in Houston County. This reservoir is currently permitted for 3,500 ac-ft per year. The firm yield using the TCEQ-approved Trinity WAM with the original storage capacity is approximately 7,000 ac-ft per year. Houston County WCID 1 has increased interest from its current customers and potential future customers to provide additional water. To meet these demands, the WCID is currently seeking a permit amendment for the full yield of the reservoir. It is assumed that there are little to no capital costs associated with the amendment (only engineering and legal costs).

4C.2.4 City of Jacksonville. The City of Jacksonville has sufficient raw water and treatment capacity to meet its projected demands. However, the City has several constraints to providing treated surface water to all its customers. The ability to move additional surface water to the eastern part of Jacksonville to meet increasing demands is limited. The City's existing surface water treatment plant is currently underutilized and could provide more surface water with the necessary infrastructure improvements. It is recommended that the City of Jacksonville implement infrastructure improvements to fully utilize its existing water sources.

In addition, the City of Jacksonville is a participant in the Lake Columbia project. This lake provides a source of additional raw water for Jacksonville beyond this planning period or sooner if the City grows faster than projected. This strategy assumes that water would be diverted at Lake Columbia and transported to Jacksonville for treatment and distribution. Jacksonville has a contract with ANRA for 4,275 ac-ft per year from Lake Columbia. It is assumed that the first phase of this project would develop 1,700 ac-ft per year (3 MGD). Subsequent phases would fully develop the City's contracted amount.

Strategy	Yield (ac-ft per year)	Capital Cost	Annual Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Infrastructure Improvements	1,000	$1,000,000	97,200	$97.20	$0.30
Lake Columbia	1,700	$ 19,133,700	$ 2,503,000	$ 1,472	$ 4.52

4C.2.5 Lower Neches Valley Authority. The projected water demands supplied by the LNVA total 1,082,654 ac-ft per year in 2060. In addition to these demands there are 32,000 ac-ft per year in potential future demands and 40,000 ac-ft per year in potential future irrigation demand increases. The LNVA is pursuing six strategies to increase its reliable water supplies. These include:

- Water conservation associated with its irrigation deliveries
- Modification of operations of the Neches River Saltwater Barrier, Lake BA Steinhagen and Sam Rayburn Reservoir as a system to maximize yield
- Permit amendment for storage and unpermitted yield in Sam Rayburn Reservoir that is associated with the flood reallocation from elevation 164 ft msl to 164.4 ft msl
- Flood storage reallocation and water right for associated storage and yield
- Sediment reduction in Lake B.A. Steinhagen
- Purchase of water from the SRA

In addition to these strategies, the construction of Rockland Reservoir is recommended as an alternate strategy. A brief discussion of each strategy is presented below.

Water Conservation. The LNVA has implemented programs to increase the efficiency of water use in agricultural applications and deliveries. The results of these programs are showing reductions in irrigation losses and use of up to nearly 30 percent of the irrigation water provided to current users. These water savings are reported as water supply but are actually demand reductions for current irrigation users. It is expected that the increased irrigation efficiencies will result in increases in irrigated acres (potential future irrigation demand). The projected water conservation savings should offset these increases in demands resulting from future growth.

System Operations. The LNVA completed a salt water barrier in 2003. Operation of the LNVA reservoirs with the salt water barrier may result in some water conservation by reducing the flow for fresh water needed to prevent the intrusion of salt water into the fresh water supply intakes. The Corps of Engineers conducted an Environmental Assessment of the impacts of the salt water barrier and reported that the average expected conservation, assuming no flow is required for prevention of salt water intrusion, is on the order of 111,000 ac-ft per year[1]. In drought years, the LNVA has realized savings as much as 500,000 ac-ft. However, some flow may be required for other purposes and the exact value of this strategy is unknown at this time. For planning purposes, it is assumed that average required flow will be available as additional supply. To realize this supply, LNVA will need to seek a systems operation permit from TCEQ.

Permit Amendment for Unpermitted Yield in Sam Rayburn Reservoir. In 1969 the Corps of Engineers converted 43,000 ac-ft of flood storage in Sam Rayburn Reservoir to water supply by raising the conservation pool from 164.0 ft msl to 164.4 ft msl. The associated firm yield was estimated at 28,000 ac-ft per year. A contract between the Corps and the City of Lufkin for this storage was approved on May 22, 1969; however, a water right for the additional yield was never submitted to the TCEQ. When the City of Lufkin began preliminary design to use this supply the LNVA converted 28,000 ac-ft per year of its Sam Rayburn water right to Lufkin, with the intent of submitting a water right application to TCEQ for this amount. This strategy recommends that the LNVA submit a water rights application for the 28,000 ac-ft per year of supply that is associated with the increase of conservation elevation to 164.4 ft msl. The implementation of this strategy would not require construction of additional infrastructure or additional studies.

Reallocation of Flood Storage in Sam Rayburn Reservoir. One of the primary purposes for the Sam Rayburn Reservoir is flood control with approximately 1,099,000 ac-ft of flood storage. Under current operations at Sam Rayburn water is released from the flood pool such that the flows at the Evadale gage on the Neches River do not exceed 20,000 cfs. When the flood pool elevation drops to 166 ft msl, the gates are closed and the remaining flood water is released through the hydropower turbines. This is the same operation for when the water is in the conservation pool (below 164.4 ft msl).

This strategy recommends that the flood storage between elevations 164.4 and 166.0 ft msl be converted to water supply purposes. There would be minimal impacts to current operations and the amount of additional water supply that could be made available is estimated at 122,000 ac-ft per year. This strategy requires Congressional action for the reallocation. It also would require the LNVA to enter into a contract with the Corps of Engineers for the additional storage, which is estimated at 186,500 ac-ft, and submit a water rights permit to TCEQ for the 122,000 ac-ft per year of additional diversion.

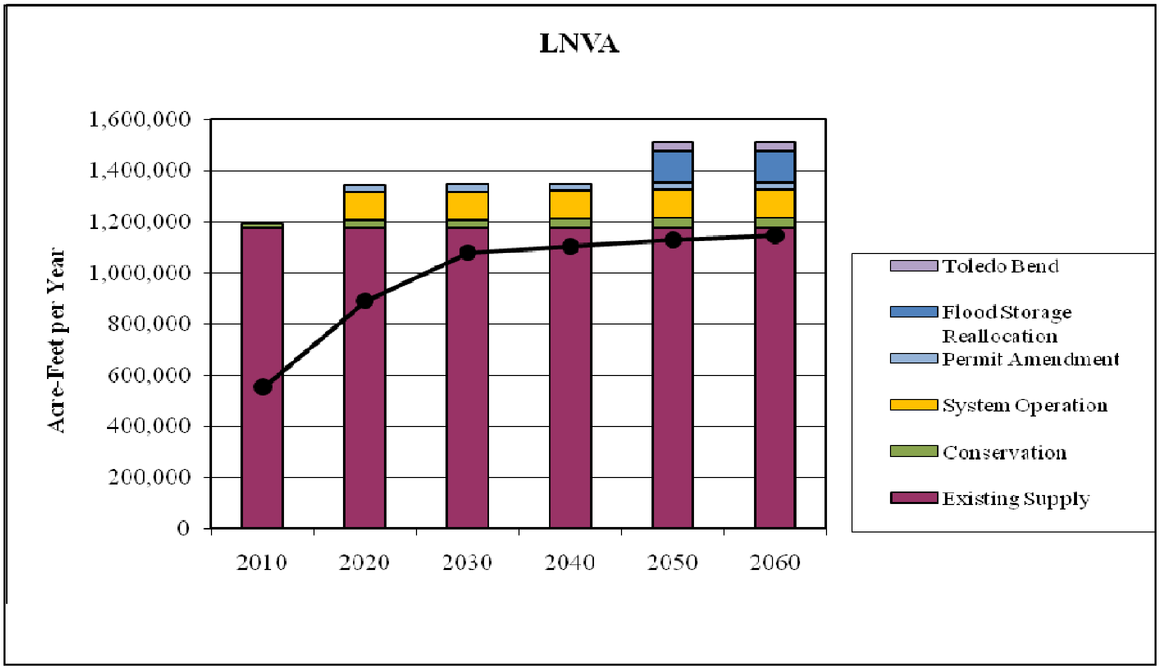
Sediment Reduction. The LNVA pursued a study of the feasibility of recapturing storage in Lake B.A. Steinhagen. The recent sediment survey of Lake B.A. Steinhagen shows a loss of nearly one third of its original capacity due to sediment. An additional loss of nearly one third (30,000 acre-feet) is projected over the planning period. Limiting the sediment accumulation and/or recapturing lost storage allow the LNVA more flexibility in its operations of its water system. The Neches WAM shows that LNVA is able to fully divert the current permitted amount from Lake B.A. Steinhagen and Sam Rayburn Reservoir through the planning period (considering projected sediment accumulations). Therefore, increasing the storage will not increase diversion; however, it will allow more water to be stored in Lake B.A. Steinhagen for operational purposes.

(Note: recapturing storage will not increase the storage amount in B.A. Steinhagen above the permitted volume.) The volume of water from this strategy is minimal, while the cost would be significant. Therefore, LNVA has determined that this project will not be pursued further at this time as a water management strategy for LNVA.

Purchase Water from the Sabine River Authority. The proximity of the Sabine River Basin could make the transfer of water from the Sabine River a feasible alternative. Infrastructure that would be required includes pump stations and transfer through open canal or closed pipe systems.

Rockland Reservoir. Rockland Reservoir was authorized for construction, as a federal facility, in 1945 along with Sam Rayburn, B. A. Steinhagen and Dam A lakes. A 1947 report recommended construction of Sam Rayburn and B.A. Steinhagen with deferral of Rockland Reservoir and Dam A until such time the need develops. The Rockland Reservoir site is located on the Neches River at River Mile 160.4. The top of the flood pool would be at elevation 174 feet, msl with top of conservation pool of 165 feet, msl. The Reservoir Site Protection Study updated the yield and costs for the Rockland Reservoir using ENR indexing (TWDB, 2007). No recent detailed cost data has been developed for Rockland Reservoir. Based on the TWDB study, the estimated yield of Rockland is 614,400 ac-ft per year and the unit cost of water is $115 per ac-ft (updated to 2008 dollars). More detailed studies are needed to confirm the yield and costs for this project.

	2010	2020	2030	2040	2050	2060
Existing Supplies (ac-ft per year)						
Sam Rayburn / B.A. Steinhagen	792,000	792,000	792,000	792,000	792,000	792,000
Pine Island	381,876	381,876	381,876	381,876	381,876	381,876
Water Management Strategies (ac-ft per year)						
Conservation (Irrigation)	20,000	30,000	33,000	35,000	40,000	40,000
System Operation with Saltwater Barrier	0	111,000	111,000	111,000	111,000	111,000
Unpermitted Yield of Sam Rayburn	0	28,000	28,000	28,000	28,000	28,000
Reallocation of Flood Storage	0	0	0	0	122,000	122,000
Purchase from SRA (Toledo Bend)					36,000	36,000
Total Supplies from Strategies	20,000	169,000	172,000	174,000	337,000	337,000
Total Supplies	**1,193,876**	**1,342,876**	**1,345,876**	**1,347,876**	**1,510,876**	**1,510,876**
Total from Conservation and Reuse	20,000	141,000	144,000	146,000	151,000	151,000
Percent of Strategy Supplies from Conservation and Reuse	100%	83%	84%	84%	45%	45%
Demands (ac-ft per year)						
Demand (Current Customers)	530,781	829,286	1,021,528	1,043,078	1,063,682	1,082,654
Demand (Potential Irrigation)	20,000	30,000	33,000	35,000	40,000	40,000
Demand (Potential Future)	1,000	32,091	25,591	25,591	25,591	25,591
Potential Demand (Total)	551,781	891,377	1,080,119	1,103,669	1,129,273	1,148,245
Surplus or (Shortage)	**642,095**	**451,499**	**265,757**	**244,207**	**381,603**	**362,631**



Strategy	Quantity (ac-ft per year)	Capital Cost	Annual Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
LNVA-1: Water Conservation	40,000	$1,400,000[1]	$30,000	$3.80	$0.01
LNVA-2: System Operations	111,000	$2,000,000	$500,000[2]	$4.50	$0.01
LNVA-3: Permit amendment Sam Rayburn	28,000	$200,000[2]	$0	$0	$0
LNVA-4:Reallocation of Flood storage	122,000	$31,736,500[3]	$3,089,700	$25.33	$0.08
LNVA-6: Purchase of Water from Sabine River Authority	36,000	$39,168,200	$ 5,967,000	$166	$0.51
Alt. Strategy LNVA-7: Rockland Reservoir	614,400	$1,050,000,000	$70,400,000	$115	$0.35

1. Based on a 10-year meter replacement program at $140,000 per year. Cost data provided by LNVA.
2. Capital costs are for water rights application. No costs for storage or O&M.
3. Costs are based on $163 per ac-ft of storage purchase from the Corps of Engineers

4C.2.6 City of Lufkin. The City of Lufkin currently relies on groundwater from the Carrizo-Wilcox aquifer. The City provides water to Huntington, Angelina WSC, Redland WSC, Woodlawn WSC and currently provides about one-third of the manufacturing needs in Angelina County. The City has recently contracted with the City of Diboll for 632 MGY. With the acquisition of Lake Kurth and additional groundwater from the Abitibi Bowater Corporation, the City expects to provide up to an additional 12 MGD of water for industrial demands. In addition to these demands, the City of Lufkin is contracted to provide up to 5 MGD to the Abitibi facility. This is a potential future demand pending final outcome of the Abitibi facilities.

Considering the currently available supply and expected demands on the City of Lufkin, the City shows a water supply shortage beginning in 2010 and increasing to over 28,000 acre-feet per year by 2060. To meet these shortages Lufkin has secured multiple water resources, including the Abitibi groundwater rights in the Carrizo-Wilcox aquifer, Lake Kurth, and water rights in Sam Rayburn Reservoir. While the former Abitibi well system is able to provide some water to the city, infrastructure improvements are needed to fully utilize each of these sources.

The City of Lufkin is developing a long-term water supply plan that develops their water supplies in the following stages:

- Rehabilitate existing wells and fully develop additional groundwater in the Carrizo-Wilcox aquifer;
- Develop surface water supplies from Lake Kurth; and
- Develop surface water supplies form Sam Rayburn Reservoir
- Develop Additional Groundwater

The groundwater rights formerly associated with the Abitibi facility are permitted for 8.3 MGD. There are 10 existing wells on the property that are in good condition and can be used to supply the 8.3 MGD. There are several other wells that will likely need to be plugged or reconditioned, if used. Three wells are located in Nacogdoches County and the other wells are located in Angelina County. The Nacogdoches County wells are permitted for 524 MG/yr, which is approximately 1.4 MGD.

To fully utilize these water rights, the City plans to construct a new groundwater treatment facility near the existing well field and install a new 24-inch pipeline to deliver the treated groundwater to the south side of Lufkin for distribution. Planning and design for groundwater treatment and distribution system has begun, and the project is expected to be completed in the next few years.

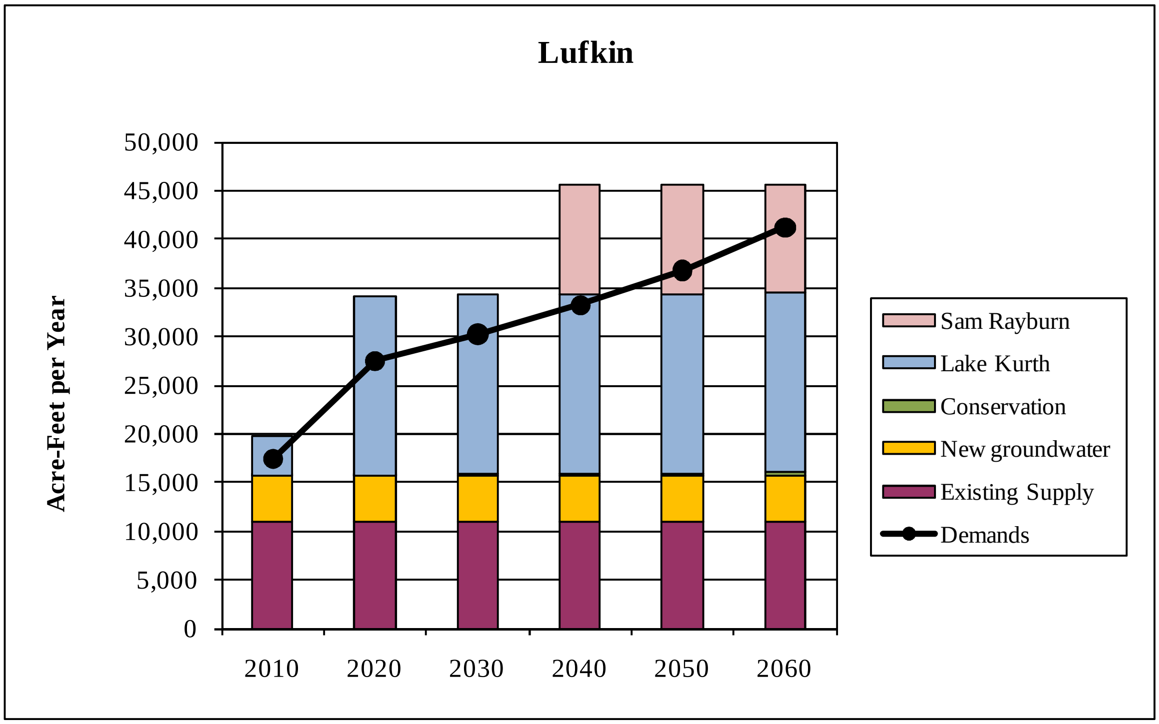
Develop Lake Kurth Surface Water. The water rights associated with Lake Kurth include the right to divert up to 19,100 acre-feet per year from the Angelina River for industrial purposes and to impound 16,200 acre-feet of water in Lake Kurth. To utilize these rights, Lufkin plans to construct a surface water treatment plant at Lake Kurth and construct a distribution system to move water to Lufkin and to current and potential wholesale customers. Upon development of this new source, Zavalla, Four Way WSC, Angelina WSC, and M&M WSC are expected to become wholesale customers of the City of Lufkin. These customers would be served with a new pipeline from the new water treatment plant at Lake Kurth. Some raw water may be sold directly from Lake Kurth for industrial purposes. As part of this strategy, a portion of the Angelina run-of-the-river rights will need to be changed from industrial use to municipal use or multi-purpose use. If the timing of this water right conversion is delayed, the City may need to develop its Sam Rayburn water rights for municipal use earlier than shown in this plan. The Lake Kurth strategy is expected to be developed in phases, with the first phase to utilize raw water from Lake Kurth for industrial purposes by 2010, followed by the construction of a surface water treatment facility by 2020. The initial size of the treatment facility will depend on the projected needs at the time. For cost purposes, it was assumed that a 15 MGD facility would be needed to utilize treated water from Lake Kurth.

Develop Sam Rayburn Reservoir Water Rights. To meet the City of Lufkin's long-term water needs, Lufkin is continuing to plan and develop a water management strategy to utilize its surface water rights in Sam Rayburn Reservoir. In the late 1960's the City of Lufkin purchased storage and water production rights for surface water from Sam Rayburn Reservoir through contracts with the Lower Neches Valley Authority (LNVA) and the U.S. Army Corp of Engineers. The City has a water right to divert up to 28,000 acre-feet annually of surface water from the reservoir. This equates to an average withdrawal rate of 25 MGD.

With the acquisition of Lake Kurth, the long-range plan is to expand the surface water treatment plant near Lake Kurth and treat raw water from Sam Rayburn Reservoir at the expanded facility. For planning purposes, it is assumed that water from Sam Rayburn would be diverted from the northern end of the lake and transported through a 36-inch pipeline. The treatment plant would be initially expanded to 25 MGD with the potential for further expansions beyond this planning period. This water management strategy is expected to be on line by 2040, pending the demands of potential future customers.

The supplies and demands associated with the City of Lufkin are shown in the following table and figure.

	2010	2020	2030	2040	2050	2060
Existing Supplies (ac-ft per year)						
Carrizo-Wilcox	11,000	11,000	11,000	11,000	11,000	11,000
Water Management Strategies (ac-ft per year)						
Conservation (City of Lufkin)	50	117	189	247	319	408
Groundwater - Carrizo-Wilcox	4,650	4,650	4,650	4,650	4,650	4,650
Lake Kurth	6,800	18,400	18,400	18,400	18,400	18,400
Sam Rayburn Reservoir				11,210	11,210	11,210
Total Supplies from Strategies	11,500	23,167	23,239	34,507	34,579	34,668
Total Supplies	22,500	34,167	34,239	45,507	45,579	45,668
Total from Conservation and Reuse	50	117	189	247	319	408
Percent of Strategy Supplies from Conservation and Reuse	0.4%	0.5%	0.8%	0.7%	0.9%	1.2%
Demands (ac-ft per year)						
Demand (Current Customers)	19,294	27,918	30,664	33,694	37,189	41,162
Demand (Potential Future)	2,800	2,800	2,800	3,900	3,900	3,900
Total Demand	22,094	30,718	33,464	37,594	41,089	45,062
Surplus or (Shortage)	**406**	**3,449**	**775**	**7,913**	**4,490**	**606**



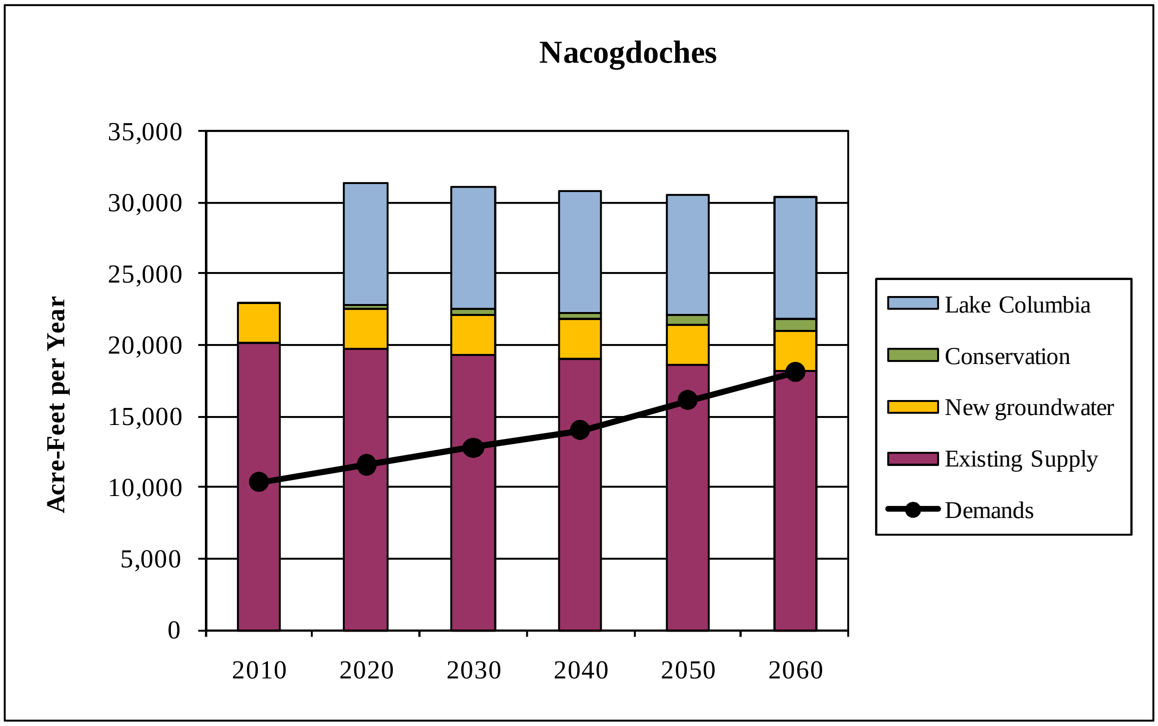
Estimates of capital costs for the Lufkin groundwater facilities are based on planning information provided by the City of Lufkin.

Strategy	Yield (ac-ft per year)	Total Capital Cost	Annual Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Conservation	408		$40,000	$98	$0.30
New Groundwater	4,650	$ 14,097,000	$1,986,800	$427	$1.31
Lake Kurth	18,400	$56,488,600	$8,387,700	$455	$1.39
Sam Rayburn Supply	11,200	$53,164,000	$17,679,000	$1,577	$4.84

4C.2.7 City of Nacogdoches. The City of Nacogdoches utilizes groundwater from the Carrizo-Wilcox aquifer and surface water from Lake Nacogdoches. The City provides water to Appleby WSC and D&M WSC. Most, if not all, of the manufacturing demands in the county are also supplied by the City of Nacogdoches. The Neches WAM shows the current firm yield of Lake Nacogdoches to be approximately 17,000 ac-ft per year, reducing to 15,100 ac-ft per year by 2060. With the City's existing groundwater supplies, Nacogdoches has a reliable supply of approximately 20,000 ac-ft per year. This supply is sufficient to meet the projected demands in this plan, but the City's current water planning efforts indicate greater population growth and higher demands by the commercial and manufacturing sectors than projected by the TWDB.

The City of Nacogdoches is pursuing two strategies to increase the reliability of its supplies and provide for projected growth: additional groundwater from the Carrizo-Wilcox and surface water from Lake Columbia. Groundwater from the Carrizo-Wilcox is used to supply much of the southern part of the city and the City of Nacogdoches is considering increasing its groundwater supplies to better serve this section of the City. The City of Nacogdoches is also among those contracted for participation in the Lake Columbia project. The City proposes to obtain raw water from Lake Columbia to transmit to Lake Nacogdoches. The existing treatment plant would be expanded to treat the additional water. As a long-term alternative, the City of Nacogdoches is considering developing strategies to use water from Sam Rayburn Reservoir and/or Toledo Bend Reservoir as potential future water sources. Raw water would be transmitted to the City and treated by Nacogdoches. Costs were developed for the Toledo Bend strategy and a more detailed evaluation of the Sam Rayburn alternative will be developed for the 2016 Regional Water Plan.

	2010	2020	2030	2040	2050	2060
Existing Supplies (ac-ft per year)						
Carrizo-Wilcox	3,100	3,100	3,100	3,100	3,100	3,100
Lake Nacogdoches	17,067	16,683	16,300	15,917	15,533	15,150
Water Management Strategies (ac-ft per year)						
Expand groundwater	2,800	2,800	2,800	2,800	2,800	2,800
Conservation (City)	0	229	425	514	654	787
Lake Columbia		8,551	8,551	8,551	8,551	8,551
Total Supplies from Strategies	2,800	11,580	11,776	11,865	12,005	12,138
Total Supplies	22,967	31,363	31,176	30,882	30,638	30,388
Total from Conservation and Reuse		229	425	514	654	787
Percent of Strategy Supplies from Conservation and Reuse	0.0%	2.0%	3.6%	4.3%	5.4%	6.5%
Demands (ac-ft per year)						
Demand (Current Customers)	10,344	11,573	12,812	14,006	16,096	18,062
Demand (Potential Future)						
Potential Demand (Total)	10,344	11,573	12,812	14,006	16,096	18,062
Surplus or (Shortage)	**12,623**	**19,790**	**18,364**	**16,875**	**14,542**	**12,326**



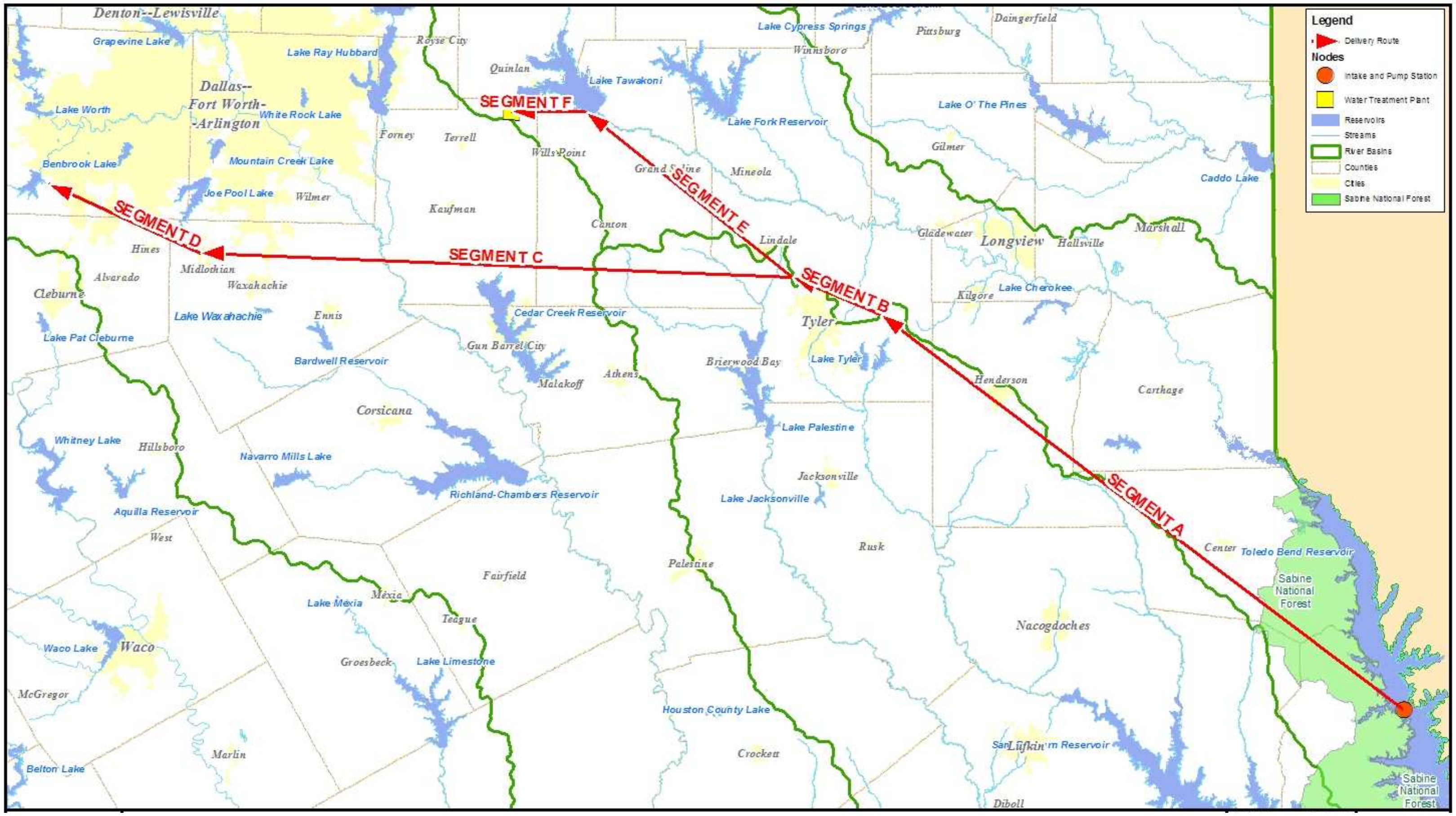
Strategy	Yield (ac-ft per year)	Capital Cost	Annual Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Conservation	787		$40,000	$51	$0.16
New Groundwater	2,800	$2,727,000	$724,600	$259	$0.79
Lake Columbia	8,551	$37,282,000	$7,287,000	$852	$2.61
Toledo Bend (Alt)	5,175	$114,419,000	$10,602,000	$2,049	$6.29

4C.2.8 Sabine River Authority (SRA). The SRA is based in North East Texas and ETRWPA. SRA currently provides water from its Lower Basin system (Toledo Bend reservoir and Canal System) to water users in the ETRWPA. The SRA provides water from its Upper Basin reservoirs (Lake Tawakoni and Lake Fork) to water users in Regions C, Region D, and the ETRWPA. These sources are fully contracted and SRA has requests for additional water in the Upper Basin. There are sufficient supplies from the Lower Basin system to meet water demands, but SRA cannot fully meet the current and future demands in the Upper Basin. To meet these shortages, SRA plans to participate in the Toledo Bend Pipeline project that would transport 500,000 ac-ft per year of water from Toledo Bend to the Upper Basin area and Region C. Of this amount, 100,000 ac-ft per year would be used for users in the Upper Sabine Basin, 200,000 ac-ft per year would be for the North Texas Municipal Water District, and 200,000 ac-ft per year would be for the Tarrant Regional Water District. Both the North Texas Municipal Water District and Tarrant Regional Water District are based in Region C. A map of the proposed project is shown on Figure 4C-1. A pipeline route has not been selected. The route indicated on Figure 4C.1 is only for illustrative purposes. Costs were developed for the full amount of the project. The project may be developed in phases, with Phase 1 supplying approximately half of the total project amount.

A recommended alternate strategy is to transport an additional 200,000 ac-ft per year from Toledo Bend to Dallas Water Utilities for a total of 700,000 ac-ft per year from Toledo Bend Reservoir. A special study for this project was conducted for the ETRWPG and the summary report, *Inter-regional Coordination on the Toledo Bend Project*, was submitted to the TWDB in March 2008. Details of the development of Toledo Bend Project can be found in this report. Recommendations for users in Region C are discussed in the 2011 Region C Water Plan.

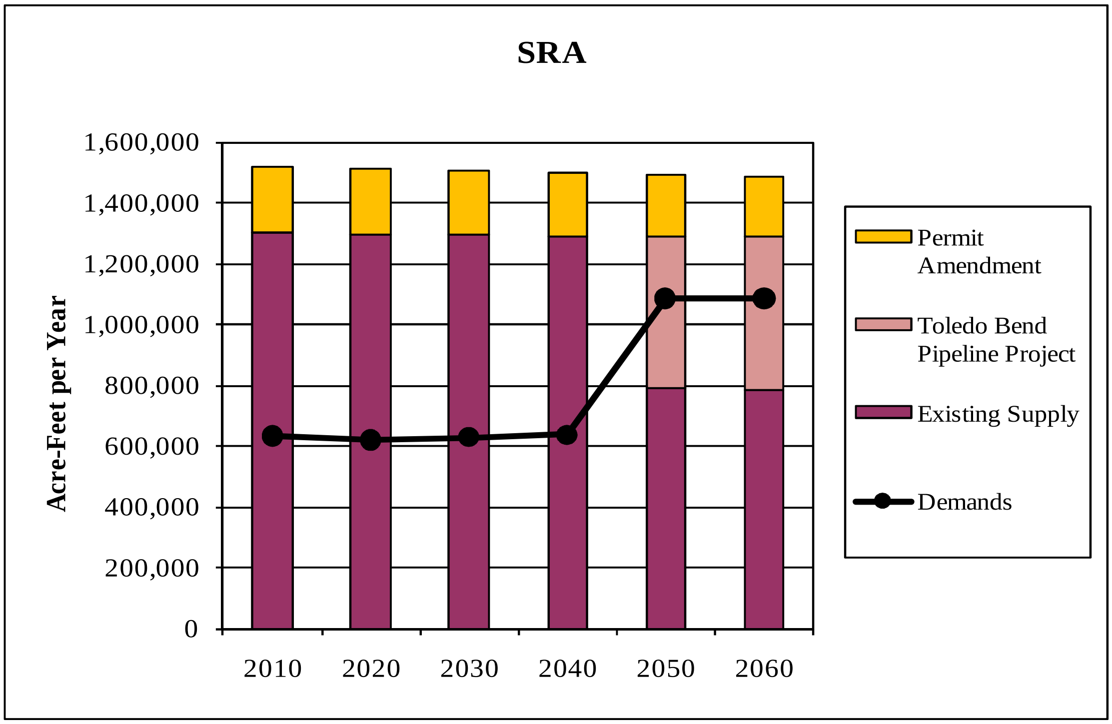
To support the increased use of water from Toledo Bend reservoir, the SRA has submitted a permit amendment to TCEQ to fully utilize Texas' share of the reservoir's firm yield. The application requested an additional 293,300 ac-ft per year of supply based on the TCEQ-approved Sabine River Basin WAM. The application has been declared administratively complete and TCEQ is currently reviewing the permit request. For planning purposes, the supply available from the permit amendment is based on the unpermitted yield for Toledo Bend as determined by the Sabine WAM that was used for regional water planning. The actual amount will be determined through the permitting process.

Toledo Bend Pipeline Project



	2010	2020	2030	2040	2050	2060
Existing Supplies (ac-ft per year)						
Lake Tawakoni	229,807	228,093	226,380	224,667	222,953	221,240
Lake Fork	173,035	171,820	170,605	169,390	168,175	166,960
Toledo Bend Reservoir	750,000	750,000	750,000	750,000	750,000	750,000
Canal System	147,100	147,100	147,100	147,100	147,100	147,100
Water Management Strategies (ac-ft per year)						
Permit Amendment	219,900	215,300	210,800	206,200	201,600	197,000
Toledo Bend Project	0	0	0	0	500,000	500,000
Total Supplies from Strategies	219900	215300	210,800	206,200	701,600	697,000
Total Supplies	1,519,842	1,512,313	1,504,885	1,497,357	1,489,828	1,482,300
Demands (ac-ft per year)						
Demand (Current Customers)	561,237	541,237	521,237	521,237	521,237	521,237
Demand (Potential Future)	72,015	78,015	106,765	115,765	563,440	563,440
Potential Demand (Total)	633,252	619,252	628,002	637,002	1,084,677	1,084,677
Surplus or (Shortage)	**886,590**	**893,061**	**876,883**	**860,355**	**405,151**	**397,623**

Note: Supplies for the Toledo Bend Pipeline Project are included in the yield of Toledo Bend.



Strategy	Yield (ac-ft per year)	Capital Cost	Annual Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Toledo Bend Pipeline Project	100,000 (1)	$475,648,000	$59,751,911	$598	$1.83

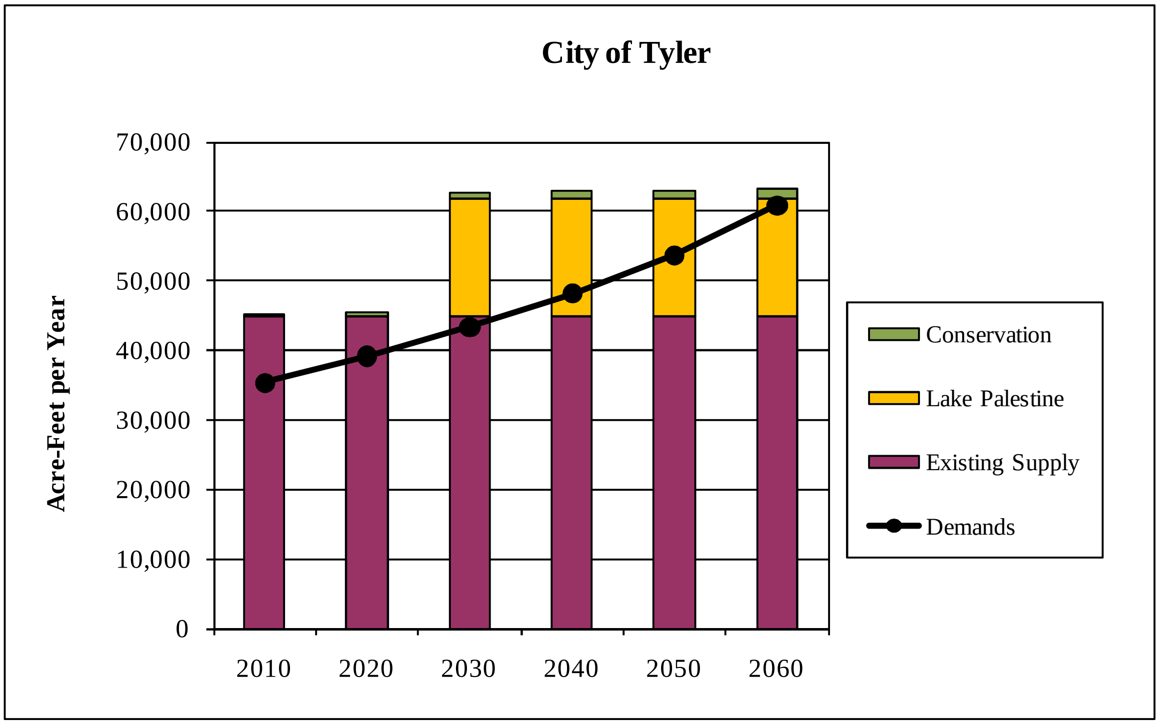
(1) Quantity shown is the amount for SRA. Total amount of strategy is 500,000 ac-ft per year. The costs for the supply difference (400,000 ac-ft per year) will be borne by other participants.

4C.2.9 City of Tyler. The City of Tyler is shown to have sufficient supplies through the planning period using the TWDB approved demand projections. Recent population data show that the City is growing at a much faster rate than previously estimated. Data reported by the State Demographer show the population in the City of Tyler has increased at an average annual growth rate of 2.4 percent, which equates to a projected decadal population growth of 26 percent. The TWDB shows a decadal growth of 7 percent for the City of Tyler. This difference is significant for the expected water demands on the City.

Assuming that only half of this observed growth for Tyler occurs for subsequent decades (2020 to 2060), the projected water demands for the City are nearly 20,000 acre-feet per year higher in 2060 than the projected demands in this plan. In addition, there is considerable interest in other users in Smith County contracting with the City of Tyler for water supplies. There are recommended strategies for Tyler to provide additional water to Community Water, Whitehouse and Manufacturing in Smith County. With these potential future demands the City of Tyler will need to develop additional supplies and expand its treatment capacities.

The City has developed about half of its contracted supply in Lake Palestine and plans to develop the remaining supply as part of its long-term water supply plan. It is recommended that the City of Tyler develop the additional 30 MGD of Lake Palestine water.

	2010	2020	2030	2040	2050	2060
Existing Supplies (ac-ft per year)						
Carrizo-Wilcox	4,340	4,340	4,340	4,340	4,340	4,340
Lakes Tyler/ Tyler East	23,541	23,541	23,541	23,541	23,541	23,541
Lake Palestine	16,815	16,815	16,815	16,815	16,815	16,815
Lake Bellwood	300	300	300	300	300	300
Water Management Strategies (ac-ft per year)						
Conservation (City of Tyler)	301	526	772	1,036	1,234	1,344
Lake Palestine	0	0	16,815	16,815	16,815	16,815
Total Supplies from Strategies	301	526	17,587	17,851	18,049	18,159
Total Supplies	45,297	45,522	62,583	62,847	63,045	63,155
Total from Conservation and Reuse	301	526	772	1036	1234	1344
Percent of Strategy Supplies from Conservation and Reuse	100%	100%	4.4%	5.8%	6.8%	7.4%
Demands (ac-ft per year)						
Demand (Current Customers)	30,506	31,903	33,224	34,506	36,865	40,656
Demand (Potential Future)	4790	7256	10133	13655	16874	20178
Potential Demand (Total)	35,296	39,159	43,357	48,161	53,739	60,834
Surplus or (Shortage)	**10,001**	**6,363**	**19,226**	**14,686**	**9,306**	**2,321**



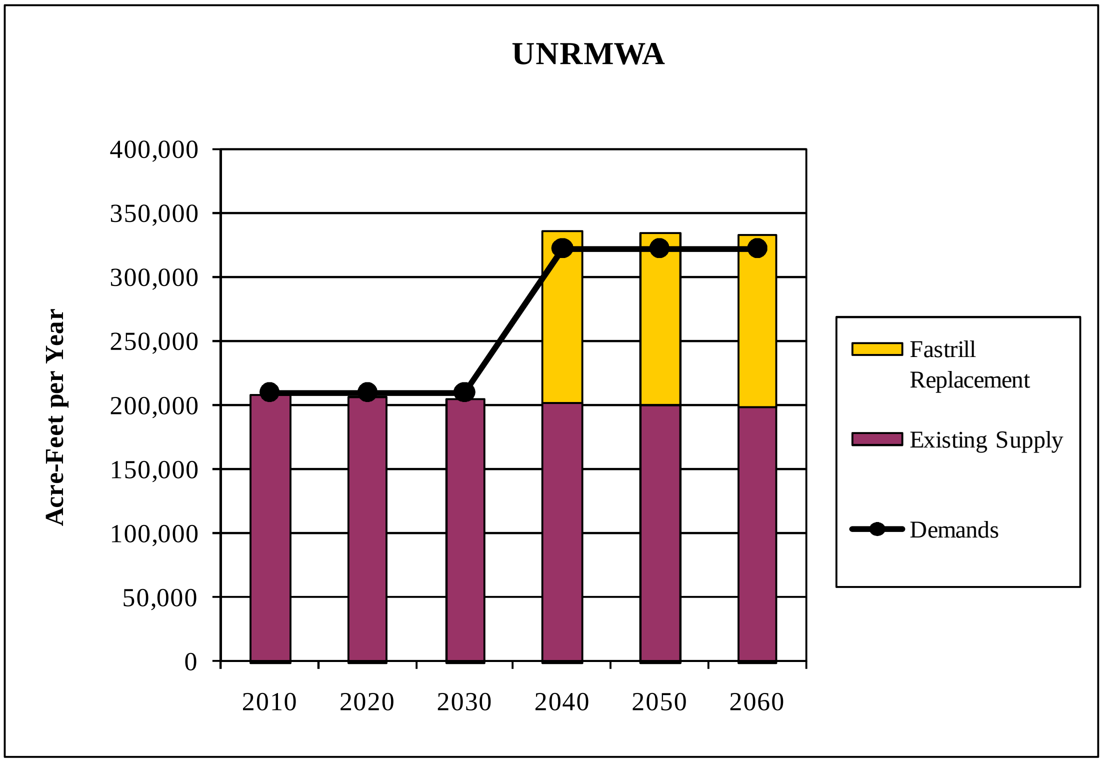
Strategy	Yield (ac-ft per year)	Capital Cost	Annual Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Conservation	1,344	$0	$60,000	$45	$0.14
Lake Palestine Infrastructure	16,815	$79,389,250	$13,957,000	$ 830	$ 2.55

4C.2.10 Upper Neches River Municipal Authority. The Upper Neches River Municipal Water Authority (UNRMWA) owns and operates the Lake Palestine system in the Neches River Basin. Based on current contracts, the UNRMWA shows a small shortage during the planning period. This shortage is primarily associated with the reduced firm yield of Lake Palestine due to projected sediment accumulation in the lake.

The UNRMWA was the sponsor the proposed Lake Fastrill project. With the current uncertainties surrounding this project, the UNRMWA in conjunction with the City of Dallas have identified the need for a Lake Fastrill replacement project. The city of Dallas is actively working with the UNRMWA to identify the best replacement project for the loss of the supply that would have been provided by Lake Fastrill. One alternative that is being considered is the Neches River Run-of-the-River Diversion. This project would divert water from the Neches River in Anderson and Cherokee Counties downstream of Lake Palestine and the Neches River National Wildlife Refuge and upstream of the Weches Dam site. The water would be pumped to off-channel storage reservoirs for subsequent diversion. The run-of-the-river diversions would be subject to senior water rights and environmental flows. Based on a total off-channel storage capacity of 540,000 ac-ft, the firm supply from this strategy is estimated at 134,500 ac-ft per year. Of this amount, 112,100 ac-ft per year would be purchased by Dallas Water Utilities, and the remaining 22,400 ac-ft per year would be available for users in the ETRWPA. The Lake Fastrill Replacement Project is a recommended water management strategy for Region C to provide 112,100 ac-ft per year of water to Dallas Water Utilities. Details of the development of this strategy to supply Dallas Water Utilities are discussed in the *2011 Region C Water Plan*.

	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Existing Supplies (ac-ft per year)						
Palestine System	207,458	205,417	203,375	201,333	199,292	197,250
Water Management Strategies (ac-ft per year)						
Lake Fastrill Replacement Project	0	0	0	134,500	134,500	134,500
Total Supplies from Strategies	0	0	0	134,500	134,500	134,500
Total Supplies	207,458	205,417	203,375	335,833	333,792	331,750
Demands (ac-ft per year)						
Demand (Current Customers)	210,135	210,124	210,115	210,106	210,099	210,093
Demand (Potential Future)	0	0	0	112,100	112,100	112,100
Potential Demand (Total)	210,135	210,124	210,115	322,206	322,199	322,193
Surplus or (Shortage)	**-2,677**	**-4,708**	**-6,740**	**13,627**	**11,592**	**9,557**

Strategy	Yield (ac-ft per year)	Capital cost	Annual Cost	Unit Cost ($/ac-ft)	Unit Cost ($/1000 gal)
Neches River Run-of-the-River	134,500	$1,980,278,000	$193,301,000	$1,437	$4.41



4C.3 Texas Water Development Board Database

The 2012 Regional Water Planning Data Web Interface (DB12) is an electronic database provided by the Texas Water Development Board which functions to collect, maintain and analyze electronic water planning data. The Regional Water Planning Groups and their contracted consultants may enter data for their respective regions in order to facilitate development of useful and relevant regional and state water plans. A copy of the data from the DB12 is provided in Appendix 4C-B.

Chapter 4D

Water Management Strategy Evaluation

Water management strategies identified to meet water needs during the planning period were evaluated based on the following criteria:

(1) Evaluation of the quantity, reliability, and cost of water delivered and treated for the end user's requirements, incorporating factors to be used in the calculation of costs as required by regional water planning;

(2) Environmental factors including the effects of the proposed water management strategy on environmental water needs, wildlife habitat, cultural resources, water quality and effect of upstream development on bays, estuaries, and arms of the Gulf of Mexico;

(3) Impacts on other water resources of the state including other water management strategies and groundwater surface water interrelationships;

(4) Impacts of water management strategies on threats to agricultural and natural resources of the regional water planning area;

(5) Impacts of the strategy on key water quality parameters;

(6) Any other factors as deemed relevant by the regional water planning group including political feasibility, implementation issues and potential recreational impacts;

(7) Equitable comparison and consistent application of all water management strategies the regional water planning groups determines to be potentially feasible for each water supply need;

(8) Consideration of the provisions in Texas Water Code, § 11.085(k)(1) for interbasin transfers; and

(9) Consideration of third party social and economic impacts resulting from voluntary redistribution of water;

The evaluation was undertaken through the development of a matrix to rate the above consideration from most desirable (1) to least desirable (5). Rating of the Environmental Factors (item 2 above) was evaluated using a separate matrix with consideration of nine factors; total acres impacted, wetland acres, environmental water needs, habitat, threatened and endangered species, cultural resources, bays and estuaries, environmental water quality and other noted factors. The evaluation matrices are included in Appendix 4D-A.

Chapter 5

Impacts of Selected Water Management Strategies on Key Parameters of Water Quality and Impacts of Moving Water from Rural and Agricultural Areas

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The regulations that describe the content and process for the development of regional water plans direct that the plan "include a description of the major impacts of recommended water management strategies on key parameters of water quality identified by the regional water planning group . . ." and "impacts on agricultural resources." [30 TAC 357.7(a)(12); 30 TAC 357.7(a)(8)]. In the 2006 East Texas Regional Water Plan, this chapter provided information and recommendations to assist the ETRWPG in identifying the key water quality parameters that may be impacted by implementation of recommended WMSs that were new to the regional water plan in 2006. Chapter 5 for the 2011 Plan reviews the selected water quality parameters, discusses how various types of WMSs could affect water quality, and presents a listing of the WMS developed in the 2011 Plan. Also included is an assessment of the key water quality parameters that could be affected by the implementation of each new WMS. In addition, this chapter provides information relating to the potential impacts of moving water used for rural or agricultural purposes to urban uses.

5.1 Key Water Quality Parameters

The following water quality parameters were selected by the ETRWPG in the 2006 Plan as parameters that could be impacted by WMS recommended for the ETRWPA:

- Total Dissolved Solids (TDS)
- Dissolved Oxygen (DO)
- Nutrients
- Metals
- Turbidity

A discussion of these parameters and the rationale for their selection by the ETRWPG is contained in the 2006 Plan. The ETRWPG has determined that these same parameters will be evaluated for the 2011 Plan.

5.2 Summary of Potential Impacts of Water Management Strategies on Water Quality

The implementation of specific WMS can potentially impact both the physical and chemical characteristics of water resources in the region. An assessment of the characteristics of each WMS that can affect water quality follows. The assessment includes a discussion of how the specific water quality parameters identified above could be affected by various types of WMS. In addition, WMS that have been identified for the first time in the 2011 Plan will be evaluated for their specific potential impacts on water quality.

The following WMS types are employed in the ETRWPA:

- Expanded use of existing surface water resources
- Interbasin water transfers
- New reservoirs
- Expanded use of groundwater resources
- Indirect Reuse
- Expansion of local supplies
- Voluntary redistribution
- Water conservation

Table 5.1 summarizes how the various types of water management strategies could impact water quality.

Table 5.1 Evaluation of Potential Water Management Strategy Impacts on Water Quality

Water Quality Parameter	Water Management Strategy Types							
	Expanded Use of Surface Water	Inter-basin Transfers	New Reservoirs	Expanded Use of Ground-water	Indirect Reuse	Expanded Use of Local Supplies*	Voluntary Re-distribution**	Water Conservation***
TDS	•	•	•	•	•		•	
Dissolved Oxygen	•	•	•		•			
Nitrogen	•	•	•		•		•	
Phosphorus	•	•	•		•		•	
Metals	•	•	•	•	•		•	
Turbidity		•					•	

*Expanded use of local supplies would not typically be expected to have a significant impact on water quality.
**Voluntary Redistribution could have an impact on the water quality of the receiving water body
***Water conservation would not typically be expected to have a significant impact on water quality

5.2.1 Expanded Use of Existing Surface Water Resources. The expanded use of existing surface water resources will provide much of the increased water supply for the ETRWPA during the planning period. The primary physical impact of this expanded use of surface water is a change in the volume of water remaining in the river basin (i.e., flow in a stream or storage in a lake).

Impacts on key water quality parameters vary depending on factors such as the location of the source and the intended destination of the water transfer. For strategies that involve pumping existing surface water directly to a water treatment plant, no impact on water quality is anticipated. However, when water is pumped from one source to another, the impacts will depend on the existing water quality of the two sources, as well as the quantities to be transferred and any mitigation that may be applied.

5.2.2 Interbasin Water Transfers. ETRWPA interbasin water transfers currently occur in Jefferson, Nacogdoches, Orange, and Rusk Counties. The major water transfers occur in Jefferson and Orange Counties. Major municipal populations and industrial activities are located in both Jefferson and Orange Counties. Water transfers in these counties are designed to compensate for the deficit of available water in specific portions of each county. Some voluntary redistribution or surface water expansion strategies may involve interbasin transfers within the region.

In cases where the water characteristics of the source and destination river basins are significantly different, the interbasin transfer can cause changes in the receiving water body. Changes in TDS, alkalinity, hardness, or turbidity can impact water users, particularly industrial users that have treatment processes to produce high quality waters (for boiler feed, for example) and water treatment plants. Water treatment processes are tailored to the quality of the water being treated. If the quality of the feed water changes, the treatment process may have to be changed as well. Changes in nutrient concentrations or water clarity can affect the extent of growth of algae or aquatic vegetation in a stream. The same concentration of nutrients can produce different levels of algal growth in different water bodies depending on factors such as water clarity, shading, stream configuration, or other chemical constituents in the waters. With respect to water clarity, there are also aesthetic considerations. It is generally not desirable to introduce waters with higher turbidity, or color, into high clarity waters. Because the river basins within the ETRWPA have similar water characteristics, interbasin transfers within the region generally do not have significant water quality impacts.

Some of the recommended and alternative strategies for the Region C water planning area call for increased use of water from reservoirs located in Region I (or proposed to be located in the region). In general, reservoirs in East Texas have higher concentrations of nutrients (i.e., nitrogen and phosphorus) than many of the Region C reservoirs. The ultimate impact of importing water with higher nutrient concentrations to Region C reservoirs is difficult to predict due to the complex kinetic relationships between nutrients and chlorophyll-a. Strategies that involve importing water from East Texas reservoirs to Region C reservoirs may result in increases in nitrogen and phosphorus, but are not likely to lead to impacts that would impair the designated uses of the Region C water bodies.

In general, the TDS concentrations in East Texas reservoirs are lower than in Region C reservoirs. Therefore, in nearly all cases, transfer of water from the ETRWPA to Region C reservoirs will have a positive impact on TDS concentrations in the receiving water bodies. All of the recommended water management strategies involving exportation of East Texas water to Region C reservoirs are anticipated to have minimal impact on key water quality parameters.

5.2.3 New Reservoirs. One proposed WMS to serve needs in the ETRWPA is the development of Lake Columbia on Mud Creek. The most significant potential impact of new reservoir construction is the inundation of bottomlands and a decrease in instream flows below the reservoir. If this occurs, the potential impacts include those described in the previous section when instream flow is reduced due to increased stream usage, i.e., potential impacts on TDS, nutrients, DO, and, in some cases, metals. Other impacts from new reservoirs on water quality could be associated with changes to the flow regime downstream of the dam that would result. Such changes in flow would result in significant changes to sediment loads, scouring in the stream, and other geomorphic changes.

Significant water quality impacts resulting from new reservoir construction could occur when the dam release structures are designed to release water from the hypolimnion (e.g., bottom release of water through the dam). During the summer season, water quality concerns with respect to waters in the hypolimnion include decreased oxygen levels, low temperature, and high nutrient concentrations.

The development of a reservoir requires extensive environmental impact analysis prior to its approval that examines all such potential water quality issues. Any water quality issue anticipated by construction of the reservoir would likely be investigated and mitigation plans developed, if deemed necessary. Therefore, adverse water quality impacts anticipated by construction of new reservoirs should be considered low, due to mitigation requirements.

5.2.4 Expanded Use of Groundwater Resources. Proposed ETRWPA WMS include increased uses of groundwater from the Carrizo-Wilcox aquifer, Gulf Coast aquifer, Yegua-Jackson aquifer, Queen City aquifer, and Sparta aquifer. The increased withdrawal of groundwater can affect both the quantity and quality of water resources in the region. There is significant potential that increased use of groundwater will increase TDS concentrations in area streams. Groundwaters frequently contain higher concentrations of TDS or hardness than are considered desirable for domestic uses. Some homeowners may install treatment systems to reduce TDS or hardness. Operation of these systems may introduce high concentrations of TDS to municipal wastewater systems or area streams. However, because these discharges are expected to be small, the overall impacts should be negligible. Increased withdrawal of groundwater resources can also affect the quality of the water in the aquifers by increasing the potential for the intrusion of saltwater and/or brackish water into the aquifers, especially in coastal regions.

5.2.5 Indirect Reuse. This strategy involves the discharge of treated wastewater effluent into a body of water used for water supply. The purpose of the discharge may simply be a result of the need to dispose of the treated wastewater or may be for the specific purpose of augmenting the water supply. Treated wastewater can contain nutrient and TDS concentrations that are high in comparison to the receiving water. However, for most of the recommended strategies that include indirect reuse, advanced wastewater treatment, constructed wetlands, or blending, etc., would be required to mitigate potential water quality impacts associated with nutrients and TDS. For the purposes of this evaluation, it is assumed that some form of mitigation for potential water quality impacts associated with the key parameters will be implemented, if necessary. For this reason, impacts on water quality resulting from indirect reuse are expected to be minimal.

5.2.6 Expansion of Local Supplies (Livestock Ponds). The development of additional livestock ponds involves the capture of localized water for individual use, generally. In East Texas, where rainfall is generally abundant, this diversion of small volumes of localized runoff would not result in a significant reduction in overall flow in streams. It is not expected to cause significant impacts to water quality.

5.2.7 Voluntary Redistribution. The voluntary redistribution of water from one water supplier to another does not cause impacts on water quality unless the redistribution includes expanded use of surface water or groundwater, or involves a transfer of water from one basin to another. Potential water quality impacts of the expansion of existing water supplies, or interbasin transfers, have been previously described.

5.2.8 Water Conservation. Water conservation is the development of water resources and practices to reduce the consumption or loss of water, increase the recycling and reuse of water, and improve the efficiency in the use of water. Water Conservation Plans are designed to implement practices to conserve water and quantitatively project water savings. The water conservation measures recommended in the ETRWPA are not expected to affect water quality adversely. The results should generally be beneficial because the demand on surface and groundwater resources will be decreased. Quantifying such positive impacts could be very difficult. Chapter 6 contains additional discussion of water conservation in the ETRWPA.

5.3 Impacts of Moving Rural and Agricultural Water to Urban Uses

As the population of Texas increases, municipal and industrial water demands will rise accordingly, even with the implementation of conservation measures. The largest proportion of additional municipal water supply that will be utilized in The ETRWPA over the planning period will be from expanded use of existing surface water supplies and, to some extent, development of new surface water supplies such as Lake

Columbia. Surface water demand will increase for municipal and industrial water users as addressed in Chapter 4. However, as currently planned, the expanded use of surface water is not expected to involve significant transfers of agricultural supplies to municipal or industrial supplies. The proposed increases in municipal water surface water supplies will rely on existing water rights or new water rights from currently unpermitted supplies.

Chapter 6

Water Conservation and Drought Management Recommendations

Water conservation is defined by Texas Water Code 11.002.8 as the development of water resources and those practices, techniques and technologies that will reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water and increase the recycling and reuse of water to be made available for future or alternative uses. Water conservation plans are long-term, permanent strategies to reduce water use. Drought contingency plans are similar to conservation plans in that they aim to reduce water use, but are only intended for temporary periods during drought conditions.

Some water demand projections 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. On a regional basis, this is about an 8 percent reduction in municipal water use (23,860 ac-ft per year) by year 2060. Additional municipal water savings may be expected as the Federal mandate for low flow clothes washing machines took effect in 2007.

Conservation savings were also included in the steam-electric power demands. Demands for steam-electric power were developed with the assumption that long-term power needs will be met with more water-efficient facilities. The estimated water savings associated with the higher efficiency power plants is nearly 27 percent of the total demands or 57,100 ac-ft per year in the ETRWPA. Reductions in demands due to conservation were not quantified by the TWDB for manufacturing, mining, irrigation and livestock needs.

SB1 requires each region's water plan to address drought management and conservation for both groundwater and surface water supply sources.

The ETRWPA is a water-rich region and water conservation in the region is driven by economics and not by lack of water supply. The ETRWPG believes that water users in the ETRWPA will implement advanced water conservation measures (i.e. savings associated with active conservation measures) as economic conditions dictate to each individual user. Given the general abundance of accessible water supply to the water users in the ETRWPA, the ETRWPG believes the conservation strategies included in this planning period represent an economically achievable level of conservation. Currently, over one fourth of the municipal water users in the ETRWPA have per capita water use less than 100 gallons per person per day and 57 percent are less than the Water Conservation Task Force recommended state average of 140 gallons per person per day. While municipal use represents about 20 percent of the total regional water demands, the potential savings from advanced municipal conservation are relatively small. This opinion may change as economics and water supply conditions change in East Texas.

6.1 Water Conservation Plans

The TCEQ requires water conservation plans for all municipal and industrial water users with surface water rights of 1,000 ac-ft per year or more and irrigation water users with surface water rights of 10,000 ac-ft 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. Legislation passed in 2003 requires all conservation plans to specify quantifiable 5-year and 10-year conservation goals and targets. While these goals are not enforceable, they must be identified. Updated water conservation plans for WUGs in the region were to be submitted to the Executive Director of the TCEQ and to the ETRWPG by May 1, 2009.

In the ETRWPA, 28 entities hold municipal or industrial rights in excess of 1,000 ac-ft per year and three entities have irrigation water rights greater than 10,000 ac-ft per year. A list of the users in the ETRWPG required to submit water conservation plans is shown in Table 6.1. Others have contracts with regional and wholesale water providers for greater than 1,000 ac-ft per year.

Presently, these water users are not required to develop water conservation plans unless the user is seeking State funding; however, a wholesale water provider may request that its customers prepare a conservation plan to assist in meeting the goals and targets of the wholesale water provider's plan.

To assist entities in the ETRWPA with developing water conservation plans, model plans for municipal water users (wholesale or retail public water suppliers), industrial users and irrigation districts may be found in the appendices of Chapter 6 in the 2006 Plan. Additionally, model conservation plans are available on the TCEQ website at http://www.tceq.state.tx.us/permitting/water_supply/water_rights/conserve.html. Each of these model plans addresses the latest TCEQ requirements and is intended to be modified by each user to best reflect the activities appropriate to the entity.

Water conservation strategies vary by water user and are shown in Table 6.2. This table lists water conservation strategies for individuals who have submitted water conservation plans as of August 25, 2009. The focus of the conservation activities for municipal water users in the ETRWPA are:

- Education and public awareness programs.
- Reduction of unaccounted for water through water audits and maintenance of water systems.
- Water rate structures that discourage water waste.

Industrial water users include large petrochemical industries as well as smaller local manufacturers. Conservation activities associated with industries are very site and industry-specific. Some industries can utilize brackish water supplies or wastewater effluent while others require only potable water. It is important in evaluating conservation strategies for industries to balance the water savings from conservation to economic benefits to the industry and the region.

Table 6.1 Water Users and Types of Use that are Required to have Water Conservation Plans

Municipal/Domestic	Industrial	Mining	Other	Irrigation Water Users
Angelina & Neches River Authority *	Angelina & Neches River Authority*	United States Department of Energy	Jefferson Co. Drainage District No. 6	Sabine River Authority
Athens Municipal Water Authority*	Angelina-Nacogdoches WCID No.1		Texas Parks and Wildlife Department	Joe Broussard
City of Beaumont	Athens Municipal Water Authority			M Half Circle Ranch Company
City of Center	City of Lufkin			
City of Jacksonville	E I Dupont De Nemours & Co			
City of Lufkin*	Entergy Texas, Inc.			
City of Nacogdoches	Exxon Mobil Oil Company			
Houston Co WCID No. 1	Independent Refining Corp.			
Lower Neches Valley Authority	Luminant Generation Co. LLC			
Panola Co FWSD No. 1	Panola Co FWSD No. 1			
Sabine River Authority*	Premcor Refining Group, Inc.			
City of Tyler*	Sabine River Authority			
Upper Neches River MWD	Temple-Inland Forest Prod Corp			
	Texas Petrochemicals LP			
	City of Tyler			
	Union Oil of California			

* Water users with multiple types of use.

Table 6.2 Primary Water Conservation Strategies Documented in Water Conservation Plans

Water User Group	Primary Water Conservation Strategies								
	Plumbing Fixture Requirements	Reduce Water Loss/Leak Detection	Public Education/Awareness Programs	Pressure Control	Universal Metering or Meter Calibration or Replacement	Rate Structure Not Promoting Excessive use	Retrofit Program/2003 International Plumbing Code	Require/Request retail water suppliers to have conservation plan/conservation strategies	Other
	Passive Strategies	Active Conservation Strategies							
Angelina & Neches River Authority	•	•	•	•	•	•		•	•
Angelina-Nacogdoches WCID No.1		•							
City of Beaumont	•	•	•		•				•
City of Jacksonville	•	•	•	•	•		•	•	•
City of Lufkin	•	•	•		•	•	•	•	•
City of Nacogdoches	•	•	•		•	•			
Entergy Texas, Inc.		•							•
Houston Co WCID No.1		•	•		•			•	•
Luminant Generation Co. LLC		•							
Sabine River Authority		•			•			•	•
United States Dept of Energy		•							•
Upper Neches River MWD	•	•	•		•		•	•	•

In the ETRWPA, where water is readily available, requiring costly changes to processes and equipment may not be practical and beneficial to the region. In light of these considerations, the focus of the conservation activities for industrial users is:

- Evaluation of water saving equipment and processes.
- Water rate structures that discourage water waste.

Most irrigation occurs in the lower parts of the Neches and Sabine Basins. Much of the irrigation water is delivered by canals and is used for rice farming along the coast. Appropriate conservation activities for the large irrigators in the ETRWPA include the following:

- Reduction in operational losses and losses associated with conveyance systems.
- Coordination of irrigation deliveries to maximize efficiencies (tailwater recovery).
- Encourage water saving irrigation equipment and land practices for customers (e.g., land leveling).

6.2 Water Trends

The State of Texas Water Conservation Implementation Task Force (WCITF) has set a recommended goal of an average per capita consumption of 140 gpcd for water suppliers. Based on a study conducted in Phase I Round 3 of Regional Water Planning, water use in the ETRWPA is well below the target value.

Study No. 3, "Study of Municipal Water Uses to Improve Water Conservation Strategies and Projections," reviewed water production and sales surveys, which were sent to 65 WUGs in the ETRWPA with approximately 1,000 connections or more. Residential and total water production and water use were calculated from the survey responses. Median residential water use and median total water production for all but two of the responding 27 WUGs demonstrated water use below 140 gpcd. Median residential water use for the region was calculated to be 68 gpcd. Based on total water production, median water use was 86 gpcd.

The City of Tyler and City of Woodville demonstrated median residential water sales above the target value at 177 and 311 gpcd, respectively. The City of Tyler is required to submit a water conservation plan and drought contingency plan to the TCEQ and RWPG. As of August 28, 2009, plans for water conservation and drought contingency were not received. Based on water supply and water demand for the City of Tyler, the city does not demonstrate a need through the end of the planning period and does not require additional water conservation strategies.

It must be recognized that long-term changes to water supplies can be brought on by impacts on water quality or quantity, or by changing economic conditions. Such changes could require additional emphasis on water conservation in the future. The need for additional water conservation will continue to be evaluated in future plans.

6.3 Drought Contingency Plans

Drought management is a temporary strategy to conserve available water supplies during times of drought or emergencies. This strategy is not recommended to meet long-term growth in demands, but rather acts as a means to minimize the adverse impacts of water supply shortages during drought. The TCEQ requires drought contingency plans for wholesale water suppliers and irrigation districts, as well as retail public water suppliers serving 3,300 or more connections. A drought contingency plan may also be required for entities seeking State funding for water projects.

Drought contingency plans typically identify different stages of drought and specific triggers and responses for each stage. In addition, the plan must specify quantifiable targets for water use reductions for each stage, and a means and method for enforcement. As with the water conservation plans, drought contingency plans are to be updated and submitted to the TCEQ and ETRWPG by May 1, 2009.

Model drought contingency plans address the latest regulations and TCEQ requirements for retail and wholesale public water suppliers, irrigation districts, water supply corporations and investor owned utilities. Model drought contingency plans may be found in appendices of Chapter 6 of the 2006 Plan. Model plans are also available at http://www.tceq.state.tx.us/permitting/water_supply/water_rights/contingency.html. Each plan identifies three to six drought stages: mild, moderate, severe, critical and emergency. The recommended responses range from notification of drought conditions and voluntary reductions in the "mild" stage to mandatory restrictions during an "emergency" stage. Each entity will select the trigger conditions for the different stages and appropriate response.

The majority of the drought contingency plans in the ETRWPA use trigger conditions based on a combination of water supply and demands placed on the water distribution system. A list of water users that are required by Texas Water Code 12.1272 to submit a drought contingency plan are included in Table 6.3. Table 6.4 lists triggers and drought response stages for individuals who submitted drought contingency plans by August 28, 2009. All plans include water conservation measures which range from voluntary water restrictions in Stage I to mandatory restrictions in the final stage. Some drought contingency plans include an emergency stage not directly related to drought, but as a result of system rupture or failure. In these instances, they are listed as the final trigger stage.

Table 6.3 Water Users Required to Submit Drought Contingency Plans

Athens Municipal Water Authority	City of Orange
Angelina and Neches River Authority	City of Palestine
Angelina-Nacogdoches WCID	City of Port Arthur
City of Athens	City of Port Neches
City of Beaumont	City of Silsbee
City of Bridge City	City of Tyler
City of Carthage	GM WSC
City of Center	Houston County WCID No. 1
City of Crockett	Lumberton MUD
City of Groves	Lower Neches Valley Authority
City of Henderson	Orange County WCID 1
City of Jacksonville	Panola County Fresh Water Supply District No. 1
City of Jasper	Sabine River Authority
City of Lufkin	Southern Utilities Company
City of Nacogdoches	Upper Neches River Municipal Water Authority
City of Nederland	

Table 6.4 Drought Trigger Conditions and Strategies Documented in Drought Contingency Plans

Water User	Drought Contingency Strategies													
	Trigger based on:		Stage I		Stage II		Stage III		Stage IV		Stage V		Stage VI	
	Supply	Demand	Voluntary Measures	Mandatory Measures	Voluntary Measures	Mandatory Measures	Voluntary Measures	Mandatory Measures	Voluntary Measures	Mandatory Measures	Voluntary Measures	Mandatory Measures	Voluntary Measures	Mandatory Measures
Athens Municipal Water Authority*														
Angelina and Neches River Authority	●	●	●		●	●	●	●	●	●	●	●		
Angelina-Nacogdoches WCID	●		●		●	●	●	●	●	●				
City of Beaumont	●	●	●		●	●	●	●	●	●	●	●		
City of Bridge City	●		●		●	●	●	●	●	●	●	●		
City of Carthage	●	●	●		●	●	●	●						
City of Groves	●	●	●		●	●	●	●						
City of Henderson	●	●	●		●	●	●	●						
City of Jacksonville	●	●	●		●	●	●	●						
City of Lufkin	●		●		●	●	●	●						
City of Nacogdoches	●	●	●		●	●	●	●	●	●				
City of Nederland	●	●	●		●	●	●	●						
City of Orange	●	●	●		●	●	●	●						
City of Palestine	●	●	●		●	●	●	●						
City of Port Arthur	●	●	●		●		●	●						
City of Silsbee	●	●	●		●	●	●	●	●	●				

Table 6.4 Drought Trigger Conditions and Strategies Documented in Drought Contingency Plans (Cont.)

Water User	Drought Contingency Strategies													
	Trigger based on:		Stage I		Stage II		Stage III		Stage IV		Stage V		Stage VI	
	Supply	Demand	Voluntary Measures	Mandatory Measures	Voluntary Measures	Mandatory Measures	Voluntary Measures	Mandatory Measures	Voluntary Measures	Mandatory Measures	Voluntary Measures	Mandatory Measures	Voluntary Measures	Mandatory Measures
Houston County WCID No. 1	●	●	●		●	●	●	●	●	●				
Lumberton MUD	●	●	●		●	●	●	●	●	●	●	●	●	●
Lower Neches Valley Authority	●		●		●	●	●	●						
Orange County WCID 1	●	●	●		●	●	●	●	●	●	●	●	●	●
Sabine River Authority	●		●		●	●	●	●	●	●	●	●		
Southern Utilities Company	●	●	●		●	●	●	●						
Upper Neches River Municipal Water Authority	●	●	●		●	●	●	●	●	●				

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Chapter 7

Description of How the Regional Water Plan is Consistent with Long-Term Protection of the State's Water Resources, Agricultural Resources, and Natural Resources

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The development of viable strategies to meet the demand for water is the primary focus of regional water planning. However, another important goal of water planning is the long-term protection of resources that contribute to water availability, and to the quality of life in the State. The purpose of this chapter is to describe how the 2011 Plan is consistent with the long-term protection of the State's water resources, agricultural resources, and natural resources. The requirement to evaluate the consistency of the regional water plan with protection of resources is found in 31 TAC Chapter 357.14(2)(C), which states, in part:

"The regional water plan is consistent with the guidance principles if it is developed in accordance with §358.3 of this title (relating to Guidelines), §357.5 of this title (relating to Guidelines for Development of Regional Water Plans), §357.7 of this title (relating to Regional Water Plan Development), §357.8 of this title (relating to Ecologically Unique River and Stream Segments), and §357.9 of this title (relating to Unique Sites for Reservoir Construction)."

Chapter 7 addresses this issue by providing general descriptions of how the plan is consistent with protection of water resources, agricultural resources, and natural resources. Additionally, the chapter will specifically address consistency of the 2011 Plan with the State's water planning requirements. To demonstrate compliance with the State's requirements, a matrix has been developed and is addressed in Section 7.4.

7.1 Consistency with the Protection of Water Resources

The water resources in the ETRWPA include portions of three river basins providing surface water, and portions of four aquifers providing groundwater. The three major river basins within the ETRWPA boundaries are the Sabine River Basin, the Neches River Basin, and the Trinity River Basin. The respective boundaries of these basins are depicted in Figure 1.2, in Chapter 1. The region's groundwater resources include, primarily, the Gulf Coast and Carrizo-Wilcox aquifers. Lesser amounts of water are also drawn from the Sparta and Queen City aquifers and localized aquifers, such as the Yegua-Jackson. The extents of these aquifers within the region are depicted on Figures 1.9 and 1.10 in Chapter 1.

Surface water accounts for approximately 75% of the total water use in the region. Sources include 11 reservoirs in the Neches River Basin, three in the Sabine River Basin, and one in the Trinity River Basin. If constructed, Lake Columbia would be located in the Neches River Basin. Currently, the majority of the available surface water supply used in the ETRWPA comes from the Neches River Basin.

The Carrizo-Wilcox aquifer and Gulf Coast aquifers are, by far, the most important groundwater resources in the ETRWPA, accounting for approximately 75% of the available groundwater. Over the past decade or more, significant water level declines have been observed in the Carrizo-Wilcox aquifer around the cities of Tyler, Lufkin, and Nacogdoches. Lufkin and Nacogdoches are both considering development of new surface water sources to meet projected shortages. The City of Tyler already relies largely on surface water supplies.

To be consistent with the long-term protection of water resources, the 2011 Plan must recommend strategies that minimize threats to the region's sources of water over the planning period. The water management strategies identified in Chapter 4 were evaluated for threats to water resources. The recommended strategies represent a comprehensive plan for meeting the needs of the region while effectively minimizing threats to water resources. Descriptions of some of the major strategies for the 2011 Plan and the ways in which they minimize threats are the following:

- **Water conservation**. Strategies for water conservation have been recommended that will help reduce the demand for water, thereby reducing the impact on the region's groundwater and surface water sources. Water conservation practices are expected to save over 23,860 ac–ft of water annually by 2060, reducing impacts on both groundwater and surface water resources. The plan also assumes significant savings in municipal demands due to the implementation of plumbing codes. Water conservation benefits the State's water resources by reducing the volumes of water withdrawals necessary to support human activity.
- **Development of Lake Columbia**. This strategy will increase surface water supplies available for cities, industry and agriculture in the ETRWPA.
- **Use of water from Toledo Bend by Regions C and D**. This strategy is planned for near the end of the planning horizon. If economically feasible, it could reduce the need for additional reservoirs in Regions C and D.
- **Optimized use of existing surface water resources**. Water management strategies that involve existing surface water resources work to optimize these resources and reduce the need for development of new surface water reservoirs. The WAM, a part of the regional planning process, assesses how the increased use of surface water resources will impact the Region's water resources. The WAMs developed for the ETRWPA indicate adequate availability of surface water in the region.
- **Optimized use of groundwater**. This strategy has generally been recommended for entities with sufficient groundwater supply available to meet needs, but currently without adequate infrastructure (i.e., well capacity). Groundwater availability reported in the plan is based on the long-term sustainability of the aquifer. No strategies are recommended to use water above the sustainable level.

7.2 Consistency with Protection of Agricultural Resources

Agriculture is an important economic cornerstone of the ETRWPA. Even with adequate rainfall, irrigation is a critical aspect of some agriculture in the region. Rice irrigation in the coastal counties is supplied by LNVA, primarily, with water from the Rayburn/Steinhagen system. The WAMs indicate adequate availability of surface water to meet the projected irrigation demands for the planning period.

7.3 Consistency with Protection of Natural Resources

The ETRWPA contains many natural resources, which must be considered in water planning. Natural resources include threatened or endangered species; local, state, and federal parks and public land; and energy/mineral reserves. Following is a brief discussion of how the 2011 Plan is consistent with the long-term protection of these resources.

7.3.1 Threatened/Endangered Species. A list of species of special concern, including threatened or endangered species, located within the ETRWPA is contained in Appendix 1-A. Included are 19 species of birds, eight insects, six mammals, 15 reptiles/amphibians, nine fish, 13 mollusks, 22 vascular plants, and two crustaceans. In general, water management strategies planned for the ETRWPA would not affect threatened or endangered species. Development of new reservoirs in the region could affect threatened or endangered species and their habitat. However, the development of any reservoir requires extensive environmental impact studies that address potential effects on threatened or endangered species. Any such impacts indicated by these studies would need to be mitigated in accordance with federal and state environmental regulations in order for the reservoir project to be allowed.

7.3.2 Parks and Public Lands. The ETRWPA contains national forests, wildlife refuges, and a preserve; as well as state parks, forests, and wildlife management areas. In addition, there are numerous local (e.g., city or county parks), recreational facilities, and other local public lands located throughout the region. None of the water management strategies currently proposed for the ETRWPA is expected to adversely impact state or local parks or public land.

In general, federal lands (i.e., national forests, wildlife refuges, or preserves) cannot be subjugated by state or local projects. It would be unlikely, therefore, that a proposed water management strategy for the ETRWPA would be permitted to adversely impact such properties.

7.3.3 Timber Resources. Much of the ETRWPA is heavily forested and timber is an important economic resource for the region. Although the development of Lake Columbia would inundate some forested areas, this loss in timber resources would be partially offset by gains in wetland areas, aquatic habitat and water recreation areas. A full environmental assessment is part of the planning process for development of reservoirs. The results of such environmental assessments identify any significant effects on timber resources and propose mitigation, as necessary. An environmental impact statement for Lake Columbia has been prepared and is under review by the U.S. Army Corps of Engineers.

7.3.4 Energy Reserves. Numerous oil and gas wells are located within the ETRWPA, including the East Texas Oil Field, and four of the top 10 producing gas fields in the state. Producing oil wells and top producing oil fields are depicted in Chapter 1 Figures 1.19 and 1.20, respectively. In addition, significant lignite coal resources can be found in the ETRWPA under portions of 12 counties. Lignite coal resources are depicted in Figure 1.22. These resources represent an important economic base for the region. None of the water management strategies is expected to significantly impact oil, gas, or coal production in the region.

7.4 Consistency with State Water Planning Guidelines

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

- 31 TAC Chapter 358.3
- 31 TAC Chapter 357.5
- 31 TAC Chapter 357.7
- 31 TAC Chapter 357.8
- 31 TAC Chapter 357.9

The information, data, evaluation, and recommendations included in Chapters 1 through 6 and Chapters 8 and 9 of the 2011 Plan collectively demonstrate compliance with these regulations. To assist with demonstrating compliance, the ETRWPA has developed a matrix addressing the specific recommendations contained in the above referenced regulations. Table 7.1 is a completed matrix, which is a checklist highlighting each pertinent paragraph of the regulations. The content of the 2011 Plan have been evaluated against this matrix.

Column 1 includes a regulatory citation for all subsections and paragraphs contained in the above regulations. A summary of each cited regulation is included in Column 2. It should be understood that this summary is intended only to provide a general description of the particular section of the regulation and should not be assumed to contain all specifics of the actual regulation. The evaluation of the Regional Water Plan should be performed against the complete regulation, as contained in the actual 31 TAC 358 and 31 TAC 357 regulations.

Column 3 of the checklist provides the evaluation response as affirmative, negative, or not applicable. A “Yes” in this column indicates that the ETRWPG believes the Regional Water Plan complies with the stated section of the regulation. A “No” response indicates that the ETRWPG believes the Regional Water Plan does not comply with the stated regulation. A response of “NA” (or not applicable) indicates that the stated section of the regulation does not apply to the Regional Water Plan.

The evidence of where in the Regional Water Plan the stated regulation is addressed is provided in Column 4. Where the regulation is addressed in multiple locations within the Regional Water Plan, this column may cite only the primary locations. In addition to identifying where the regulation is addressed, this column may include commentary about the application of the regulation in the Regional Water Plan.

The above-listed regulations are repetitive, in some instances. One section of the regulations may be restated or paraphrased elsewhere within the regulations. In some cases, multiple sections of the regulations may be combined into one separate regulation section. Column 5 indicates cross-referencing for water planning regulations.

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Table 7.1 Checklist for Comparison of the Regional Water Plan to Applicable Water Planning Regulations

(Column 1) Regulatory Citation	(Column 2) Summary of Requirement	(Column 3) 2011 Plan Complies? (Yes/No/ NA)	(Column 4) Location(s) in Regional Plan and/or Other Commentary	(Column 5) Regulatory Cross References
31 TAC §358.3				
(a)	TWDB shall develop a State Water Plan (SWP) with 50-year planning cycle, and based on the Regional Water Plan (RWP)	NA	Applies to the State Water Plan. The Regional Water Plan is based on a 50-year planning cycle, however.	
(b)	RWP is guided by the following principles:			
(b)(1)	Identified policies and actions so that water will be available at reasonable cost, to satisfy reasonable projected use and protect resources	Yes	Chapters 4, 6, and 7	§358.3(b)(4), §357.5 (a); §357.7 (a)(9); §357.5(e)(1); § 357.7(a)(10)
(b)(2)	Open and accountable decision-making based on accurate, objective information	Yes	Regular public meetings of the RWPG; Public Hearings scheduled throughout the region.	§357.5 (e)(6)
(b)(3)	Consideration of effects of plan on the public interest, and on entities providing water supply	Yes	Chapters 4, 5, and 7	
(b)(4)	Consideration and approval of cost-effective strategies that meet needs and respond to drought, and are consistent with long-term protection of resources	Yes	Chapters 4, 6, and 7	§358.3(b)(1), §357.5 (e)(4) and §357.5 (e)(6); §357.7(a)(9)
(b)(5)	Consideration of opportunities that encourage the voluntary transfer of water resources	Yes	Chapter 4	
(b)(6)	Consideration and approval of a balance of economic, social, aesthetic, and ecological viability	Yes	Chapters 4 and 7	
(b)(7)	The use of information from the adopted SWP for regions without a RWP	NA		
(b)(8)	The orderly development, management, and conservation of water resources	Yes	Chapters 4 and 6	§357.5(a)
(b)(9)	Surface waters are held in trust by the State, and governed by doctrine of prior appropriation	Yes	Chapters 3 and 4	
(b)(10)	Existing water rights, contracts, and option agreements are protected	Yes	Chapter 4	§357.5(e)(3)

Table 7.1 Checklist for Comparison of the Regional Water Plan to Applicable Water Planning Regulations (Cont.)

(Column 1) Regulatory Citation	(Column 2) Summary of Requirement	(Column 3) 2011 Plan Complies? (Yes/No/ NA)	(Column 4) Location(s) in Regional Plan and/or Other Commentary	(Column 5) Regulatory Cross References
(b)(11)	Groundwater is governed by the right of capture unless under local control of a groundwater conservation district	Yes	Chapter 1 and Chapter 4	
(b)(12)	Consideration of recommendation of stream segments of unique ecological value	Yes	Chapter 8. The RWPG decided to not recommend any of the Region's stream segments for designation as a segment of unique ecological value	§357.8
(b)(13)	Consideration of recommendation of sites of unique value for the construction of reservoirs	Yes	Chapter 8. The RWPG decided to not recommend any location as a site of unique value for construction of a reservoir.	§357.9
(b)(14)	Local, regional, state, and federal agency water planning coordination	Yes	The regional water planning process has included all levels of coordination, as necessary.	
(b)(15)	Improvement or maintenance of water quality and related uses as designated by the State Water Quality Plan	Yes	Chapters 4 and 5	
(b)(16)	Cooperation between neighboring water planning regions to identify common needs and issues	Yes	The regional planning process has included coordination with neighboring regions, as needed.	
(b)(17)	WMS described sufficiently to allow a state agency making financial or regulatory decisions to determine consistency of the WMS with the RWP	Yes	Chapter 4	§357.7(a)(9)
(b)(18)	Environmental evaluations are based on site-specific information or state environmental planning criteria	Yes	Chapter 4. To the extent that such information is available.	§357.5(e)(1); §357.5 (e)(6); §357.5(k)(1)(H)
(b)(19)	Consideration of environmental water needs, including instream flows and bay and estuary inflows	Yes	Chapters 3 and 4	§357.5(e)(1); §357.5(l); §357.7 (a)(8)(A)(ii)
(b)(20)	Planning is consistent with all laws applicable to water use for state and regional water planning	Yes	The regional water planning process has considered applicable water laws.	§357.5(f)

Table 7.1 Checklist for Comparison of the Regional Water Plan to Applicable Water Planning Regulations (Cont.)

(Column 1) Regulatory Citation	(Column 2) Summary of Requirement	(Column 3) 2011 Plan Complies? (Yes/No/ NA)	(Column 4) Location(s) in Regional Plan and/or Other Commentary	(Column 5) Regulatory Cross References
(b)(21)	Ongoing permitted water development projects are included	Yes	Chapters 1, 3, and 4	
31 TAC §357.5				
(a)	The RWP: provides for the orderly development, management, and conservation of water resources; prepares for drought conditions; and protects agricultural, natural, and water resources	Yes	Chapters 4, 6, and 7	§358.3(b)(1); §358.3(b)(1); §357.7(a)(10)
(b)	The RWP submitted by January 5, 2011	NA	To be submitted	
(c)	The RWP is consistent with 31 TAC §358 and 31 TAC §357, and guided by state and local water plans	Yes		
(d)(1) & (2)	The RWP uses state population and water demand projections from the SWP; or revised population or water demand projections that are adopted by the State	Yes	Chapter 2. Population of the ETRWPA did not change in this round, per TWDB. Water demands changes were approved by TWDB in January 2010	
(e)(1)	The RWP provides WMS adjusted for appropriate environmental water needs; environmental evaluations are based on site-specific information or state environmental planning criteria	Yes	Chapter 4; to the extent that site-specific information was available.	§358.3(b)(1); §358.3(b)(18); §357.7 (a)(8)(A)(ii), §358.3(b)(19)
(e)(2)	The RWP provides WMS that may be used during a drought of record	Yes	Chapter 4	
(e)(3)	The RWP protects existing water rights, contracts, and option agreements	Yes	Chapter 4	§358.3(b)(10)

Table 7.1 Checklist for Comparison of the Regional Water Plan to Applicable Water Planning Regulations (Cont.)

(Column 1) Regulatory Citation	(Column 2) Summary of Requirement	(Column 3) 2011 Plan Complies? (Yes/No/ NA)	(Column 4) Location(s) in Regional Plan and/or Other Commentary	(Column 5) Regulatory Cross References
(e)(4)	The RWP provides cost-effective and environmentally sensitive WMS based on comparisons of all potentially feasible WMS; The process is documented and presented to the public for comment.	Yes	Chapter 4. WMS have been presented to the public and adopted by the RWPG.	§358.3(b)(4)
(e)(5)	The RWP incorporates water conservation planning and drought contingency planning	Yes	Chapters 4 and 6	§357.5(k)(1)(A)&(B); §357.7(a)(7)(B)
(e)(6)	The RWP achieves efficient use of existing supplies and promotes regional water supplies or regional management of existing supplies; Public involvement is included in the decision-making process	Yes	Chapter 4. Regular public meetings held to discuss WMS and conservation issues.	§358.3(b)(2); §358.3(b)(4); §358.3(b)(18)
(e)(7)(A)&(B)	The RWP identifies (A) drought triggers, and (B) drought responses for designated water supplies	Yes	Chapter 6	§357.5(e)(5); §357.5(k)(1)(A)&(B)
(e)(8)	The RWP considers the effect of the plan on navigation	Yes		
(f)	Planning is consistent with all laws applicable to water use in the Region	Yes	The regional planning process has considered applicable water laws.	§358.3(b)(20)
(g)	The following characteristics of a candidate special water resource are considered:			
(g)(1)	The surface water rights are owned by an entity headquartered in another region.	Yes	Chapter 1	
(g)(2)	A water supply contract commits water to an entity headquartered in another region.	Yes	Chapter 1	
(g)(3)	An option agreement may result in water being supplied to an entity headquartered in another region.	Yes	Chapter 1	

Table 7.1 Checklist for Comparison of the Regional Water Plan to Applicable Water Planning Regulations (Cont.)

(Column 1) Regulatory Citation	(Column 2) Summary of Requirement	(Column 3) 2011 Plan Complies? (Yes/No/ NA)	(Column 4) Location(s) in Regional Plan and/or Other Commentary	(Column 5) Regulatory Cross References
(h)	Water rights, contracts, and option agreements of special water resources are protected in the RWP	NA		
(i)	The RWP considers emergency transfers of surface water rights	Yes	No emergency transfers of water are anticipated in this plan update.	
(j)(1)-(3)	Simplified planning is used in the RWP in accordance with TWDB rules	NA		
(k) (1)&(2)	The RWP shall consider existing plans and information, and existing programs and goals related to local or regional water planning	Yes	Chapters 1 through 6	§358.3(b)(18); §357.5(e)(5); §357.5(e)(7); §357.7(a)(1)(A)(M)
(l)	The RWP considers environmental water needs including instream flows and bays and estuary flows	Yes	Chapters 3 and 4	§358.3(b)(19); §357.7 (a)(8)(A)(ii)
31 TAC §357.7				
(a)(1)(A)-(M)	The RWP shall describe the region, including specific requirements of paragraphs A through M of this section of the regulations	Yes	Chapter 1	§357.7(a)(8)(A)(iii); §357.7(a)(8)(D); §357.5(k)(1)(C); §357.7(a)(7)(A)(iv)
(a)(2)(A)-(C)	The RWP includes a presentation of current and projected population and water demands, reported in accordance with paragraphs A through C of this section of the regulations	Yes	Chapter 2	

Table 7.1 Checklist for Comparison of the Regional Water Plan to Applicable Water Planning Regulations (Cont.)

(Column 1) Regulatory Citation	(Column 2) Summary of Requirement	(Column 3) 2011 Plan Complies? (Yes/No/ NA)	(Column 4) Location(s) in Regional Plan and/or Other Commentary	(Column 5) Regulatory Cross References
(a)(3)(A)&(B)	The RWP includes the evaluation of current water supplies available (including a presentation of reservoir firm yields) to the Region for use during drought of record conditions, reported by the type of entity and wholesale providers	Yes	Chapter 3	
(a)(4) (A)&(B)	The RWP includes water supply and demand analysis, comparing the type of entity and wholesale providers	Yes	Chapter 4	
(a)(5)(A)-(C)	The RWP provides sufficient water supply to meet the identified needs, in accordance with requirements of paragraphs A through C of this section of the regulations	Yes	Chapter 4	
(a)(6)	The RWP presents data required in paragraphs (2) - (5) of this subsection in subdivisions of the reporting units required, if desired by the RWPG	Yes	Chapters 2 through 4	
(a)(7)(A)-(G)	The RWP evaluates all WMS determined to be potentially feasible, in accordance with paragraphs A through G of this section of the regulations	Yes	Chapter 1	§357.5(k)(1)(C); §357.7(a)(1)(M); §357.5(e)(5); §357.5(k)(1)(B)
(a)(8)(A)-(H)	The RWP evaluates all WMS determined to be potentially feasible, by considering the requirements of paragraphs A through H of this section of the regulations	Yes	Chapter 4	§358.3(b)(19); §357.5(e)(1); §357.5(l); §357.7(a)(1)(L); §357.7(a)(8)(D); §357.7(a)(8)(A)(iii);
(a)(9)	The RWP makes specific recommendations of WMS in sufficient detail to allow state agencies to make financial or regulatory decisions to determine the consistency of the proposed action with an approved RWP	Yes	Chapter 4	§358.3(b)(1); §358.3(b)(4); §358.3(b)(17)

Table 7.1 Checklist for Comparison of the Regional Water Plan to Applicable Water Planning Regulations (Cont.)

(Column 1) Regulatory Citation	(Column 2) Summary of Requirement	(Column 3) 2011 Plan Complies? (Yes/No/ NA)	(Column 4) Location(s) in Regional Plan and/or Other Commentary	(Column 5) Regulatory Cross References
(a)(10)	The RWP includes regulatory, administrative, or legislative recommendations to facilitate the orderly development, management, and conservation of water resources; prepares for drought conditions; and protects agricultural, natural, and water resources	Yes	Chapters 4, 6, and 7	§358.3(b)(1) §357.5(a)
(a)(11)	The RWP includes a chapter consolidating the water conservation and drought management recommendations	Yes	Chapter 6	
(a)(12)	The RWP includes a chapter describing the major impacts of recommended WMS on key parameters of water quality	Yes	Chapter 5	
(a)(13)	The RWP includes a chapter describing how it is consistent with long-term protection of the state's water, agricultural, and natural resources	Yes	Chapter 7	
(a)(14)	The RWP includes a chapter describing the financing needed to implement the water management strategies recommended	Yes	Will be provided as Chapter 9	
(b)	The RWP excludes WMS for political subdivisions that object to inclusion and provide reasons for objection	NA		
(c)	The RWP includes model water conservation plan(s)	Yes	Chapter 6 of the 2006 Plan. Referenced in the 2011 Plan.	
(d)	The RWP includes model drought contingency plan(s)	Yes	Chapter 6 of the 2006 Plan. Referenced in the 2011 Plan.	
(e)	The RWP includes provisions for assistance of the TWDB in performing regional water planning activities and/or resolving conflicts within the Region	NA	No known conflicts within the region.	

Table 7.1 Checklist for Comparison of the Regional Water Plan to Applicable Water Planning Regulations (Cont.)

(Column 1) Regulatory Citation	(Column 2) Summary of Requirement	(Column 3) 2011 Plan Complies? (Yes/No/ NA)	(Column 4) Location(s) in Regional Plan and/or Other Commentary	(Column 5) Regulatory Cross References
31 TAC §357.8				
(a)	The RWP considers the inclusion of recommendations for the designation of river and stream segments of unique ecological value within the Region	Yes	Chapter 8. The RWPG decided to not recommend any of the Region's stream segments for designation as a segment of unique ecological value.	§358.3(b)(12)
(b)	If river or stream segments of unique ecological value are recommended, such recommendations are made in the plan on the basis of the criteria established in this section of the regulations	NA	No river or stream segments of unique ecological value have been recommended in this update.	
(c)	If the RWP recommends designation of river or stream segments of unique ecological value, the impact of the regional water plan on these segments is assessed	NA	No river or stream segments of unique ecological value have been recommended in this update.	
31 TAC §357.9				
(1)	The RWP considers the inclusion of recommendations for the designation of sites of unique value for construction of reservoirs	Yes	The RWPG decided to not recommend any location as a site of unique value for construction of a reservoir.	§358.3(b)(13)
(2)	If sites of unique value for construction of reservoirs are recommended, such recommendations are made in the plan on the basis of criteria established in this section of the regulations	NA	No sites have been recommended for designation as having unique value for construction of a reservoir in this update.	

Chapter 8

Ecologically Unique Stream Segments, Unique Reservoir Sites, and Legislative Recommendations

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This chapter of the 2011 Plan addresses unique stream segment designation, unique reservoir site designation, and water planning recommendations to the Texas Legislature. Information relevant to these issues was considered by the ETRWPG and the group voted on each issue. Following is a discussion of each issue.

8.1 Unique Stream Segments

Designation of a river or stream segment as ecologically unique is defined by §16.051(f) of the Texas Water Code to mean "that a state agency or political subdivision of the state may not finance the actual construction of a reservoir in a specific river or stream designated." Based on this legislation, the ETRWPG is obligated to consider potential river or stream segments as being of unique ecological value based upon the following criteria:

(1) **Biological function** – stream segments which display significant overall habitat value including both quantity and quality considering the degree of biodiversity, age, and uniqueness observed and including terrestrial, wetland, aquatic, or estuarine habitats;

(2) **Hydrologic function** – stream segments which are fringed by habitats that perform valuable hydrologic functions relating to water quality, flood attenuation, flow stabilization, or groundwater recharge and discharge;

(3) **Riparian conservation areas** – stream segments which are fringed by significant areas in public ownership including state and federal refuges,

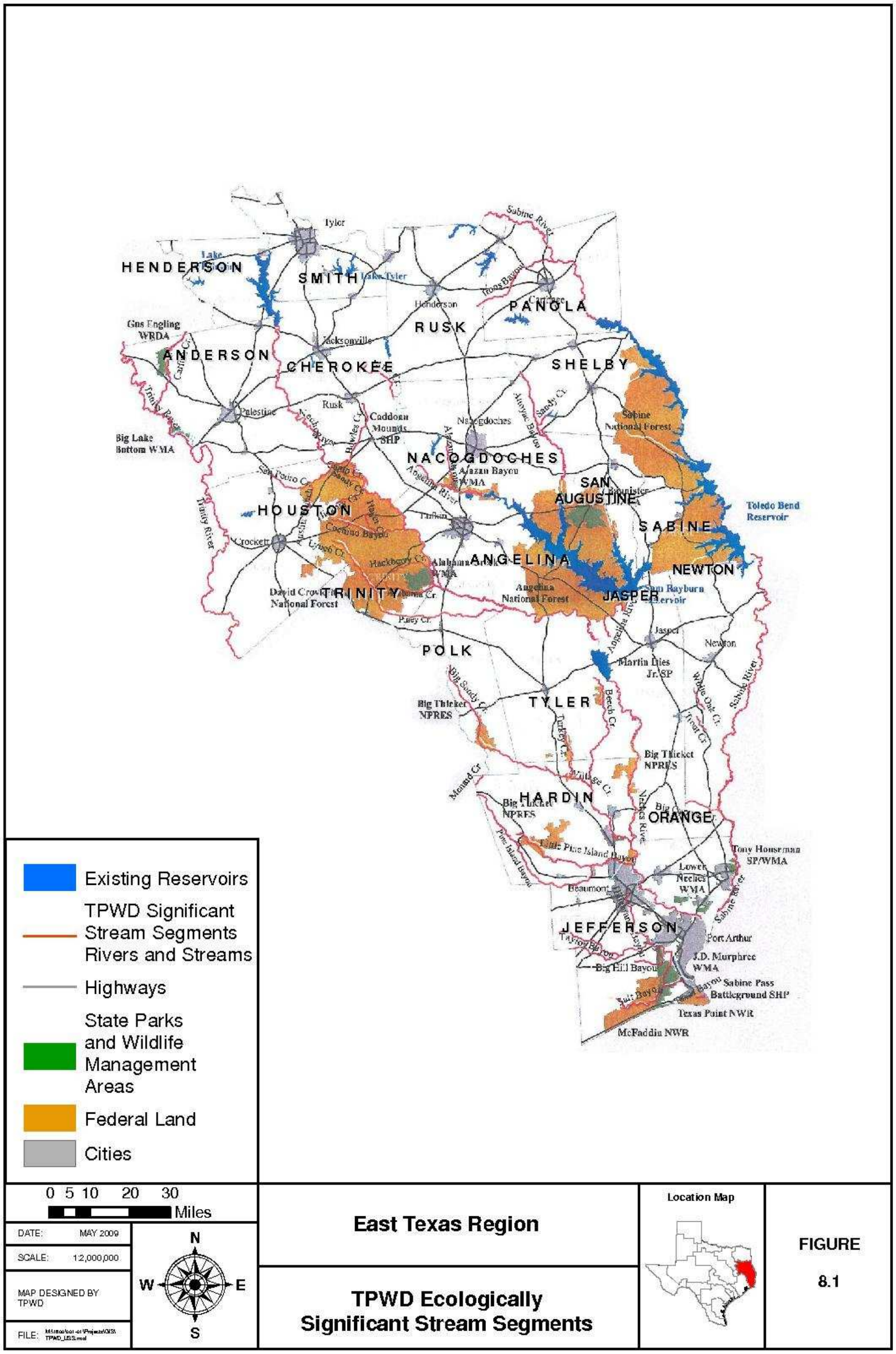
wildlife management areas, preserves, parks, mitigation areas, or other areas held by governmental organizations for conservation purposes, or stream segments which are fringed by other areas managed for conservation purposes under a governmentally approved conservation plan;

(4) **High water quality/exceptional aquatic life/high aesthetic value –** stream segments and spring resources that are significant due to unique or critical habitats and exceptional aquatic life uses dependent on or associated with high water quality; or

(5) **Threatened or endangered species/unique communities –** sites along streams where water development projects would have significant detrimental effects on state or federally listed threatened and endangered species, and sites along streams significant due to the presence of unique, exemplary, or unusually extensive natural communities.

To assist the ETRWPG with identifying potential stream segments for designation, the TPWD developed a draft report[1] of ecologically significant river and stream segments in the ETRWPA. The TPWD draft report identified 41 river and stream segments in the ETRWPA as possibly ecologically significant. A map prepared by TPWD showing the locations of the 41 river and stream segments is presented on Figure 8.1. The draft report has not been finalized and no action has been taken as of yet.

The planning rules do not provide guidance on how many of the criteria need to be met as a prerequisite for consideration for designation as a unique stream segment. As an initial screening tool, the ETRWPG determined that those segments that meet three or more of the criteria would be further evaluated.


HENDERSON
SMITH
RUSK
PANOLA
ANDERSON
CHEROKEE
SHELBY
NACOGDOCHES
SAN AUGUSTINE
SABINE
HOUSTON
ANGELINA
NEWTON
TRINITY
JASPER
POLK
TYLER
HARDIN
ORANGE
JEFFERSON
Tyler
Lake Tyler
Henderson
Jacksonville
Palestine
Rusk
Caddoan Mounds SHP
Nacogdoches
Crockett
Sabine National Forest
Toledo Bend Reservoir
Sam Rayburn Reservoir
Angelina National Forest
David Crockett National Forest
Big Lake Bottom WMA
Martin Dies Jr. SP
Big Thicket NPRES
Tony Houseman SP/WMA
Lower Neches WMA
Beaumont
Port Arthur
J.D. Murphree WMA
Sabine Pass Battleground SHP
Texas Point NWR
McFaddin NWR
Existing Reservoirs
TPWD Significant Stream Segments
Rivers and Streams
Highways
State Parks and Wildlife Management Areas
Federal Land
Cities
0 5 10 20 30
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DATE: MAY 2009
SCALE: 12,000,000
MAP DESIGNED BY TPWD
N
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East Texas Region
TPWD Ecologically Significant Stream Segments
Location Map
FIGURE
8.1

Only nine of the 41 segments have three or more applicable criteria. Table 8.1 presents a summary of the 41 segments identified by TPWD and which of the five criteria are identified by TPWD for each segment. Some of the segments are categorized as having threatened or endangered species or unique communities. The specific threatened or endangered species or unique community that is the basis for this categorization is presented in Table 8.2.

When the first regional water plans were prepared (2001), the RWPGs requested clarification of the intent of unique stream segment designations. The legislature addressed that issue in the 77th Legislative Session. The results are reflected in Section 16.051(f) of the Texas Water Code, which states:

> *This designation solely means that a state agency or political subdivision of the state may not finance the actual construction of a reservoir in a specific river or stream designated by the legislature under this subsection.*

This implies that it would be irrelevant to consider recommending a segment for designation if it does not have potential to be a reservoir site. Despite the above clarification, there continues to be concern among many regional water planning groups (including the ETRWPG) that designation of a stream segment might lead to additional unwarranted restrictions on the use of the segment, including water diversions and discharges of treated effluent. During the current round of regional water planning, representatives of Region C met with TCEQ, TWDB, and TPWD to discuss potential issues related to restrictions associated with unique stream segment designation. As a result of this meeting, the TWDB has determined that a stakeholder committee should be formed to address the potential concerns. The committee has not yet been formed. However, it is understood that recommendations of the committee should be developed before the next round of water planning is complete.

Table 8.1 TPWD Ecologically Significant River and Stream Segments

River/Stream Segment	Biological Function	Hydrologic Function	Riparian Conservation Areas	High Water Quality/ Exceptional Aquatic Life/High Aesthetic Value	Threatened or Endangered Species/Unique Communities
Alabama Creek			•		
Alazan Bayou	•		•		
Upper Angelina River	•		•		•
Lower Angeline River			•		•
Attoyac Bayou					•
Austin Branch			•		
Beech Creek			•	•	
Big Cypress Creek			•	•	
Big Hill Bayou	•		•		
Big Sandy Creek	•		•	•	
Bowles Creek			•		
Camp Creek			•		•
Catfish Creek			•	•	•
Cochino Bayou			•		
Hackberry Creek			•		•
Hager Creek			•		
Hickory Creek			•		
Hillebrandt Creek			•		
Irons Bayou				•	
Little Pine Island Bayou			•		
Lynch Creek			•		•
Menard Creek	•		•		
Mud Creek	•				•
Upper Neches River	•		•	•	•
Lower Neches River	•		•	•	•
Pine Island Bayou			•		
Piney Creek			•	•	•
Upper Sabine River	•			•	
Middle Sabine River	•		•		
Lower Sabine River	•			•	•
Salt Bayou	•		•		
San Pedro Creek			•		
Sandy Creek (Trinity County)					•
Sandy Creek (Shelby County)			•		•
Taylor Bayou	•		•		
Texas Bayou	•		•		
Trinity River	•		•		•
Trout Creek			•		
Turkey Creek			•		
Village Creek	•		•	•	•
White Oak Creek				•	

Table 8.2 TPWD Threatened and Endangered Species/Unique Communities

Threatened/ Endangered Species	Angelina River	Big Sandy Creek	Catfish Creek	Upper Neches River	Lower Neches River	Piney Creek	Sabine River	Trinity River	Village Creek
Paddlefish	•			•	•		•		
Creek chubsucker				•		•			
Sandbank pocketbook freshwater mussel					•				
Texas heelsplitter freshwater mussel					•			•	
Neches River rose-mallow				•					
Rough-stem aster			•						
Unique community		•							•

Six of the nine stream segments identified for further evaluation are not currently considered as potentially suitable for reservoir construction. Therefore, these segments have been eliminated from further consideration at this time. These segments are as follows:

- Angelina River (Segment 0611; Nacogdoches County)
- Big Sandy Creek (0608B)
- Catfish Creek (Segment 0804G)
- Neches River (Segments 0601/0602)
- Trinity River (Segment 0803/0804)
- Village Creek (Segment 0608)

Three segments include reaches that have been identified as potentially suitable for a reservoir site.

- Neches River (Segment 0604) – Rockland Reservoir and Fastrill Reservoir
- Piney Creek (Segment 0604D) – Rockland Reservoir

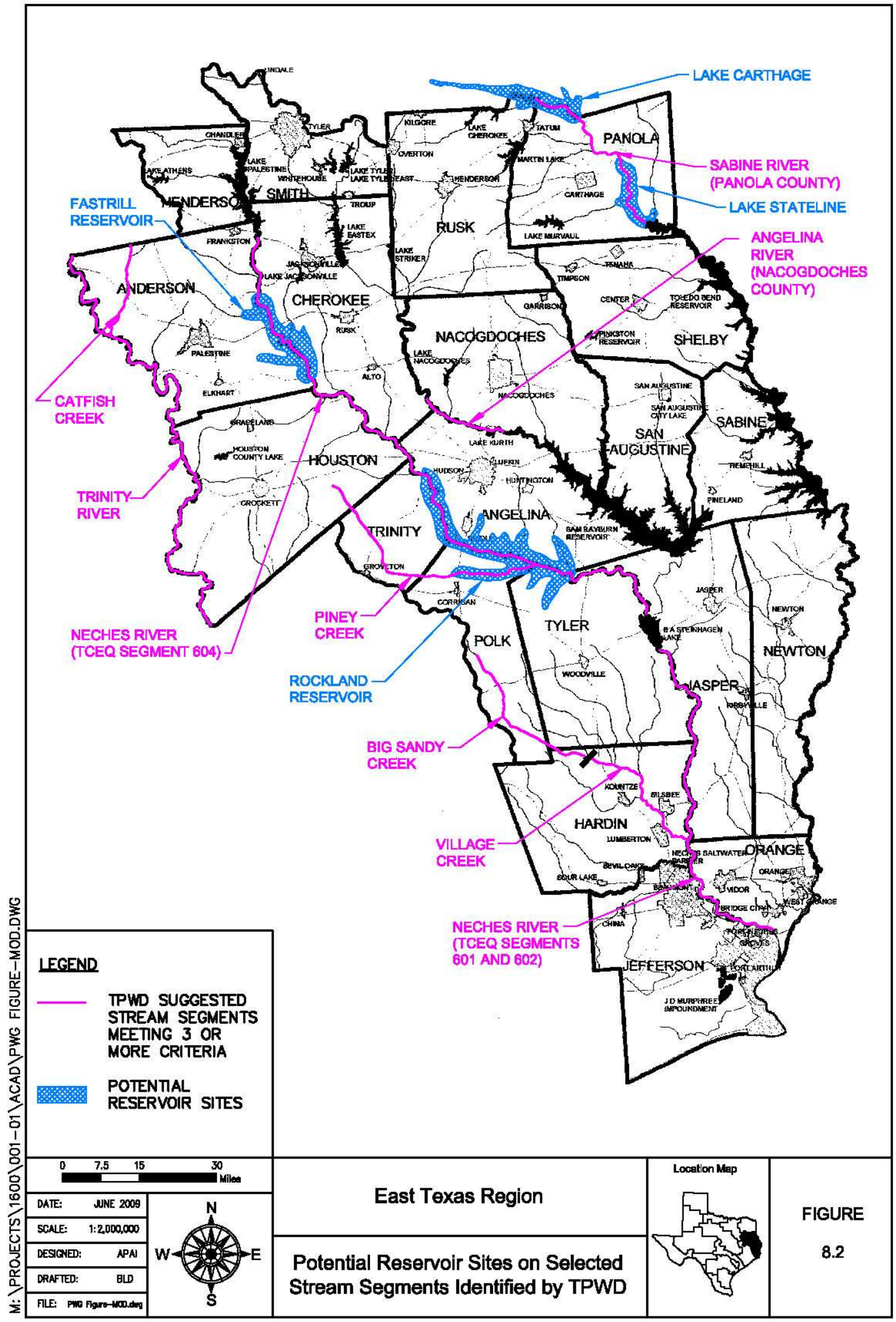
- Sabine River (Segment 0505; Panola County) – Lake Stateline and Lake Carthage

Figure 8.2 provides locations of the four proposed reservoirs with respect to potential unique stream segments.

Very little information currently exists on the relative value of using these sites for a reservoir compared to maintaining a riverine environment. Prior to proceeding with the construction of a reservoir at any of these sites, extensive environmental studies must be conducted to determine the extent and nature of potential environmental impacts and whether these impacts can be effectively mitigated. The information obtained through such environmental studies is the type of data needed to provide a basis for decisions regarding the relative merits of constructing a reservoir or preserving a riverine environment.

No regulatory purpose has been identified that would be served by a unique stream segment designation, other than precluding reservoir construction. Indeed, there are currently extensive regulations and programs to protect the environment in the ETRWPA.

The ETRWPA has a high proportion of land that has been assigned a special protective status. There are three national forests (Davy Crockett National Forest, Angelina National Forest, and Sabine National Forest) that encompass 475,000 acres. The Big Thicket National Preserve covers 97,000 acres. The McFaddin National Wildlife Refuge, Neches National Wildlife Refuge, Texas Point National Wildlife Refuge, J.D. Murphree Wildlife Management Area, Tony Houseman Wildlife Management Area, Engling Wildlife Management Area, Alabama Creek Wildlife Management Area, Alazan Bayou Wildlife Management Area, Lower Neches River Wildlife Management Area, Big Lake Bottom Wildlife Management Area, and E.O. Siecke State Forest encompass 138,000 acres. In addition, there are a number of state parks, state historic sites, and the Alabama and Coushatta Indian Reservation.


LAKE CARTHAGE
SABINE RIVER (PANOLA COUNTY)
LAKE STATELINE
ANGELINA RIVER (NACOGDOCHES COUNTY)
FASTRILL RESERVOIR
CATFISH CREEK
TRINITY RIVER
NECHES RIVER (TCEQ SEGMENT 604)
PINEY CREEK
ROCKLAND RESERVOIR
BIG SANDY CREEK
VILLAGE CREEK
NECHES RIVER (TCEQ SEGMENTS 601 AND 602)
PANOLA
RUSK
SMITH
HENDERSON
ANDERSON
CHEROKEE
NACOGDOCHES
SHELBY
SAN AUGUSTINE
SABINE
HOUSTON
TRINITY
ANGELINA
POLK
TYLER
JASPER
NEWTON
HARDIN
ORANGE
JEFFERSON
LEGEND
TPWD SUGGESTED STREAM SEGMENTS MEETING 3 OR MORE CRITERIA
POTENTIAL RESERVOIR SITES
0 7.5 15 30 Miles
DATE: JUNE 2009
SCALE: 1:2,000,000
DESIGNED: APAI
DRAFTED: BLD
FILE: PWG Figure-MOD.dwg
N S E W
East Texas Region
Potential Reservoir Sites on Selected Stream Segments Identified by TPWD
Location Map
FIGURE 8.2
M:\PROJECTS\1600\001-01\ACAD\PWG FIGURE-MOD.DWG

Areas of the ETRWPA that are not part of a state or federal preserve are also protected by various regulatory programs. These activities include state and federal permitting activities, requirements for environmental assessments for certain activities that could adversely affect the environment.

At its regularly scheduled meeting in July 2009, the ETRWPG considered the above information and voted to not recommend any stream segments in the region for unique status. The ETRWPG concluded that sufficient programs are already in place to protect the regions streams from inappropriate reservoir construction. In addition, the ETRWPG prefers to allow the TWDB to study issues associated with unique stream segment designation before further considering potential designations in the ETRWPA.

8.2 Unique Reservoir Sites

Regional water planning guidelines allow regional water planning groups to recommend sites of unique value for construction of new reservoirs. Considerations include physical characteristics (location, hydrology, geology, and topography), environmental factors, water availability and other pertinent features that make the site uniquely suited for water supply. The ETRWPA has a long history of water supply planning and reservoir development. There are numerous sites that have been identified as being hydrologically and topographically ideal for reservoir development. Two sites in the ETRWPA are currently designated as unique reservoir sites: Lake Columbia and Fastrill Reservoir. Fastrill Reservoir was designated by the 79th Legislature through SB 3. Lake Columbia received its unique designation by the State Legislature, SB1362. Lake Columbia is currently being pursued for development. Other sites have been considered for water supply development in the past and may be considered again for future supplies.

The ETRWPG considered potential reservoir sites for possible designation as unique but did not designate any additional unique reservoir sites. The considered sites are described below.

Lake Columbia is identified as a recommended strategy to meet water shortages in the current planning cycle. Rockland Reservoir is identified as an alternative water management strategy for LNVA to meet its future water demands if reallocation of water in the Rayburn-Steinhagen system, or access to water from Toledo Bend Reservoir proves not to be viable.

There are several reservoir sites in the ETRWPA that have long been discussed as potential sources of water. The ETRWPG agrees with past evaluations of these sites as being hydrologically and topographically unique for reservoir construction. The ETRWPG recognizes that reservoirs can have major impacts on the environment and that protection of the environment is already afforded through a process which is more thorough than the regional water planning effort. The ETRWPG is not recommending these sites be designated as unique reservoir sites. The ETRWPG is recommending that these sites be recognized as potential long-term water management strategies for the time period more than fifty years in the future. The ETRWPG believes that the lengthy and thorough economic and environmental review process will determine if any of these reservoirs are constructed as opposed to any decision by the ETRWPG.

At its regularly scheduled meeting in December 2009, the ETRWPG voted to not recommend any proposed reservoir sites as unique during this planning cycle. Proposed sites, including the two sites already designated as unique, are included in Table 8.3, following.

Table 8.3 Potential Reservoirs for Designation as Unique Reservoir Sites

Major Water Provider	Reservoir Site
Angelina Neches River Authority	Lake Columbia (Already Unique Site)
	Ponta
Lower Neches Valley Authority	Rockland Reservoir (Alternate WMS)
Sabine River Authority	Big Cow Creek
	Bon Weir
	Carthage Reservoir
	Kilgore Reservoir
	Rabbit Creek
	State Hwy. 322, Stage I
	State Hwy. 322, Stage II
	Stateline
	Socagee
Upper Neches River Municipal Water Authority	Fastrill Reservoir (Already Unique Site)

In addition to the above sites, Lake Naconiche, located in northeast Nacogdoches County may also be a potential water supply. Lake Naconiche has a main purpose of flood control. The dam for Lake Naconiche has been completed and the lake is now impounding water. At normal pool elevation (348 ft. msl) the lake will impound 9,074 acre-feet. A brief description of each of the above reservoir sites follows. Appendix 8-A contains maps showing the proposed locations for each reservoir.

8.2.1 Rockland Reservoir. The Rockland Reservoir site is located on the Neches River at River Mile 160.4. Appendix 8-A, Figure 8-A.1 indicates the proposed location. The top of the flood pool would be at elevation 174 feet, msl with top of conservation pool of 165 feet, msl. It is estimated the reservoir site would affect 99,524 acres of wildlife habitat (Frye, 1990).

Rockland Reservoir was authorized for construction as a federal facility in 1945, along with Sam Rayburn, B. A. Steinhagen and Dam A lakes. A report in 1947 recommended construction of Sam Rayburn and B. A. Steinhagen with deferral of Rockland Reservoir and Dam A until such time the need develops. Rockland and Dam A were classified as inactive in 1954. A re-evaluation study performed in 1987 identified the potential for significant benefits in the areas of flood control, water supply, hydropower, and recreation.

8.2.2 Big Cow Reservoir The Big Cow Reservoir is a proposed local water supply project on Big Cow Creek in Newton County. The Big Cow Creek dam site is located about one-half mile upstream from U.S. Hwy 190, west-northwest of the Town of Newton. It is in the Lower Sabine Basin. Figure 8-A.2 indicates the location of the proposed reservoir. The expected yield of the reservoir is 61,700 ac-ft per year with a storage capacity of 79,852 ac-ft and an area of 4,618 acres. The conservation level would be 212 feet msl.

The perennial streams that feed Big Cow Creek and abundant rainfall should provide sufficient inflow for considerable yield for a reservoir of this size.

8.2.3 Bon Weir Reservoir. The Bon Weir dam site is located on the state line reach of the Sabine River in Newton County, Texas and Beauregard Parish, Louisiana. The reservoir would extend from about 5 miles upstream of U.S. Hwy 190 to approximately Highway 63. Figure 8-A.2 indicates the location of the proposed reservoir. It was originally proposed for re-regulation of the hydropower discharges from Toledo Bend Reservoir and for the generation of hydropower. The reservoir, if constructed, would yield 440,000 ac-ft per year at a normal operating elevation of 90 feet above msl. The area and capacity would be 34,540 acres and 353,960 acre-feet, respectively.

It is estimated that the Bon Weir Reservoir would affect 35,000 acres of wildlife habitat (Frye, 1990). This includes several acid bogs/baygalls, which are unique and sensitive areas of the region. Several threatened and endangered species are known to occur in this area. No cultural resource survey has been conducted, but the site is expected to impact numerous archeological and historical sites in both Texas and Louisiana. The Clean Rivers Program Water Quality data reported possible concerns for elevated TDS and low dissolved oxygen during the summer months. The site also requires congressional approval for construction of a dam, because it is on interstate navigable waters of the U.S.

8.2.4 Carthage Reservoir. The Carthage Reservoir is a proposed main stem project on the Sabine River in Panola, Harrison, Rusk and Gregg counties. It is located immediately upstream of the U.S. Highway 59 crossing and downstream of the City of Longview. Figure 8-A.3 indicates the proposed location. The yield of this reservoir, if constructed, would be approximately 537,000 ac-ft per year at a conservation pool elevation of 244 feet msl. The area and capacity would be 41,200 acres and 651,914 acre-feet, respectively.

Developmental concerns for Carthage Reservoir include bottomland hardwoods, aquatic life, lignite deposits and cultural resources. The downstream half of the site encompasses a USFWS Priority 1 bottomland hardwood area. This portion of the Sabine River is designated a significant stream segment and is home to several protected aquatic species (Bauer, 1991). Other potential conflicts with this site include oil and gas wells. Permitting for this reservoir will require an act of Congress since the dam is located on navigable interstate waters of the U.S. There is one active lignite mine, South Hallisville Mine No. 1, near the reservoir boundary.

The water quality assessment of the Sabine River (SRA, 1996a) indicates this segment of the river has possible concerns for nutrients, but the water quality is improving. The advantage of this reservoir is its large yield. The estimated yield of 537,000 ac-ft per year would provide for all projected needs well beyond the year 2060.

8.2.5 State Highway 322 Stage I. The Highway 322 Reservoir is a proposed local water supply project in Rusk County, upstream of Lake Cherokee. Figure 8-A.3 indicates the proposed location. The project, as originally proposed, was to be developed in two stages: 1) a dam and reservoir on Tiawichi Creek (Stage I), and 2) a separate dam and reservoir on Mill Creek (Stage II). The reservoirs were to be joined by a connecting channel that would allow one spillway to serve both dams.

The proposed Stage I dam is located on Tiawichi Creek, approximately one mile upstream of its confluence with the upper end of Lake Cherokee. The reservoir, at its normal operating elevation of 330 feet msl, would provide a net yield of 22,000 ac-ft per year. Its area and capacity would be 4,450 acres and 82,450 acre-feet, respectively. If Stage I is operated independently from Lake Cherokee, the firm yield of the reservoir would be reduced due to Lake Cherokee's superior water rights.

The primary developmental concern for the Stage I reservoir is active lignite mining. In 1995, the Oak Hill Mine expanded its current permit area to include approximately one third of the proposed Stage I reservoir area. There have been no environmental studies conducted for this site. Based on preliminary screening, the site is located outside priority bottomland hardwood areas, and there are no known water quality issues.

8.2.6 State Highway 322 Stage II. The State Highway 322 - Stage II reservoir is the second phase of the State Highway 322 water supply project in Rusk County. The Stage II dam would be located on Mill Creek, approximately one mile upstream of the existing Lake Cherokee. Figure 8-A.3 indicates the proposed location. Operated at the same level as Stage I (330 feet msl), this project would provide an increased yield to the Cherokee Lake system of 13,000 ac-ft per year with added storage capacity of 112,000 acre-feet. Stage II surface area would be 2,060 acres. The State Highway 322 project (Stages I and II) and Lake Cherokee could be operated as a system to provide a total yield of 53,000 ac-ft per year and maintain the recreational and aesthetic benefits currently provided by Lake Cherokee. If State Highway 322 project is operated independently from Lake Cherokee, the firm yield would be reduced due to Lake Cherokee's superior water rights.

The primary developmental concern for Stage II is the active lignite mining. Surface mining records indicate that the Oak Hill Mine permit encompasses much of the Stage II reservoir. Preliminary screening indicates no priority bottomland hardwoods in the reservoir area, and there are no known water quality issues. The advantages to this reservoir site is its location near the areas with projected water needs and the possibility that when mining is completed, the site will already be cleared and ready for reservoir development.

8.2.7 Stateline Reservoir. The Stateline Reservoir is a proposed main stem project on the Sabine River, approximately eight miles upstream of Logansport, Louisiana and about four miles upstream from the headwaters of Toledo Bend Reservoir. Figure 8-A.3 indicates the proposed location. The project site is located in the southeastern section of Panola County and would have an estimated yield of 280,000 ac-ft per year. At the conservation level of 187 feet msl, the area and capacity would be 24,100 acres and 268,330 acre-feet, respectively.

Developmental concerns for this site include bottomland hardwoods, oil and gas wells, water quality, and permitting issues. The northern half of the site lies in a USFWS designated Priority 1 hardwood area. The southern half is a high quality wetland area and currently being considered for a wetland mitigation bank by the SRA. The mineral rights associated with the Carthage Oilfield significantly affect land acquisition for the reservoir. The Clean Rivers Program Water Quality data indicated possible concerns for elevated nutrient levels, metals, low dissolved oxygen and fecal coliform. This segment of the stream is also a known habitat for several protected aquatic species. Permitting for this reservoir will require an act of Congress since the dam is located on navigable interstate waters of the U.S. (Rivers and Harbors Act, 1899). Construction of the dam and reservoir may also require consent of Louisiana for the part that will impact the state of Louisiana (Sabine River Compact). As currently proposed, the dam site is located immediately upstream of the Stateline reach and there is minimal impact to Louisiana lands. However, due to the close proximity of Toledo Bend Reservoir, it is unlikely that Stateline Reservoir would be more economical than Toledo Bend in meeting the needs of the Upper Basin.

8.2.8 Socagee Reservoir. The Socagee Reservoir site is located in the eastern portion of Panola County on Socagee Creek, approximately six miles upstream of its mouth. Figure 8-A.3 indicates the proposed location. The reservoir, at normal pool elevation, would have a yield of 39,131 ac-ft per year. The reservoir area would be approximately 9,100 acres and the capacity would be about 160,000 acres.

Approximately 40 percent of the site overlies existing lignite deposits. As of 1986, there was no known exploitation of the lignite deposits, and there currently are no active mines within the area. One cultural resource site is reported in the reservoir boundary. There are no known water quality issues or priority bottomland hardwoods that affect this reservoir site. Socagee Reservoir could be used to meet the local needs of Panola County; however, Lake Murvaul, which has been designated for Panola County use only, has adequate yield to meet the future needs of Panola County.

8.2.9 Lake Columbia. The reservoir is a project of ANRA located predominantly in Cherokee County but extends into the southern portion of Smith County. Figure 8-A.4 indicates the location for Lake Columbia. The reservoir would be formed by construction of a dam on Mud Creek approximately 2.5 miles downstream of the U. S. Highway 79 crossing. The dam is expected to impound water approximately 14 miles upstream with an estimated surface area of 10,133 acres. The reservoir is permitted for 85,507 ac-ft per year of water. It has a total storage volume at normal pool elevation, 315 feet msl, of 195,500 acre-feet. State of Texas Senate Bill 1362 designated the site for Lake Columbia as a site of unique value for the construction of a dam and reservoir.

In January 2010, ANRA released a draft Environmental Impact Study (EIS) for Lake Columbia. The EIS underwent public comment in the first half of 2010. ANRA is currently responding to comments of state and federal review agencies, including the TPWD and EPA. Support for Lake Columbia also came from TPWD in its comments on the 2011 IPP, recognizing "the value of Lake Columbia in meeting certain local water supply needs[...]" The complete text of their comments may be found in Appendix 10-C.

8.2.10 Fastrill Reservoir. The Fastrill Reservoir has long been a project of the City of Dallas and UNRMWD. The site was designated as unique by the Texas Legislature in 2007. It would be located on the Neches River in Anderson and Cherokee Counties downstream of Lake Palestine and upstream of the Weches Dam site. The dam would be located at River Mile 288. Figure 8-A.4 indicates the proposed location. Normal pool elevation would be at an elevation of 275 ft msl and would have an area of 24,950 acres based on digital topographic information. Recent analyses using the Neches River Basin Water Availability Model (WAM) indicate that the firm yield of Fastrill Reservoir may range from approximately 140,000 ac-ft per year (stand-alone operations) to about 155,000 ac-ft per year (system operations with Lake Palestine) subject to senior water rights and Consensus Criteria for Environmental Flow Needs.

The development of Fastrill Reservoir is unlikely at this time due to the designation of a portion of the site as a national wildlife refuge by the USFWS. The following discussion of Fastrill Reservoir's status is found in the Region C 2011 Plan:

> *Lake Fastrill was a recommended water management strategy in the approved 2006 Region C Water Plan and the 2007 State Water Plan and was designated by the Texas Legislature as a unique site for reservoir development. The lake was intended to meet projected water supply needs for Dallas and water user groups in Anderson, Cherokee, Henderson, and Smith Counties in Region I. A decision of the United States Supreme Court on February 22, 2010 not to hear the appeals of the State of Texas and Dallas has effectively supported the creation of the Neches River National Wildlife Refuge (NRNWR) and rendered the development of Lake Fastrill extremely unlikely.*

As the Texas Legislature has designated Fastrill Reservoir as a unique reservoir site, the ETRWPG will not eliminate it from the list of proposed reservoirs in the ETRWPA at this time. In accordance with a request of the City of Dallas, however, Fastrill Reservoir has been removed as a WMS in the 2011 Plan.

8.2.11 Ponta Reservoir. The Ponta Reservoir would be located on Mud Creek in Cherokee County east of Jacksonville, Texas. The dam site is located approximately one mile upstream from the Southern Pacific Railroad crossing over Mud Creek. Figure 8-A.4 indicates the proposed location. The normal pool elevation would be about elevation

302 ft msl and would have an area of 11,000 acres. Storage capacity at normal pool elevation would be 200,000 acre-feet. Previous studies have indicated that the reservoir could provide a dependable yield of 105,000 ac-ft per year. However, with the construction of Lake Columbia the yield would be substantially less.

8.2.12 Kilgore Reservoir. The Kilgore Reservoir is a proposed local water supply project located on the Upper Wilds Creek in Rusk, Gregg and Smith counties. Figure 8-A.5 indicates the proposed location of the reservoir. It was originally proposed to supplement the City of Kilgore's water supply. The project would provide a yield of 5,500 ac-ft per year at the normal operating elevation of 398 feet msl. At that level, the area and capacity would be 817 acres and 16,270 acre-feet, respectively.

Construction of this reservoir has never been initiated, and the City of Kilgore is using diversions from the Sabine (purchased from SRA and released from Lake Fork) and ground water for its water supply. However, this project still has the potential as a local water supply source in the Kilgore area should other proposed projects not be developed. Only preliminary studies have been performed for the Kilgore Reservoir and no environmental impacts have been assessed. Based on preliminary screening data, the site is not located within a priority bottomland hardwood area; there are no known water quality issues and no active mines within the reservoir site.

8.2.13 Rabbit Creek Reservoir. Several reservoir projects have been proposed on Rabbit Creek for local water supply. The latest proposal for the City of Overton and surrounding communities was completed in 1998 (Burton, 1998). The proposed reservoir project is located on Rabbit Creek in Smith and Rusk counties, and would have a firm yield of 3,500 ac-ft per year. Figure 8-A.5 indicates the proposed location of the reservoir. This is considerably less yield than the previous studies, which is due in part to the smaller storage capacity and conservative inflows that were assumed for the study. In the latest study, the area would be 520 acres and the capacity would be 8,000 acre-feet at a conservation level of 406 ft msl. However, this yield is considered satisfactory to meet the regional demands of the area. Environmental review of the site reports no significant concerns that would preclude development. There are also no significant cultural resources in the area, no known water quality issues, and no active mining within the reservoir area.

The advantages of this reservoir site are the few developmental concerns. However, it was rejected as a water supply alternative in the 1998 study due to costs. A large percentage of the total costs were associated with a water treatment and distribution system. Due to the relatively low yield of Rabbit Reservoir, this project could only be considered for local water supply.

8.3 Legislative Recommendations

Rules in 31 TAC 357.7(a)(10) state that regional water planning groups are to consider and make recommendations to the legislature regarding regulatory, administrative, or legislative issues that the group believes are needed and desirable to facilitate the orderly development, management and conservation of water resources and preparation for and response to drought conditions to ensure sufficient water will be available at a reasonable cost. For this update of the regional water plan, the Executive Committee of the ETRWPG reviewed previous recommendations made pursuant to this rule and evaluated new potential recommendations. Proposed recommendations were brought to the ETRWPG for consideration. Legislative recommendations adopted by the ETRWPG are discussed following.

8.3.1. Junior Water Rights. The ETRWPG supports legislation allowing exemptions to junior water rights by contracts that reserve sufficient surface water to meet 125% of the total projected demand of the basin of origin for the next 50 years. Such contracts shall require the receiving basin to pay for development of future water supplies needed to maintain the 125% reserve for renewal of the water supply contract.

8.3.2. Flexibility in Determining Water Plan Consistency. The ETRWPG is concerned that small cities and unincorporated areas that fall under the group of "county-other" may not have specific water needs and water management strategies identified in the regional water plan due to the nature of aggregating these entities. As such there is concern that these entities may not be eligible for state funding assistance. The ETRWPG is also concerned that there is sufficient flexibility in identifying and implementing water management strategies as it pertains to permitting and funding such projects. Water suppliers need to have a full range of options as they seek to provide new water supplies for Texas' future. It is impossible to foresee all the possibilities for new water supplies in a planning process such as this, and changing circumstances can change the timing, amounts and preferred options for new supplies very quickly. The inclusion of alternate strategies in regional water planning is the first step in providing this flexibility. In addition, the ETRWPG recommends that the following steps be taken to address these concerns.

- The TWDB should add language to their guidance for funding that allows entities that fall under the planning limits to retain eligibility for state funding of water related projects without having specific needs identified in the regional water plans.
- The TWDB and the TCEQ should interpret existing legislation to give the maximum possible flexibility to water suppliers as they seek to serve the public and provide new supplies. Changes in the timing of supply development, the order in which strategies are implemented, the amount of supply from a management strategy, or the details of a project should not be interpreted as making that project inconsistent with the regional plan.
- Willing buyer/willing seller transactions of water rights and treated water should not be controlled by this regulation. Such transactions may be beneficial to all concerned and may simply not have been foreseen in the planning process.
- The TWDB and TCEQ should make use of their ability to waive consistency requirements if local water suppliers elect strategies that differ from those in the regional plan.

8.3.3 Continued Funding by the State of the Regional Water Planning Process on a Five-Year Cycle. The ETRWPG believes the grassroots planning effort created by Senate Bill 1 is important to the state of Texas and should be continued. In addition, the ETRWPG believes that the most fair and efficient method of financing continuation of this effort for future planning cycles is to continue funding of this effort by the state with administrative expenses for the region being provided from sources within the region. There are important tasks that need to continue. Improvement of data for the next planning cycle is very important. State funding of those efforts needs to be made available.

8.3.4. Groundwater Conservation Districts. The ETRWPG recognizes the critical importance of groundwater conservation and proper management of this resource in the ETRWPA. Therefore, as an important component of regional planning, the ETWRPG encourages those portions of the ETRWPA not presently participating in a groundwater conservation district to carefully review groundwater management practices in their area and to consider whether creating or joining a groundwater conservation district would be appropriate.

8.3.5. Unique Reservoir Designation. The 79^{th} Texas Legislature designated 19 sites as having unique value for the construction of a reservoir. One of these sites, Fastrill Reservoir, is located in the ETRWPA. As part of this designation, efforts to develop the site as a water supply reservoir must be taken by 2015 or the designation becomes null. Many of these sites are identified for potential water supply way beyond the 2015 time frame. Loss of this designation could allow others to permanently limit the ability of developing a reservoir on the site. The ETRWPG recommends that the designation of unique reservoir for the sites currently designated be extended to 2060, which would be through the current planning period.

In order to properly plan for mitigation banks in relationship to unique reservoir sites or potential reservoir sites, the ETRWPG recommends that the USACE Mitigation Bank Review Teams have TWDB and appropriate regional water planning agencies be added to the review teams.

8.3.6 Wastewater Reuse. The ETRWPG recommends that current regulations as they pertain to wastewater reuse should be reviewed and amended, as necessary, to encourage the reuse of wastewater effluent.

8.3.7 Funding. In order to take advantage of the variety of funding options available through the TWDB, increased flexibility by the agency is needed. For example, TWDB guidance currently excludes the replacement of aging infrastructure from eligibility for funding through the existing Water Infrastructure Fund (WIF). The ETRWPG recommends that the TWDB expand existing programs to assist entities with funding replacement and repairs to aging infrastructure and/or allow replacement of water supply infrastructure to be funded through the WIF program. This would include existing well fields, transmission lines and storage facilities.

In addition, the TWDB does not provide for sufficient flexibility in categorical exclusions for Environmental Information Documents that are required for funding of water projects. Increasing flexibility regarding these exclusions could ease the crisis in funding available for water projects.

The TWDB offers the Economically Distressed Areas Program (EDAP) to certain areas in need of water projects. The EDAP provides grants, loans, or combination grant/loans when requirements are met:

- for water and wastewater services;
- in economically distressed areas; and
- present facilities are inadequate to meet residents' minimal needs

However, requirements to meet the EDAP are very difficult for local governments and areas to administer, causing otherwise eligible local governmental entities to elect to not pursue the EDAP funding. EDAP requirements should be revised to reduce unnecessary and difficult requirements for eligibility, including requirements for model subdivision planning.

8.3.8 Environmental Flows. Texas is currently in a process of identifying and recommending instream flows for the 23 river basins in Texas. The Neches and Sabine River Basins are two of the first basins to begin this process. The ETRWPG acknowledges the importance of these studies for the future of its water resources and supports the efforts of the various advisory teams and stakeholders in this endeavor. The ETRWPG also recognizes the need for water for growth and economic development. There is concern among local water rights holders that a significant portion of their water supply could be reallocated to meet instream flow demands. The ETRWPG recognizes that future flow conditions in Texas' rivers and streams must be sufficient to support a sound ecological environment that is appropriate for the area. However, the ETRWPG believes it is imperative that existing water rights are protected. In addition, SB 2 and SB 3 processes that relate to environmental flows should be closely coordinated with the SB 1 planning effort, involving regional water planning.

8.3.9 Uncommitted Water. The Texas Water Code currently allows the TCEQ to cancel any water right, in whole or in part, for ten consecutive years of non-use. This rule inhibits long-term water supply planning. Water supplies are often developed for ultimate capacity to meet needs far into the future. Some entities enter into contracts for supply that will be needed long after the first ten years. Many times, only part of the supply is used in the first ten years of operation.

The regional water plans identify water supply projects to meet water needs over a 50-year use period. In some cases, there are water supplies that are not currently fully utilized or new management strategies that are projected to be used beyond the 50-year planning period. To support adequate supply for future needs and encourage reliable water supply planning, the ETRWPG:

- Opposes unilateral cancellation of uncommitted water contracts/rights;
- Supports long term contracts that are required for future projects and drought periods; and

- Supports shorter term “interruptible” water contracts as a way to meet short term needs before long-term water rights are fully utilized.

Chapter 9

Infrastructure Financing Report

The purpose of the infrastructure financing report (IFR) is to identify funding needed to implement the WMSs recommended in the 2011 Plan. The primary objectives of the report are:

- To determine the number of political subdivisions with identified needs for additional water supplies that will be unable to pay for their water infrastructure needs without some form of outside financial assistance;
- To determine how much of the infrastructure costs in the regional water plans cannot be paid for solely using local utility revenue sources;
- To determine the financing options proposed by political subdivisions to meet future water infrastructure needs (including the identification of any State funding sources considered); and,
- To determine what role(s) the RWPGs propose for the State in financing the recommended water supply projects.

A survey of WUGs with identified infrastructure needs was conducted by the ETRWPG and the TWDB. The survey form was designed by the TWDB and distributed after the IPP was approved by the ETRWPG.

9.1 Summary of Survey Results

Surveys were sent to seventeen municipal WUGs and seven WWPs with projected water shortages. Surveys were completed and returned for eight of the municipal WUGs and six of the WWPs. There were 31 WUGs with needs identified in the 2011 Plan which were not surveyed. These WUGs were in the manufacturing, power generation, irrigation, livestock, and mining categories. The results of the survey are included in Appendix 9-A.

In the IFR study, $1,348,737,330 of water supply and infrastructure needs were identified. Of that, $1,236,774,491 was the estimated cost of new surface water supply projects and major transmission systems. The remaining $111,962,839 was in development of new wells, local infrastructure, and public/private partnership projects. A summary of the projected financing required to meet the needs in the East Texas Region and a listing of the projects considered are provided in Appendix 9-A.

9.1.1 Municipal Water User Groups.

A separate accounting was made for cost of project, by decade, to meet water needs for municipal WUGs, and is summarized in Table 9-1. Not included in this group are the costs of projects being undertaken by WWPs to meet the needs of municipal users. Projects for WWPs are discussed separately.

Table 9-1: Infrastructure Improvement Cost by Decade for Municipal Use

	2010	2020	2030	2040	2050	2060
Cost	$43,337,189	$17,569,450	0	0	0	0

Maintenance and replacement of existing treatment and transmission systems are not addressed in the 2011 Plan cost estimates. However, these are significant and on-going costs, and will impact communities' ability to fund additional infrastructure. These maintenance costs are expected to increase as a percentage of water system budgets as facilities constructed in the mid-20th century reach the end of their design life.

In the 14 survey responses received, four respondents (40%) anticipated fully funding the infrastructure costs through utility revenues supplemented in part with bank loans. The ten remaining respondents anticipated utilizing State or Federal programs to cover some or all of the estimated infrastructure costs.

9.1.2 Non-Municipal Water User Groups. Non-municipal WUGs were not surveyed. Water demands were aggregated at the county level. It is expected that within the non-municipal water use categories, any local infrastructure will be funded using a combination of the methods outlined below.

Manufacturing. It is anticipated that companies with projected shortages will coordinate directly with surface water providers identified for any infrastructure needed to bring water to their sites. The funding of this construction may occur in a number of ways. The typical method is for the water provider to construct the distribution system supplying the customers, and pass through the cost in the water rate. State assistance may be requested through the State Loan Program for some projects. A second funding option is for the manufacturer to directly construct the required infrastructure, which would be a site-specific consideration. In areas not currently served by a surface water provider, a private developer may choose to establish a distribution utility, or a public-private partnership may be formed between the water supplier and end user to develop a new system.

Steam Electric Power. It is expected that power plant owners, as a part of facility construction, will include any required water supply intakes and pipelines or contract directly with existing major water providers to obtain the needed additional water.

Mining. Mining is projected to experience water shortages in four counties. It is anticipated that those companies with projected shortages will either provide new supplies for themselves by drilling new wells or coordinate directly with surface water providers in their area for any infrastructure needed to bring water to their sites. It is expected that private companies will pay the cost of required infrastructure.

Irrigation. Anticipated infrastructure costs for irrigation are related to increased water needs due to business expansion. The needs are expected to be met by irrigators drilling wells or by contractual arrangement for increased supplies with surface water providers local to the point of need.

Livestock. Shortages in meeting livestock water demands are expected in seven counties. It is anticipated that those individuals and private companies with projected shortages will either provide new supplies for themselves by drilling new wells or coordinate directly with surface water providers in their area for any infrastructure needed to bring water to their sites. It is expected that payment of the cost for infrastructure will be made by the individuals or private companies needing the water.

9.1.3 Wholesale Water Providers.

All six WWP respondents indicated they would be implementing the recommended strategy in the 2011 Plan. Five of the respondents indicated that all or most of the funding source would be through TWDB programs. One respondent indicated funding would be from cash reserves as the strategy involved agreement with downstream water right holders. The estimated cost, by decade and TWDB Funding program is shown in Table 9-2.

Table 9-2: Infrastructure Improvement Cost for Wholesale Water Provider

Decade of Improvement	TWDB Funding Source Amount	
	State Participation	Drinking Water SRF
		$336,428,550
2020	$85,790,050	$266,992,250
2030		$79,389,250
2040		$79,783,000
2050		$475,648,000
2060		$12,387,000
Total	**$85,790,050**	**$1,164,838,000**

9.2 Infrastructure Finance Policy Statements

The Legislature has directed each regional water planning group to propose ways for the State to finance a portion of the water supply projects recommended by the State Water Plan. The ETRWPG has reviewed the needs of the region, and offers the following recommendations. Recommendations are grouped by the following categories: Policy Recommendations, Financial Assistance Programs, and New Funding Sources.

9.2.1 Policy Recommendations. Several general policy recommendations are provided, as follows:

- Water users should pay for the required infrastructure.
  - From local funds including those borrowed locally
  - From state revolving fund loan programs
  - From federal loan programs
  - From existing state and/or federal grant programs
- The State of Texas should participate in constructing new water supplies to make development of large water supplies feasible. State money to be recouped at the earliest possible date through sale of state portion of the project to water user.
- If water users are unable to pay for the required infrastructure, merging with another local entity to improve financial capacity must be considered.
- If merger is not an option, the State must provide some safety net type funds to provide safe water supply for small water users (less than 200 connections) that cannot afford the required infrastructure as determined by EPA affordability calculation.

9.2.2 Financial Assistance Programs. Recommendations regarding financial assistance programs include the following:

- The State Participation Program will be one of the most important financing programs for water supply projects sized to meet projected long-term demands. Increase the funding of this program as needed to allow development of these water supply projects (Lake Columbia).
- The State Revolving Fund Programs will remain important to assist some systems in meeting minimum water quality standards. As infrastructure ages and water quality standards increase, the demand for this assistance will grow. Increase the funding of this program in future decades, and

expand the program to include coverage for system capacity increases to meet projected growth for communities.

- The State Loan Program for political subdivisions and water supply corporations offers loans at a cost advantage over many commercial and many public funding options. Increase funding of this program to allow financing of near-term infrastructure cost projections.

- The USDA Rural Utilities Service offers Water and Waste Disposal Loans and Grants to rural areas and towns of up to 10,000 people. Disadvantaged communities within Texas are specifically targeted for these loans. Support continued and increased funding of this program at the Federal level, and fund the state Rural Water Assistance Fund.

- The Regional Water Supply and Wastewater Facilities Planning Program assists political subdivisions with planning grants, allowing small communities to pursue cost-efficient regional solutions. Increase funding of this program in anticipation of upcoming development throughout the state, and expand the program to include the costs for preliminary engineering design and development of detailed engineering cost estimates of recommended facilities.

- The USACE constructs civil works projects for flood control, hydropower, and navigation and ecosystem restoration. USACE participation in water supply projects is limited by current regulations. The ETRWPG supports legislative or regulatory changes that will:

  – Increase USACE's flexibility regarding increasing water supply storage in the reservoirs that they manage, and investigate other alternatives for increased involvement of USACE in funding water supply projects.

  – Allow the USACE to construct reservoirs with water supply as a primary purpose.

9.2.3 New Funding Sources. The ETRPWG believes that revenue generated by imposing a tax on bottled beverages, including bottled water, could be an important new source of income for financing water projects in Texas in the future. The legislative budget board has estimated that a 5 cent tax on bottled water only could raise in excess of $65.2 million dollars (2006 estimate).

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Chapter 10

Public Participation and Adoption of Plan

Regional water planning in Texas is a public process, requiring strategy for ensuring that the region's citizens are able to participate in the process. Rules in 31 TAC Chapter 357.12 define the notice and public participation requirements of the process. These rules include the following requirements:

- A public meeting prior to preparation of the regional water plan.
- Ongoing opportunities for public input during preparation of the plan.
- A Public Hearing following adoption of an initially prepared plan (IPP).

In addition, opportunities for public participation and input have specific requirements regarding public notice and open meetings in the State of Texas. The rules call for the following:

- Public meetings and hearings noticed and held in accordance with the Texas Open Meetings Act.
- Agendas, meeting notices, IPP, and final regional water plan published on the internet.
- Copies of the IPP made available for public viewing.

This chapter addresses the ETRWPG's strategy for public involvement and participation in the development and adoption of the final 2011 Plan. The strategy included regular meetings of the ETRWPG, consultation with representatives of the major water user groups, publication of a region newsletter, distribution of regular press releases, and maintenance of a website for the ETRWPA. In addition, the regional planning process requires holding a Public Hearing to introduce the 2011 IPP and accept public comment. A description of the ETRWPG and the process follows.

10.1 East Texas Regional Water Planning Group Members

Original legislation for SB1 and the TWDB planning guidelines establish regional water planning groups to manage the planning process in their respective regions. The regional water planning groups include representatives of eleven specific community interests. Table 10.1 lists members of the ETRWPG and the interests they represent.

Table 10.1 Voting Members of the East Texas Regional Water Planning Group and Group Representation

Member	Interest
David Alders	Agriculture
Jeff Branick	Counties
David Brock	Municipalities
George P. Campbell	Other
Jerry Clark	River Authorities
Josh David	Other
Judge Chris Davis	Counties
Mark Dunn	Small Businesses
Michael Harbordt	Industries
Scott Hall	River Authorities
William Heugel	Public
Kelley Holcomb	Water Utilities
Dr. Joseph Holcomb	Small Businesses

Member	Interest
Bill Kimbrough	Other
Glenda Kindle	Public
Duke Lyons	Municipalities
Dale R. Peddy	Electric Power
Judge Hermon Reed	Agriculture
Monty D. Shank	River Authorities
Darla Smith	Industries
Worth Whitehead	Water Districts
Dr. J. Leon Young	Environmental

The ETRWPG appointed a Technical Committee comprised of individuals within the planning group. The charge to the Technical Committee was to work with the East Texas Region consulting team to develop recommended population and water demand projections, review work product of the consulting team, and provide technical advice to the planning group. Members of the Technical Committee during this round of planning included:

- Michael Harbordt
- David Brock
- George Campbell
- Chris Davis
- Glenda Kindle
- Monty Shank
- Scott Hall

The ETRWPG also worked closely with water planning staff at the TWDB during the planning process. TWDB water planning staff provided valuable technical and regulatory guidance to the ETRWPG regarding the final 2011 Plan.

10.2 Preplanning for the Final 2011 Plan

Rules in 31 TAC Chapter 357.6 define tasks that must be performed prior to development of the regional water plan. These rules include the following requirements:

- A public meeting to discuss recommendations and suggestions of issues that should be addressed in the regional or state water plan.
- Prepare a scope of work including a detailed description of tasks to be performed.
- Designate a political subdivision as a representative of the regional water planning group.

The ETRWPG held a public meeting on June 4, 2008, to discuss issues and provisions important to the ETRWPA that should be included in the regional water plan. As a result of this public meeting, a scope of work was prepared by the consulting team. The scope detailed tasks and activities to be performed during the planning cycle, including expense budgets, schedule, and description of reports to be developed as part of the planning process. The City of Nacogdoches was designated as the political subdivision representative of the ETRWPG, responsible for applying for financial assistance for the scope of work and regional water plan development.

10.3 Opportunities for Public Input

The ETRWPG utilized various types of media and outreach to keep the public informed and to receive input throughout the development of the final 2011 Plan, including the following:

- Water user group involvement
- Press releases
- Newsletters
- ETRWPA website – www.etexwaterplan.org
- Public meetings
- Public hearings

These means of media and outreach are described below.

10.3.1 Contact with Water User Groups. The ETRWPG made special efforts to contact WUGs in the region and obtain their input in the planning process. Chapters 1 through 4 of the final 2011 Plan cite specific instances of contact with WUGs.

10.3.2 Public Media and Press Releases. Press releases were sent to approximately 105 media entities within one week of each regularly scheduled RWPG meeting. Releases were frequently published in area newspapers, and more in-depth stories were occasionally written by newspaper staff. Copies of news releases and newspaper articles concerning water planning in the ETRWPA are included in Appendix 10-A.

10.3.3 Newsletters. The ETRWPG published newsletters to periodically inform the public of the progress of the planning process and to provide other relevant news. Newsletters were posted on the ETRWPA website http://www.etexwaterplan.org, and digitally and/or physically mailed to the following:

- Members of the ETRWPG
- Elected officials in the region
- Cities in the region
- Counties in the region
- Individuals who requested to be on the mailing list

Copies of newsletters produced since February 2009 are provided in Appendix 10-A.

10.3.4 East Texas Regional Water Planning Area Website. The ETRWPA website, www.etexwaterplan.org was regularly updated to inform the public of scheduled meetings and to provide minutes, agenda, press releases, newsletters, presentations, and memoranda.

10.3.5 Regular Meetings of the East Texas Regional Water Planning Group. In execution of its duties as the water planning organization for the region, the ETRWPG held regular meetings during the development of the final 2011 Plan, received information from the region's consultants, accepted public comment on issues relevant to water planning, reviewed proposed planning elements, and made decisions on planning efforts. ETRWPG meetings were open to the public, with notice made in accordance with the ETRWPG By-Laws and the Texas Open Meetings Act. Regular meetings were held on the following dates:

- January 23, 2008
- April 9, 2008
- June 4, 2008
- August 13, 2008
- November 5, 2008
- February 11, 2009
- April 8, 2009
- July 8, 2009
- October 14, 2009
- December 9, 2009
- February 17, 2010

- June 30, 2010
- August 11, 2010

The 2011 IPP was adopted by the ETRWPG at its regularly scheduled meeting on February 17, 2010. The 2011 Plan was adopted by the ETRWPG on August 11, 2010.

10.3.6 Public Hearings for the Initially Prepared Plan. Following adoption of the IPP, hard-copies of the 2011 IPP were provided to at least one public library and county clerk's office in each county within the ETRWPA for public review. In addition, electronic copies were available for review on the ETRWPG website at www.etexwaterplan.org and at the Office of the City Secretary for the City of Nacogdoches.

According to rules in 30 TAC § 357.12(a)(3), a Public Hearing must be held in a central location within the ETRWPA following the adoption of an IPP. Appropriate public notice was provided for the Public Hearing, held in Jacksonville, Nacogdoches, and Beaumont on three consecutive evenings on April 20, 21, and 22, 2010. The purpose of the Public Hearing was to receive comments from the public on the 2011 IPP. Oral and written comments were received from two individuals at the Beaumont portion of the Public Hearing and are summarized in Section 10.5. Transcripts, presentations, and minutes from the Public Hearing are included in Appendix 10-B.

10.4 Comments from the Public and Agencies

As a public planning process, the ETRWPG must accept comments by the public and federal and state agencies regarding the development of the regional water plan. The public are invited to provide comments at each regularly scheduled meeting of the ETRWPG. Likewise, comment in the form of letters, emails, or by telephone may be received. These comments are considered by the ETRWPG during the development of the 2011 IPP. After publication of the 2011 IPP, there is an official comment period during which public and federal and state agencies may submit formal comments on the IPP.

Comments received through the end of the comment period were reviewed and evaluated by the ETRWPG and consulting team. The ETRWPG modified the 2011 IPP as necessary, in response to comments.

Following are responses to the comments received from individuals, entities, and agencies regarding the IPP for the 2011 update of the ETRWPA regional water plan. In all, comments were received from eight persons on behalf of various agencies or groups. These included one oral comment provided at the Public Hearing for the 2011 IPP, one hand-written response provided at the Public Hearing, and six letters received during the comment period. In four cases, the comments received related to a single issue of the commenter. The other comments received addressed multiple issues. Appendix 10-C contains a transcript of the one oral comment and copies of all other comments received during the public comment period.

Responses to the comments are separated by commenter and provided in the order in which they were received. Where practical to do so, comments are first restated verbatim. Otherwise, a summary of the comment is provided. Some comments appeared to be, essentially, observations about the 2011 IPP instead of comments for which a response was intended. In such cases, the observation is summarized and acknowledged. In cases where the comment has resulted in modifications to the 2011 IPP, the locations within the plan are identified within this response to comments.

10.4.1 Comment of Richard Harrel on Behalf of Clean Air And Water, Inc.

Dr. Richard Harrel attended the Public Hearing held in Beaumont on April 22, 2010, and offered one oral comment, restated as follows:

> *My name is Richard Harrel, and I am the president of the citizen's environmental organization, Clean Air & Water, Inc. And Clean Air & Water, Inc., has been active since 1966. And Clean Air & Water, Inc., the*

Board of Directors, is opposed to construction of any new reservoirs in either of the drainage basins concerned. We think that construction of reservoirs, which would include – especially Fastrill reservoir but also the old Rockland reservoir, would have untold environmental effects that would all be harmful. And so, we want to go down on the record that we are opposed to taking water from our upper basins and moving it to Houston, Dallas or the Fort Worth area. We need the water. There are shortages in this region; and we will need the water, especially during those times. That's all.

Response: The ETRWPG acknowledges the comment. No changes have been made to the 2011 IPP as a result of the comment.

10.4.2 Comment of Bruce Drury on Behalf of the Big Thicket Association. Dr. Bruce Drury attended the Public Hearing held in Beaumont on April 22, 2010, and offered one written comment on the Public Comment Request Form, restated as follows:

Strike the provisions for Fastrill and Rockland. Impoundment of the Neches will do great harm to the floodplain – the core of the Big Thicket.

Response: The ETRWPG acknowledges the comment. Fastrill Reservoir is no longer a recommended strategy for the City of Dallas (see comment and response in Section 10.4.7). Fastrill Reservoir remains a unique reservoir site. No changes have been made to Chapter 8 in the 2011 IPP as a result of the comment.

10.4.3 Comment of Fred Manhart on Behalf of Entergy Texas, Inc. Fred Manhart, manager of environmental support with Entergy Texas, Inc., offered one comment in a letter to the ETRWPG dated June 17, 2010. Mr. Manhart's comment is summarized as follows:

The comment referenced the 2011 IPP Executive Summary, Section 8.3, first bullet of the section, in which the ETRWPG encourages all areas in the region not presently in a groundwater management area to create or join one. Mr. Manhart expressed concern about this "one size fits all" approach and that individual areas within the region should be responsible for selecting the methods by which protection of future uses and natural resources would be accomplished.

Response: The referenced location in the 2011 IPP is the Executive Summary, which is a summary of language found in Chapter 8 of the 2011 IPP (Section 8.3.4). The ETRWPG's intent was to point out that conservation of groundwater resources is important to the future of water supply within the region. At the June 30, 2010, meeting of the ETRWPG, it was noted by some members that a groundwater conservation district had prevented over-drafting of the aquifer. Had the district not already been in place, it would have been too late to prevent potential loss of resource. Nevertheless, it was not the intent of the ETRWPG to imply that management of groundwater be addressed in only one manner. As a result of this comment, the applicable section within Chapter 8 (Section 8.3.4) and the referenced section within the Executive Summary of the 2011 IPP have been modified.

10.4.4 Comments of Billy Sims on Behalf of the City of Woodville. Billy Sims offered two comments in a letter to Rex Hunt, dated June 21, 2010. The comments are discussed following:

Comment 1. Mr. Sims noted that the City of Woodville is in need of a new water well to supplement its supply. He indicated that the population and water demands shown for the City in the 2011 IPP are too low, not showing the presence of two prison facilities and the commensurate water demand for these facilities. Mr. Sims requested that the plan be changed to more accurately reflect the City's demand, and to add a new well to their water management strategies.

Response: The ETRWPG responds that the population and water demands contained within the 2011 IPP have previously been approved by the ETRWPG and the

TWDB and cannot be changed at this time in the water planning process. Such changes will be evaluated in the next update of the water plan. However, the 2011 IPP will be modified to note this issue. A footnote to Table 2.1: Distribution of Population by County/Entity in Chapter 2 has been added. In addition, the 2011 IPP has been modified to add the new well as a water management strategy for the City. This addition is found in Chapter 4C, Section 4C.20.

Comment 2. Mr. Sims noted that the East Texas Electric Cooperative is planning to construct a bio-mass power plant in Tyler County, south of the City of Woodville, but that the 2011 IPP does not include any demand for power production in Tyler County. He requested that the 2011 IPP be modified to include power production demands in Tyler County.

Response: The ETRWPG responds that steam-electric water demands contained within the 2011 IPP have previously been approved by the ETRWPG and the TWDB, and cannot be changed at this time. The proposed power facility in Tyler County was not identified by the TWDB previously. It is still in the planning stages. The ETRWPG will consider this potential new demand in the next round of planning. No changes to the 2011 IPP were made regarding this comment.

10.4.5 Comments of Ross Meinchuk on Behalf of the Texas Parks and Wildlife Department.

Ross Meinchuk offered several general observations and five comments on the 2011 IPP in a letter to Kelley Holcomb dated June 21, 2010. The comments are discussed following:

Comment 1. Mr. Meinchuk noted that the following listed Species of Special Concern listed in Appendix 1-A, Table 1-A.1, should be denoted in the plan as "State Threatened" species:

- Texas pigtoe
- Louisiana pigtoe

- Texas heelsplitter
- Triangle pigtoe
- Sandbank pocketbook
- Southern hickorynut

Mr. Meinchuk also requested that these species be included in Chapter 1, Table 1.13 of the 2011 IPP.

Response: Table 1-A.1 has been modified to add the designation of State Threatened for the above listed species. In addition, these species have been added to Table 1.13.

Comment 2. Mr. Meinchuk noted that fish consumption advisories due to mercury contamination have been issued by the Texas Department of State Health Services for a number water bodies within the ETRWPA.

Response: The ETRWPG acknowledges that fish consumption advisories resulting from mercury contamination have been issued for water bodies in the region. No changes to the 2011 IPP have been made as a result of this comment.

Comment 3. Mr. Meinchuk noted the following in regard to the water management strategy, Lake Columbia:

> *TPWD recognizes the value of Lake Columbia in meeting certain local water supply needs and is committed to assisting the Angelina-Neches River Authority (ANRA) in attenuating impacts to fish and wildlife from reservoir constructions, as well as working with ANRA to develop compatible recreational and natural resources plans for the reservoir once constructed.*

Response: The ETRWPG appreciates TPWD's support of the appropriate development of water resources and protection of environmental resources in the

ETRWPA. Discussion of this statement of support has been added to the description of the Lake Columbia project found in Chapter 8, Section 8.2.9 of the final 2011 Plan.

Comment 4. Mr. Meinchuk noted that the TPWD wonders whether the Fastrill Reservoir project should continue to be recommended as a viable water management strategy.

Response. Based on comments from the City of Dallas (see Section 10.4.7), Fastrill Reservoir has been removed as a water management strategy for the City of Dallas. There are no other entities proposing the reservoir as a water management strategy. Therefore, the final 2011 Plan for the ETRWPA has been modified to remove Fastrill Reservoir as a water management strategy. However, Fastrill Reservoir is a Unique Reservoir Site, so designated by the Texas Legislature in 2007. Therefore, a discussion of the Fastrill Reservoir project remains in the final 2011 Plan in Chapter 8, Section 8.2.10. This section has been updated from the 2011 IPP to reflect the current status of the site.

Comment 5. Mr. Meinchuk also made the following comment:

> *TPWD does wish to reiterate its perspective that there are other conservation alternatives that are favorable to wildlife and the environment, such as water conservation, wastewater reuse, full use of existing supplies, and good land stewardship, to name a few. Construction of off-channel reservoirs can also help to minimize wildlife impacts if reservoirs are located to minimize inundation of habitats and diversions are modified to avoid impacts to environmental flows.*

Response: The context of this comment is unclear; however, the ETRWPG believes that the conservation alternatives listed in the comment are at least not harmful to wildlife and the environment, and may be considered favorable in many instances. The ETRWPG currently does not have an opinion regarding off-channel reservoirs. No changes to the plan have been made as a result of this comment.

10.4.6 Comment of Jim Jeffers on Behalf of the City of Nacogdoches.

Nacogdoches City Manager, Jim Jeffers, provided two comments on the 2011 IPP in a letter to Rex Hunt dated June 22, 2010. The comments are discussed following:

Comment 1. Mr. Jeffers related the City's desire to replace their alternate water management strategy for water from Toledo Bend with an alternate water management strategy for water from Sam Rayburn Reservoir. The comment provided reasons for the requested change and suggested modifications to the 2011 IPP to address the requested change.

The ETRWPG discussed the City's comment with Mr. Jeffers during a regularly scheduled ETRWPG meeting on June 30, 2010. At that time, it was suggested that the City need not delete the Toledo Bend alternate water management strategy in order to add another alternate water management strategy. Mr. Jeffers agreed and indicated that it would be acceptable to leave the Toledo Bend alternate water management strategy in the plan for now. In addition, the ETRWPG stated that the proposed new Sam Rayburn strategy could not be incorporated into the plan as an alternate water management strategy at this time due to time and resource limitations. However, the ETRWPG agreed that the proposed new alternate water management strategy could be described in the plan with the intent of finalizing it in the next round of regional water planning. This would mean the alternate water management strategy could be in the 2016 update of the regional water plan. Mr. Jeffers agreed that this would be acceptable to the City.

Response: Based on the discussions held during the June 30 meeting, the ETRWPG has modified Chapter 4C, Section 4C.2.7, of the 2011 IPP to incorporate a discussion of the proposed future alternate water management strategy.

Comment 2. Mr. Jeffers expressed the City's concern that the water demand projections for the City in the 2011 IPP are too low, and that the City is not in agreement with the projections.

Response: The ETRWPG appreciates the City's concern about water demand projections, but cannot modify the demands further in this round of planning. Water demands will be evaluated more closely in the next round of regional water planning where the 2010 Census population data can be used to better support water demand projections for all of the ETRWPA. Section 4C.2.7 acknowledges that the City's current planning efforts indicate greater population growth and higher demands by the commercial and manufacturing sectors.

10.4.7 Comments of Jody Puckett on Behalf of Dallas Water Utilities.

Jody Puckett offered seven comments on the 2011 IPP in a letter to Kelley Holcomb dated June 28, 2010. The comments are discussed following:

Comment 1. Ms. Puckett provided an updated description of Lake Palestine for Chapter 1 of the plan, for consideration of the ETRWPG.

Response: The updated description provided has been added to the final 2011 Plan.

Comment 2. Ms. Puckett noted changes in the status of Lake Fastrill resulting from the recent decision of the United States Supreme Court to not hear appeals of the TWDB and City of Dallas, stating that the decision "rendered the development of Lake Fastrill extremely unlikely." Excerpts from the Region C Plan outlining the plans for replacements to the Lake Fastrill water management strategy were provided for consideration of the ETRWPG.

Response: The ETRWPG agrees that the Region C plan and the ETRWPA plan should be consistent with regard to Lake Fastrill. The final 2011 Plan has been revised to incorporate the Neches Run-of-the-River Project or Fastrill Replacement Project in place of Fastrill Reservoir.

Comment 3. Ms. Puckett noted that Lake Fastrill has been designated by the Texas Legislature as a Unique Reservoir Site and likewise identified in the 2007 State Water Plan. As such, Ms. Puckett suggested that Lake Fastrill should remain in the final 2011

Plan "in the event conditions change and it becomes favorable to proceed with Lake Fastrill."

Response: The ETRWPG agrees that it would be inappropriate to remove Lake Fastrill from the final 2011 Plan as long as the proposed lake is designated as a Unique Reservoir Site. While the description of Lake Fastrill in Chapter 8 (Section 8.2.10) has been modified to reflect the changes suggested in the Region C plan, Lake Fastrill will remain as an Unique Reservoir Site in the final 2011 Plan.

Comment 4. Ms. Puckett noted that demand by Lake Fastrill, in the amount of 112,100 ac-ft per year beginning in 2040, was left blank in Table 4.B.18. The comment indicated that this demand will be met through UNRMWA.

Response: Table 4B.18 was titled, "Demands Supplied by Lake Fastrill." With the removal of Lake Fastrill as a water management strategy, the title of this table will be modified to reflect the change in source of supply. In addition, the demand for the City of Dallas will be included in the table in the amount of 112,100 ac-ft per year beginning in 2040.

Comment 5. Ms. Puckett noted that the volume of "future potential" demand shown in the UNRMWA demand table on page 4C-90 was inconsistent with the volume provided in the text above the table for water to Dallas Water Utilities.

Response: The table has been corrected.

Comment 6. This comment is in reference to a discussion in Chapter 1, Section 1.16.4 regarding Lake Murvaul. The comment provides updated information regarding the contract between the City of Dallas and Luminant.

Response: The final 2011 Plan has been updated to reflect the updated information.

Comment 7. The comment refers to the Tables and Figures in Chapter 4C not being identified with names or numbers.

Response: The ETRWPG acknowledges the comment. No changes have been made to the final 2011 Plan relevant to this comment.

10.5 Comments of Carolyn Brittin on Behalf of the Texas Water Development Board

Carolyn Brittin offered comments to the 2011 IPP in a letter to Kelley Holcomb dated June 28, 2010. The comments were divided between "Level 1" and "Level 2" comments. Level 1 includes comments, questions, and online planning database revisions that must be satisfactorily addressed in order to meet statutory, agency rule, and/or contract requirements. Level 2 includes comments and suggestions for consideration that may improve the readability and overall understanding of the regional plan. Each comment is addressed following.

10.5.1 Level 1 Comments. There were 21 Level 1 comments offered by Ms. Brittin.

Comment 1. Please describe the plan's impact to navigation. [Title 31 Texas Administrative Code (TAC) §357.5(e)(8)]

Response: A new section with a description of the plan's impact to navigation has been added to Chapter 1, Section 1.2.3.

Comment 2. Please describe how the plan considered existing regional water plans, existing recommendations in state water plan and existing local water plans. [31 TAC 31§357.7(a)(1)(I), (J), and (K)]

Response: A new section with a discussion of how the plan considered existing regional water plans, existing recommendations in the state water plan, and existing local water plans has been added to Chapter 1, Section 1.15.

Comment 3. Provide a list of potentially feasible water management strategies that were considered and evaluated by the planning group. [Contract Exhibit "C" Section 11.1]

Response: A list has been included in Appendix 4C-B of the final 2011 Plan. The potentially feasible strategies are also listed on page 4B-1 of the 2011 IPP.

Comment 4. Page 1-24, Figure 1.12; Page 3-15, Figure 3.5: Complete outcrop areas of minor aquifers in the region are not displayed and sub-crop areas overlap and cover the outcrop areas of younger units. Please review plan text to reflect the accurate locations. For example: In chapter 1, page 1-26, although the Yegua-Jackson aquifer is located in the southern portion of Houston county it is not shown on the map (Figure 1.12) or discussed in text. [31 TAC §357.7(a)(1)(D)]

Response: Figures and text have been revised to appropriately demonstrate minor aquifer locations.

Comment 5. Water demand projections are not split out by river basins. Please present water demand projections by river basin for each county. [31 TAC §357.7(a)(2)(A)(iv)]

Response: Water demand projections have been split out by river basin in the plan, in Appendix 2-B of the final 2011 Plan.

Comment 6. The plan does not include categories of water demands for wholesale water providers by river basins. Please present water demands for wholesale water providers by river basin. [31 TAC §357.7(a)(2)(B)]

Response: Water demands for wholesale water providers have been split out by river basin in the plan, in Appendix 2-B of the final 2011 Plan.

Comment 7. Page 3-10, Table 3.4: It appears that the Trinity County-Neches Basin-Irrigation water supply is mislabeled as "mining." Please revise if appropriate.

Response: The use type was changed to irrigation and supply summaries were updated.

Comment 8. Page 3-17, Table 3.5: Water supply sources are not summarized by county and river basin. Please revise to summarize by county and river basin. [31 TAC § 357.7(a)(4)(B) ; Contract Exhibit "D" Section 3.0]

Response: Water supply sources have been summarized by county and river basin in Appendix 3-B of the final 2011 Plan.

Comment 9. Page 3-28, second paragraph: A reference is made to "Appendix 3-B." The referenced appendix was not included in plan. Please include appendix or revise text.

Response: Appendix 3-B has been included in the final 2011 Plan.

Comment 10. Pages 3-29 and 3-30, Tables 3.9 and 3-10: Please revise tables to summarize water supplies by county and river basin. [31 TAC § 357.7(a)(4)(B)]

Response: The available supplies to water users are shown by county and basin in Appendix 3-B of the final 2011 Plan. No changes were made to table 3-9 and 3-10.

Comment 11. Page 4A-5, Table 4A.3: It appears that total county surplus and shortage (water need) volumes were calculated incorrectly by subtracting total [county-wide] supply from total [county-wide] demand. Please revise to reflect total county water needs as the sum of the individual needs of each water user group in the county; needs that are calculated based on each water user group's own demands and supplies. Please also delete region totals at bottom of table as this further mis-aggregates water needs (shortages) region-wide.

Response: These tables reflect a supply and demand comparison by county. The projected shortages by water user group are shown in Table 4A.5. The projected surplus or shortage for each water user group by county and river basin is included in the DB12 tables in Appendix 4C-B of the final 2011 Plan. A footnote was added to Table 4A.3 noting that the sum of individual shortages may differ from the surplus or shortage shown in this table. A reference to Table 4A.5 with the WUG shortages was added.

Comment 12. Please include a table with recommended and, if applicable, alternative water management strategies with project capital costs and water supply by decade. [31 TAC §357.7(a)(7)(H); Contract Exhibit "C" Sections 4.3, 11.1]

Response: The requested table has been included in Appendix 4C-B of the final 2011 Plan.

Comment 13. Please explain how the region considered emergency transfers of non-municipal use surface water without causing unreasonable damage to the property of the non-municipal water rights holder pursuant to Texas Water Code §11.139. [TAC 31 §357.5(i)]

Response: Only water management strategies to meet long-term needs were identified in the East Texas Regional Water Plan. Emergency transfers are strategies implemented on a short term basis and were not considered in this update.

Comment 14. Please describe how alternative water management strategies were evaluated using environmental criteria. [31 TAC §358.3(b)(180]

Response: Alternative strategies were evaluated in the same manner as all strategies discussed in the plan. Details of the strategy evaluation process are outlined in Appendix 4B-A.

Comment 15. Please confirm that capital costs are based on September 2008 dollars as required, or revise as appropriate. [Contract Exhibit "C" Section 4.1.2]

Response: The assumptions used for cost estimates have been included in Appendix 4C-A. This was inadvertently omitted from the 2011 IPP.

Comment 16. In instances when conservation was considered but not recommended as a water management strategy, please indicate why conservation was not recommended. [31 TAC §357.7(a)(4)]

Response: The screening of conservation strategies is outlined in Appendix 4B-A.

Comment 17. Please include a summary of information regarding water loss audits specific to Region I. [31 TAC § 357.7 (a)(1)(M)]

Response: A summary of information regarding water loss audits for the ETRWPA has been added to Section 1.14.3 of the final 2011 Plan.

Comment 18. Page 6-3, paragraph 3: Plan does not include a model water conservation/drought contingency plan. Please include a model water conservation/drought contingency plan. [31 TAC §357.7(c)]

Response: The final 2011 Plan is an update of the 2006 Plan only. Model water conservation and drought contingency plans were included in the 2006 Plan and have been referenced in the final 2011 Plan. To further aid water user groups in development of water conservation and drought contingency plans, a hyperlink to model plans on the Texas Commission on Environmental Quality website was provided.

Comment 19. Page 6-8, first paragraph: Plan does not include a model drought contingency plan from an affected water user group. Please include a model drought contingency plan for an affected water user group. [31 TAC §357.7(d)]

Response: The final 2011 Plan is an update of the 2006 Plan only. Model water conservation and drought contingency plans were included in the 2006 Plan and have been referenced in the final 2011 Plan. To further aid water user groups in development of water conservation and drought contingency plans, a hyperlink to model plans on the Texas Commission on Environmental Quality website was provided.

Comment 20. (Attachment B) Comments on the online planning database (i.e. DB12) are herein being provided in spreadsheet format. These Level 1 comments are based on a direct comparison of the online planning database against the Initially Prepared Regional Water Plan document as submitted. The table only includes numbers that do not reconcile between the plan (left side of spreadsheet) and online database (right side of spreadsheet). An electronic version of this spreadsheet will be provided upon request.

Response: The planning data base (DB12) and the final 2011 Plan have been reconciled. Responses to specific comments are documented on the spreadsheet provided by the TWDB in Appendix 10-D.

Comment 21. (Attachment C) Based on the information provided to date by the regional water planning groups, TWDB has also attached a summary, in spreadsheet format, of apparent unmet water needs that were identified during the review of the online planning database and Initially Prepared Regional Water Plan. [Additional TWDB comments regarding the general conformance of the online planning database (DB12) format and content to the Guidelines for Regional Water Planning Data Deliverables (Contract Exhibit D) are being provided by TWDB staff under separate cover as 'Exception Reports']

Response: Shortages for Cherokee and Hardin Mining demands and Nacogdoches Steam Electric Power are correct. Discussions of the needs for these entities are included in Chapter 4C. The ETRWPG did not develop water management strategies for needs less than 5 ac-ft per year. No changes were made to the ETRWP.

10.5.2 Level 2 Comments.

There were six Level 2 comments offered by Ms. Brittin.

Comment 1. Page 1-27, Section 1.6.1: "Springs" appears to incorrectly refer to Section 1.9.8. Please consider revising reference as appropriate (i.e., to "Section 1.9.7")

Response: The reference to springs has been corrected in the final 2011 Plan.

Comment 2. Page 1-42, Section 1.9: Please consider including assessment of the importance of recreational uses of natural resources (fishing, boating, etc.).

Response: The ETRWPG agrees that recreational uses of natural resources are important. However, such uses will not be assessed at this time and no change will be made to the final 2011 Plan.

Comment 3. Page 3-7: A reference is made in the "Reservoirs" paragraph to a summary of "firm yields" in Table 3.2. The Table is titled "Currently Available Supplies from Permitted Reservoirs…" Please consider clarifying in Table 3.2 that it presents firm yields, if applicable.

Response: The last sentence under paragraph "Reservoirs" was modified to reflect available supplies. The definition of available supply is defined earlier in the paragraph.

Comment 4. Page 3-17, Table 3.5: Please consider revising two of the table headings from "Yegua" to "Yegua-Jackson" and from "Carrizo" to "Carrizo-Wilcox."

Response: The requested revisions were made.

Comment 5. Page 4C-62, table: Table is referenced in the text as "4C.A". Please consider adding the missing table number "4C.A" to the table title to be consistent with other tables.

Response: The requested revisions were made.

Comment 6. Appendix 4C-A: Project cost estimates are presented in two different formats (e.g., Anderson County Other, page 4C-A-3 format vs. Hardin County-Other, page 4C-A-28 format). Please consider using a consistent format for presenting "Cost Estimate" worksheets.

Response: The requested revisions were not made.

10.6 Adoption of the Final 2011 Plan

The ETRWPG met in August 2010, to review comments and propose modifications to the 2011 IPP. The final 2011 Plan was adopted by the ETRWPG on August 11, 2010, and published on the Internet for public viewing. The final 2011 Plan was submitted to the TWDB by September 1, 2010.

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Appendix 1-A

Species of Special Concern in the Region

The TPWD has compiled a list of species of special concern in the State of Texas. Rare species are listed by county in the Rare, Threatened, and Endangered Species Database, which includes regulatory listing and habitats of each species.

Table 1-A.1 identifies rare, threatened or endangered species in the region by county and lists federal and state status for each species. Species are grouped by taxonomic assemblage (i.e., bird, insect, fish, mammal, vascular plant, etc.). Information on habitats for these species may be found on the TPWD website.[1]

The key to the federal and state status for threatened and endangered species follows:

LE, LT	Federally Listed Endangered/Threatened
PE, PT	Federally Proposed Endangered/Threatened
SAE, SAT	Federally Listed Endangered/Threatened by Similarity of Appearance
C	Federal Candidate for Listing; formerly Category 1 Candidate
DL, PDL	Federally Delisted/Proposed for Delisting
NL	Not Federally Listed
E, T	State Listed Endangered/Threatened
NT	Not tracked or no longer tracked by the State
“blank”	Rare, but with no regulatory listing status

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Table 1-A.1 Species of Special Concern

	Species	Federal Status	State Status	County: Anderson	Angelina	Cherokee	Hardin	Henderson	Houston	Jasper	Jefferson	Nacogdoches	Newton	Orange	Panola	Polk	Rusk	Sabine	San Augustine	Shelby	Smith	Trinity	Tyler
Birds	American Peregrine Falcon	DL	T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Birds	Arctic Peregrine Falcon	DL		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Birds	Bachman's Sparrow		T	•	•	•	•	•	•	•		•	•		•	•	•	•	•	•	•	•	•
Birds	Bald Eagle	DL	T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Birds	Black Rail										•												
Birds	Brown Pelican	DL	E								•			•									
Birds	Henslow's Sparrow			•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•
Birds	Interior Least Tern	LE	E	•		•		•	•						•					•	•		
Birds	Peregrine Falcon	DL	T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Birds	Piping plover	LT	T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Birds	Red-cockaded Woodpecker	LE	E	•	•	•	•		•	•		•	•		•	•		•	•	•		•	•
Birds	Reddish egret		T								•												
Birds	Southeastern snowy plover										•												
Birds	Sooty tern		T											•									
Birds	Swallow-tailed kite		T		•		•			•	•	•	•	•				•	•	•		•	•
Birds	Western snowey plover										•												
Birds	White-faced Ibis		T	•			•			•	•		•	•								•	
Birds	Whooping Crane	LE	E	•				•															
Birds	Wood Stork		T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Insects	A Caddisfly			•																			

Table 1-A.1 Species of Special Concern (Cont.)

	Species	Federal Status	State Status	County																			
				Anderson	Angelina	Cherokee	Hardin	Henderson	Houston	Jasper	Jefferson	Nacogdoches	Newton	Orange	Panola	Polk	Rusk	Sabine	San Augustine	Shelby	Smith	Trinity	Tyler
	A purse casemaker caddisfly			•																			
	Holzenthal's philopotamid caddisfly			•																			
	A mayfly									•													
	Bay skipper										•												
	Morse's net-spinning caddisfly			•																			
	Texas emerald dragonfly			•					•									•	•	•		•	
	Gulf Coast clubtail												•										
Fish	American Eel			•	•	•	•		•	•	•		•	•		•						•	•
Fish	Blackside darter		T									•			•					•	•		
Fish	Blue sucker		T				•			•			•					•					•
Fish	Creek chubsucker		T		•	•	•		•	•		•	•		•	•	•	•	•	•	•	•	•
Fish	Orangebelly darter				•	•				•		•	•		•	•	•	•	•	•	•		
Fish	Paddlefish		T	•	•	•			•			•	•		•	•	•	•	•	•	•	•	•
Fish	Western sand darter						•			•			•				•	•			•		•
Fish	Smalltooth sawfish	LE	E								•												
Fish	Ironcolor shiner												•	•	•		•	•		•	•		
Mammals	Black bear	T/SA; NL	T	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Mammals	Louisiana black bear	LT	T	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•		•	•
Mammals	Plains spotted skunk			•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•
Mammals	Rafinesque's big-eared bat		T		•	•	•		•	•	•	•	•	•	•	•	•	•	•	•		•	•

Table 1-A.1 Species of Special Concern (Cont.)

	Species	Federal Status	State Status	Anderson	Angelina	Cherokee	Hardin	Henderson	Houston	Jasper	Jefferson	Nacogdoches	Newton	Orange	Panola	Polk	Rusk	Sabine	San Augustine	Shelby	Smith	Trinity	Tyler
				County																			
	Red wolf	LE	E	•	•	•	•		•		•	•	•	•		•	•	•	•	•	•	•	•
	Southeastern myotis			•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Reptiles and Amphibians	Alligator snapping turtle		T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Atlantic hawksbill sea turtle	LE	E								•												
	Green sea turtle	LT	T								•												
	Gulf saltmarsh snake										•			•									
	Kemp's ridley sea turtle	LE	E								•												
	Leatherback sea turtle	LE	E								•												
	Loggerhead sea turtle	LT	T								•												
	Louisiana pine snake	C	T	•	•	•	•		•	•		•	•			•	•	•	•	•	•	•	•
	Northern Scarlet Snake		T			•	•	•		•	•		•	•	•		•	•	•	•	•		•
	Pig frog						•			•	•		•	•									•
	Sabine map turtle			•	•	•	•	•		•	•	•	•	•	•		•	•	•	•	•		•
	Southern redback salamander											•											
	Texas diamondback terrapin										•			•									
	Texas horned lizard		T	•		•		•	•		•	•		•			•				•		
	Timber/canebrake rattlesnake		T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Mollusks	Creeper (Squawfoot)			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Fawnsfoot			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Little Spectaclecase			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Louisiana pigtoe		T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Table 1-A.1 Species of Special Concern (Cont.)

	Species	Federal Status	State Status	County																			
				Anderson	Angelina	Cherokee	Hardin	Henderson	Houston	Jasper	Jefferson	Nacogdoches	Newton	Orange	Panola	Polk	Rusk	Sabine	San Augustine	Shelby	Smith	Trinity	Tyler
	Pistolgrip			•	•	•	•	•	•	•	•	•	•		•	•		•	•	•	•	•	•
	Rock pocketbook			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Sandbank pocketbook		T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Southern hickorynut		T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Texas heelsplitter		T	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Texas pigtoe		T	•	•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•
	Triangle Pigtoe		T				•					•							•	•			
	Wabash pigtoe			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	Wartyback			•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Vascular Plants	Boynton's Oak				•																		
	Carrizo leather flower					•															•		
	Chapman's Orchid						•				•			•									•
	Chapman's yellow-eyed grass							•															
	Earth fruit (Tinytim)	LT	T	•											•								
	Long-sepaled false dragon-head						•			•			•	•									•
	Navasota false foxglove																						•
	Navasota ladies' –tresses	LE	E							•													
	Neches River rose-mallow	C				•			•	•												•	
	Nodding yucca									•			•										
	Rough-stem aster			•				•													•		
	Sandhill woolywhite			•																			

Table 1-A.1 Species of Special Concern (Cont.)

	Species	Federal Status	State Status	County: Anderson	Angelina	Cherokee	Hardin	Henderson	Houston	Jasper	Jefferson	Nacogdoches	Newton	Orange	Panola	Polk	Rusk	Sabine	San Augustine	Shelby	Smith	Trinity	Tyler
	Shinner's sunflower												•								•		
	Small-headed pipewort			•				•															
	Texas golden glade cress	C																•	•				
	Texas Prairie dawn	LE	E																			•	
	Texas screwstem				•		•			•		•	•			•			•				•
	Texas three-birds orchid								•														
	Texas trailing phlox	LE	E				•									•							•
	Texas trillium				•	•			•	•		•			•		•				•		
	White bladderpod	LE	E																•				
	White firewheel						•																•
Crustaceans	A crayfish				•																	•	
Crustaceans	Texas prairie crayfish				•																		

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Appendix 1-B

2008 303(d) List of Impaired Water Bodies Within the East Texas Regional Water Planning Area

Under Section 303(d) of the 1972 Clean Water Act, the TCEQ evaluates surface water in or bordering the state and compiles a list of impaired water bodies, or water bodies that do not meet uses and criteria defined in the Texas Surface Water Quality Standards. All impaired water bodies are placed into one of five categories, dependent on the water quality or status of TMDLs for these waters.

The TCEQ prepares a list of impaired water bodies on a bi-annual basis. The TCEQ 2008 Texas 303(d) List identifies such water bodies within the ETRWPA. The 303(d) list is expected to be finalized by mid-2010.

Tables 1-B.1 and 1-B.2 follow in this appendix. Table 1-B.1 provides a general listing of the types of water quality impairments currently identified in the ETRWPA. A total of 69 separate impairments are noted. These include impairments in water, sediment, and fish or shellfish tissue. A range of use impairments is noted. Table 1-B.2 lists, by segment number, the specific water quality impairments identified in the 2008 303(d) List. The following describes the information provided in the tables:

Segment Number and Name: Segment Numbers (TCEQ defined unique identifier or SegID) and Segment Names are provided. Four-digit numbers are classified segments as defined in Appendix A of the *Texas Surface Water Quality Standards*. Five-digit numbers are described in Appendix D of the *Texas Surface Water Quality Standards* and are partially classified or unclassified water bodies associated with a classified water body because it is in the same watershed.

Concern: A water use concern is designated based upon the impairment(s) in the water body.

Description of Impairment: Pollutants or water quality conditions found in the water body which do not meet Texas Surface Water Quality Standards.

Category: Category 5 constitutes water bodies included on the 303(d) List of Impaired Waters, in which a TMDL may be required. Each impaired parameter was assigned one of three subcategories based upon the status of a TMDL schedule. A summary of the subcategories follows:

- 5a – A TMDL is underway, scheduled, or will be scheduled.
- 5b – A review of the water quality standards for the water body will be conducted before a TMDL is scheduled
- 5c – Additional data and information will be collected before a TMDL is scheduled.

Texas Commission on Environmental Quality 2008 303(d) List of Impaired Water Bodies Within the East Texas Regional Water Planning Area

Table 1-B.1 Impairments in ETRWPA

Impairment Parameters	2008 Number of Impairments	Use
Bacteria in water	29	Recreation
Dissolved Oxygen	18	Aquatic Life
Toxicity in Water or Sediment	4	Aquatic Life
Metals (except Mercury) in Water or Fish/Shellfish	5	Fish Consumption, Aquatic Life
Mercury in Water or Fish/Shellfish	9	Aquatic Life, Fish Consumption
pH	3	General
Biological	3	Aquatic Life
Total	**69**	

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Table 1-B.2 Impaired Water Bodies in ETRWPA

Segment		Concern is for					
Number	Name	Aquatic Life	Recreation	Fish Consumption	General Use	Description of Impairment	Category
0501	Sabine River Tidal		●			Bacteria.	5c
0501B	Little Cypress Bayou (unclassified water body)	●	●			Depressed dissolved oxygen, toxicity in water, bacteria.	5c
0502A	Nichols Creek (unclassified water body)	●	●			Depressed dissolved oxygen, toxicity in water, bacteria.	5c
0502B	Caney Creek (unclassified water body)		●			Bacteria.	5c
0504	Toledo Bend Reservoir	●		●		Depressed dissolved oxygen, mercury in edible tissue.	5c
0504C	Palo Gaucho Bayou (unclassified water body)	●				Toxicity in water.	5c
0504E	Clear Lake	●		●		Mercury in edible tissue.	5c
0505	Sabine River above Toledo Bend Reservoir		●			Bacteria.	5a
0505O	Hills Lake	●		●		Mercury in edible tissue.	5c
0603	B. A. Steinhagen Lake	●		●		Mercury in edible tissue.	5c

Table 1-B.2 Impaired Water Bodies in ETRWPA (Cont.)

Segment		Concern is for					
Number	Name	Aquatic Life	Recreation	Fish Consumption	General Use	Description of Impairment	Category
0603A	Sandy Creek (unclassified water body)		●			Bacteria.	5c
0603B	Wolf Creek (unclassified water body)		●			Bacteria.	5c
0604	Neches River Below Lake Palestine	●		●		Lead in water.	5c
0604A	Cedar Creek (unclassified water body)		●			Bacteria.	5c
0604B	Hurricane Creek (unclassified water body)		●			Bacteria.	5c
0604C	Jack Creek (unclassified water body)		●			Bacteria.	5c
0604D	Piney Creek (unclassified water body)	●	●			Depressed dissolved oxygen, bacteria.	5c
0604M	Biloxi Creek (unclassified water body)	●	●			Depressed dissolved oxygen, bacteria.	5c

Table 1-B.2 Impaired Water Bodies in ETRWPA (Cont.)

Segment		Concern is for					
Number	**Name**	**Aquatic Life**	**Recreation**	**Fish Consumption**	**General Use**	**Description of Impairment**	**Category**
0604T	Lake Ratcliff (unclassified water body)	●		●		Mercury in edible tissue.	5c
0605	Lake Palestine				●	pH	5c
0605A	Kickapoo Creek (unclassified water body)	●	●			Depressed dissolved oxygen, bacteria.	5c
0606	Neches River Above Lake Palestine	●	●	●	●	Depressed dissolved oxygen, zinc in water, bacteria, pH.	5c
0606A	Prairie Creek (unclassified water body)		●			Bacteria.	5c
0607	Pine Island Bayou	●	●			Depressed dissolved oxygen, bacteria.	5b (dissolved oxygen), 5c (bacteria)
0607A	Boggy Creek (unclassified water body)	●				Depressed dissolved oxygen.	5b
0607B	Little Pine Island Bayou (unclassified water body)	●	●			Depressed dissolved oxygen, bacteria.	5b (dissolved oxygen), 5c (bacteria)
0607C	Willow Creek (unclassified water body)	●				Depressed dissolved oxygen.	5b
608	Village Creek				●	pH.	5b

Table 1-B.2 Impaired Water Bodies in ETRWPA (Cont.)

Segment		Concern is for					
Number	Name	Aquatic Life	Recreation	Fish Consumption	General Use	Description of Impairment	Category
0608A	Beech Creek (unclassified water body)		●			Bacteria.	5c
0608B	Big Sandy Creek (unclassified water body)		●			Bacteria.	5c
0608C	Cypress Creek (unclassified water body)	●	●	●		Depressed dissolved oxygen, aluminum in water, bacteria.	5b (dissolved oxygen), 5c (aluminum & bacteria)
0608E	Mill Creek	●				Depressed dissolved oxygen.	5c
0608F	Turkey Creek (unclassified water body)		●			Bacteria.	5c
0608G	Lake Kimball (unclassified water body)	●		●		Mercury in edible tissue.	5c
0610	Sam Rayburn Reservoir	●		●		Mercury in edible tissue.	5c
0610A	Ayish Bayou (unclassified water body)		●			Bacteria.	5a
0611	Angelina River Above Sam Rayburn Reservoir		●			Bacteria.	5a
0611A	East Fork Angelina River (unclassified water body)	●	●	●		Bacteria, Lead in water.	5c

Table 1-B.2 Impaired Water Bodies in ETRWPA (Cont.)

Segment		Concern is for				Description of Impairment	Category
Number	Name	Aquatic Life	Recreation	Fish Consumption	General Use		
0611B	La Nana Bayou (unclassified water body)		●			Bacteria.	5a
0612	Attoyac Bayou		●			Bacteria.	5a
0615	Angelina River/Sam Rayburn Reservoir	●	●	●		Depressed dissolved oxygen, impaired fish community, mercury in edible tissue, bacteria.	5c
0615A	Papermill Creek (unclassified water body)		●			Bacteria.	5c
0701	Taylor Bayou above Tidal	●				Depressed dissolved oxygen.	5a
0701D	Shallow Prong Lake (unclassified water body)	●				Depressed dissolved oxygen.	5a
0702A	Alligator Bayou (unclassified water body)	●				Impaired fish community, toxicity in water and sediment.	5c
0704	Hillebrandt Bayou	●				Depressed dissolved oxygen.	5a
0804G	Catfish Creek (unclassified water body)	●				Depressed dissolved oxygen, impaired macrobenthic community.	5c
2501	Gulf of Mexico *(areas in or next to East Texas Region)*	●		●		Mercury in edible tissue.	5c

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Appendix 1-C

Determination of Available Groundwater Supplies and Quality

This appendix was prepared for the ETRWPA 2006 Water Plan. It has been reviewed for applicability to the 2011 Plan, and updated where necessary.

1-C.1 Groundwater Availability Modeling

The ETRWPG used the groundwater availability estimates from the previous round of planning because official managed available groundwater (MAG) values had not been determined by the GCDs in the GMAs. In the previous plan, the ETRWPG used the Queen City/Sparta/Carrizo-Wilcox GAM to estimate regional groundwater availability in the ETRWPA for the Carrizo-Wilcox and Queen City/Sparta aquifers. Since the 2006 Plan was completed, the GCDs in both GMA 11 and 14 have been working on developing DFCs and MAGs. A predictive groundwater availability model (GAM) for the Gulf Coast aquifer is being used to determine MAGs for the Gulf Coast aquifers. A draft GAM has been completed for the Yegua-Jackson aquifer, but was not ready for use during the current planning period. Therefore, the groundwater availability assessment for the Gulf Coast and Yegua-Jackson and other small aquifers were based on published information, historical water use data from these aquifers, available well and water level records, and the knowledge base of the consultant team.

The GAMs are regional models that were developed as a tool to better understand long-term regional impacts from historical and proposed groundwater pumping. The GAMs do not define, estimate, or prescribe groundwater availability or supply for the ETRWPA, but rather provide a tool to evaluate aquifer water level impacts under different pumping scenarios.

1-C.2 Groundwater Availability Assessment

As stated above, the groundwater availability estimates for the 2011 Plan were adopted from the 2006 Plan. For the 2006 Plan, the ETRWPG determined that it is in the best interest of the ETRWPA to maintain an acceptable level of aquifer sustainability during the 50-year planning window, as well as for future generations beyond the 50-year planning period. Thus, for the Carrizo-Wilcox, Queen City, and Sparta aquifers (for which a GAM exists), the groundwater availability for the planning period was defined as the amount of groundwater that could be withdrawn from aquifers over the next 50 years that would not cause more than 50 feet of water level decline (or more than a 10% decrease in the saturated thickness in outcrop areas) in the aquifers as compared to water levels in 2000. These criteria were used to guide the development of the groundwater availability assessment and to determine groundwater supply for each aquifer in each county. The planning group acknowledges that additional water does occur in storage within the aquifers and that a portion of that water (above the estimated supply) could be pumped if there is not a groundwater conservation district in place to prevent such withdrawals.

The steps involved in determining the water supply by county and aquifer using the Queen City/Sparta/Carrizo-Wilcox GAM is summarized below. Because the GAM does not "output" a value for groundwater availability or supply, the model was used to determine the impact of different pumping scenarios so that those impacts could be compared to the criteria set by the planning group. In other words, an iterative approach was used to determine what groundwater demand in each county would result in no more than 50 feet of water level decline or 10% decline in saturated thickness in the outcrop areas. Future pumping locations are not known with certainty. Therefore, the total "estimated" supply was distributed equally across each county and implemented into the predictive GAM model (2000-2050). The pumping was assumed to be constant starting in 2001, and was held at the projected level for 50 years.

The drawdown across the model area was then assessed to determine if the drawdown criteria were met (i.e., if the average drawdown across the county was less about 50 feet). Depending on the drawdown results, projected supplies were adjusted and another simulation completed. This approach was used until the average drawdown in each county met the criteria at the end of the 50-year simulation period. The supply for the county and aquifer was then set equal to the total county pumping that was necessary to meet the drawdown criteria.

Some of the groundwater in the ETRWPA is brackish (i.e., above 1000 mg/L of total dissolved solids [TDS]). In order to be used for municipal supply, the brackish groundwater may require treatment. The portion of groundwater that is brackish can be estimated by observing the overall water quality in each county on an aquifer-by-aquifer basis. The groundwater quality information is discussed in more detail in the following sections.

1-C.3 Groundwater Quality

The TWDB well database was used to complete a detailed water quality assessment of the aquifers in the ETRWPA. TWDB standard water quality constituent analytical results from wells within the ETRWPA were compared to primary and secondary drinking water maximum contaminant levels (MCLs) when the database contained sufficient data. In the case of fluoride, the lower secondary MCL of 2 milligrams per liter (mg/L) was used for comparison purposes. The standard water quality constituents studied were: sulfate, chloride, pH, TDS, nitrate, and fluoride.

TWDB infrequent water quality constituent analytical results were also compared to primary drinking water MCLs. Only constituents with primary drinking water MCLs and representative data records were selected for this effort. Only the most recent data for each well was used. The infrequent water quality constituents studied were: gross alpha, arsenic, barium, cadmium, chromium, copper, lead, and selenium. In the following discussions, gross alpha is reported in units of picocuries per liter (pCi/L), while the other infrequent constituents are reported in units of micrograms per liter (µg/L). Organic and other regulated infrequent constituent data was very sparse and were not considered to be representative.

1-C.3.1 Carrizo-Wilcox Water Quality. Table 1-C.1 summarizes the results for the Carrizo-Wilcox aquifer and maps of Carrizo-Wilcox groundwater quality in the ETRWPA are included at the end of this Appendix in Figures 1-C.1 through 1-C.16.

Table 1-C.1 Groundwater Quality Summary for Carrizo-Wilcox Aquifer in the ETRWPA

MCL Class	Constituent	Limit(s)	Units	Total Results	Results Over MCL	% Over	Average	Median
primary	Alpha	15	pCi/L	144	1	0.7%	< 3	< 2
primary	Arsenic	10	µg/L	303	1	0.3%	< 6	< 2
primary	Barium	2000	µg/L	236	0	0.0%	< 140	30.05
primary	Cadmium	5	µg/L	286	0	0.0%	< 4	< 2
primary	Chromium	100	µg/L	282	0	0.0%	< 10	< 5
primary	Lead	15	µg/L	263	3	1.5%	< 12	< 5
primary	Nitrate as N	10	mg/L	830	6	0.7%	1.7	0.22
primary	Selenium	50	µg/L	288	3	1.0%	< 6	< 2
secondary	Copper	1000	µg/L	297	0	0.0%	< 20	4.77
secondary	Fluoride	2	mg/L	819	5	0.6%	0.33	0.2
secondary	Chloride	300	mg/L	909	5	0.6%	59	15
secondary	Iron	300	µg/L	811	192	23.7%	821	< 100
secondary	Manganese	50	µg/L	488	48	9.8%	35	< 20
secondary	pH	6.5 - 8.5	std. units	817	287	35.1%	7.9	8.2
secondary	Sulfate	300	mg/L	908	3	0.3%	32	16
secondary	TDS	1000	mg/L	909	5	0.6%	404	299

Alpha. Only one result for dissolved alpha particles exceeded the 15 pCi/L primary MCL in the Carrizo-Wilcox in the ETRWPA. This result was 23 pCi/L and the sample was collected from a shallow well on the Carrizo outcrop in northern Sabine county. The alpha results are well distributed spatially in the outcrop and downdip sections of the Carrizo-Wilcox in the ETRWPA. Alpha particles were only detected in 15% of the groundwater results in the ETRWPA. Typical reporting limits were 2, 3, and 4 pCi/L.

Arsenic. No arsenic results exceeded the 10 µg/L primary MCL in the Carrizo-Wilcox aquifer group in the ETRWPA. The results were well distributed spatially throughout the Carrizo-Wilcox aquifer group in the ETRWPA. One arsenic result was non-detect with a reporting limit that exceeded the current MCL. This result was not included on the figure for this aquifer group in the ETRWPA. Arsenic was detected above the 10 µg/L primary

MCL in only one result from the Carrizo-Wilcox aquifer in the ETRWPA. Arsenic was detected in less than 2% of all of the results in the ETRWPA. Typical reporting limits were 1, 2, 5, and 10 µ/L.

Barium. No barium results exceeded the 2,000 µg/L primary MCL in the Carrizo-Wilcox aquifer group in the ETRWPA. The results were well distributed spatially throughout the Carrizo-Wilcox aquifer group in the ETRWPA. Barium was detected in most of the results, and the average for all of the detections is less than 140 µg/L, and the median is less than 2 µg/L.

Cadmium. No cadmium results exceeded the 5 µg/L primary MCL in the Carrizo-Wilcox aquifer group in the ETRWPA. The results were well distributed spatially throughout the Carrizo-Wilcox aquifer group in the ETRWPA. Cadmium was only detected in 1% of the results in the ETRWPA. Typical reporting limits were 1, 2, and 5 µ/L. There were several results in which cadmium was not detected with a reporting limit of 10 µg/L. These results were not considered useful since the reporting limit exceeded the MCL and were not included in the summary table or figure.

Chromium. Chromium was not detected in any of the results above the 100 µg/L primary MCL in the Carrizo-Wilcox aquifer in the ETRWPA. The results were well distributed spatially throughout the Carrizo-Wilcox aquifer group in the ETRWPA. Chromium was detected in approximately 30% of the results, and the average for all of the results is <10 µg/L, and the median is <5 µg/L.

Lead. Lead was not detected in any of the results above the 15 µg/L primary MCL in the Carrizo-Wilcox aquifer in the ETRWPA. Three lead results exceeded the 15 µg/L primary MCL in the Carrizo-Wilcox aquifer group in the ETRWPA. The remaining results were well distributed spatially throughout the Carrizo-Wilcox aquifer group in the ETRWPA. Lead was detected in approximately 12% of the results, and the average for all of the results is <12 µg/L, and the median is <5 µg/L. There were 95 lead results that were below reporting limits that exceeded the current MCL (reporting limits greater than 15 µg/L). These results were not included on the figure or in the table for this aquifer group in the ETRWPA.

Nitrate as N. Six nitrate results exceeded the 10 mg/L (as N) primary MCL in the Carrizo-Wilcox aquifer group in the ETRWPA. Most of these were from samples collected from shallow wells on the Carrizo outcrop, but these were not concentrated in any particular area. The remaining results were well distributed spatially throughout the Carrizo-Wilcox aquifer group in the ETRWPA. Nitrate (as N) was detected above the primary MCL of 10 mg/L in less than 1% of the results in the Carrizo-Wilcox aquifer in the ETRWPA. The average for all of the results is 1.7 mg/L, and the median for all of the results is 0.22 mg/L.

Selenium. Three selenium results exceeded the 50 µg/L primary MCL in the Carrizo-Wilcox aquifer group in the ETRWPA. Two of these results were in Angelina County, and one was in Anderson County. All three were in the downdip section of the Carrizo. The results were well distributed spatially throughout the Carrizo-Wilcox aquifer group in the ETRWPA. Selenium was detected above the 50 µg/L primary MCL in 1% of the results in the Carrizo-Wilcox aquifer in the ETRWPA. Selenium was detected in only 7% of the results, and the average for all of the results is <6 µg/L, and the median is 4.77 µg/L.

Copper. Copper was not detected above the 1,000 µg/L secondary MCL or the 1,300 µg/L primary MCL in the Carrizo-Wilcox aquifer in the ETRWPA. The results considered were well distributed spatially throughout the Carrizo-Wilcox aquifer group in the ETRWPA. The average for all of the results is <20 µg/L, and the median is 0.2 µg/L.

Fluoride. Five fluoride results exceeded the 2 mg/L secondary MCL in the Carrizo-Wilcox aquifer group in the ETRWPA. Three of these results were from deep wells in the Wilcox in western Rusk County, and there were several other wells in this area with elevated levels of fluoride (well above the average for the ETRWPA, in the 1.5 - 2 mg/L range). The other two results that exceeded the secondary MCL were in eastern Shelby County. No results exceeded the 4 mg/L primary MCL. The available results were well distributed spatially throughout the Carrizo-Wilcox aquifer group in the ETRWPA. Fluoride was detected above the secondary MCL of 2 mg/L in less than 1% of the results in the Carrizo-Wilcox aquifer in the ETRWPA. None of the results exceeded the primary

MCL of 4 mg/L. The average for all of the results is 0.33 mg/L, and the median for all of the results is 0.2 mg/L.

Chloride. Only five chloride results exceeded the 300 mg/L secondary MCL in the Carrizo-Wilcox aquifer group in the ETRWPA, and no significant spatial trends appear to be associated with these results. A disproportionate number of results in Panola County are in the 100-300 mg/L range, but these are all below the 300 mg/L secondary MCL. The available results were well distributed spatially throughout the Carrizo-Wilcox aquifer group in the ETRWPA. Chloride was detected in less than 1% of the results above the secondary MCL of 300 mg/L in the Carrizo-Wilcox aquifer in the ETRWPA. The average for all of the results is 59 mg/L, and the median for all of the results is 15 mg/L.

Iron. About one-quarter of iron sample results in the Carrizo-Wilcox aquifer group exceeded the 300 µg/L secondary MCL in the ETRWPA. The results that exceeded the MCL were evenly distributed spatially and represented samples collected from wells completed in both the Carrizo and Wilcox Formations. Iron was detected above the secondary MCL of 300 µg/L in 23.7% of the results above in the Carrizo-Wilcox aquifer in the ETRWPA. The average for all of the results is 821 µg/L, and the median for all of the results is <100 µg/L, indicating that the average is skewed upward due to the presence of a limited number of high values.

Manganese. Forty-eight manganese sample results in the Carrizo-Wilcox aquifer group exceeded the 50 µg/L secondary MCL in the ETRWPA. The results that exceeded the MCL were evenly distributed spatially and represented samples collected from wells completed in both the Carrizo and Wilcox Formations. Manganese was detected in 9.8% of the results above the secondary MCL of 50 µg/L in the Carrizo-Wilcox aquifer in the ETRWPA. Manganese was detected in approximately half of the results, and the average for all of the results is 35 µg/L, and the median for all of the results is <20 µg/L.

pH. About one-third of pH results in the Carrizo-Wilcox aquifer group were outside of the 6.5 - 8.5 secondary MCL range in the ETRWPA. Most of the out-of-range results were more alkaline than the upper pH MCL of 8.5. The results that were out of the MCL range were evenly distributed spatially and represented samples collected from wells completed in both the Carrizo and Wilcox Formations. The pH of water samples was outside the secondary MCL range of 6.5 to 8.5 in 35% of the results in the Carrizo-Wilcox aquifer in the ETRWPA. The range of all of the results was 3.6 to 10.7, and the average is 7.9 and the median is 8.2.

Sulfate. Only three sulfate results exceeded the 300 mg/L secondary MCL in the Carrizo-Wilcox aquifer group in the ETRWPA. Two of these are from wells in the Wilcox in northwestern Nacogdoches County. However, several other results in the immediate area are well below the MCL. A disproportionate number of results in northwestern Cherokee County are in the 150-300 mg/L range, but these are all below the 300 mg/L secondary MCL. The available results were well distributed spatially throughout the Carrizo-Wilcox aquifer group in the ETRWPA. Sulfate was detected in less than 1% of the results above the secondary MCL of 300 mg/L in the Carrizo-Wilcox aquifer in the ETRWPA. The average for all of the results is 32 mg/L, and the median for all of the results is 16 mg/L.

Total Dissolved Solids. Only four TDS results exceeded the 1,000 mg/L secondary MCL in the Carrizo-Wilcox aquifer group in the ETRWPA. TDS results tended to be higher in Panola, Rusk, Shelby, and eastern Anderson Counties, but these were for the most part below the secondary MCL. The available results were well distributed spatially throughout the Carrizo-Wilcox aquifer group in the ETRWPA. The TDS concentration was above the secondary MCL of 1,000 mg/L in less than 1% of the results in the Carrizo-Wilcox aquifer in the ETRWPA. The average for all of the results is 404 mg/L, and the median for all of the results is 299 mg/L.

1-C.3.2 Gulf Coast Water Quality. Table 1-C.2 summarizes the results for the Gulf Coast aquifer and maps of Gulf Coast groundwater quality in the ETRWPA are included at the end of this Appendix in Figures 1-C.1 through 1-C.16.

Table 1-C.2 Groundwater Quality Summaries for Gulf Coast Aquifer in the ETRWPA

MCL Class	Constituent	Limits	Units	Total Results	Results Over MCL	% Over	Average	Median
primary	Alpha	15	pCi/L	82	1	1.2%	3	2
primary	Arsenic	10	µg/L	116	0	0.0%	4	2
primary	Barium	2000	µg/L	116	1	0.9%	177	109
primary	Cadmium	5	µg/L	97	0	0.0%	< 2	< 1
primary	Chromium	100	µg/L	97	0	0.0%	< 10	< 1
primary	Lead	15	µg/L	115	0	0.0%	< 2	< 1
primary	Nitrate as N	10	mg/L	712	58	8.1%	3	0.0
primary	Selenium	50	µg/L	116	0	0.0%	4	4
secondary	Copper	1000	µg/L	116	0	0.0%	10	2.26
secondary	Fluoride	2	mg/L	511	5	1.0%	0	0.20
secondary	Chloride	300	mg/L	952	120	12.6%	154	32
secondary	Iron	300	µg/L	373	100	26.8%	520	100
secondary	Manganese	50	µg/L	142	51	35.9%	65	26
secondary	pH	6.5 - 8.5	std. units	393	93	23.7%	7.2	7.3
secondary	Sulfate	300	mg/L	947	9	1.0%	18	3
secondary	TDS	1000	mg/L	950	96	10.1%	450	224

Alpha. Only one result for alpha particles exceeded the 15 pCi/L primary MCL in the Gulf Coast in the ETRWPA. This result was 29 pCi/L and the sample was collected from a 532-ft well in Beaumont completed in the Chicot Aquifer. The alpha results are well distributed spatially in the Gulf Coast Aquifer in the ETRWPA. The average for all of the results is 3 pCi/L, and the median for all of the results is 2 pCi/L.

Arsenic. No arsenic results exceeded the 10 µg/L primary MCL in the Gulf Coast aquifer group in the ETRWPA. The results were well distributed spatially throughout the Gulf Coast aquifer group in the ETRWPA. The average for all of the results is 4 µg/L, and the median is 2 µg/L.

Barium. Barium was detected in only one of the results above the 2,000 µg/L primary MCL in the Gulf Coast aquifer group in the ETRWPA. This result was from a sample collected from a well completed in the Chicot in Jefferson County. The results were well distributed spatially throughout the Gulf Coast aquifer group in the ETRWPA. Barium was detected in more than 95% of the results, and the average for all of the results is 177 µg/L, and the median is 109 µg/L.

Cadmium. No cadmium results exceeded the 5 µg/L primary MCL in the Gulf Coast aquifer group in the ETRWPA. The results were well distributed spatially throughout the Gulf Coast aquifer group in the ETRWPA. There were 44 cadmium results were below reporting limits that exceeded the current MCL. These results were not included in the figure for this aquifer group in the ETRWPA. Cadmium was not detected in any results in the Gulf Coast aquifer group in the ETRWPA. The typical reporting limit was 1 mg/L. There were several results in which cadmium was not detected with a reporting limit of 10 µg/L. These results were not considered useful since the reporting limit exceeded the MCL and were not included in the summary table or figure.

Chromium. No chromium results exceeded the 100 µg/L primary MCL in the Gulf Coast aquifer group in the ETRWPA. The results were well distributed spatially throughout the Gulf Coast aquifer group in the ETRWPA. Chromium was only detected in one of the results in the Gulf Coast aquifer group in the ETRWPA, and it was not above the 100 µg/L primary MCL. Typical reporting limits were 1 and 20 µg/L.

Lead. No lead results exceeded the 15 µg/L primary MCL in the Gulf Coast aquifer group in the ETRWPA. The results were well distributed spatially throughout the Gulf Coast aquifer group in the ETRWPA. There were 35 lead results that were below reporting limits that exceeded the current MCL (reporting limits greater than 15 µg/L). These results were not included the figure or table for this aquifer group in the ETRWPA. The average for all of the lead results is less than 2 µg/L, and the median for all of the results is less than 1 µg/L.

Nitrate as N. For 58 out of 712 samples, the analytical results exceeded the Gulf Coast aquifer in the ETRWPA primary MCL of 10 mg/L (as N). Most of the results that exceeded the MCL were from samples collected from shallow wells. The remaining results were well distributed spatially throughout the Gulf Coast aquifer group in the ETRWPA. It should also be noted that the majority of these nitrate results are from samples collected before 1970. These represent the most recent results from these wells.

Relatively few samples have been collected in the Gulf Coast aquifer group in the ETRWPA since that time. Nitrate (as N) was detected in 8.1% of the results above the primary MCL of 10 mg/L in the Gulf Coast aquifer group in the ETRWPA. The average for all of the results is 3 mg/L, and the median for all of the results is 0.05 mg/L.

Selenium. Selenium was not detected above the 50 µg/L primary MCL in any of the results in the Gulf Coast aquifer group in the ETRWPA. The results were well distributed spatially throughout the Gulf Coast aquifer group in the ETRWPA. Selenium was detected in only three of the results, with typical reporting limits in the 2 – 6 µg/L range.

Copper. No copper results exceeded the 1,000 µg/L primary MCL in the Gulf Coast aquifer group in the ETRWPA. The results considered were well distributed spatially throughout the Gulf Coast aquifer group in the ETRWPA. Copper was detected in 27.5% of the results, and the average for all of the results is 10 µg/L, and the median is 2.26 µg/L, indicating that the average is skewed upward due to the presence of a limited number of high values.

Fluoride. Five fluoride results exceeded the 2 mg/L secondary MCL in the Gulf Coast aquifer group in the ETRWPA. Four of these were from samples collected from wells completed in the Evangeline, Jasper, and Gulf Coast in Hardin County. Sample results from three other wells completed in the Evangeline, Chicot, and Gulf Coast in this area had elevated levels of fluoride (well above the average for the ETRWPA, in the 1.5 - 2 mg/L range). The remaining sample result that exceeded the MCL was collected from a well completed in the Chicot in Jefferson County. The available results were well distributed spatially throughout the Gulf Coast aquifer group in the ETRWPA. Fluoride was detected in 1% of the results above the secondary MCL of 2 mg/L in the Gulf Coast aquifer group in the ETRWPA. Of these, none were above the primary MCL of 4 mg/L. Fluoride was detected in nearly all of the results, and the average for all of the results is 0.35 mg/L, and the median for all of the results is 0.2 mg/L.

Chloride. About 13% of chloride results exceeded the 300 mg/L secondary MCL in the Gulf-Coast aquifer group in the ETRWPA. Most of these results were collected from wells completed in the Chicot in Jefferson, Orange, and southern Hardin Counties. Six results from the Catahoula in northern Tyler and Jasper Counties exceeded the secondary MCL. The available results were well distributed spatially throughout the Gulf Coast aquifer group in the ETRWPA. The average for all of the chloride results is 154 mg/L, and the median for all of the results is 32 mg/L, indicating that the average is skewed upward due to the presence of a limited number of relatively high values.

Iron. About one-quarter of iron sample results in the Gulf Coast aquifer group exceeded the 300 µg/L secondary MCL in the ETRWPA. Several results from samples collected from wells completed in the Jasper Aquifer south of Woodville in Tyler County exceeded the MCL. Shallow wells completed in the Burkeville Aquiclude in central Polk County also produced samples (in 1947) that exceeded the current secondary MCL for iron. The Catahoula in northern Polk, Tyler, and Jasper Counties was as third source of sample results that exceeded the MCL. The remaining results that exceeded the MCL were evenly distributed spatially and represented samples collected from wells completed in several formations in the Gulf Coast aquifer group. Iron was detected in 26.8% of the results above the secondary MCL of 300 µg/L in the Gulf Coast aquifer group in the ETRWPA. Iron was detected in more than 80% of the results, and the average for all of the results is 520 µg/L, and the median for all of the results is only 100 µg/L, indicating that the average is skewed upward due to the presence of a limited number of high values.

Manganese. About one-third manganese sample results in the Gulf Coast aquifer group exceeded the 50 µg/L secondary MCL in the ETRWPA. A significant percentage of results from Jasper aquifer wells in Polk, Tyler, Jasper, and Newton Counties exceeded the MCL. Several other results exceeding the MCL were from samples collected from the Chicot aquifer in Jefferson, Jasper, Newton, and Hardin Counties. A small percentage of results from wells completed in the Evangeline also exceeded the MCL for manganese. Manganese was detected in 35.9% of the results above the secondary MCL of 50 µg/L in the Gulf Coast aquifer group in the ETRWPA. Manganese was detected in approximately 78% of the results, and the average for all of the results is 65 µg/L, and the median for all of the results is only 26 μg/L, indicating that the average is skewed upward due to the presence of a limited number of high values.

pH. About one-quarter of results from the Gulf Coast aquifer group were outside of the 6.5 - 8.5 secondary MCL range in the ETRWPA. Most of the out-of-range results were more below the lower pH MCL of 6.5, and these were from samples collected from the Chicot, Jasper, and Evangeline aquifers in Polk, Tyler, Jasper, and Newton Counties. The results available were evenly distributed spatially in the Gulf Coast aquifer group in the ETRWPA. The pH of water samples was outside the secondary MCL range of 6.5 to 8.5 in 23.7% of the results in the Gulf Coast aquifer group in the ETRWPA. The range of all of the results was 4.7 to 9.08, and the average is 7.2, and the median is 7.3.

Sulfate. Only 9 sulfate results exceeded the 300 mg/L secondary MCL in the Gulf-Coast aquifer group in the ETRWPA. All of these results were collected from wells in Jefferson County. The available results were well distributed spatially throughout the Gulf Coast aquifer group in the ETRWPA. Sulfate was detected in 1% of the results above the secondary MCL of 300 mg/L in the Gulf Coast aquifer group in the ETRWPA. The average for all of the results is 18 mg/L, and the median for all of the results is 3 mg/L.

Total Dissolved Solids. About 10% of TDS results exceeded the 1,000 mg/L secondary MCL in the Gulf-Coast aquifer group in the ETRWPA. Most of these results were collected from wells completed in the Chicot in Jefferson, Orange, and southern Hardin Counties. Six results from the Catahoula in northern Tyler and Jasper Counties exceeded the secondary MCL. The available results were well distributed spatially throughout the Gulf Coast aquifer group in the ETRWPA. The TDS concentration was above the secondary MCL of 1,000 mg/L in 96 results in the Gulf Coast aquifer group in the ETRWPA. The average for all of the results is 450 mg/L, and the median for all of the results is 224 mg/L.

1-C.3.3 Queen City-Sparta Water Quality.

Table 1-C.3 summarizes the results for the Queen City/Sparta Aquifer.

Table 1-C.3 Groundwater Quality Summaries for Queen City/Sparta Aquifer in the ETRWPA

MCL Class	Constituent	Limit(s)	Units	Total Results	Results Over MCL	% Over	Average	Median
primary	Alpha Radiation	15	pCi/L	43	0	0.0%	< 3	< 3
primary	Arsenic	10	µg/L	68	0	0.0%	< 2	< 2
primary	Barium	2000	µg/L	68	0	0.0%	62	45.75
primary	Cadmium	5	µg/L	65	1	1.5%	< 1	< 1
primary	Chromium	100	µg/L	65	0	0.0%	3	1.43
primary	Lead	15	µg/L	68	0	0.0%	< 3	< 1
primary	Nitrate (as N)	10	mg/L	338	15	4.4%	2.0	0.19
primary	Selenium	50	µg/L	65	0	0.0%	< 4	< 4
secondary	Copper	1000	µg/L	68	0	0.0%	8	2.8
secondary	Fluoride	2	mg/L	332	6	1.8%	0.3	0.1
secondary	Chloride	300	mg/L	568	11	1.9%	45	17
secondary	Iron	300	µg/L	287	97	33.8%	1375	125
secondary	Manganese	50	µg/L	86	13	15.1%	42	13
secondary	pH	6.5 - 8.5	std. units	328	143	43.6%	6.9	6.975
secondary	Sulfate	300	mg/L	537	13	2.4%	55	10
secondary	TDS	1000	mg/L	569	15	2.6%	261	130

Alpha. Dissolved alpha particles were not detected above the 15 pCi/L primary MCL in the Queen City-Sparta aquifer in the ETRWPA. No alpha results were available for the Sparta in Sabine County Alpha particles were only detected in less than 20% of the groundwater results in the ETRWPA.

Arsenic. Arsenic was detected in only two results from the Queen City-Sparta aquifer in the ETRWPA, and neither was above the 10 µg/L primary MCL. No arsenic results were available for the Sparta in Sabine County.

Barium. Barium was not detected in any of the results above the 2,000 µg/L primary MCL in the Queen City-Sparta aquifer in the ETRWPA. No barium results were available for the Sparta in Sabine County. Barium was detected in all but one of the results, and the average of the results is 62 µg/L, and the median is 45.75 µg/L.

Cadmium. Cadmium was detected in only one of the results in the Queen City-Sparta aquifer in the ETRWPA, at a concentration of 19.8 µg/L, which is above the 5 µg/L primary MCL. This result was from sample collected from a shallow well on the Queen City outcrop near Murchison in Henderson County. However, other shallow Queen City wells near Murchison have produced waters with no cadmium above detection limits. The available results in the Queen City-Sparta were generally well distributed, but no cadmium results were available for the Sparta in Sabine County. Typical reporting limits for cadmium were 1 – 2 µg/L.

Chromium. Chromium was not detected in any of the results above the 100 µg/L primary MCL in the Queen City-Sparta aquifer in the ETRWPA. No chromium results were available for the Sparta in Sabine County. Chromium was detected in approximately one-third of the results. The average for all of the results is 3 µg/L, and the median is 1.43 µg/L.

Lead. Lead was not detected in any of the results above the 15 µg/L primary MCL in the Queen City-Sparta aquifer in the ETRWPA. No lead results were available for the Sparta in Sabine County. Lead was detected in only seven of the results, all at concentrations of 2 µg/L or less. Typical reporting limits were 1 and 5 µg/L. There were three lead results that were below reporting limits that exceeded the current MCL (reporting limits greater than 15 µg/L). These results were not included the figure or table for this aquifer group in the ETRWPA.

Nitrate as N. Fifteen nitrate results exceed the 10 mg/L (as N) primary MCL in the Queen City-Sparta aquifer group in the ETRWPA. The majority of these were from samples collected from shallow wells on the Queen City outcrop in Anderson and Cherokee Counties. The available results in the Queen City-Sparta were well distributed. Nitrate (as N) was detected above the primary MCL of 10 mg/L in 4.4% of the results in the Queen City-Sparta aquifer in the ETRWPA. The average for all of the results is 2 mg/L, and the median for all of the results is 0.19 mg/L.

Selenium. Selenium was detected in only two samples in the Queen City-Sparta aquifer in the ETRWPA, and it was not detected above the 50 µg/L primary MCL. No selenium results were available for the Queen City-Sparta in Sabine County.

Copper. No copper results exceeded the 1,000 µg/L secondary MCL or the 1,300 µg/L primary MCL in the Queen City-Sparta aquifer group in the ETRWPA. The available results in the Queen City-Sparta were generally well distributed, but no cadmium results were available for the Sparta in Sabine County. The average for all of the results is 8 µg/L, and the median is 2.8 µg/L.

Fluoride. Six fluoride results exceeded the 2 mg/L secondary MCL in the Queen City-Sparta aquifer group in the ETRWPA. Most of these were from samples collected from Sparta Sand wells in northern Angelina and southern Nacogdoches Counties. The available results in the Queen City-Sparta were well distributed. Fluoride was detected above the secondary MCL of 2 mg/L in 1.8% of the results in the Queen City-Sparta aquifer in the ETRWPA. None of the results exceeded the primary MCL of 4 mg/L. The average for all of the results is 0.3 mg/L, and the median for all of the results is 0.1 mg/L.

Chloride. Less than 2% of chloride results exceeded the 300 mg/L secondary MCL in the Queen City-Sparta aquifer group in the ETRWPA. The Queen City wells in the ETRWPA portion of Henderson County generally had higher chloride results than other counties with Queen City or Sparta wells. The available results in the Queen City-Sparta were well distributed. The average for all of the results is 45 mg/L, and the median for all of the results is 17 mg/L.

Iron. One-third of iron results exceeded the 300 µg/L secondary MCL in the Queen City-Sparta aquifer group in the ETRWPA. The iron results that exceeded the MCL were proportionally distributed between the Queen City and Sparta and among the counties that contain these formations in the ETRWPA. Iron was detected above the secondary MCL of 300 µg/L in 33.8% of the results in the Queen City-Sparta aquifer in the ETRWPA. Iron was detected in approximately 85% of the results, and the average for all of the results is 1375 µg/L, and the median for all of the results is 125 µg/L, indicating that the average is significantly skewed upward due to the presence of a limited number of very high values.

Manganese. About 15% of manganese results exceeded the 50 µg/L secondary MCL in the Queen City-Sparta aquifer group in the ETRWPA. Most of these results were from

Queen City wells in northeastern ETRWPA. However, there were several elevated manganese results from the Sparta in Houston County, two of which exceeded the MCL. The available results in the Queen City-Sparta in the ETRWPA were well distributed. Manganese was detected in 15.1% of the results above the secondary MCL. Manganese was detected approximately 75% of the results, and the average for all of the results is 42 µg/L, and the median for all of the results is 13 µg/L.

pH. A large number of results from the Queen City-Sparta aquifer group were outside of the 6.5 - 8.5 secondary MCL range in the ETRWPA. The majority of these out-of-range results were below the 6.5 lower pH MCL, and were from samples collected from Queen City and Sparta wells in northeastern ETRWPA. The results that exceeded the upper 8.5 pH MCL were mostly from samples collected from wells in the Sparta outcrop areas. The available results were well distributed throughout the Queen City-Sparta in the ETRWPA. The pH of water samples was outside the secondary MCL range of 6.5 to 8.5 in 43.6% of the results in the Queen City-Sparta aquifer in the ETRWPA. The range of all of the results was 3.8 to 9. The average pH was 6.9, and the median pH was 6.975.

Sulfate. Sulfate was detected in 2.4% of the results above the secondary MCL of 300 mg/L in the Queen City-Sparta aquifer in the ETRWPA. The Queen City wells in the ETRWPA portion of Henderson County and downdip Sparta wells in central ETRWPA generally had higher TDS results than other areas. The available results in the Queen City-Sparta were well distributed. The average for all of the results is 55 mg/L, and the median for all of the results is 10 mg/L.

Total Dissolved Solids. The TDS concentration was above the secondary MCL of 1,000 mg/L in 2.6% of the results in the Queen City-Sparta aquifer in the ETRWPA. The Queen City wells in the ETRWPA portion of Henderson County and generally had higher TDS results than other counties with Queen City or Sparta wells. The available results in the Queen City-Sparta were well distributed. The average for all of the results is 261 mg/L, and the median for all of the results is 130 mg/L.

1-C.3.4 Yegua-Jackson Water Quality. Table 1-C.4 summarizes the results for the Yegua-Jackson aquifer.

Table 1-C. 4 Groundwater Quality Summaries for Yegua-Jackson Aquifer in the ETRWPA

MCL Class	Constituent	Limit(s)	Units	Total Results	Results Over MCL	% Over	Average	Median
primary	Alpha Radiation	15	pCi/L	15	0	0.0%	< 2	< 2
primary	Arsenic	10	µg/L	34	0	0.0%	< 7	< 10
primary	Barium	2000	µg/L	16	0	0.0%	59	28.4
primary	Cadmium	5	µg/L	32	0	0.0%	< 3	< 5
primary	Chromium	100	µg/L	34	0	0.0%	12	20
primary	Lead	15	µg/L	15	0	0.0%	< 1	< 1
primary	Nitrate (as N)	10	mg/L	200	7	3.5%	1.5	0.09
primary	Selenium	50	µg/L	34	0	0.0%	< 4	< 2
secondary	Copper	1000	µg/L	30	0	0.0%	29	13.045
secondary	Fluoride	2	mg/L	166	3	1.8%	0.5	0.3
secondary	Chloride	300	mg/L	214	18	8.4%	125	65.5
secondary	Iron	300	µg/L	157	51	32.5%	1363	130
secondary	Manganese	50	µg/L	60	11	18.3%	49	20
secondary	pH	6.5 - 8.5	std. units	157	39	24.8%	7.81	8.04
secondary	Sulfate	300	mg/L	214	14	6.5%	113	47.9
secondary	TDS	1000	mg/L	214	38	17.8%	672	557

Alpha. No alpha particles results exceeded the 15 pCi/L primary MCL in the Yegua-Jackson aquifer group in the ETRWPA. The alpha results are not well distributed spatially in the Yegua-Jackson in the ETRWPA, most of the alpha results available are from samples collected in Angelina County. Dissolved alpha particles were not detected in the Yegua-Jackson aquifer in the ETRWPA. All reporting limits were 2 µg/L.

Arsenic. No arsenic results exceeded the 10 µg/L primary MCL in the Yegua-Jackson aquifer group in the ETRWPA. Most of the arsenic results available are from samples collected in Angelina County, although samples were also collected from the Yegua-Jackson in Nacogdoches, Houston, Trinity, and Sabine Counties in the ETRWPA.

Arsenic was not detected in the Yegua-Jackson aquifer in the ETRWPA, and typical reporting limits were 2 and 10 µg/L.

Barium. No barium results exceeded the 2,000 µg/L primary MCL in the Yegua-Jackson aquifer group in the ETRWPA. Most of the barium results available are from samples collected in Angelina County, although samples were also collected from the Yegua-Jackson in Nacogdoches, Houston, Trinity, and Sabine Counties in the ETRWPA. Barium was detected in all but one of the results, and the average of the results is 59 µg/L, and the median is 28.4 µg/L.

Cadmium. No cadmium results exceeded the 5 µg/L primary MCL in the Yegua-Jackson aquifer group in the ETRWPA. Most of the cadmium results available are from samples collected in Angelina County, although samples were also collected from the Yegua-Jackson in Nacogdoches, Houston, Trinity, Polk, and Sabine Counties in the ETRWPA. Cadmium was not detected in any results in the Yegua-Jackson aquifer in the ETRWPA, and typical reporting limits were 1 and 5 µg/L.

Chromium. No chromium results exceeded the 100 µg/L primary MCL in the Yegua-Jackson aquifer group in the ETRWPA. Most of the chromium results available are from samples collected in Angelina County, although samples were also collected from the Yegua-Jackson in Nacogdoches, Houston, Jasper, Polk, Trinity, and Sabine Counties in the ETRWPA. Chromium was detected in less than 25% of the results. The average for all of the results is 12 µg/L, and the median is 20 µg/L.

Lead. No lead results exceeded the 15 µg/L primary MCL in the Yegua-Jackson aquifer group in the ETRWPA. Most of the lead results available are from samples collected in Angelina County, although samples were also collected from the Yegua-Jackson in Houston, Trinity, Polk, Jasper, and Sabine Counties in the ETRWPA. Lead was detected in only two of the results, both at concentrations of less than 2 µg/L.

Nitrate as N. Seven nitrate results (out of 200) exceeded the 10 mg/L (as N) primary MCL in the Yegua-Jackson aquifer group in the ETRWPA. Most of the results that exceed the MCL were from samples collected from shallow wells, but these were not concentrated in any particular area. The remaining results were well distributed spatially throughout the Yegua-Jackson aquifer group in the ETRWPA. Nitrate (as N) was detected above the primary MCL of 10 mg/L in 3.5% of the results in the Yegua-Jackson aquifer in the ETRWPA. The average for all of the results is 1.5 mg/L, and the median for all of the results is 0.09 mg/L.

Selenium. No selenium results exceeded the 50 µg/L primary MCL in the Yegua-Jackson aquifer group in the ETRWPA. Most of the selenium results available are from samples collected in Angelina County, although samples were also collected from the Yegua-Jackson in Jasper, Nacogdoches, Houston, Polk, Trinity, and Sabine Counties in the ETRWPA. Selenium was detected in only one sample in the Yegua-Jackson aquifer in the ETRWPA, and typical reporting limits were 2 – 20 µg/L.

Copper. Copper was not detected above the 1,000 µg/L secondary MCL or the 1,300 µg/L primary MCL in the Yegua-Jackson aquifer in the ETRWPA. Most of the copper results available are from samples collected in Angelina County, although samples were also collected from the Yegua-Jackson in Jasper, Nacogdoches, Houston, Polk, Trinity, and Sabine Counties in the ETRWPA. The average for all of the results is 29 µg/L, and the median is 13 µg/L.

Fluoride. Three fluoride results exceeded the 2 mg/L secondary MCL in the Yegua-Jackson aquifer group in the ETRWPA. All three were from wells completed in the Yegua Formation in Angelina County. One of the three results mentioned in Angelina County was 5 mg/L, which exceeds the 4 mg/L primary MCL. The available results were well distributed spatially throughout the Yegua-Jackson aquifer group in the ETRWPA. Fluoride was detected above the secondary MCL of 2 mg/L in 1.8% of the results in the Yegua-Jackson aquifer in the ETRWPA. Only one result also exceeded the primary MCL of 4 mg/L. The average for all of the results is 0.5 mg/L, and the median for all of the results is 0.3 mg/L.

Chloride. Eighteen chloride results exceeded the 300 mg/L secondary MCL in the Yegua-Jackson aquifer group in the ETRWPA. Most of these results were collected from wells completed in downdip sections of the Yegua Formation in Houston, Trinity, and

Polk Counties. Six Jackson Group wells in these counties also exceeded the secondary MCL. Chloride results are lower on the Yegua outcrop and in downdip sections in Angelina and Sabine Counties. The available chloride results were well distributed spatially throughout the Yegua-Jackson aquifer group in the ETRWPA. Chloride was detected in 8.4% of the results above the secondary MCL of 300 mg/L in the Yegua-Jackson aquifer in the ETRWPA. The average for all of the results is 125 mg/L, and the median for all of the results is 65.5 mg/L.

Iron. About one-third of the available results in the Yegua-Jackson exceeded the 300 µg/L secondary MCL for iron. No significant trends were observed in these results. The available results were well distributed spatially throughout the Yegua-Jackson aquifer group in the ETRWPA. Iron was detected above the secondary MCL of 300 µg/L in 32.5% of the results in the Yegua-Jackson aquifer in the ETRWPA. Iron was detected in approximately 90% of the results, and the average for all of the results is 1363 µg/L, and the median for all of the results is 130 µg/L, indicating that the average is significantly skewed upward due to the presence of a limited number of very high values.

Manganese. Eleven manganese results exceeded the 50 µg/L secondary MCL in the Yegua-Jackson aquifer group in the ETRWPA. Five of these results were from samples collected from wells completed in the Yegua Formation near Lufkin in Angelina County. Other sample results exceeding the current MCL were collected in Houston, Nacogdoches, and Polk Counties. Most of the manganese results available are from samples collected in Angelina County, although samples were also collected from the Yegua-Jackson in Jasper, Nacogdoches, Houston, Polk, Trinity, and Sabine Counties in the ETRWPA. Manganese was detected in 18.3% of the results above the secondary MCL of 50 µg/L in the Yegua-Jackson aquifer in the ETRWPA. Manganese was detected approximately in half of the results, and the average for all of the results is 49 µg/L, and the median for all of the results is 20 µg/L.

pH. About one-quarter of results from the Yegua-Jackson aquifer group were outside of the 6.5 - 8.5 secondary MCL range in the ETRWPA. The majority of these out-of-range results exceeded the 8.5 upper pH MCL, and were from samples collected from wells in downdip areas. The results that were below the lower 6.5 pH MCL were from samples collected from wells in outcrop areas. The available results were well distributed throughout the Yegua-Jackson in the ETRWPA. The pH of water samples was outside the secondary MCL range of 6.5 to 8.5 in 24.8% of the results in the Yegua-Jackson aquifer in the ETRWPA. The range of all of the results was 5.33 to 9. The average pH was 7.8, and the median pH was 8.0.

Sulfate. Sulfate was detected in 6.5% of the results above the secondary MCL of 300 mg/L in the Yegua-Jackson aquifer in the ETRWPA. Most of these were in the downdip area of the Yegua Formation throughout the ETRWPA. The available results were well distributed throughout the Yegua-Jackson in the ETRWPA. The average for all of the results is 113 mg/L, and the median for all of the results is 47.9 mg/L.

Total Dissolved Solids. The TDS concentration was above the secondary MCL of 1,000 mg/L in 17.8% of the results in the Yegua-Jackson aquifer in the ETRWPA. Most of these results were from samples collected from downdip Yegua Formation wells. The available results were well distributed throughout the Yegua-Jackson in the ETRWPA. The average for all of the results is 672 mg/L, and the median for all of the results is 557 mg/L.

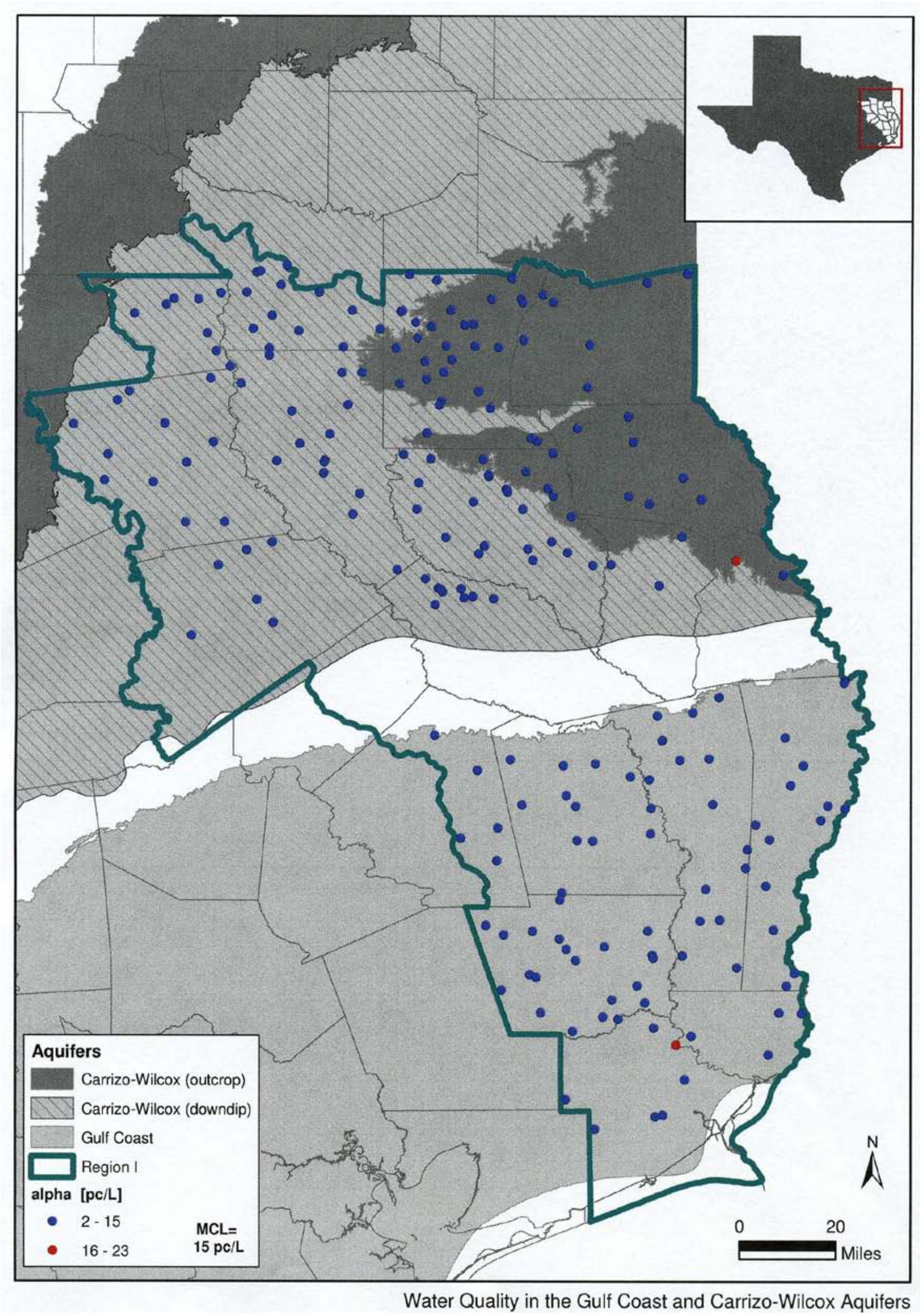

Figure 1-C.1 Distribution of Alpha in Groundwater in the ETRWPA

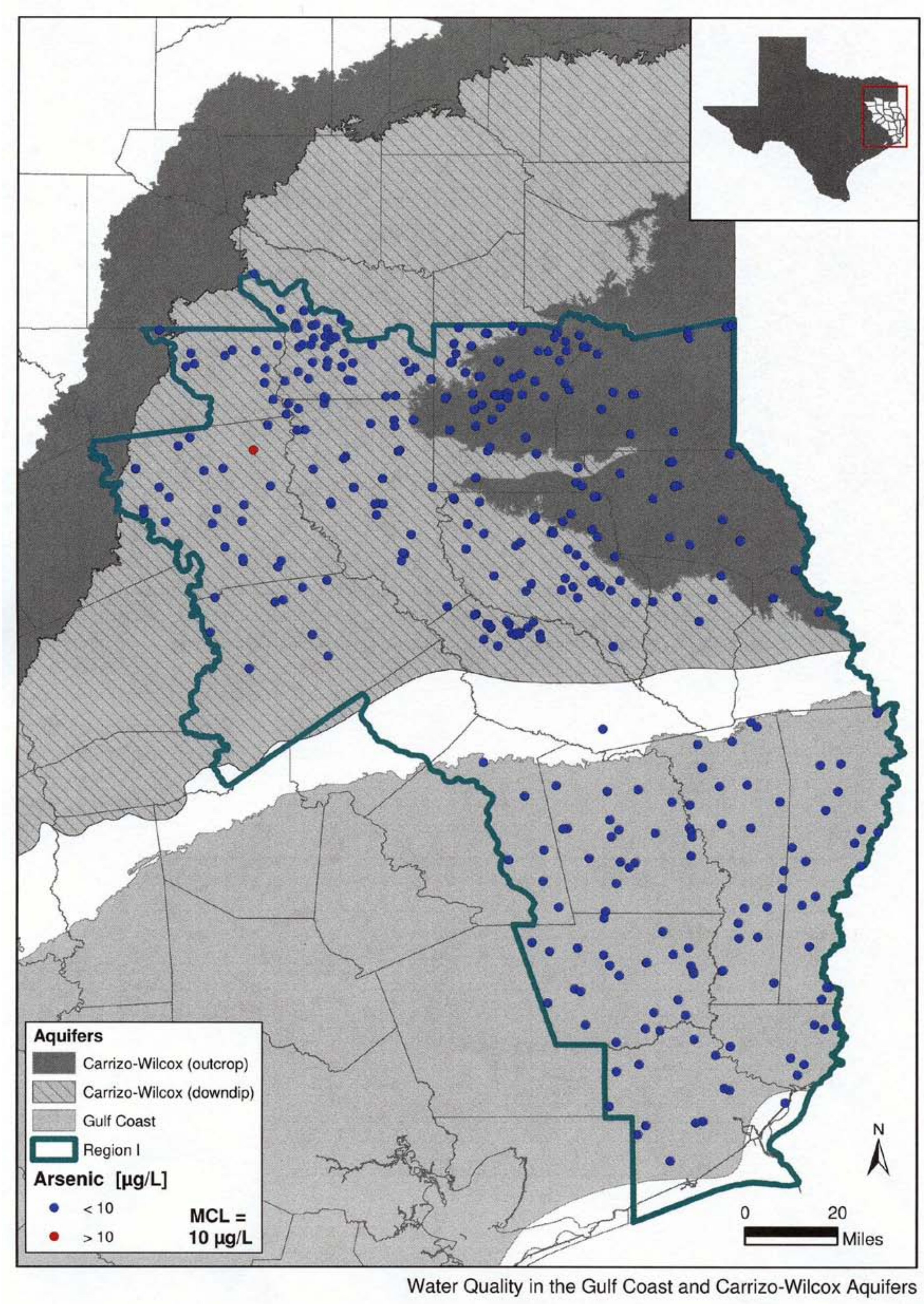

Figure 1-C.2 Distribution of Arsenic in Groundwater in the ETRWPA

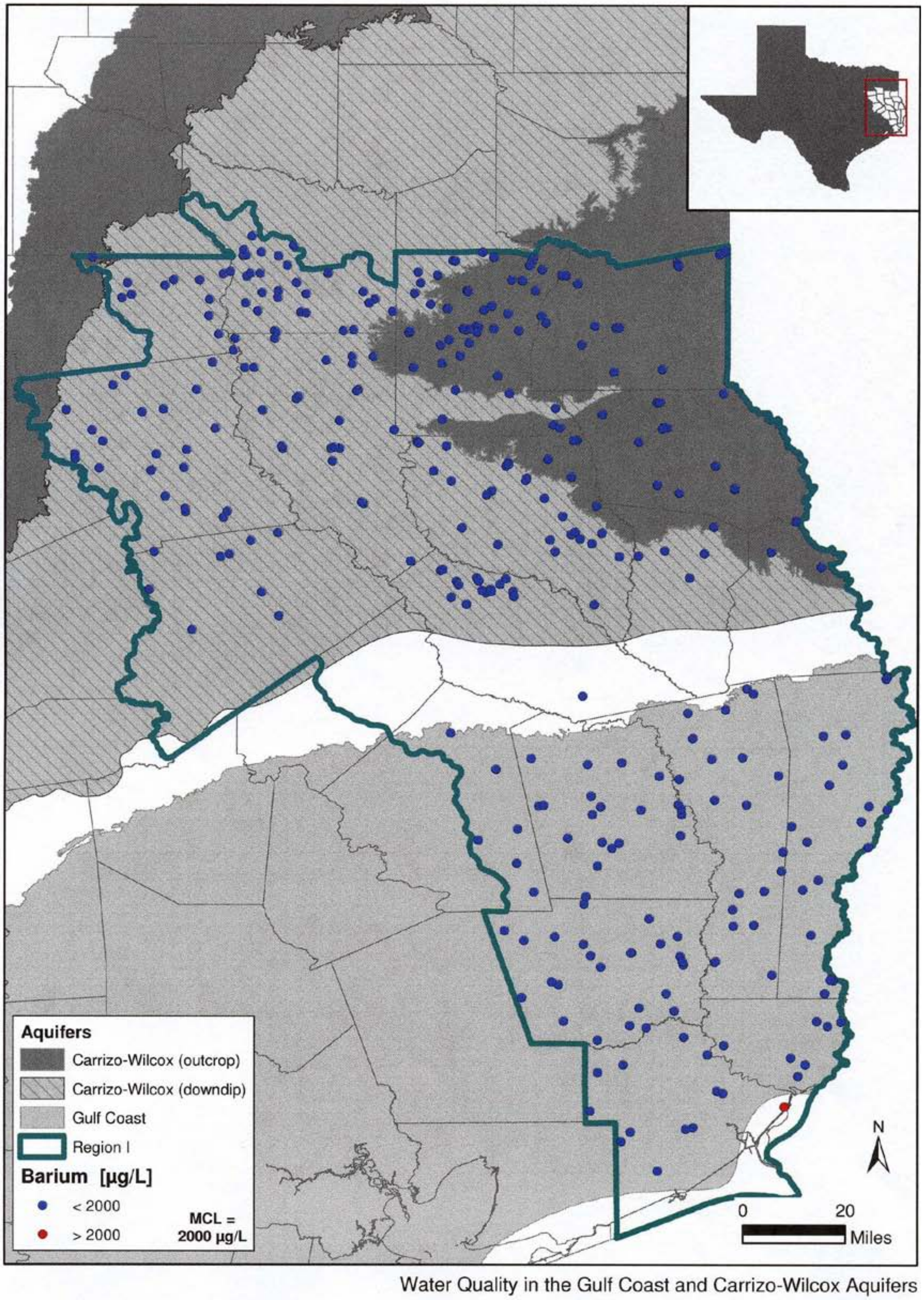

Figure 1-C.3 Distribution of Barium in Groundwater in the ETRWPA

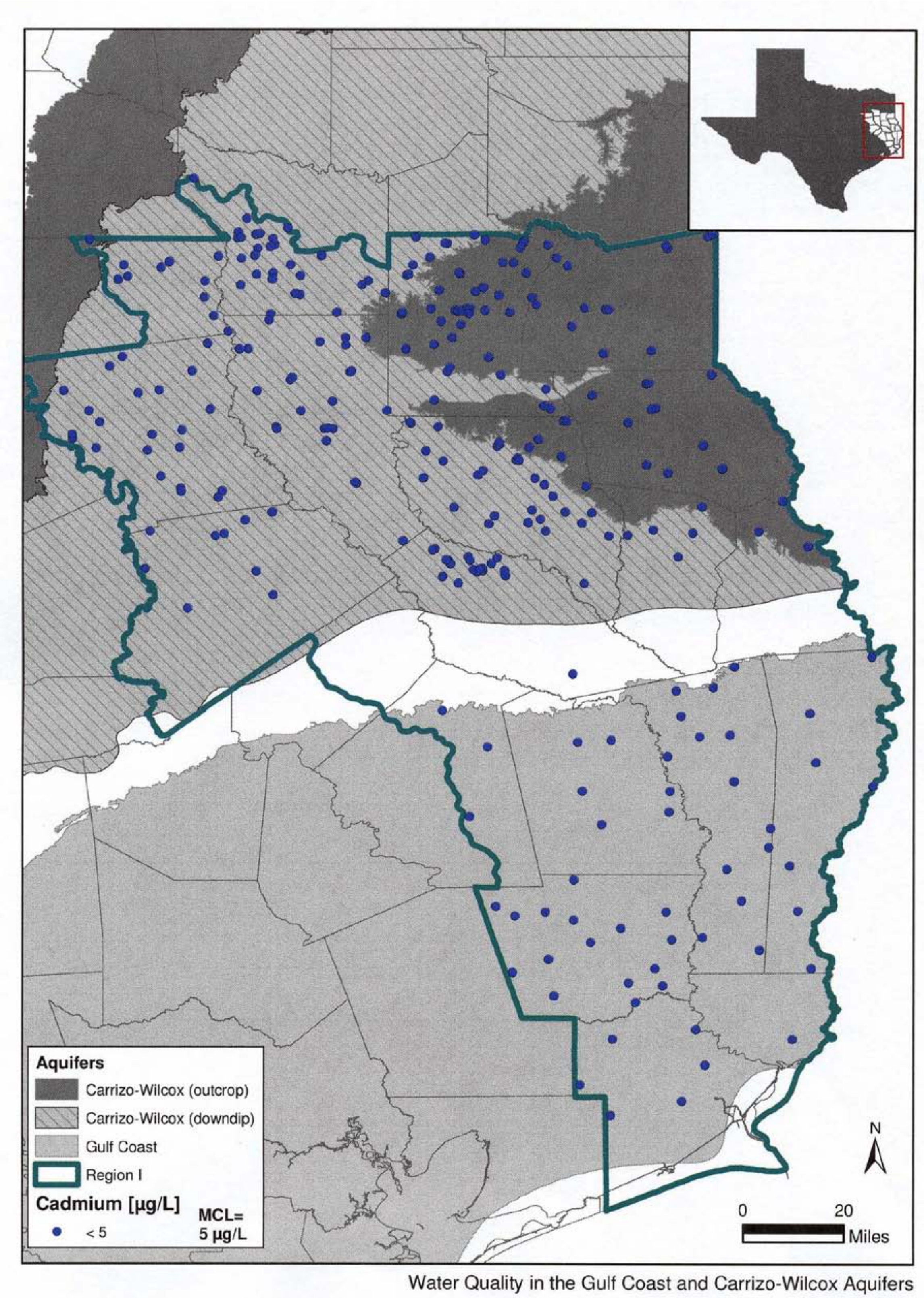

Figure 1-C.4 Distribution of Cadmium in Groundwater in the ETRWPA

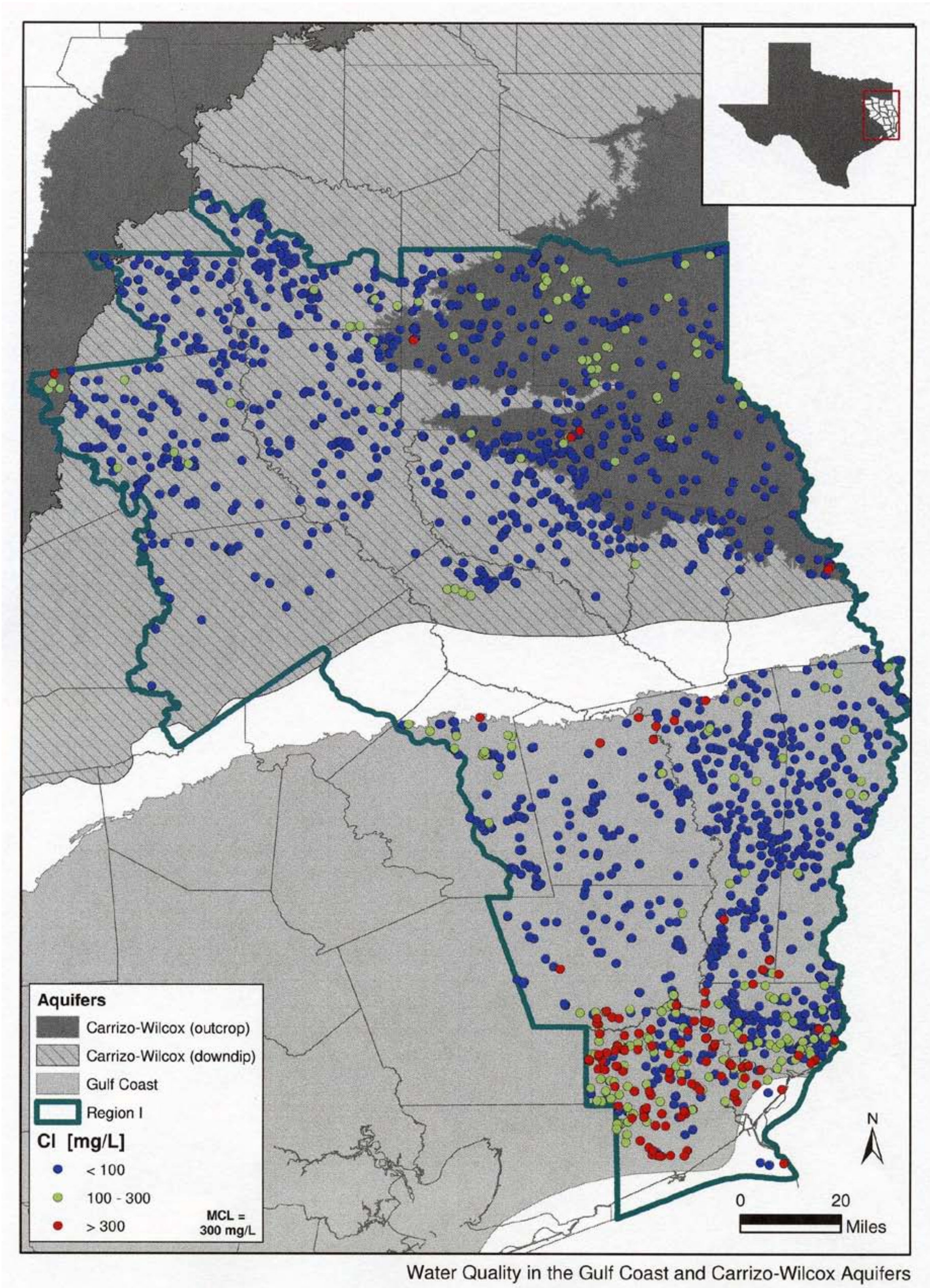

Figure 1-C.5 Distribution of Chloride in Groundwater in the ETRWPA

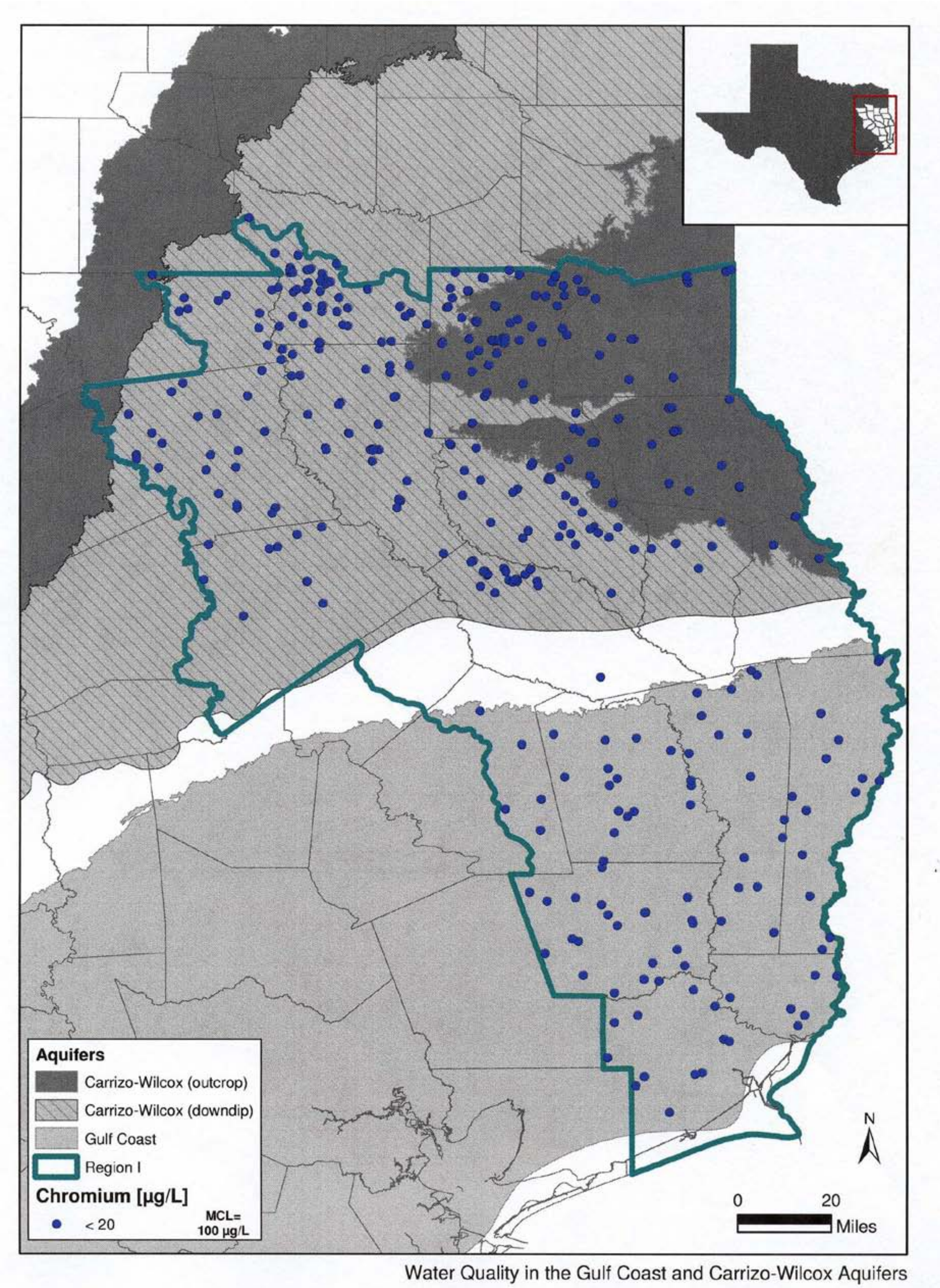

Figure 1-C.6 Distribution of Chromium in Groundwater in the ETRWPA

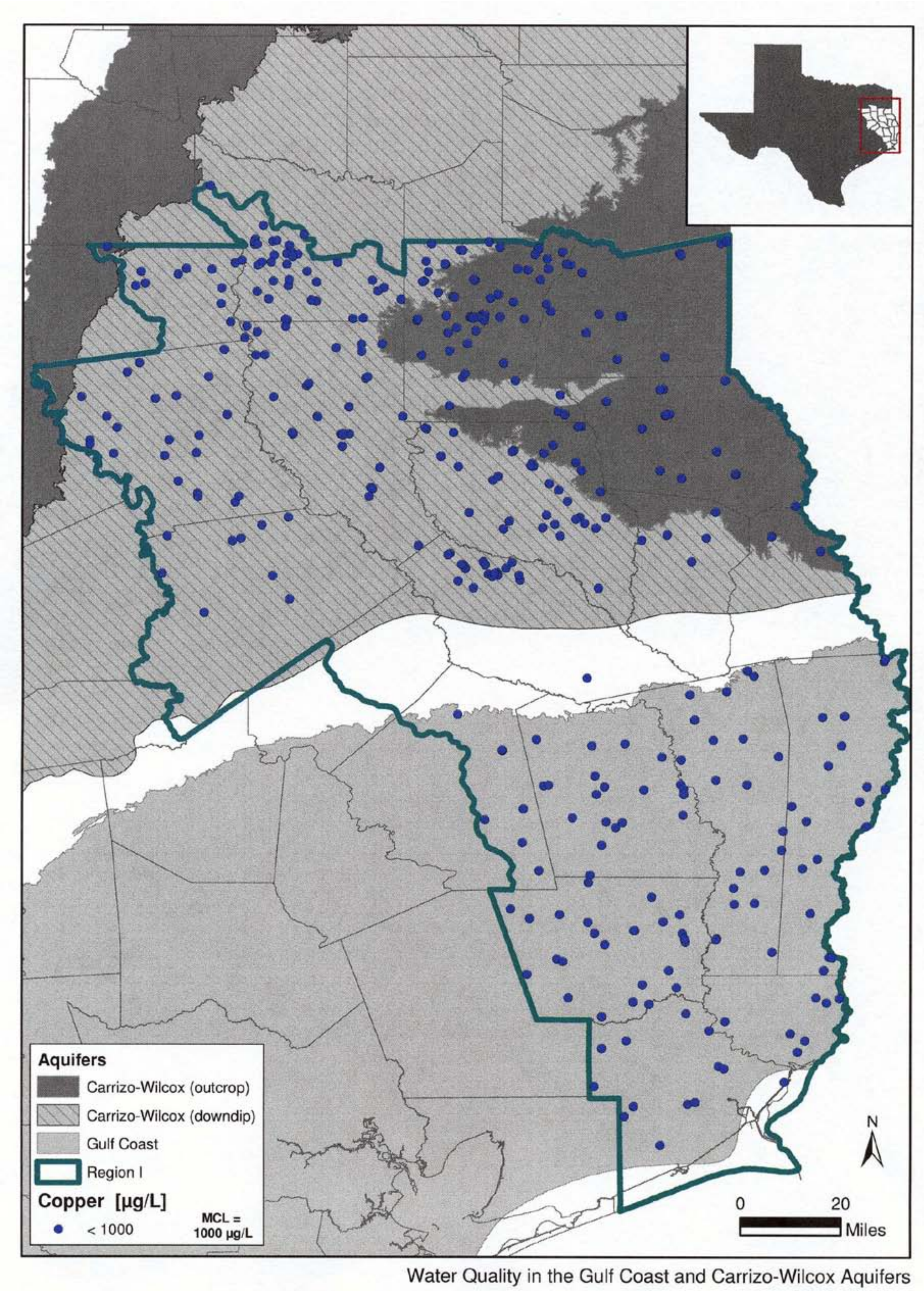

Figure 1-C.7 Distribution of Copper in Groundwater in the ETRWPA

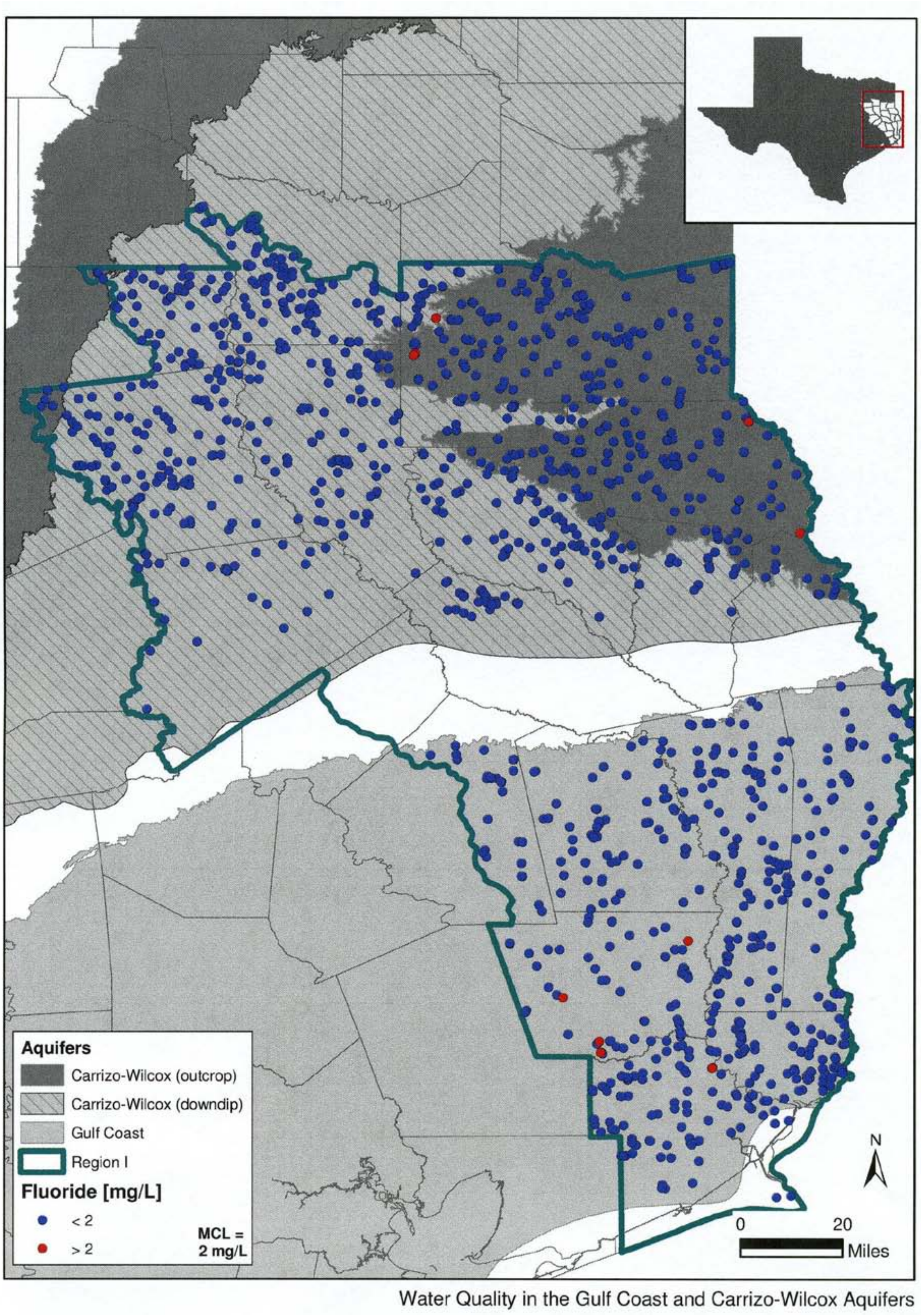

Figure 1-C.8 Distribution of Fluoride in Groundwater in the ETRWPA

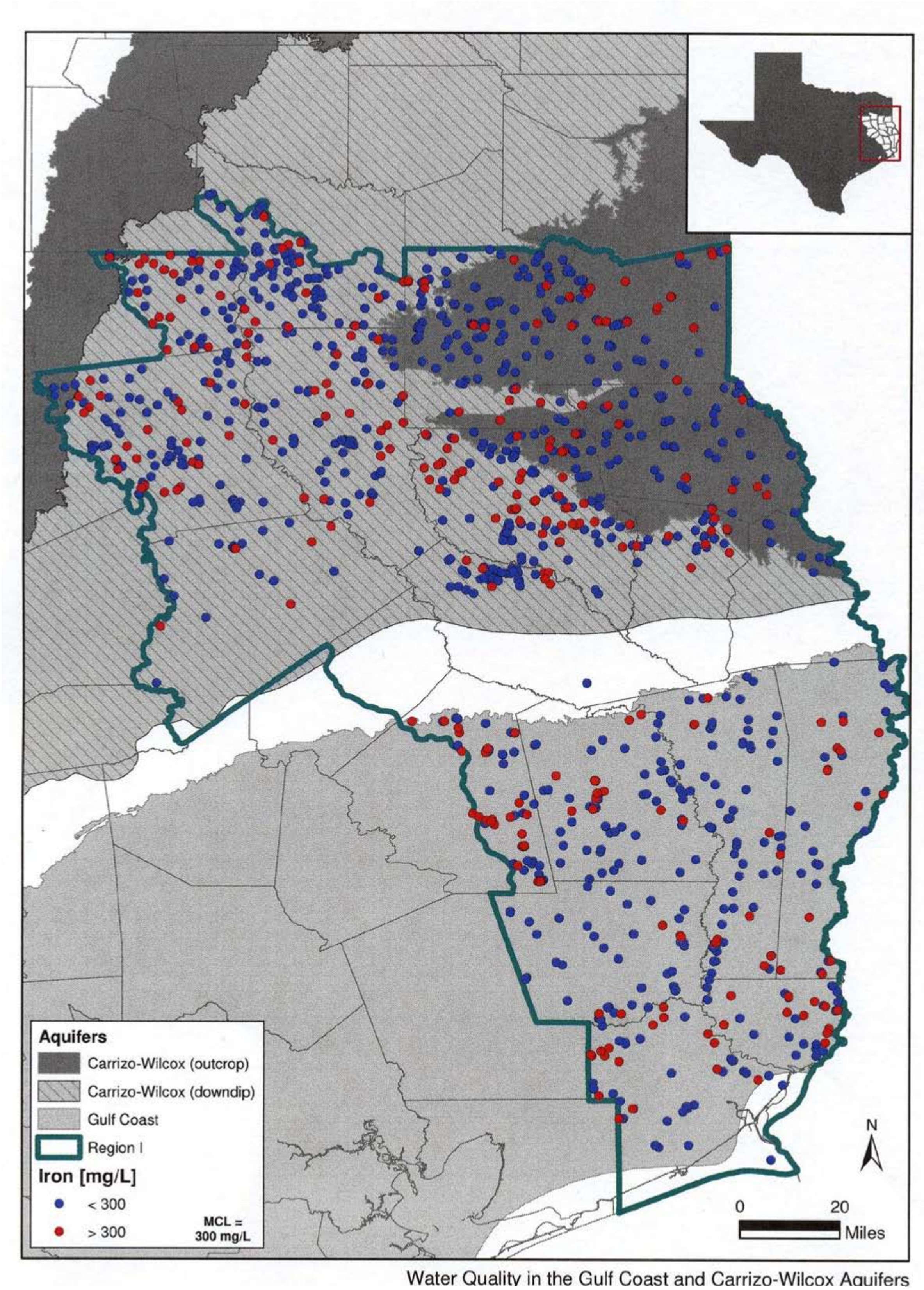

Figure 1-C.9 Distribution of Iron in Groundwater in the ETRWPA

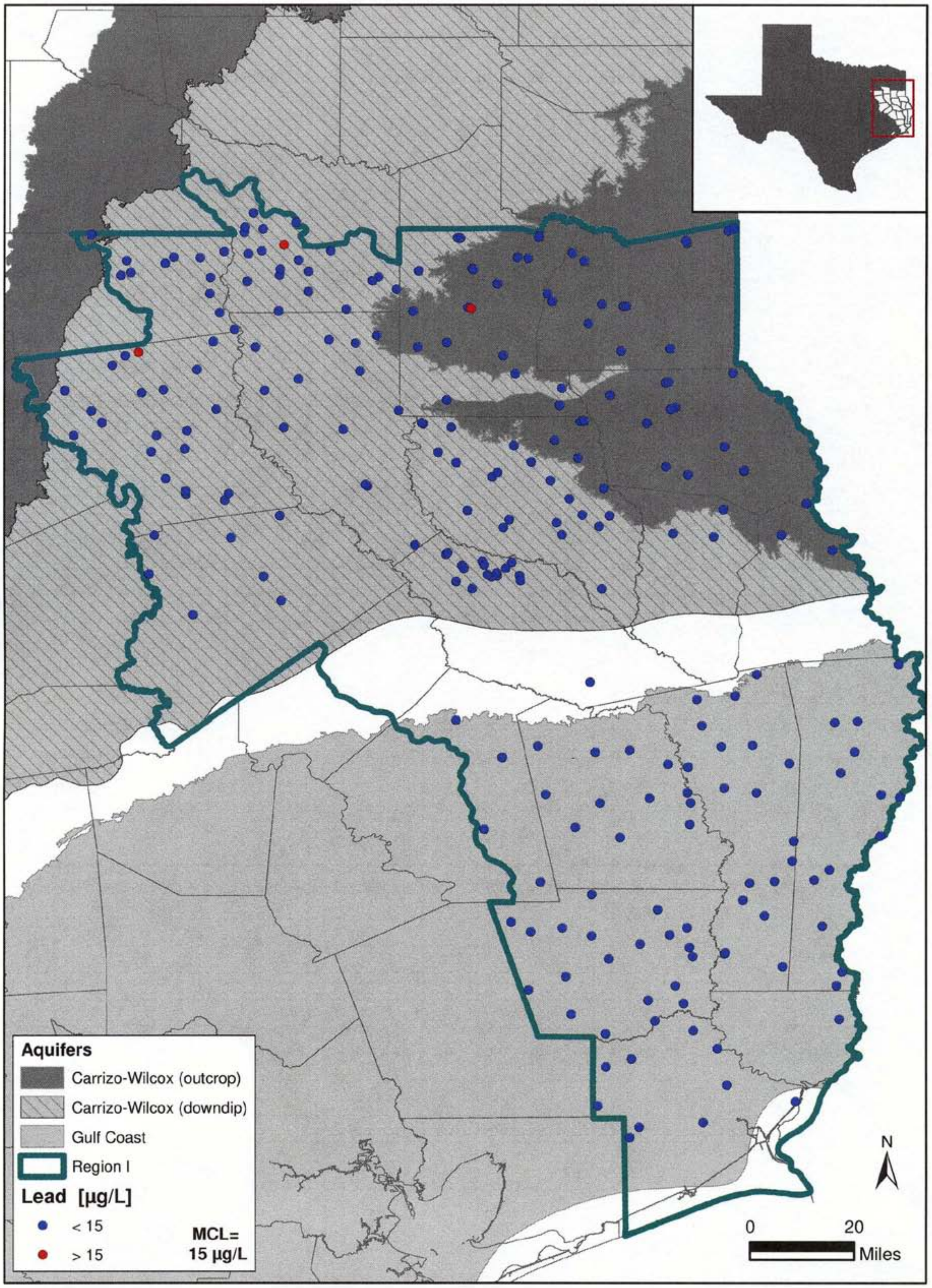

Figure 1-C.10 Distribution of Lead in Groundwater in the ETRWPA

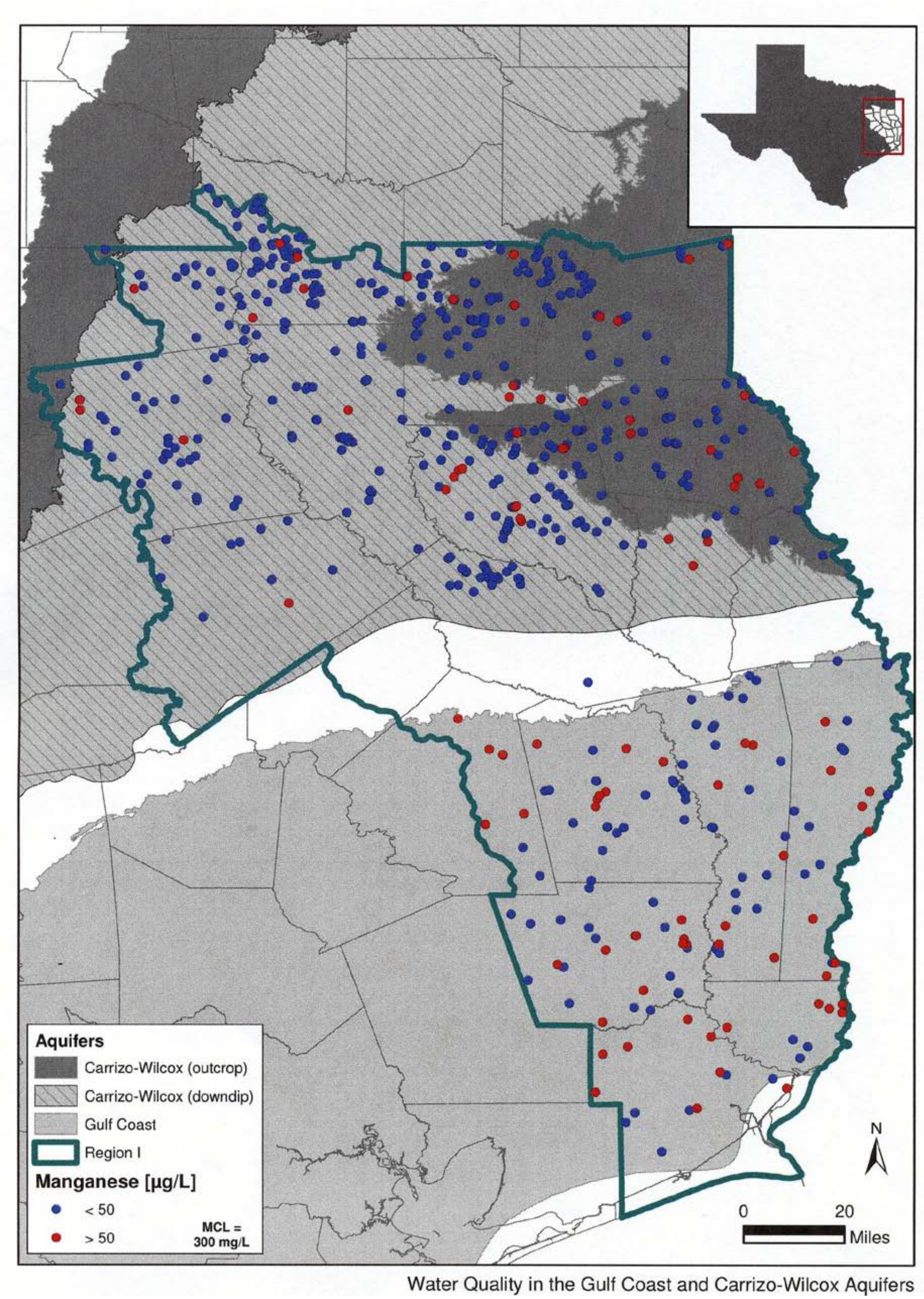

Figure 1-C.11 Distribution of Manganese in Groundwater in the ETRWPA

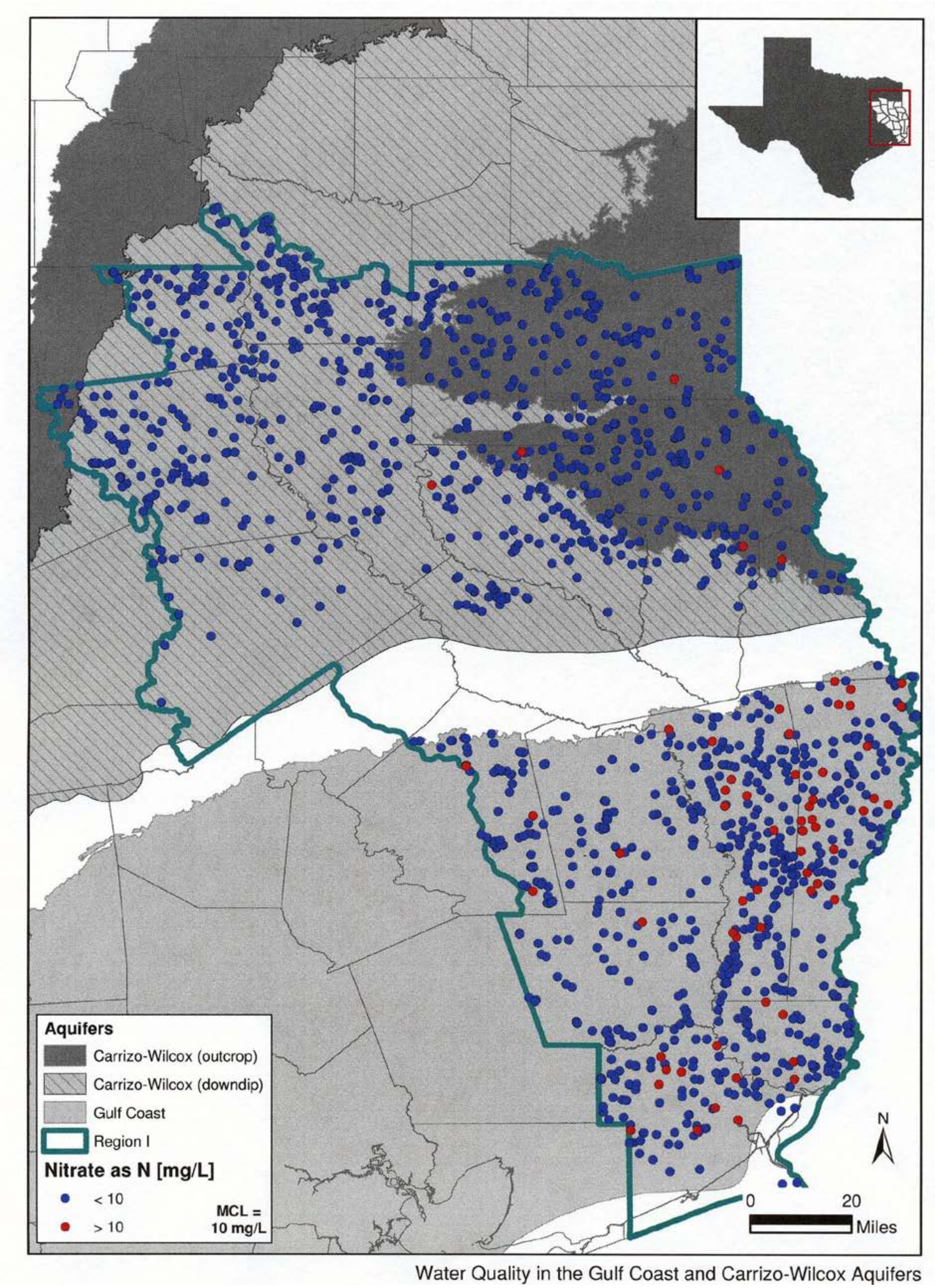

Figure 1-C.12 Distribution of Nitrate as Nitrogen in Groundwater in the ETRWPA

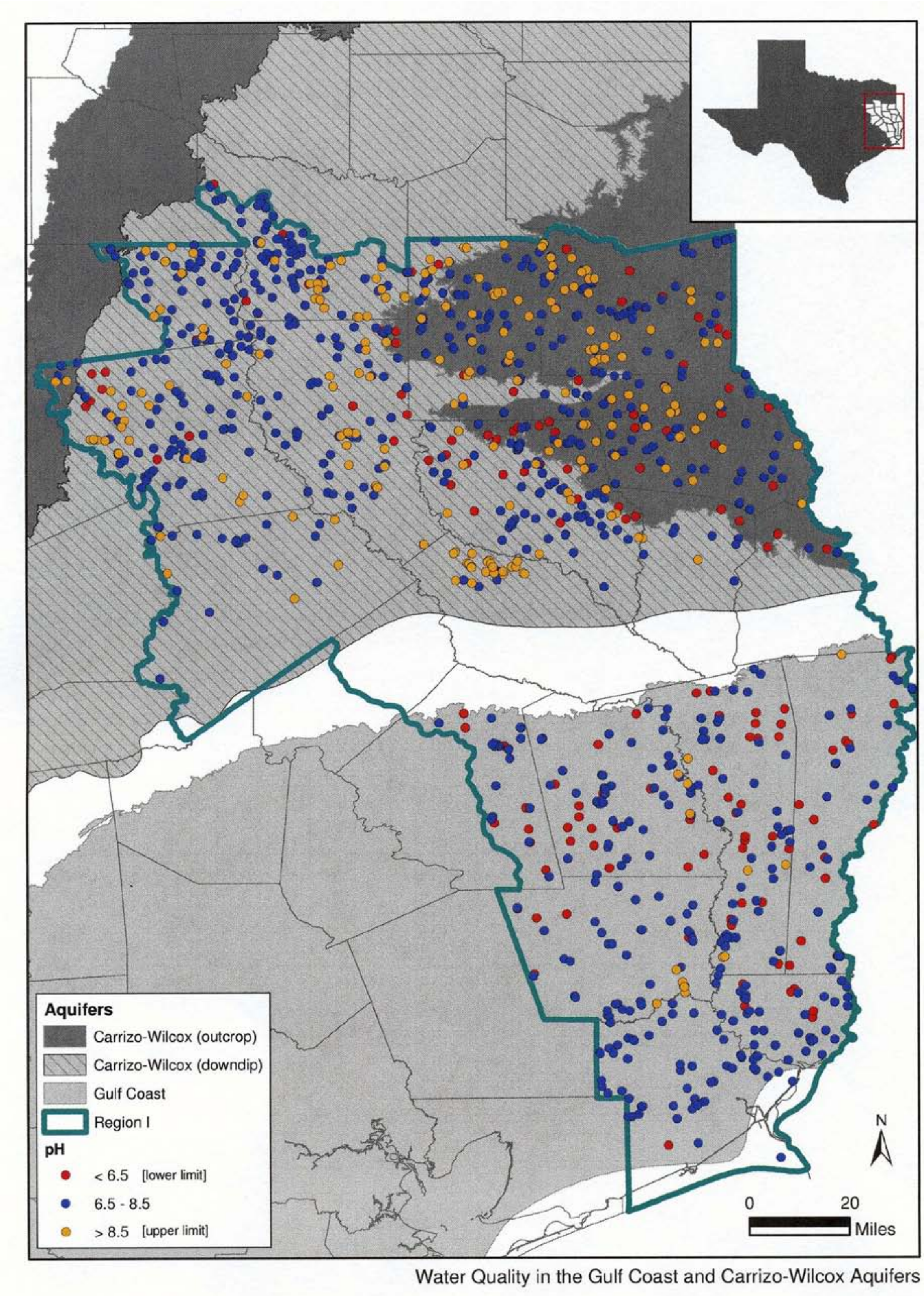

Figure 1-C.13 Distribution of pH in Groundwater in the ETRWPA

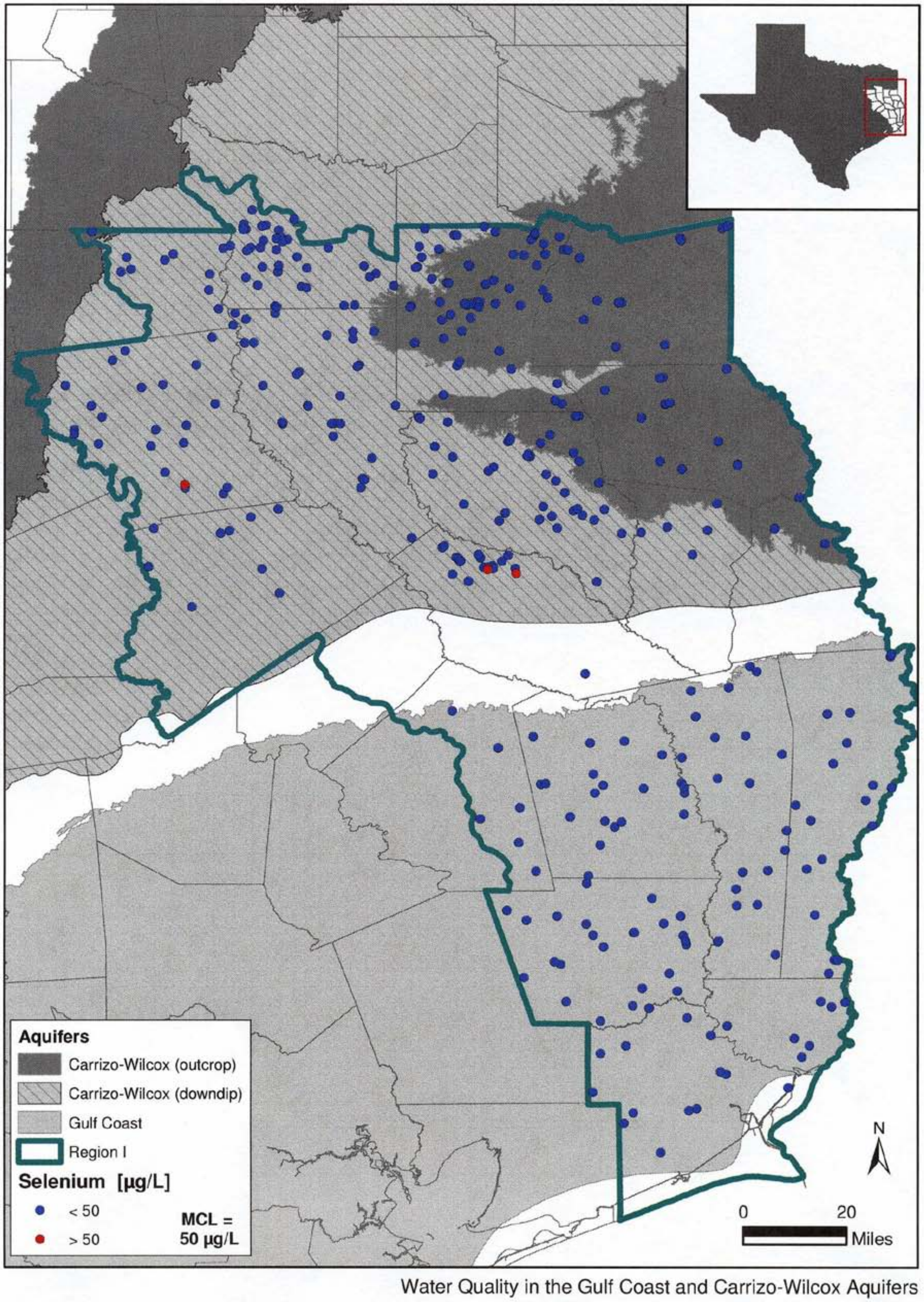

Figure 1-C.14 Distribution of Selenium in Groundwater in the ETRWPA

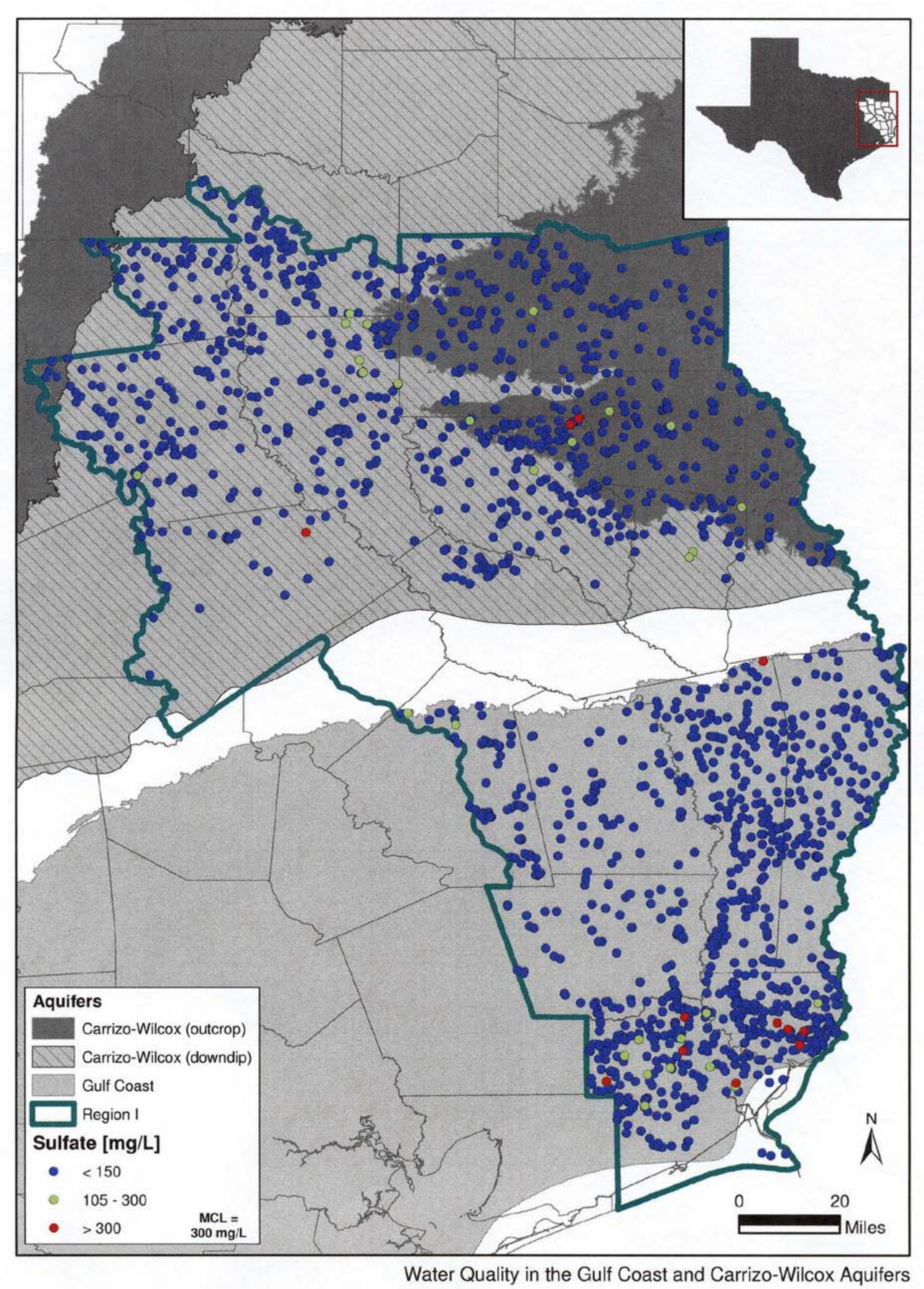

Figure 1-C.15 Distribution of Sulfate in Groundwater in the ETRWPA

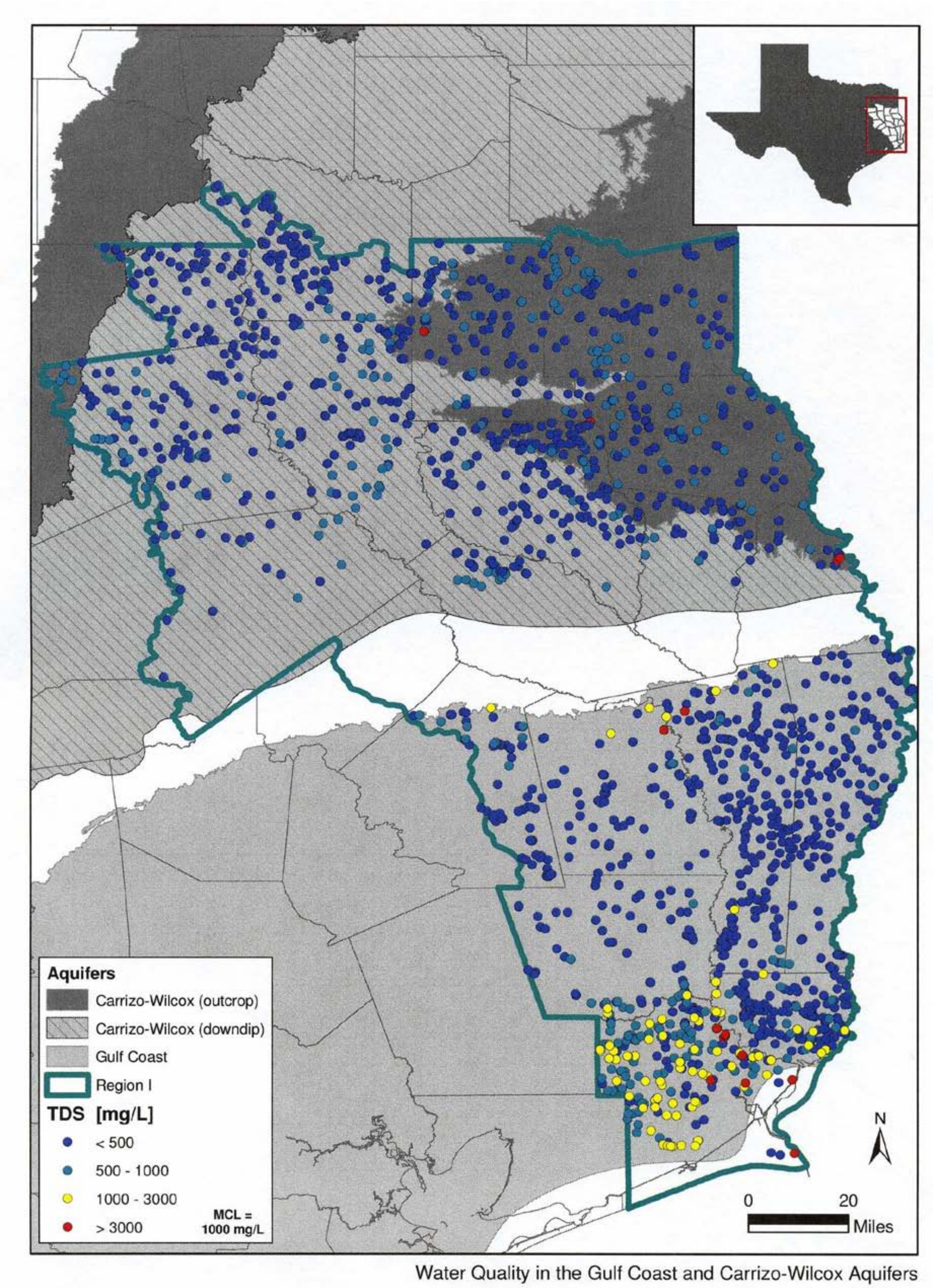

Figure 1-C.16 Distribution of Total Dissolved Solids in Groundwater in the ETRWPA

Appendix 1-D

Water Loss and Water Loss Audits

The TWDB established new requirements requiring water audit reporting for public utilities that provide potable water. Every five years public utilities must perform a water audit computing the utility's most recent annual water loss. This appendix provides the Executive Summary and water loss comparison by regional water planning area from the report prepared for the TWDB entitled, *An Analysis of Water Loss as Reported by Public Water Suppliers in Texas*.

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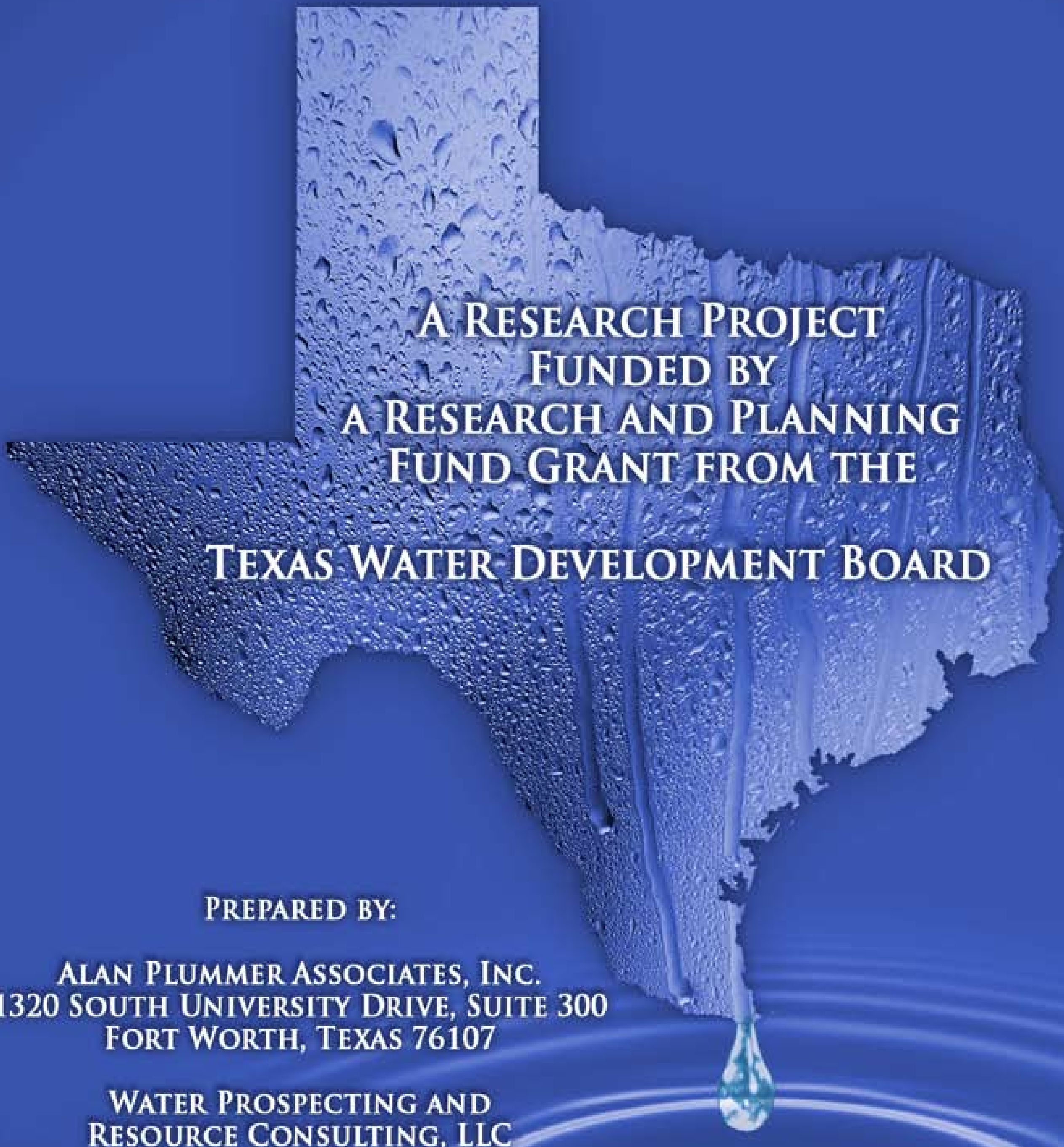
Final Report

An Analysis of Water Loss as Reported by Public Water Suppliers in Texas



A Research Project Funded by a Research and Planning Fund Grant from the

Texas Water Development Board

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January 24, 2007

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1 EXECUTIVE SUMMARY – ANALYSIS OF WATER LOSS

The first broad analysis of water loss for retail public utilities in Texas reveals that:

- Approximately half of retail public utilities in Texas reported their water loss data.
- Reporting utilities serve as much as 84 percent of the state's population.[1]
- A substantial amount of water (the balancing adjustment) was not attributed to any water use category, causing significant uncertainty in estimates of water loss and non-revenue water.
- Reporting utilities experienced total water loss[2] of 212,221 to 464,219 acre-feet per year,[3] or 5.6 to 12.3 percent[3] of all water entering the reporting systems. Based on the 2004 statewide average municipal water use of 150 gallons per capita per day,[A,4] equivalent water volumes could supply between 1.3 million and 2.7 million Texans.[5]
- Reporting utilities experienced non-revenue water[6] of 311,333 to 563,331 acre-feet per year,[3] or 8.3 to 15.0 percent[3] of all water entering the reporting systems.
- When extrapolated to all retail public utilities in Texas, the statewide value of total water loss is estimated to be between $152 million and $513 million per year.
- Reporting utilities may have underestimated their real water loss.

This research provides information necessary for the Texas Water Development Board (TWDB), Regional Water Planning Groups (RWPGs), and retail public utilities to direct planning and funding resources, to recover lost revenue through reduction of non-revenue water, and to achieve water savings through reduction of real loss.

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1 This percentage is uncertain because some utilities reported both retail and wholesale customer populations.
2 Total water loss includes real loss (water that was physically lost from the system, such as main breaks and leaks, customer service line breaks and leaks, and storage overflows) and apparent loss (water that was not accurately measured and billed to a customer, such as unauthorized consumption, customer meter under-registering, and billing adjustment and waivers).
3 The smaller number is the total reported by the utilities. The larger number is based on the assumption that the entire balancing adjustment is water loss.
4 References are denoted with letters and are presented in Chapter 17. Footnotes are denoted with numbers and are presented at the bottom of the same page.
5 However, it is not possible to recover all water loss.
6 Non-revenue water includes real loss, apparent loss, and unbilled authorized consumption. Unbilled authorized consumption includes water used for fire fighting, sewer flushing, etc.

1.A Introduction

Water loss minimization can be an important water conservation strategy for retail water suppliers. Historically, retail public utilities have lacked detailed knowledge about their water loss performance. This is due partially to a lack of careful water auditing and partially to inconsistent water loss reporting using non-uniform statistics, including the use of "unaccounted-for water" percentages to compare performance. As a result, utilities may not know whether their water losses are due to leaks, accounting practices, theft, metering problems, or other factors, and may have difficulty developing water loss minimization strategies.

To address the lack of information on water loss, the 78th Texas Legislature passed House Bill 3338, which required retail public utilities that provide potable water to "perform and file with the [Texas Water Development Board] a water audit computing the utility's most recent annual system water loss"[B] every five years. Under this authority, the Texas Water Development Board (TWDB) instituted new water audit reporting requirements[C] that require retail public utilities to carefully audit their system water use at least once every five years; to estimate system water use in standard, well defined categories; and to report their first set of water loss data to the TWDB by March 31, 2006.

The new water audit reporting requirements follow a methodology that is recommended by the International Water Association (IWA) and the American Water Works Association (AWWA) Water Loss Control Committee. This methodology relies on strictly defined water use categories (Table 1-1) and water loss performance indicators and is becoming the international water loss accounting standard. The IWA Water Loss Task Force (which included AWWA participation) developed this methodology from 1997 through 2000.[D] The first reference to the methodology's performance indicators was published in 2000.[E (cited in D)]

The U.S. Bureau of Reclamation (BOR) has designated a number of "hot spots" in the Western U.S. where existing water supplies are projected to be inadequate to meet the demands of people, farms, and the environment by the year 2025, including six hot spots in Texas.[F] As part of the Water 2025 Program, the BOR offered Challenge Grants to fund projects related to "water conservation, efficiency and markets and collaboration. Recognizing this program as an opportunity to partner with the BOR, to leverage its existing budget, and to enhance conservation technical assistance, the TWDB applied for and received a Challenge Grant for two purposes: 1) to purchase 10 acoustical leak-detection units and make them available to public water suppliers, and 2) to perform an analysis of water loss in Texas, using water loss data provided by public water suppliers. The TWDB solicited proposals for the analysis of water loss and subsequently awarded a Research and Planning Fund Grant to the research team of Alan Plummer Associates, Inc., and Water Prospecting and Resource Consulting, LLC.

This executive summary describes the results of a research project to examine the reported water loss data for consistency, errors, omissions, and other quality control issues; to calculate water loss performance statistics; to compare water loss performance by utility location, type, and size; and to make recommendations for improving the water audit reporting process. The details of the data quality control are discussed in later chapters. A statewide summary of water loss performance, comparative analysis of water loss performance, and recommendations are presented below.

1.B Statewide Summary of Water Loss Performance

For reporting utilities, statewide totals for each water use category are shown in Table 1-1 (acre-feet), Table 1-2 (gallons), and Table 1-3 (percent of corrected input volume). The total reported corrected input volume[7] is 3,761,965 acre-feet over approximately one year. This figure includes retail water sales and wholesale water sales[8] for the reporting utilities.

The balancing adjustment in Table 1-1 through Table 1-3 is the water volume remaining after authorized consumption and total water loss are subtracted from the amount of water that entered the utility system (the corrected input volume). If a utility perfectly accounts for its water use, the balancing adjustment equals zero.

[7] Corrected input volume is the amount of water that was actually delivered to a utility, including water that was not measured by the master meter(s).
[8] A retail water sale is the sale of water to the end user. A wholesale water sale is the sale of water to a utility that resells the water.

Table 1-1: Statewide Totals of Reported Water Loss* (acre-feet)

Corrected input volume (3,758,484)	Authorized consumption (3,294,265)	Billed authorized consumption (3,195,153)	Billed metered consumption (3,190,972)	Revenue water (3,195,153)
			Billed unmetered consumption (4,181)	
		Unbilled authorized consumption (99,112)	Unbilled metered consumption (52,698)	Non-revenue water (311,333)
			Unbilled unmetered consumption (46,414)	
	Water losses (212,221)	Apparent losses (109,310)	Unauthorized consumption (10,770)	
			Customer meter under-registering (87,218)	
			Billing adjustment and waivers (11,322)	
		Real losses (102,910)	Main breaks and leaks (83,529)	
			Storage overflows (3,341)	
			Customer service line breaks and leaks (16,040)	
	Balancing Adjustment** (251,998)			

* Over approximately one year. Most utilities reported data for calendar or fiscal year 2005.

** Balancing adjustment is the corrected input volume minus authorized consumption minus total water loss. If all water is fully attributed to the various potential uses, balancing adjustment is zero. Balancing adjustment may consist of underestimated real loss, apparent loss, or authorized consumption. Without further refinement of a utility's water audit, there is no accurate *ad hoc* method for determining the actual water use for water that has been allocated to balancing adjustment.

Table 1-2: Statewide Totals of Reported Water Loss* (gallons)

<table>
<tr><td rowspan="11">Corrected input volume
(1,224,705,675,107)</td><td rowspan="4">Authorized consumption
(1,073,439,695,489)</td><td rowspan="2">Billed authorized consumption
(1,041,143,853,511)</td><td>Billed metered consumption
(1,039,781,485,415)</td><td rowspan="2">Revenue water
(1,041,143,853,511)</td></tr>
<tr><td>Billed unmetered consumption
(1,362,368,096)</td></tr>
<tr><td rowspan="2">Unbilled authorized consumption
(32,295,841,978)</td><td>Unbilled metered consumption
(17,171,730,325)</td><td rowspan="8">Non-revenue water
(101,448,133,344)</td></tr>
<tr><td>Unbilled unmetered consumption
(15,124,111,653)</td></tr>
<tr><td rowspan="6">Water losses
(69,152,291,366)</td><td rowspan="3">Apparent losses
(35,618,824,222)</td><td>Unauthorized consumption
(3,509,318,446)</td></tr>
<tr><td>Customer meter under-registering
(28,420,204,130)</td></tr>
<tr><td>Billing adjustment and waivers
(3,689,301,646)</td></tr>
<tr><td rowspan="3">Real losses
(33,533,467,144)</td><td>Main breaks and leaks
(27,218,129,878)</td></tr>
<tr><td>Storage overflows
(1,088,723,441)</td></tr>
<tr><td>Customer service line breaks and leaks
(5,226,613,826)</td></tr>
<tr><td colspan="4">Balancing Adjustment**
(82,113,688,252)</td></tr>
</table>

* Over approximately one year. Most utilities reported data for calendar or fiscal year 2005.

** Balancing adjustment is the corrected input volume minus authorized consumption minus total water loss. If all water is fully attributed to the various potential uses, balancing adjustment is zero. Balancing adjustment may consist of underestimated real loss, apparent loss, or authorized consumption. Without further refinement of a utility's water audit, there is no accurate *ad hoc* method for determining the actual water use for water that has been allocated to balancing adjustment.

Table 1-3: Statewide Percentages of Reported Water Loss*

Corrected input volume (100.0)	Authorized consumption (87.6)	Billed authorized consumption (85.0)	Billed metered consumption (84.9)	Revenue water (85.0)
			Billed unmetered consumption (0.1)	
		Unbilled authorized consumption (2.6)	Unbilled metered consumption (1.4)	Non-revenue water (8.3)
			Unbilled unmetered consumption (1.2)	
	Water losses (5.6)	Apparent losses (2.9)	Unauthorized consumption (0.3)	
			Customer meter under-registering (2.3)	
			Billing adjustment and waivers (0.3)	
		Real losses (2.7)	Main breaks and leaks (2.2)	
			Storage overflows (0.1)	
			Customer service line breaks and leaks (0.4)	
	Balancing Adjustment** (6.7)			

* Over approximately one year. Most utilities reported data for calendar or fiscal year 2005.

** Balancing adjustment is the corrected input volume minus authorized consumption minus total water loss. If all water is fully attributed to the various potential uses, balancing adjustment is zero. Balancing adjustment may consist of underestimated real loss, apparent loss, or authorized consumption. Without further refinement of a utility's water audit, there is no accurate *ad hoc* method for determining the actual water use for water that has been allocated to balancing adjustment.

Some or all of the balancing adjustment is due to underestimation of real and apparent water losses. Without further refinement of a utility's water audit, there is no accurate *ad hoc* method for determining the actual water use for water that has been allocated to balancing adjustment. Therefore, for a given water loss performance indicator, a range of potential values are presented. One end of the range is calculated directly from the reported water loss data, and the other end of the range is based on the assumption that all of the balancing adjustment is unreported water loss (either real or apparent, depending on the performance indicator). The balancing adjustment may be a positive quantity or a negative quantity.

Assuming the real loss is valued at the marginal production water cost and that apparent loss and the balancing adjustment are valued at the retail water cost, the estimated value of total water loss in Texas is between $152 million and $513 million per year.[9] Adding the value of unbilled authorized consumption to these totals gives an estimated value of non-revenue water in Texas between $253 million and $635 million. To increase the reliability and narrow the range of these estimates, the production and retail water costs must be more uniformly reported, and utilities must refine their water accounting, thereby reducing the balancing adjustment.

Statewide median and average water loss performance indicators are shown in Table 1-4. Generally speaking, the balancing adjustment is too large in relation to other quantities to draw reliable conclusions about water loss trends. From all reported data, balancing adjustment was 6.7 percent of total corrected input volume, while real loss was 2.7 percent, and apparent loss was 2.9 percent. On average, therefore, the balancing adjustment is larger than sum of the real and apparent losses. Given similar statistics, an individual utility would not be able to determine whether its best strategy is to reduce real loss or to reduce apparent loss.

The screening-level infrastructure leakage index (SLILI) is the real loss divided by the theoretical unavoidable annual real loss. In theory, the SLILI should not be less than one, because the real loss should not be less than the unavoidable real loss. However, the statewide median SLILI is 0.22 when calculated from reported data. In addition, the statewide median real loss is 3.6 gallons per connection per day, which is only about 23 percent of the lowest identified

[9] This estimate is not fully reliable, because up to 10 percent of the reported production and retail water costs were modified as discussed in Chapters 3.B.13 and 3.B.14. Not all non-revenue water can be recovered.

Table 1-4: Statewide Summary of Reported Water Loss Data

Statistic or Performance Indicator	Units	Median from Reported Data	Median With Balancing Adjustment Assumption	Average from Reported Data	Average With Balancing Adjustment Assumption
Absolute Value of Balancing Adjustment/Corrected Input Volume[10]	%	2.6	2.6	7.1	7.1
Real Loss per Mile of Main Per Day	gal/mi/day	77	233	204	417
Real Loss per Service Connection per Day	gal/conn/day	3.6	18.8	14	51
Apparent Loss per Service Connection per Day	gal/conn/day	6.4	17.5	15	51
Non-Revenue Water/Corrected Input Volume	%	7.3	13.4	8.3	15.0
Value of Real Loss per Mile of Main Per Day	$/mi/day	0.12	0.31	0.24	0.49
Value of Real Loss per Service Connection per Day	$/conn/day	0.004	0.018	0.010	0.040
Value of Apparent Loss per Service Connection per Day	$/conn/day	0.018	0.046	0.042	0.140
Screening-Level Infrastructure Leakage Index (SLILI)[11]	--	0.22	2.04	1.08	4.10

[10] The average of the absolute value balancing adjustment as a percentage of corrected input volume does not match the balancing adjustment percentage shown in Table 9-3, because the balancing adjustment is a negative quantity for some utilities.

[11] Calculation of the Screening-Level Infrastructure Leakage Index was performed only for utilities with 5,000 or more connections and 32 or more connections per mile of main. See discussion in Chapter 5.C.

real loss for a North American system (16 gal/conn/day for Halifax Central, shown in Table 7-1).

Even assuming that the balancing adjustment is unreported real loss, the statewide median SLILI is only 2.04, and the statewide median real loss is 18.8 gal/conn/day. Compared to the American Water Works Association (AWWA) guidelines for ILI goals (Table 7-3) and real loss performance by North American utilities (Table 7-1), these statistics seem to indicate that at least half of reporting utilities have excellent real loss control. However, most utilities in Texas practice real loss control in a reactive way (rather than a proactive way), so it is surprising that half of the reporting utilities have such excellent real loss performance, particularly in comparison to other North American utilities.

Because the actual statewide median SLILI value is so low (somewhere between 0.22 and 2.04), it appears that most reporting utilities have underestimated actual real loss. Furthermore, from comparison to AWWA guidelines and real loss performance by other North American utilities, it appears likely that the actual real loss is underestimated even if the balancing adjustment is treated as real loss. Real loss estimation problems notwithstanding, at least 8 to 30 percent of Texas utilities with more than 5,000 connections and 32 or more connections per mile of main have an SLILI greater than 3.0 (Appendix C).

1.C Comparative Analysis of Water Loss Performance

Water loss performance was also compared on the basis of utility location, type, size, water source, and connection density. The primary findings of the comparative analysis are similar to the findings in the statewide summary: the balancing adjustment is too large to allow identification of trends in the water loss data, and real loss appears to be underestimated. Other findings from the comparative analysis are discussed further in the conclusions and recommendations section (Chapter 1.D).

1.D Recommendations

This report, the first broad analysis of water loss and water loss accounting for retail public utilities in Texas, provides information necessary for the TWDB, RWPGs, and retail public utilities to direct planning and funding resources, to recover lost revenue through reduction of non-revenue water, and to achieve water savings through reduction of real loss. However, the size of the balancing adjustment results in significant uncertainty in the water loss performance indicators. Recommendations for improving water loss performance and water loss accounting are presented below in the following categories: water loss performance, regional water planning, and TWDB actions.

1.D.1 Water Loss Performance

Recommendations regarding balancing adjustment, real loss, connection density, non-revenue water, and the value of total water loss are discussed below.

Balancing Adjustment

Recommendation #1: Utilities should refine their water audits until the balancing adjustment is small in comparison to the other quantities of interest (*e.g.*, real and apparent water loss) so that reliable conclusions about water loss trends can be drawn. It may be tempting to change the volumes in some water use categories for the sole purpose of eliminating the balancing adjustment. This is not a legitimate way to reduce balancing adjustment: it only disguises the real issues, making it harder to identify what strategies a utility should pursue in the future. To legitimately reduce balancing adjustment, a utility should refine its estimates for each water use category by implementing more accurate measurement and/or estimation procedures.

Recommendation #2: Although utilities are only required to report their water audits every five years, utilities should implement annual or biennial programs to develop the data necessary to gradually reduce the uncertainty in their water audits and should review their water audits annually or biennially. Programs should target the water audit categories with the most uncertain water volume estimates.

Real Loss

Recommendation #3: Because it appears that utilities have underestimated real loss, utilities should refine their water audits to better estimate their actual real loss. This may involve confirmation of existing information (*e.g.*, calibration of production and consumption meters), additional analysis of existing information, and collection of new information (*e.g.*, flow monitoring in District Metered Areas).

Recommendation #4: Utilities should determine their economic level of leakage (ELL) and should use the ELL as a goal for real loss. Prior to determining an ELL, utilities should strive for a maximum ILI of 3.0 (Table 7-3). Utilities with an SLILI greater than 3.0 and other utilities with significant real loss in comparison to other North American utilities (Table 7-1) should consider implementing real loss control measures.

Water Loss Performance and Connection Density

Recommendation #5: Average real loss per mile of main per day increases with increasing connection density,[12] and average non-revenue water percentage decreases with increasing connection density (Figure I-2 in Appendix I). Reasons for these trends should be identified. Future analysis of water loss performance should consider connection density as an independent variable, along with utility location, type, and size.

Non-Revenue Water

Recommendation #6: Utilities should determine their economic target level for non-revenue water and strive to reduce their non-revenue water to the economic target level. In particular, utilities in Regions I and J should consider steps to recover lost revenue from unbilled authorized consumption, and utilities in Harris, Hidalgo, Nueces, Tarrant, and Travis Counties should consider steps to reduce non-revenue water.

Statewide Value of Total Water Loss

Recommendation #7: The estimated total value of total water loss in Texas is between $152 million and $513 million per year. To increase the reliability and narrow the range of this estimate, the production and retail water costs should be reported in consistent units, and utilities must refine their water accounting, thereby reducing the balancing adjustment.

[12] The number of service connections per mile of main.

1.D.2 Regional Water Planning

Recommendation #8: RWPGs should use the research results to estimate potential water savings from system water audits and water loss prevention strategies and should update the regional water plans as appropriate.

Recommendation #9: The TWDB should work to align the regional water planning cycle and the water audit reporting cycle so that up-to-date water loss data is used in developing the regional water plans.

1.D.3 TWDB Actions to Enhance Water Loss Accounting and Prevention

The TWDB should consider the following general actions to enhance water loss accounting and prevention in Texas:

Recommendation #10: To provide a more comprehensive picture of water loss in Texas, the TWDB should consider extending water auditing requirements to include wholesale utilities that provide raw or potable water. This may require additional authorization from the Legislature.

Recommendation #11: The TWDB should continue to promote water loss prevention to retail public utilities, focusing on the retail public utilities that have the greatest need for water loss reduction.

Recommendation #12: To make the water loss data more comprehensive, the TWDB should continue to seek water audit data from retail public utilities that have not reported.

Recommendation #13: The TWDB should continue to provide equipment, education, and financial assistance to help retail public utilities achieve improved water loss accounting and water loss performance.

Recommendation #14: To minimize the impact of balancing adjustment on the water loss analysis, the TWDB should consider devoting additional personnel and/or resources to assisting utilities with refinement of their water audits.

Recommendation #15: The TWDB should convey the findings, conclusions, and recommendations of this research effort to stakeholders through workshops or other means of communication.

In addition, the water loss reporting process should be revised to help assure data quality and to make the maximum use of reported water loss data. Additional recommendations regarding data quality control and the water loss reporting process are presented in Chapter 16.

10 COMPARATIVE ANALYSIS BY REGIONAL WATER PLANNING AREA

Water loss results were compared across the 16 regional water planning areas in Texas (Figure 10-1). The distribution of reporting utilities and the total corrected input volume is shown by region in Figure 10-2. As discussed in the previous chapter, wholesale water sales are included in the corrected input volume multiple times, so the total corrected input volume does not necessarily reflect total retail water use.

Regional statistics and water loss performance indicators are presented in the following sections.

10.A Regional Statistics

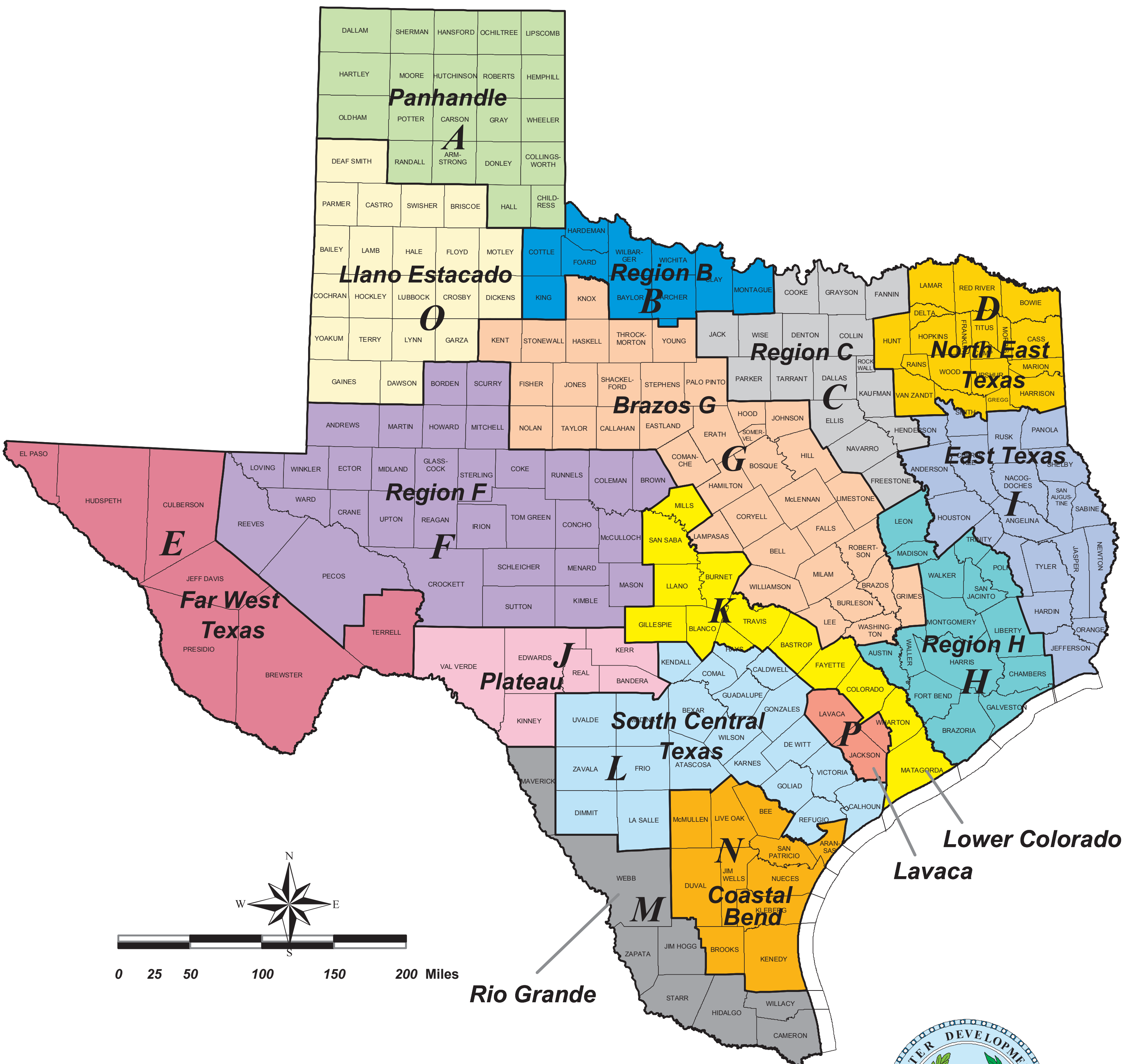
Several additional regional average quantities can be derived from the reported data (Table 10-1). The ranges of the regional averages are:

- Master meter accuracy: 95.7 – 100.3 percent
- Customer meter accuracy: 94.1 – 99.5 percent
- Production water cost: $0.34 – $2.02 per thousand gallons
- Retail water cost: $0.94 – $5.13 per thousand gallons
- Service connections per mile of main: 14.6 – 89.6
- Reporting period: 346.7 – 383.5 days

10.B Regional Water Loss Performance Indicators

The average reported non-revenue water as a percentage of corrected input volume for each region is shown in Figure 10-3. Regions I and J have the highest average non-revenue water percentage (ranging from approximately 19 percent to as much as 27 percent). These regions also had the highest reported average unbilled authorized water use, at 5.5 percent and 9.4 percent of corrected input volume, respectively, compared to the statewide reported average of 2.6 percent. Utilities in Regions I and J should consider steps to recover lost revenue from unbilled authorized consumption. This will reduce the non-revenue water percentage in these regions.

*Figure 10-1: Regional Water Planning Areas in Texas**



* Texas Water Development Board,
Available URL: http://www.twdb.state.tx.us/mapping/maps/pdf/sb1_groups_8x11.pdf,
accessed November 2006.

Figure 10-2: Distribution of Reporting Utilities by Regional Water Planning Area

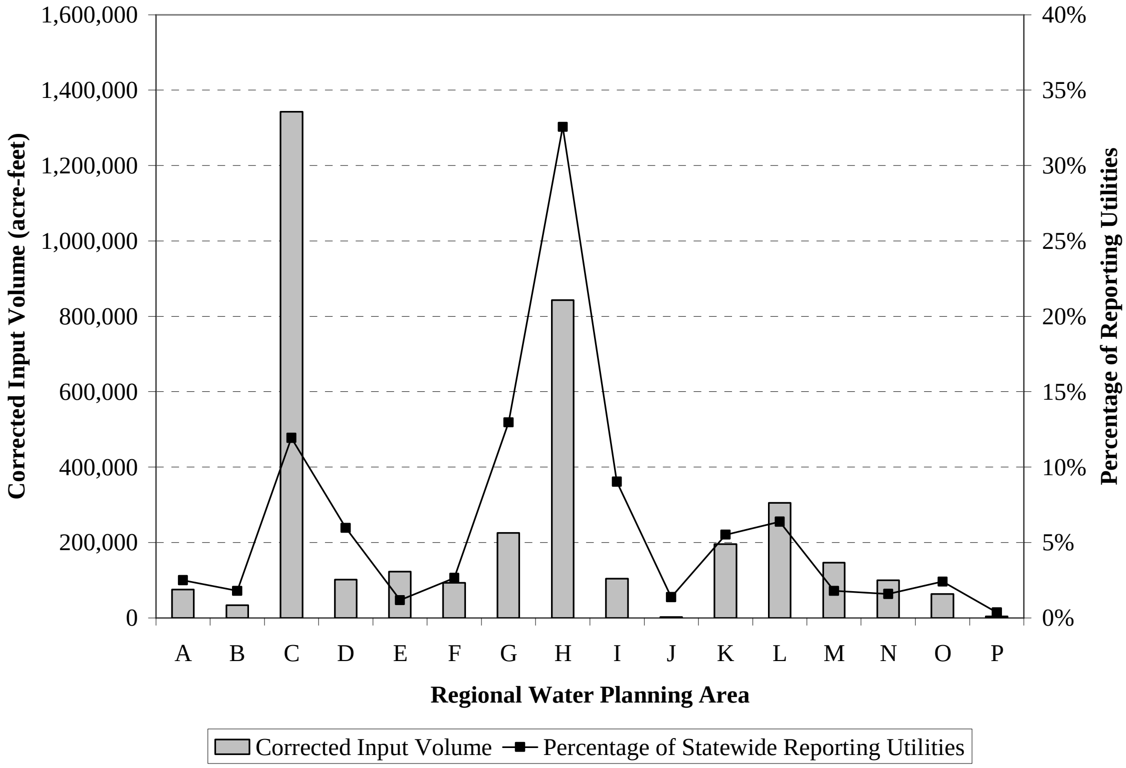
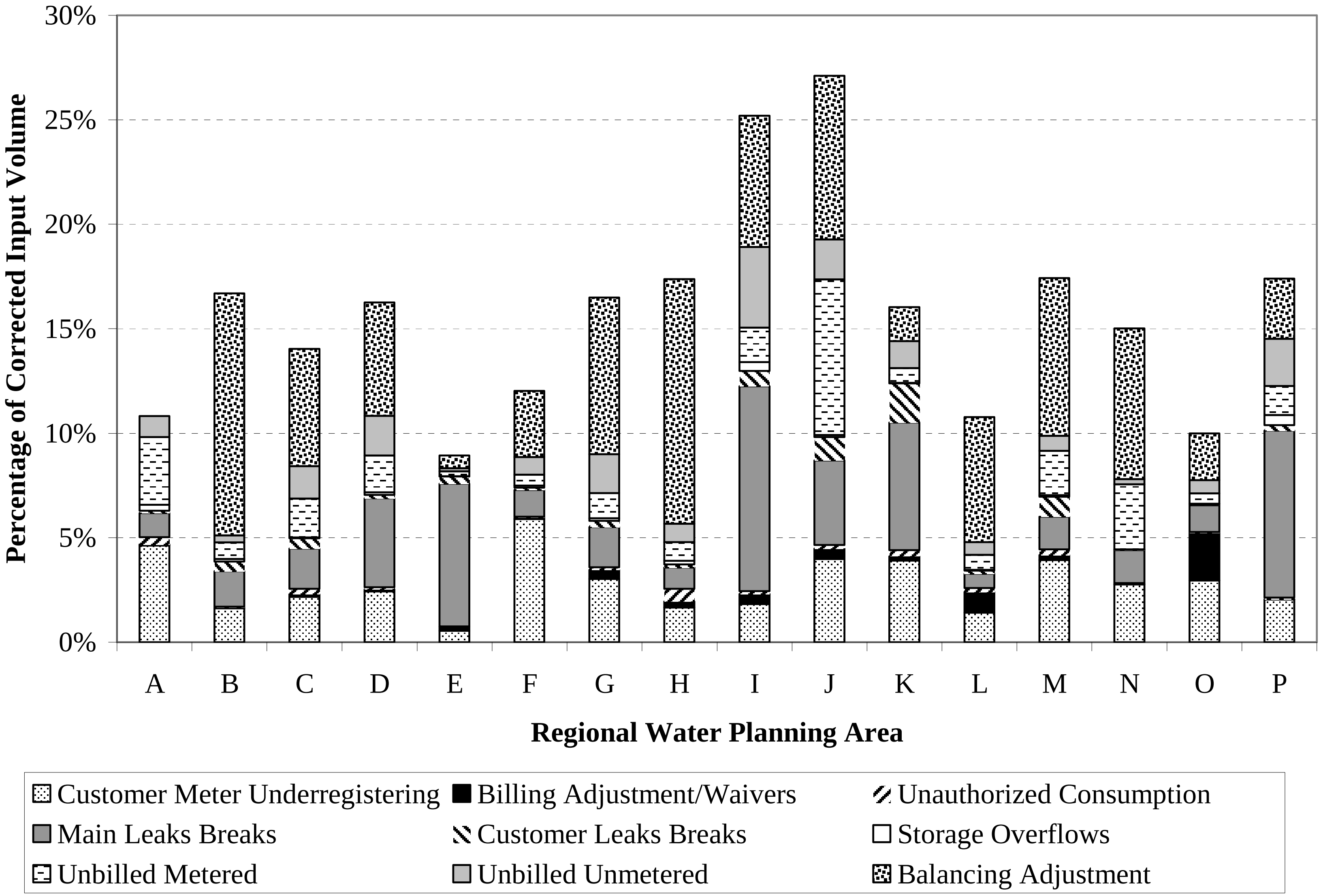


Table 10-1: Regional Average Quantities

Region	Master Meter Accuracy	Customer Meter Accuracy	Production Water Cost ($/1,000 gallons)	Retail Water Cost ($/1,000 gallons)	Service Connections per Mile of Main	Reporting Period
A	98.0%	95.4%	$0.70	$1.89	40.2	362.8
B	98.4%	98.4%	$1.70	$3.11	22.3	365.4
C	99.7%	97.8%	$0.90	$2.60	51.2	366.0
D	99.0%	97.6%	$1.51	$3.96	14.6	383.5
E	99.4%	99.5%	$0.61	$2.52	73.9	346.7
F	99.1%	94.1%	$2.02	$2.66	29.6	372.1
G	98.5%	97.0%	$1.42	$2.85	19.5	363.0
H	98.4%	98.3%	$0.80	$2.38	89.6	363.4
I	99.8%	98.2%	$0.34	$2.68	19.2	363.5
J	97.9%	96.0%	$0.91	$3.09	27.9	360.7
K	100.3%	96.1%	$0.57	$2.89	38.8	360.0
L	99.6%	98.6%	$1.20	$5.13	50.0	364.6
M	99.3%	96.1%	$0.72	$1.81	38.2	364.2
N	95.7%	97.2%	$1.62	$2.46	38.7	364.1
O	98.5%	97.0%	$0.86	$1.64	49.0	380.4
P	98.3%	98.0%	$0.36	$0.94	47.0	365.0
TOTAL	99.1%	97.7%	$0.84	$2.72	43.5	365.2

Figure 10-3: Average Annual Non-Revenue Water by Region



The average annual value of non-revenue water per connection is shown by region in Figure 10-4.[9] On a per-connection basis, utilities in Region E report the lowest average value of non-revenue water (approximately $14 per connection per year), and utilities in Regions D and K report the highest average value of non-revenue water (more than $50 per connection per year). Reported values include real loss, apparent loss, and unbilled authorized consumption. However, after accounting for the balancing adjustment, the average value of non-revenue water in Regions B, C, D, G, L, and N may be more than $80 per connection per year. The total balancing adjustment for Region A is negative, which causes the balancing adjustment assumption to reduce the average value of non-revenue water.

Graphs showing other average water loss performance indicators by region for all reporting water utilities (after quality control) are presented in Appendix D. These graphs present the performance indicators with and without the balancing adjustment assumption discussed in Chapter 6.A. The ranges of average real loss and average SLILI are on the low end of the ranges of real loss and ILI reported by North American utilities (Table 7-1), while the range of average apparent loss is similar to, or perhaps somewhat greater than, the range of apparent loss reported by North American utilities.

Regions B, H, and M each have an average balancing adjustment (absolute value) that is more than 10 percent of the corrected input volume (Figure D-1). With the balancing adjustment assumption, this results in a relatively wide range of upper and lower bounds for water loss performance indicators for these regions. This suggests that utilities in these regions should refine their water accounting procedures to more accurately quantify water use in each category.

Three regions (A, F, and O) have average SLILI values that range from 0.36 to 0.71 as calculated from the reported data and range from 0.71 to 1.77 with the balancing adjustment assumption (Figure D-4). As discussed in Chapter 5.C, the theoretical minimum SLILI is 1. These observations suggest that the larger utilities[25] in these regions may be underestimating real loss. It is interesting to note that these regions are contiguous and are located in West Texas and the Panhandle (Figure D-12). It is not known whether there is a common geographic or system factor that would result in low levels of real loss in these regions.

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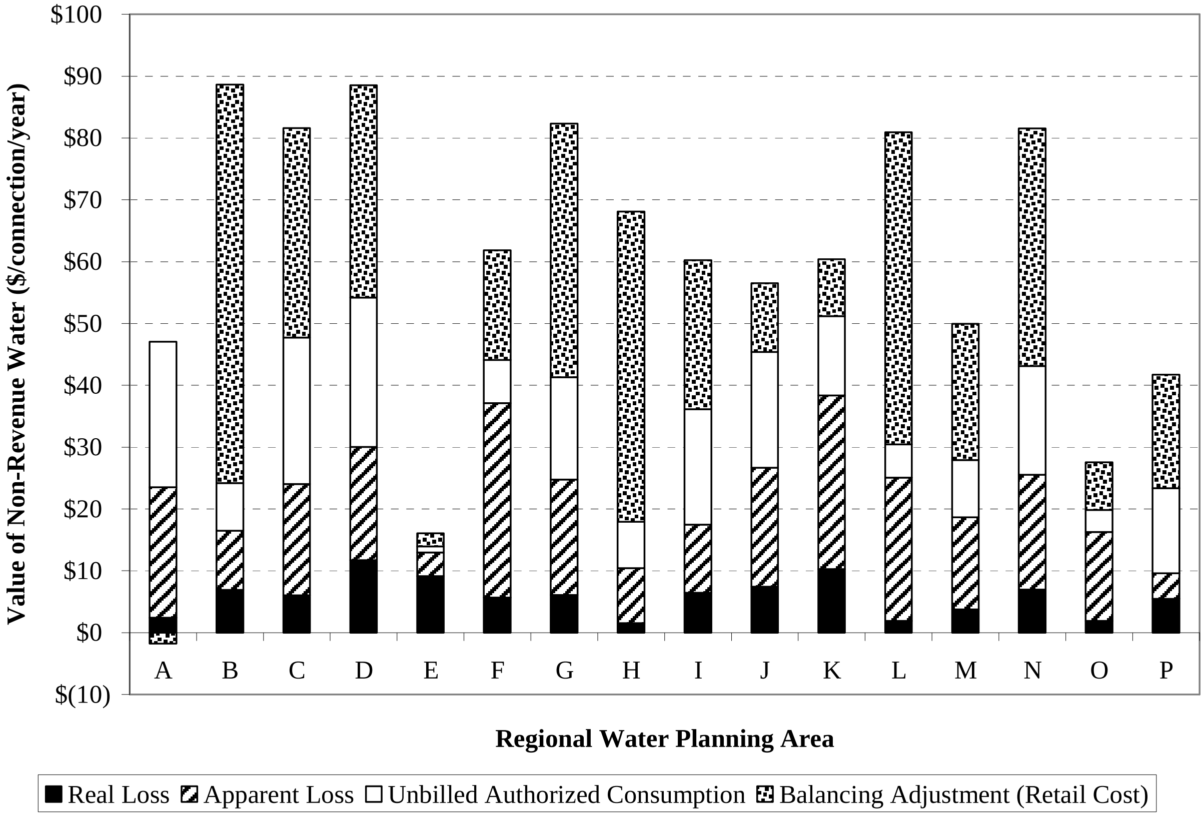
[25] Utilities having 5,000 connections or more and 32 or more connections per mile of main.

Figure 10-4: Average Annual Value of Non-Revenue Water per Connection by Region



The average SLILI values for Regions I and K suggest that the larger utilities[25] in these regions might benefit from real loss control measures.

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Appendix 2-A

Correspondence of the East Texas Regional Water Planning Group Chair to the Texas Water Development Board

Following are three letters from Kelley Holcomb, Chair of the ETRWPG, to the TWDB, regarding the 2011 Plan. The first letter, dated August 26, 2009, contains a memorandum prepared by Freese and Nichols, Inc. presenting revised water demand projections for steam-electric power generation in the ETRWPA for the 2011 Plan. The second letter, dated December 18, 2009, contains approved population projections and water demand changes for the ETRWPA for the current planning cycle. The third letter, dated February 26, 2010, is a request by the ETRWPG to the TWDB for technical assistance in conducting a socioeconomic analysis for the *2011 East Texas Regional Water Plan*.

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EAST TEXAS
Regional Water Planning Group
Region I WPG

Kelley Holcomb, Chair
P.O. Box 387
Lufkin, TX 75902
936-633-7543 (Phone)
936-632-2564 (Fax)

August 26, 2009

Mr. Kevin Ward
Executive Administrator
Texas Water Development Board
1700 North Congress
Austin, Texas 78711-3231

Re: Steam-Electric Water Demand Projections
Current (2007-2011) Planning Cycle
East Texas Regional Water Planning Area

Dear Mr. Ward:

The purpose of this letter is to provide to the Texas Water Development Board with approved steam-electric water demands for the current regional water planning cycle. Steam-electric water demand projections were discussed and approved by the East Texas Regional Water Planning Group at its regular meeting on April 8, 2009.

In a memorandum prepared by Freese and Nichols (see Attachment A), water demand projections for steam-electric power generation in Region I were evaluated. Two approaches were reviewed, including projections developed by the Bureau of Economic Geology (BEG) and projections provided in the *2006 Regional Water Plan*. In general, BEG projections were considerably lower than those provided in the 2006 Water Plan. The BEG projections did not include power plant projects that have been either postponed or canceled. In addition, neither the BEG nor 2006 Water Plan projections included new water demands in Angelina County where a 50 MW biomass power plant is currently being developed.

The East Texas Regional Water Planning Group approved revised steam-electric power demand projections, as recommended in the attached memorandum. The revised demands include steam-electric power demands developed for the 2006 water plan, with the addition of new demands for Angelina County.

Thank you for your attention to this matter. Please call me if you have any questions.

Sincerely,

Kelley Holcomb
Chairman, East Texas Region

Attachment

cc: Temple McKinnon, Texas Water Development Board
Lila Fuller, City of Nacogdoches
Rex Hunt, Alan Plummer Associates, Inc.

Lila Fuller, Administrative Contact
P. O. Box 635030, Nacogdoches, TX 75963-5030
Phone: 936-559-2504 Fax: 936-559-2912

Attachment A

Memorandum: Review of Steam Electric Power Demands

Freese and Nichols

MEMORANDUM

TO: East Texas Regional Water Planning Group; File, PLU09129

FROM: Simone Kiel

SUBJECT: Review of Steam Electric Power Demands

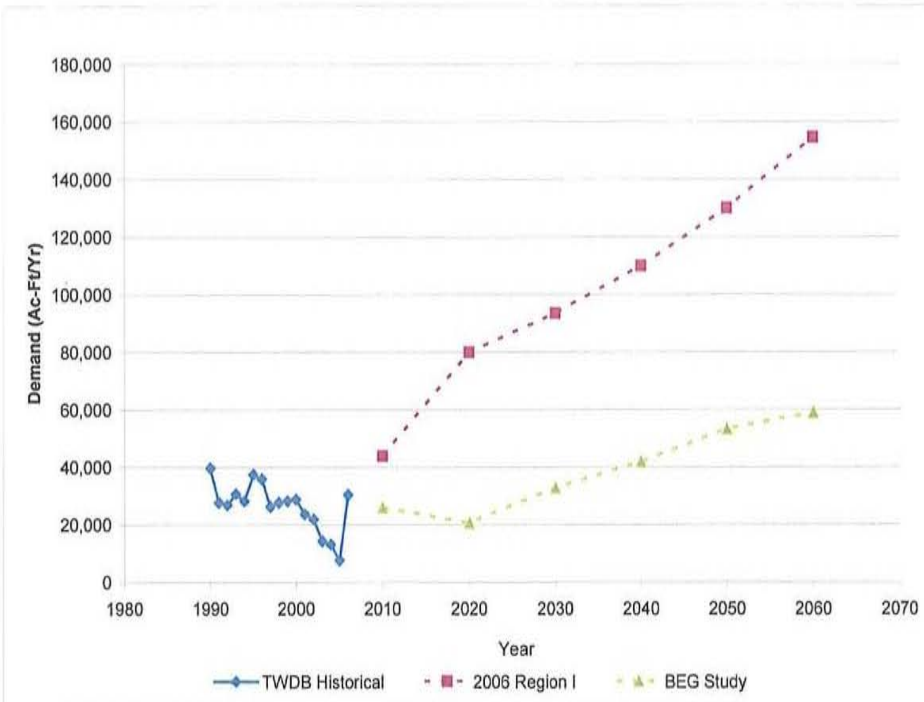
DATE: March 16, 2009 (Updated April 2, 2009)

The TWDB contracted with the Bureau of Economic Geology (BEG) to develop water demand projections for power generation in Texas. This report provided a comprehensive review of existing and planned power needs for Texas. Eight different demand scenarios were evaluated. The demand methodology recommended by the TWDB for regional water planning is the BEG Scenario 2L, which assumes low annual electric sales growth, high natural gas prices and carbon capture technology for future facilities.

The TWDB has asked the regions to select the preferred demand projections for steam electric power by choosing either the projections developed for the 2006 regional water plans or the recommended BEG projections. The regions can choose either projection on a county-level basis. Alternatively, if the region has data to support demands that are different from either of the above projections, the region can submit the proposed projections to the TWDB for consideration. To assist the region in this selection, this memorandum focuses on comparing the BEG developed projections to the steam electric power projections in the *2006 East Texas Region Water Plan.*

Figure 1 shows the historical steam electric power demand, adopted demands for the 2006 East Texas Regional Water Plan, and the recommended demands from the BEG study.

Figure 1: East Texas Region Steam Electric Power Demand Comparison



As shown on Figure 1, the BEG water demand estimates for steam electric power are lower than those in the 2006 regional water plan. The BEG projections were developed through 2015 based on existing and planned facilities (those reported to the PUC or obtained a permit). The drop in demand in 2020 is associated with a higher percentage of power generation from new more efficient facilities. By 2030, it is assumed that additional power will be needed across the state and this demand will be met by additional facilities. The future power plants were located in the same counties as existing facilities based on the percentage of generation by facility type. For the East Texas Region, this results in low to moderate growth in water demands.

One of the considerations in the BEG report was the status of existing facilities. For the East Texas Region, there are six existing facilities that are reported with a status of "delayed" or "cancelled". Future water demands for these facilities are not included in the BEG projections.

The six facilities are:

FACILITY	COUNTY	STATUS
Sabine Power/ Port of Port Arthur	Jefferson	Delayed
Nacogdoches Power (2)	Nacogdoches	Cancelled
Amelia Energy Center	Jefferson	Cancelled (air permit expired)
Hartburg Power	Newton	Cancelled (air permit expired)
Palestine Project Power	Anderson	Cancelled
Martin Lake 4	Rusk	Cancelled

Note: There were two proposed facilities in Nacogdoches County. One facility was cancelled.

All counties show a lower projected demand in the BEG report than reported in the 2006 regional water plan. For Cherokee and Orange Counties, the BEG projected demands are lower than the TWDB reported historical water usage. Summaries of this comparison for years 2020 and 2060 are shown in Figures 2 and 3.

Figure 2: Steam Electric Power Demand Comparison by County for Year 2020

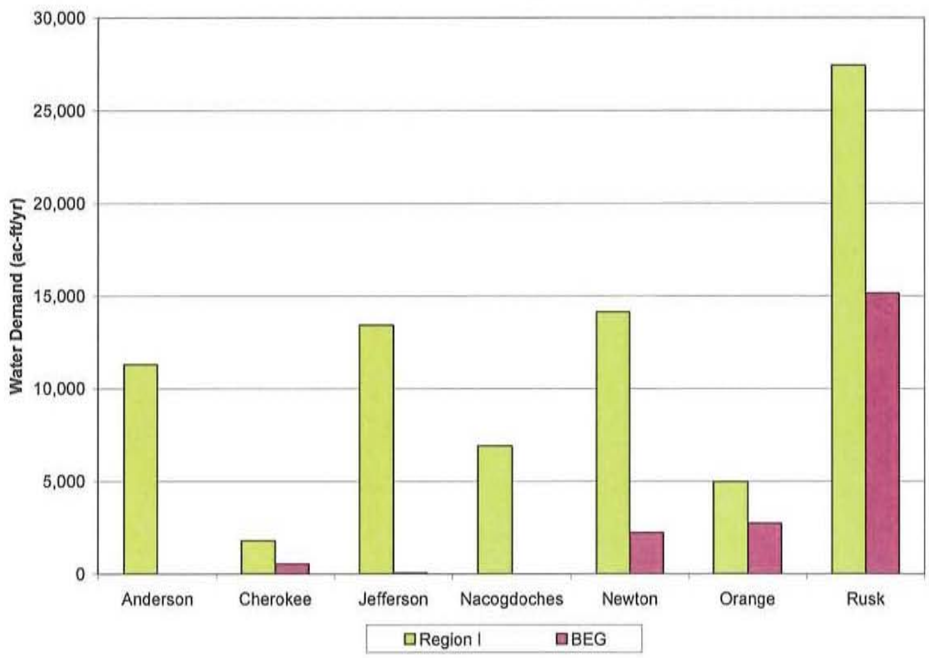
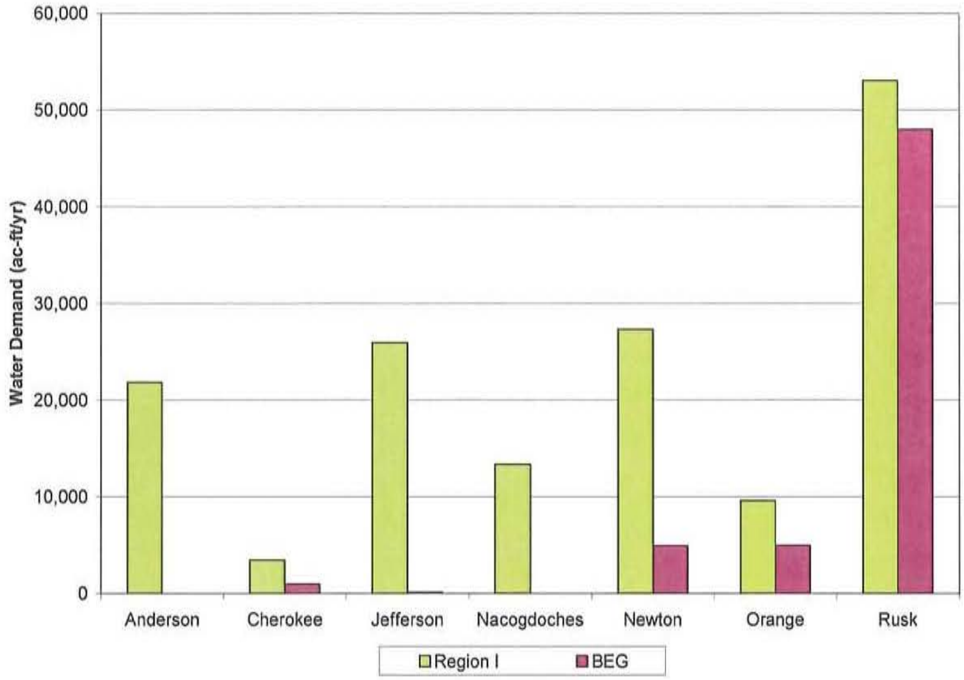


Figure 3: Steam Electric Power Demand Comparison by County for Year 2060



Since the 2006 East Texas Regional Water Plan was developed, a new power facility in Angelina County is being developed. The Aspen Power Facility is 50 MW bioelectric plant. The facility is located in Lufkin and intends to use on-site groundwater for cooling with back-up supplies from the City of Lufkin. Total water usage is estimated at 1,000 acre-feet per year (based on usage estimates provided by Aspen Pipeline on April 2, 2009). This facility was not included in either the 2006 water plan or the BEG report. Water demands are expected to begin before 2010, and stay relatively constant over the planning cycle.

Also, one of two proposed Nacogdoches Power Plants is moving forward. This facility is a 100 MW plant that will use wood/wood waste for fuel. The BEG report identifies a water demand with this facility only in 2015. After 2015, there is no demand in Nacogdoches County. On a decadal basis the BEG report shows no demands in Nacogdoches County.

RECOMMENDATIONS

Based on this review and the uncertainty of the locations of new facilities, it is recommended that the East Texas Region continue to use the steam electric power demands developed for the 2006 water plan, with the addition of new demands for Angelina County. The recommended demands by county are shown on Table 1.

Table 1

Recommended Demands for 2011 East Texas Regional Water Plan

	Demands (Acre-feet per Year)					
County	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Anderson	0	11,306	13,218	15,549	18,390	21,853
Angelina	1,000	1,000	1,000	1,000	1,000	1,000
Cherokee	2,245	1,790	2,093	2,462	2,912	3,460
Hardin	0	0	0	0	0	0
Henderson	0	0	0	0	0	0
Houston	0	0	0	0	0	0
Jasper	0	0	0	0	0	0
Jefferson	0	13,426	15,696	18,464	21,838	25,951
Nacogdoches	4,828	6,911	8,079	9,504	11,241	13,358
Newton	5,924	14,132	16,522	19,436	22,987	27,317
Orange	6,228	4,966	5,805	6,829	8,077	9,598
Panola	0	0	0	0	0	0
Polk	0	0	0	0	0	0
Rusk	24,760	27,458	32,102	37,762	44,663	53,074
Sabine	0	0	0	0	0	0
San Augustine	0	0	0	0	0	0
Shelby	0	0	0	0	0	0
Smith	0	0	0	0	0	0
Trinity	0	0	0	0	0	0
Tyler	0	0	0	0	0	0
Region I Total	**44,985**	**80,989**	**94,515**	**111,006**	**131,108**	**155,611**

EAST TEXAS
Regional Water Planning Group
Region I WPG

Kelley Holcomb, Chair
P.O. Box 387
Lufkin, TX 759023
936-633-7543 (Phone)
936-632-2564 (Fax)

December 18, 2009

Mr. Kevin Ward
Executive Administrator
Texas Water Development Board
1700 North Congress
Austin, Texas 78711-3231

Re: Population Projection and Water Demand Changes
Current (2011) Planning Cycle East Texas Regional Water Planning Area

Dear Mr. Ward:

The purpose of this letter is to provide approved population projections and water demand changes to the Texas Water Development Board for the 2011 regional water planning cycle for the East Texas Regional Water Planning Area, Region I. Population projections and water demand changes were discussed and approved by the East Texas Regional Water Planning Group (Planning Group) at regular meetings of the group on October 14, 2009 and December 9, 2009. Tables 1 through 5, attached, contain the approved changes for population projections and water demands.

As instructed by the Planning Group, an explanation of the manufacturing water demand changes for Jefferson County is necessary. As seen in Table 3, the proposed manufacturing demands for Jefferson County substantially exceed those of the 2006 Plan beginning in 2020 and extending through the remainder of the planning period. The increases are due, primarily, to new demands projected by the Lower Neches Valley Authority (LNVA) for two liquid natural gas (LNG) facilities in development in Jefferson County.

LNVA is proposing to provide water to these facilities as a heat transfer fluid for warming the LNG to a gaseous state for pipeline transport. LNVA estimates that approximately 179,225 acre-feet per year of water will be necessary for each of the two plants. The Golden Pass LNG facility is currently under construction and expected to begin operation in 2010. The Golden Pass plant is expected to need this volume of water annually by 2020. The second facility, Sempra LNG, is currently in development and awaiting finalized commercial arrangements. LNVA estimates the Sempra plant will need this annual volume by 2030.

The projected manufacturing water demands for Jefferson County were unanimously approved by the Planning Group at its October 14, 2009 meeting, with the understanding of the Planning Group that the demands would be met by LNVA's current water rights. At the December 9, 2009 meeting, this approval was clarified to note that the additional demands requested by LNVA for these LNG facilities is understood to be within LNVA's currently unmodified, unamended water rights permits with all of the terms, statutes, conditions and legal authority, as they read as of October 14, 2009.

If I can be of any further service, please contact me at 936-633-7543.

Respectfully,

Kelley Holcomb
Chairman

Attachment

cc: Temple McKinnon, Texas Water Development Board
Lila Fuller, City of Nacogdoches
Rex Hunt, Alan Plummer Associates, Inc.

Lila Fuller, Administrative Contact
P. O. Box 635030, Nacogdoches, TX 75963-5030
Phone: 936-559-2504 Fax: 936-559-2912

Attachment A

Tables of Population Projections and Water Demand Changes

Table 1 Proposed Population Projection Changes							
County/WUG		**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Angelina County							
County-Other	2006 RWP	21,111	22,526	24,269	26,466	29,479	33,473
	Requested 2011	15,180	16,197	17,451	19,031	21,197	24,069
	Difference	- 5,931	- 6,329	- 6,818	-7,435	- 8,282	- 9,404
Angelina WSC	2006 RWP	*Not a WUG in 2006 RWP					
	Requested 2011	3,537	3,774	4,066	4,434	4,939	5,608
	Difference	+ 3,537	+ 3,774	+4,066	+ 4,434	+4,939	+ 5,608
Redland WSC	2006 RWP	*Not a WUG in 2006 RWP					
	Requested 2011	2,394	2,555	2,752	3,001	3,343	3,796
	Difference	+ 2,394	+ 2,555	+ 2,752	+ 3,001	+ 3,343	+ 3,796
Angelina County Total	2006 RWP	91,399	104,853	120,936	140,497	165,783	197,878
	Requested 2011	91,399	104,853	120,936	140,497	165,783	197,878
	Difference	0	0	0	0	0	0
Nacogdoches County							
County-Other	2006 RWP	21,463	23,669	25,755	28,054	32,380	36,944
	Requested 2011	9,802	10,810	11,762	12,812	14,788	16,872
	Difference	-11,661	-12,859	-13,993	-15,242	-17,592	-20,072
D&M WSC	2006 RWP	*Not a WUG in 2006 RWP					
	Requested 2011	5,742	6,331	6,890	7,506	8,662	9,883
	Difference	+ 5,742	+ 6,331	+ 6,890	+ 7,506	+ 8,662	+ 9,883
Melrose WSC	2006 RWP	*Not a WUG in 2006 RWP					
	Requested 2011	3,381	3,729	4,057	4,419	5,101	5,820
	Difference	+ 3,381	+ 3,729	+ 4,057	+ 4,419	+ 5,101	+ 5,820
Woden WSC	2006 RWP	*Not a WUG in 2006 RWP					
	Requested 2011	2,538	2,799	3,046	3,317	3,829	4,369
	Difference	+ 2,538	+ 2,799	+ 3,046	+ 3,317	+ 3,829	+ 4,369
Nacogdoches County Total	2006 RWP	67,357	75,914	84,183	92,628	108,753	124,453
	Requested 2011	67,357	75,914	84,183	92,628	108,753	124,453
	Difference	0	0	0	0	0	0

Table 2 Proposed Municipal Water Demand Changes (acre-feet per year)							
County/WUG		2010	2020	2030	2040	2050	2060
Angelina County							
County-Other	2006 RWP	2,530	2,624	2,746	2,905	3,203	3,637
	Requested 2011	1,819	1,886	1,975	2,089	2,303	2,616
	Difference	-711	-738	-771	-816	-900	-1,021
Angelina WSC	2006 RWP	*Not a WUG in 2006 RWP					
	Requested 2011	424	440	460	487	537	609
	Difference	+ 424	+ 440	+ 460	+ 487	+ 537	+ 609
Redland WSC	2006 RWP	*Not a WUG in 2006 RWP					
	Requested 2011	287	298	311	329	363	412
	Difference	+ 287	+ 298	+ 311	+ 329	+ 363	+ 412
Angelina County Total	2006 RWP	13,650	15,224	17,080	19,302	22,359	26,315
	Requested 2011	13,650	15,224	17,080	19,302	22,359	26,315
	Difference	0	0	0	0	0	0
Nacogdoches County							
County-Other	2006 RWP	2,452	2,625	2,770	2,954	3,373	3,849
	Requested 2011	1,120	1,199	1,265	1,350	1,541	1,758
	Difference	-1,332	-1,426	-1,505	-1,604	-1,832	-2,091
D&M WSC	2006 RWP	*Not a WUG in 2006 RWP					
	Requested 2011	656	702	741	790	902	1,030
	Difference	+ 656	+ 702	+ 741	+ 790	+ 902	+ 1,030
Melrose WSC	2006 RWP	*Not a WUG in 2006 RWP					
	Requested 2011	386	414	436	465	531	606
	Difference	+ 386	+ 414	+ 436	+ 465	+ 531	+ 606
Woden WSC	2006 RWP	*Not a WUG in 2006 RWP					
	Requested 2011	290	310	328	349	399	455
	Difference	+ 290	+ 310	+ 328	+ 349	+ 399	+ 455
Nacogdoches County Total	2006 RWP	12,024	13,375	14,670	15,974	18,589	21,098
	Requested 2011	12,024	13,375	14,670	15,974	18,589	21,098
	Difference	0	0	0	0	0	0

Table 3 Proposed Manufacturing Water Demand Changes (acre-feet per year)							
County		2010	2020	2030	2040	2050	2060
Angelina	2006 RWP	30,266	34,359	37,982	41,642	44,887	48,356
	Requested 2011	14,750	23,500	25,980	28,490	30,720	33,100
	Difference	-15,516	-10,859	-12,002	-13,152	-14,167	-15,256
Jefferson	2006 RWP	237,954	267,434	292,871	318,669	341,559	365,636
	Requested 2011	151,672	423,258	603,321	629,171	655,034	680,914
	Difference	-86,282	+ 155,824	+ 310,450	+ 310,502	+ 313,475	+315,278

Table 4 Proposed Irrigation Water Demand Projection Changes (acre-feet per year)							
County		2010	2020	2030	2040	2050	2060
Hardin	2006 RWP	7,213	7,213	7,213	7,213	7,213	7,213
	Requested 2011	3,502	3,502	3,502	3,502	3,502	3,502
	Difference	-3,711	-3,711	-3,711	-3,711	-3,711	-3,711
Jefferson	2006 RWP	208,035	208,035	208,035	208,035	208,035	208,035
	Requested 2011	140,000	140,000	140,000	140,000	140,000	140,000
	Difference	-68,035	-68,035	-68,035	-68,035	-68,035	-68,035

Table 5 Proposed Mining Water Demand Changes (acre-feet per year)							
County		2010	2020	2030	2040	2050	2060
Angelina	2006 RWP	18	17	17	17	17	17
	Requested 2011	2,018	4,017	17	17	17	17
	Difference	+2,000	+4,000	0	0	0	0
Cherokee	2006 RWP	93	97	99	101	103	105
	Requested 2011	593	1,597	99	101	103	105
	Difference	+500	+1,500	0	0	0	0
Nacogdoches	2006 RWP	215	213	212	211	210	209
	Requested 2011	2,715	7,213	212	211	210	209
	Difference	+2,500	+7,000	0	0	0	0
Shelby	2006 RWP	0	0	0	0	0	0
	Requested 2011	500	1,500	0	0	0	0
	Difference	+500	+1,500	0	0	0	0
San Augustine	2006 RWP	0	0	0	0	0	0
	Requested 2011	1500	7000	0	0	0	0
	Difference	+1,500	+7,000	0	0	0	0

EAST TEXAS
Regional Water Planning Group
Region I WPG

Kelley Holcomb, Chair
P.O. Box 387
Lufkin, TX 759023
936-633-7543 (Phone)
936-632-2564 (Fax)

February 26, 2010

Mr. Kevin Ward
Executive Administrator
Texas Water Development Board
1700 North Congress
Austin, Texas 78711-3231

Re: Request for the Texas Water Development Board to Conduct a Socio-economic Analysis for the East Texas Region (Region I)

Dear Mr. Ward:

At the East Texas Regional Water Planning Group Meeting on February 17, 2010, we discussed and approved a request for the Texas Water Development Board to provide technical assistance in conducting a socio-economic analysis for the *2011 East Texas Regional Water Plan*. The East Texas Regional Water Planning Group requests that the analysis be conducted utilizing information specific to the East Texas Region, and that the models correspond to the needs of the East Texas Regional Planning Area.

Data will be available in the 2012 Regional Water Planning Data Web Interface (DB12) by March 1, 2010.

Thank you for your attention to this matter. Please call me if you have any questions regarding our request.

Sincerely,

Kelley Holcomb
Chairman, East Texas Regional Water Planning Group

cc: Lann Bookout, Texas Water Development Board
Temple McKinnon, Texas Water Development Board
Lila Fuller, City of Nacogdoches
Rex Hunt, Alan Plummer Associates, Inc.

Lila Fuller, Administrative Contact
P. O. Box 635030, Nacogdoches, TX 75963-5030
Phone: 936-559-2504 Fax: 936-559-2912

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Appendix 2-B

Population Estimates and Water Demand Projections from the Data Web Interface

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The following appendix includes a copy of the data from the TWDB Data Web Interface. This appendix provides a summary of population estimates and water demand projections for entities in the ETRWPA.

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Region I Water User Group Population Projections

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
BRUSHY CREEK WSC	ANDERSON	NECHES	1,735	1,832	1,906	1,982	2,041	2,092
BRUSHY CREEK WSC	ANDERSON	TRINITY	1,420	1,500	1,560	1,622	1,671	1,713
CONSOLIDATED WSC	ANDERSON	NECHES	359	379	394	410	422	433
CONSOLIDATED WSC	ANDERSON	TRINITY	1,201	1,268	1,319	1,371	1,412	1,448
COUNTY-OTHER	ANDERSON	NECHES	3,860	4,077	4,240	4,409	4,542	4,655
COUNTY-OTHER	ANDERSON	TRINITY	22,484	23,744	24,694	25,682	26,452	27,113
ELKHART	ANDERSON	TRINITY	1,309	1,383	1,438	1,496	1,541	1,579
FOUR PINE WSC	ANDERSON	TRINITY	2,939	3,104	3,228	3,357	3,458	3,544
FRANKSTON	ANDERSON	NECHES	1,303	1,376	1,431	1,488	1,533	1,571
PALESTINE	ANDERSON	NECHES	9,975	10,534	10,956	11,394	11,736	12,029
PALESTINE	ANDERSON	TRINITY	8,990	9,494	9,874	10,269	10,577	10,841
WALSTON SPRINGS WSC	ANDERSON	NECHES	3,815	4,029	4,190	4,358	4,488	4,601
ANGELINA WSC	ANGELINA	NECHES	3,537	3,774	4,066	4,434	4,939	5,608
CENTRAL WCID OF ANGELINA COUNTY	ANGELINA	NECHES	6,564	6,886	7,283	7,783	8,470	9,380
COUNTY-OTHER	ANGELINA	NECHES	15,180	16,197	17,451	19,031	21,197	24,069
DIBOLL	ANGELINA	NECHES	6,449	7,654	9,137	11,007	13,574	16,976
FOUR WAY WSC	ANGELINA	NECHES	4,503	6,388	8,708	11,634	15,649	20,970
HUDSON	ANGELINA	NECHES	5,021	6,535	8,398	10,747	13,971	18,243
HUDSON WSC	ANGELINA	NECHES	7,579	9,268	11,346	13,967	17,564	22,331
HUNTINGTON	ANGELINA	NECHES	2,306	2,598	2,958	3,412	4,035	4,861
LUFKIN	ANGELINA	NECHES	37,219	42,351	48,190	54,834	62,394	70,997
REDLAND WSC	ANGELINA	NECHES	2,394	2,555	2,752	3,001	3,343	3,796
ZAVALLA	ANGELINA	NECHES	647	647	647	647	647	647
ALTO	CHEROKEE	NECHES	1,290	1,404	1,502	1,592	1,681	1,786
ALTO RURAL WSC	CHEROKEE	NECHES	4,806	5,156	5,456	5,732	6,006	6,329
BULLARD	CHEROKEE	NECHES	54	55	56	57	58	59
COUNTY-OTHER	CHEROKEE	NECHES	6,288	5,555	4,406	2,811	2,110	1,690
CRAFT-TURNEY WSC	CHEROKEE	NECHES	5,672	7,032	8,719	10,810	12,000	13,000
JACKSONVILLE	CHEROKEE	NECHES	14,543	15,316	15,978	16,587	17,191	17,904
NEW SUMMERFIELD	CHEROKEE	NECHES	1,290	1,624	1,910	2,173	2,434	2,742
NORTH CHEROKEE WSC	CHEROKEE	NECHES	4,116	4,834	5,449	6,015	6,576	7,238
RUSK	CHEROKEE	NECHES	5,525	6,029	6,461	6,858	7,252	7,717
RUSK RURAL WSC	CHEROKEE	NECHES	3,166	3,391	3,584	3,761	3,937	4,145
SOUTHERN UTILITIES COMPANY	CHEROKEE	NECHES	2,525	2,799	3,034	3,250	3,464	3,717
TROUP	CHEROKEE	NECHES	44	49	53	57	61	66
WELLS	CHEROKEE	NECHES	774	780	785	789	793	798
COUNTY-OTHER	HARDIN	NECHES	12,692	13,766	14,254	14,760	15,283	15,825
COUNTY-OTHER	HARDIN	TRINITY	132	143	148	153	158	164

Region I Water User Group Population Projections

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
KOUNTZE	HARDIN	NECHES	2,398	2,601	2,693	2,788	2,887	2,990
LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE CO	HARDIN	TRINITY	100	108	112	116	120	124
LUMBERTON	HARDIN	NECHES	9,899	10,736	11,117	11,511	11,919	12,342
LUMBERTON MUD	HARDIN	NECHES	8,241	8,939	9,256	9,584	9,923	10,275
NORTH HARDIN WSC	HARDIN	NECHES	7,370	7,993	8,276	8,570	8,874	9,188
SILSBEE	HARDIN	NECHES	7,248	7,861	8,140	8,429	8,728	9,037
SOUR LAKE	HARDIN	NECHES	1,890	2,050	2,123	2,198	2,276	2,356
WEST HARDIN WSC	HARDIN	NECHES	4,534	4,918	5,092	5,272	5,459	5,653
ATHENS	HENDERSON	NECHES	380	536	690	848	1,040	1,283
BERRYVILLE	HENDERSON	NECHES	977	1,071	1,164	1,259	1,375	1,521
BETHEL-ASH WSC	HENDERSON	NECHES	3,096	3,860	4,614	5,387	6,330	7,521
BROWNSBORO	HENDERSON	NECHES	949	1,115	1,279	1,447	1,652	1,910
BRUSHY CREEK WSC	HENDERSON	NECHES	837	951	1,063	1,178	1,318	1,495
CHANDLER	HENDERSON	NECHES	2,385	2,695	3,001	3,314	3,696	4,179
COUNTY-OTHER	HENDERSON	NECHES	14,004	14,971	15,923	16,904	18,097	19,604
MURCHISON	HENDERSON	NECHES	642	696	749	804	871	955
R P M WSC	HENDERSON	NECHES	495	552	608	665	735	823
CONSOLIDATED WSC	HOUSTON	NECHES	3,751	3,847	4,001	4,161	4,327	4,500
CONSOLIDATED WSC	HOUSTON	TRINITY	9,640	9,885	10,280	10,691	11,119	11,564
COUNTY-OTHER	HOUSTON	NECHES	197	202	210	219	228	237
COUNTY-OTHER	HOUSTON	TRINITY	856	878	913	950	988	1,027
CROCKETT	HOUSTON	TRINITY	7,376	7,563	7,866	8,180	8,507	8,848
GRAPELAND	HOUSTON	NECHES	567	581	605	629	654	680
GRAPELAND	HOUSTON	TRINITY	932	955	994	1,033	1,075	1,118
LOVELADY	HOUSTON	TRINITY	628	644	670	696	724	753
COUNTY-OTHER	JASPER	NECHES	14,492	15,379	15,902	16,035	16,035	16,035
COUNTY-OTHER	JASPER	SABINE	7,752	8,245	8,537	8,612	8,612	8,612
JASPER	JASPER	NECHES	8,315	8,883	9,218	9,303	9,303	9,303
JASPER COUNTY WCID #1	JASPER	SABINE	4,319	4,595	4,757	4,799	4,799	4,799
KIRBYVILLE	JASPER	SABINE	2,251	2,395	2,480	2,501	2,501	2,501
MAURICEVILLE SUD	JASPER	SABINE	1,316	1,400	1,450	1,462	1,462	1,462
BEAUMONT	JEFFERSON	NECHES	41,490	41,490	41,490	41,490	41,490	41,490
BEAUMONT	JEFFERSON	NECHES-TRINITY	72,376	72,376	72,376	72,376	72,376	72,376
BEVIL OAKS	JEFFERSON	NECHES	1,346	1,346	1,346	1,346	1,346	1,346
CHINA	JEFFERSON	NECHES-TRINITY	1,096	1,072	1,051	1,035	1,018	987
COUNTY-OTHER	JEFFERSON	NECHES	148	197	239	273	308	373
COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	21,101	28,068	34,349	39,191	44,073	53,302
GROVES	JEFFERSON	NECHES	217	217	217	217	217	217

Region I Water User Group Population Projections

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
GROVES	JEFFERSON	NECHES-TRINITY	15,516	15,516	15,516	15,516	15,516	15,516
JEFFERSON COUNTY WCID #10	JEFFERSON	NECHES	1,871	2,103	2,312	2,473	2,636	2,944
JEFFERSON COUNTY WCID #10	JEFFERSON	NECHES-TRINITY	3,052	3,431	3,773	4,036	4,301	4,803
MEEKER MUD	JEFFERSON	NECHES	531	643	744	822	900	1,048
MEEKER MUD	JEFFERSON	NECHES-TRINITY	2,791	3,379	3,909	4,317	4,729	5,508
NEDERLAND	JEFFERSON	NECHES	698	733	765	789	814	860
NEDERLAND	JEFFERSON	NECHES-TRINITY	17,354	18,225	19,010	19,615	20,225	21,378
NOME	JEFFERSON	NECHES	390	425	457	481	506	552
NOME	JEFFERSON	NECHES-TRINITY	159	173	186	196	206	225
PORT ARTHUR	JEFFERSON	NECHES	350	350	350	350	350	350
PORT ARTHUR	JEFFERSON	NECHES-TRINITY	57,405	57,405	57,405	57,405	57,405	57,405
PORT NECHES	JEFFERSON	NECHES	7,119	7,379	7,614	7,795	7,977	8,322
PORT NECHES	JEFFERSON	NECHES-TRINITY	6,837	7,087	7,312	7,486	7,661	7,992
WEST JEFFERSON COUNTY MWD	JEFFERSON	NECHES-TRINITY	7,853	9,071	10,169	11,016	11,870	13,484
APPLEBY WSC	NACOGDOCHES	NECHES	4,341	5,481	6,560	7,749	9,985	12,345
COUNTY-OTHER	NACOGDOCHES	NECHES	9,802	10,810	11,762	12,812	14,788	16,872
CUSHING	NACOGDOCHES	NECHES	683	730	774	823	915	1,012
D&M WSC	NACOGDOCHES	NECHES	5,742	6,331	6,890	7,506	8,662	9,883
GARRISON	NACOGDOCHES	NECHES	844	844	844	844	844	844
LILLY GROVE SUD	NACOGDOCHES	NECHES	3,229	4,172	5,064	6,047	7,896	9,847
MELROSE WSC	NACOGDOCHES	NECHES	3,381	3,729	4,057	4,419	5,101	5,820
NACOGDOCHES	NACOGDOCHES	NECHES	33,044	36,501	39,946	43,074	49,198	54,345
SWIFT WSC	NACOGDOCHES	NECHES	3,753	4,517	5,240	6,037	7,535	9,116
WODEN WSC	NACOGDOCHES	NECHES	2,538	2,799	3,046	3,317	3,829	4,369
COUNTY-OTHER	NEWTON	SABINE	9,967	10,417	10,476	10,790	11,114	11,447
MAURICEVILLE SUD	NEWTON	SABINE	485	507	510	525	541	557
NEWTON	NEWTON	SABINE	2,612	2,730	2,745	2,827	2,912	3,000
SOUTH NEWTON WSC	NEWTON	SABINE	2,944	3,077	3,094	3,187	3,282	3,381
BRIDGE CITY	ORANGE	NECHES	1,299	1,357	1,381	1,391	1,412	1,427
BRIDGE CITY	ORANGE	NECHES-TRINITY	1,220	1,275	1,297	1,307	1,327	1,341
BRIDGE CITY	ORANGE	SABINE	6,745	7,049	7,173	7,226	7,336	7,416
COUNTY-OTHER	ORANGE	NECHES	14,800	14,998	15,079	15,113	15,185	15,237
COUNTY-OTHER	ORANGE	NECHES-TRINITY	6	6	6	6	6	6
COUNTY-OTHER	ORANGE	SABINE	17,757	17,994	18,092	18,133	18,220	18,284
MAURICEVILLE SUD	ORANGE	SABINE	9,467	11,866	12,848	13,265	14,137	14,769
ORANGE	ORANGE	SABINE	18,643	18,643	18,643	18,643	18,643	18,643
PINE FOREST	ORANGE	NECHES	632	632	632	632	632	632
PINEHURST	ORANGE	SABINE	2,274	2,274	2,274	2,274	2,274	2,274

Region I Water User Group Population Projections

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
ROSE CITY	ORANGE	NECHES	519	519	519	519	519	519
SOUTH NEWTON WSC	ORANGE	SABINE	1,108	1,299	1,377	1,410	1,479	1,529
VIDOR	ORANGE	NECHES	9,538	9,801	9,909	9,955	10,050	10,119
VIDOR	ORANGE	SABINE	2,384	2,450	2,477	2,488	2,512	2,529
WEST ORANGE	ORANGE	SABINE	4,111	4,111	4,111	4,111	4,111	4,111
BECKVILLE	PANOLA	SABINE	790	806	820	831	840	846
CARTHAGE	PANOLA	SABINE	7,000	7,146	7,263	7,362	7,444	7,497
COUNTY-OTHER	PANOLA	CYPRESS	46	47	48	49	49	49
COUNTY-OTHER	PANOLA	SABINE	15,113	15,429	15,680	15,895	16,072	16,186
GILL WSC	PANOLA	SABINE	728	743	755	766	774	780
TATUM	PANOLA	SABINE	226	231	234	238	240	242
CORRIGAN	POLK	NECHES	2,232	2,720	3,132	3,409	3,580	3,759
COUNTY-OTHER	POLK	NECHES	8,190	9,981	11,490	12,508	13,132	13,789
COUNTY-OTHER	RUSK	NECHES	12,861	13,700	14,177	14,415	15,076	16,702
COUNTY-OTHER	RUSK	SABINE	15,069	16,054	16,612	16,892	17,665	19,569
EASTON	RUSK	SABINE	61	83	96	102	120	163
ELDERVILLE WSC	RUSK	SABINE	2,518	2,741	2,868	2,931	3,107	3,539
HENDERSON	RUSK	NECHES	10,167	10,239	10,280	10,300	10,357	10,497
HENDERSON	RUSK	SABINE	1,191	1,199	1,204	1,206	1,213	1,229
KILGORE	RUSK	SABINE	2,580	2,580	2,580	2,580	2,580	2,580
MOUNT ENTERPRISE	RUSK	NECHES	540	554	562	566	577	605
NEW LONDON	RUSK	NECHES	535	554	565	570	585	622
NEW LONDON	RUSK	SABINE	491	509	519	524	538	572
OVERTON	RUSK	NECHES	252	267	275	279	291	320
OVERTON	RUSK	SABINE	2,111	2,236	2,307	2,342	2,441	2,683
SOUTHERN UTILITIES COMPANY	RUSK	NECHES	426	451	465	472	492	541
TATUM	RUSK	SABINE	960	960	960	960	960	960
WEST GREGG WSC	RUSK	SABINE	112	114	115	116	118	123
COUNTY-OTHER	SABINE	NECHES	1,498	1,559	1,606	1,654	1,704	1,755
COUNTY-OTHER	SABINE	SABINE	377	393	404	416	429	442
G-M WSC	SABINE	SABINE	7,157	7,451	7,675	7,905	8,142	8,386
HEMPHILL	SABINE	SABINE	1,192	1,241	1,278	1,316	1,356	1,396
PINELAND	SABINE	NECHES	1,056	1,099	1,132	1,166	1,201	1,237
COUNTY-OTHER	SAN AUGUSTINE	NECHES	6,160	6,284	6,445	6,638	6,838	6,974
COUNTY-OTHER	SAN AUGUSTINE	SABINE	43	44	45	47	48	49
G-M WSC	SAN AUGUSTINE	SABINE	824	841	862	888	915	933
SAN AUGUSTINE	SAN AUGUSTINE	NECHES	2,688	2,742	2,812	2,897	2,984	3,043
CENTER	SHELBY	SABINE	5,974	6,363	6,668	6,896	7,092	7,306

Region I Water User Group Population Projections

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
COUNTY-OTHER	SHELBY	NECHES	2,639	2,825	2,971	3,080	3,174	3,277
COUNTY-OTHER	SHELBY	SABINE	14,778	15,822	16,643	17,253	17,779	18,355
JOAQUIN	SHELBY	SABINE	974	1,038	1,088	1,126	1,158	1,193
TENAHA	SHELBY	SABINE	1,046	1,046	1,046	1,046	1,046	1,046
TIMPSON	SHELBY	NECHES	15	15	15	15	15	15
TIMPSON	SHELBY	SABINE	1,105	1,139	1,166	1,186	1,203	1,222
ARP	SMITH	NECHES	965	1,013	1,061	1,109	1,189	1,295
BULLARD	SMITH	NECHES	1,284	1,424	1,563	1,702	1,936	2,245
COMMUNITY WATER COMPANY	SMITH	NECHES	1,340	1,557	1,773	1,989	2,352	2,832
COUNTY-OTHER	SMITH	NECHES	4,253	3,807	3,409	3,052	2,732	2,446
CRYSTAL SYSTEMS INC	SMITH	NECHES	321	355	389	423	480	555
DEAN WSC	SMITH	NECHES	5,111	5,710	6,307	6,903	7,904	9,229
JACKSON WSC	SMITH	NECHES	3,832	4,650	5,535	6,420	7,000	7,550
LINDALE	SMITH	NECHES	673	673	673	673	673	673
LINDALE RURAL WSC	SMITH	NECHES	2,714	3,064	3,413	3,761	4,346	5,119
NEW CHAPEL HILL	SMITH	NECHES	635	697	758	819	922	1,058
NOONDAY	SMITH	NECHES	550	576	602	628	672	730
OVERTON	SMITH	NECHES	61	64	67	70	75	81
R P M WSC	SMITH	NECHES	228	249	269	289	323	368
SOUTHERN UTILITIES COMPANY	SMITH	NECHES	36,295	38,496	40,620	42,736	47,202	53,328
TROUP	SMITH	NECHES	2,113	2,266	2,418	2,570	2,825	3,163
TYLER	SMITH	NECHES	88,332	92,372	96,399	100,415	107,168	116,102
WHITEHOUSE	SMITH	NECHES	6,305	7,022	7,736	8,449	9,647	11,232
COUNTY-OTHER	TRINITY	NECHES	3,186	3,435	3,518	3,660	3,817	3,960
GROVETON	TRINITY	NECHES	604	652	668	660	633	610
COLMESNEIL	TYLER	NECHES	756	872	946	974	974	974
COUNTY-OTHER	TYLER	NECHES	13,363	15,398	16,707	17,209	17,209	17,209
LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE CO	TYLER	NECHES	104	120	130	134	134	134
TYLER COUNTY WSC	TYLER	NECHES	7,658	8,824	9,574	9,862	9,862	9,862
WOODVILLE	TYLER	NECHES	2,863	3,299	3,580	3,687	3,687	3,687

Region I Water User Group Demand
(Ac-ft per Year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
BRUSHY CREEK WSC	ANDERSON	NECHES	150	152	154	153	155	159
BRUSHY CREEK WSC	ANDERSON	TRINITY	122	124	126	125	127	130
CONSOLIDATED WSC	ANDERSON	NECHES	29	30	30	29	30	31
CONSOLIDATED WSC	ANDERSON	TRINITY	98	99	99	98	100	102
COUNTY-OTHER	ANDERSON	NECHES	800	831	850	869	890	912
COUNTY-OTHER	ANDERSON	TRINITY	4,659	4,841	4,951	5,063	5,185	5,315
ELKHART	ANDERSON	TRINITY	177	183	185	188	192	196
FOUR PINE WSC	ANDERSON	TRINITY	283	292	296	301	306	314
FRANKSTON	ANDERSON	NECHES	524	547	564	582	598	612
IRRIGATION	ANDERSON	NECHES	14	14	14	14	14	14
IRRIGATION	ANDERSON	TRINITY	198	198	198	198	198	198
LIVESTOCK	ANDERSON	NECHES	803	803	803	803	803	803
LIVESTOCK	ANDERSON	TRINITY	905	905	905	905	905	905
MINING	ANDERSON	NECHES	462	502	525	548	570	592
MINING	ANDERSON	TRINITY	51	55	58	60	63	65
PALESTINE	ANDERSON	NECHES	1,955	2,018	2,062	2,106	2,156	2,210
PALESTINE	ANDERSON	TRINITY	1,762	1,819	1,858	1,898	1,943	1,992
STEAM ELECTRIC POWER	ANDERSON	NECHES	0	11,306	13,218	15,549	18,390	21,853
WALSTON SPRINGS WSC	ANDERSON	NECHES	427	438	441	444	452	464
ANGELINA WSC	ANGELINA	NECHES	424	440	460	487	537	609
CENTRAL WCID OF ANGELINA COUNTY	ANGELINA	NECHES	676	686	702	724	778	862
COUNTY-OTHER	ANGELINA	NECHES	1,819	1,886	1,975	2,089	2,303	2,616
DIBOLL	ANGELINA	NECHES	968	1,123	1,310	1,554	1,901	2,377
FOUR WAY WSC	ANGELINA	NECHES	368	501	673	886	1,192	1,597
HUDSON	ANGELINA	NECHES	579	732	931	1,168	1,518	1,982
HUDSON WSC	ANGELINA	NECHES	654	768	902	1,095	1,358	1,726
HUNTINGTON	ANGELINA	NECHES	243	262	288	325	380	457
IRRIGATION	ANGELINA	NECHES	30	30	30	30	30	30
LIVESTOCK	ANGELINA	NECHES	598	620	647	677	712	749
LUFKIN	ANGELINA	NECHES	7,546	8,444	9,446	10,565	11,951	13,599
MANUFACTURING	ANGELINA	NECHES	14,750	23,500	25,980	28,490	30,720	33,100
MINING	ANGELINA	NECHES	2,018	4,017	17	17	17	17
REDLAND WSC	ANGELINA	NECHES	287	298	311	329	363	412
STEAM ELECTRIC POWER	ANGELINA	NECHES	1,000	1,000	1,000	1,000	1,000	1,000
ZAVALLA	ANGELINA	NECHES	86	84	82	80	78	78
ALTO	CHEROKEE	NECHES	233	248	261	273	286	304
ALTO RURAL WSC	CHEROKEE	NECHES	393	404	409	411	424	447
BULLARD	CHEROKEE	NECHES	13	13	13	13	13	14
COUNTY-OTHER	CHEROKEE	NECHES	902	790	617	378	272	218

Region I Water User Group Demand
(Ac-ft per Year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
CRAFT-TURNEY WSC	CHEROKEE	NECHES	515	614	742	908	995	1,078
IRRIGATION	CHEROKEE	NECHES	321	321	321	321	321	321
JACKSONVILLE	CHEROKEE	NECHES	3,502	3,637	3,741	3,827	3,948	4,111
LIVESTOCK	CHEROKEE	NECHES	1,765	1,765	1,765	1,765	1,765	1,765
MANUFACTURING	CHEROKEE	NECHES	718	784	839	891	934	1,007
MINING	CHEROKEE	NECHES	593	1,597	99	101	103	105
NEW SUMMERFIELD	CHEROKEE	NECHES	208	258	302	338	379	427
NORTH CHEROKEE WSC	CHEROKEE	NECHES	387	439	482	519	560	616
RUSK	CHEROKEE	NECHES	1,194	1,283	1,353	1,421	1,495	1,591
RUSK RURAL WSC	CHEROKEE	NECHES	358	372	381	388	401	423
SOUTHERN UTILITIES COMPANY	CHEROKEE	NECHES	421	458	486	513	543	583
STEAM ELECTRIC POWER	CHEROKEE	NECHES	2,245	1,790	2,093	2,462	2,912	3,460
TROUP	CHEROKEE	NECHES	6	6	7	7	8	8
WELLS	CHEROKEE	NECHES	122	121	119	117	115	116
COUNTY-OTHER	HARDIN	NECHES	1,834	1,943	1,964	1,984	2,037	2,109
COUNTY-OTHER	HARDIN	TRINITY	19	20	20	21	21	22
IRRIGATION	HARDIN	NECHES	3,502	3,502	3,502	3,502	3,502	3,502
KOUNTZE	HARDIN	NECHES	306	323	326	328	336	348
LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE CO	HARDIN	TRINITY	6	7	7	7	7	7
LIVESTOCK	HARDIN	NECHES	154	154	154	154	154	154
LIVESTOCK	HARDIN	TRINITY	2	2	2	2	2	2
LUMBERTON	HARDIN	NECHES	1,430	1,515	1,544	1,573	1,615	1,673
LUMBERTON MUD	HARDIN	NECHES	1,929	2,073	2,125	2,179	2,245	2,325
MANUFACTURING	HARDIN	NECHES	146	165	182	200	216	233
MINING	HARDIN	NECHES	7,800	8,648	9,219	9,788	10,361	10,798
NORTH HARDIN WSC	HARDIN	NECHES	685	716	714	720	736	762
SILSBEE	HARDIN	NECHES	1,072	1,136	1,149	1,161	1,193	1,235
SOUR LAKE	HARDIN	NECHES	176	184	183	182	186	193
WEST HARDIN WSC	HARDIN	NECHES	315	325	325	325	330	342
ATHENS	HENDERSON	NECHES	77	107	136	163	199	246
BERRYVILLE	HENDERSON	NECHES	126	134	142	149	162	179
BETHEL-ASH WSC	HENDERSON	NECHES	250	303	351	404	468	556
BROWNSBORO	HENDERSON	NECHES	158	182	206	232	263	304
BRUSHY CREEK WSC	HENDERSON	NECHES	72	79	86	91	100	114
CHANDLER	HENDERSON	NECHES	409	453	494	538	596	674
COUNTY-OTHER	HENDERSON	NECHES	2,761	2,901	3,032	3,162	3,365	3,645
IRRIGATION	HENDERSON	NECHES	10	10	10	10	10	10
LIVESTOCK	HENDERSON	NECHES	2,594	2,594	2,594	2,594	2,594	2,594
MANUFACTURING	HENDERSON	NECHES	12	14	16	18	20	22

Region I Water User Group Demand
(Ac-ft per Year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
MINING	HENDERSON	NECHES	14	14	14	14	14	14
MURCHISON	HENDERSON	NECHES	139	148	157	166	179	196
R P M WSC	HENDERSON	NECHES	69	75	80	86	95	106
CONSOLIDATED WSC	HOUSTON	NECHES	307	302	300	298	305	318
CONSOLIDATED WSC	HOUSTON	TRINITY	788	775	772	766	785	816
COUNTY-OTHER	HOUSTON	NECHES	33	33	34	35	36	37
COUNTY-OTHER	HOUSTON	TRINITY	145	146	148	151	156	162
CROCKETT	HOUSTON	TRINITY	1,438	1,449	1,480	1,512	1,553	1,615
GRAPELAND	HOUSTON	NECHES	100	100	102	104	107	111
GRAPELAND	HOUSTON	TRINITY	164	165	168	171	176	183
IRRIGATION	HOUSTON	NECHES	879	971	1,073	1,185	1,309	1,446
IRRIGATION	HOUSTON	TRINITY	1,860	2,053	2,270	2,506	2,768	3,057
LIVESTOCK	HOUSTON	NECHES	698	756	820	888	962	1,042
LIVESTOCK	HOUSTON	TRINITY	1,417	1,535	1,663	1,802	1,953	2,116
LOVELADY	HOUSTON	TRINITY	75	75	76	76	78	81
MANUFACTURING	HOUSTON	NECHES	7	8	9	10	10	11
MANUFACTURING	HOUSTON	TRINITY	162	182	200	217	233	252
MINING	HOUSTON	NECHES	62	61	60	59	58	58
MINING	HOUSTON	TRINITY	101	99	98	97	96	95
COUNTY-OTHER	JASPER	NECHES	1,834	1,895	1,906	1,868	1,850	1,850
COUNTY-OTHER	JASPER	SABINE	981	1,016	1,023	1,003	994	994
JASPER	JASPER	NECHES	1,602	1,682	1,714	1,699	1,688	1,688
JASPER COUNTY WCID #1	JASPER	SABINE	324	329	325	312	306	306
KIRBYVILLE	JASPER	SABINE	474	494	506	501	499	499
LIVESTOCK	JASPER	NECHES	197	197	197	197	197	197
LIVESTOCK	JASPER	SABINE	120	120	120	120	120	120
MANUFACTURING	JASPER	NECHES	64,231	67,611	70,123	72,318	73,965	74,028
MANUFACTURING	JASPER	SABINE	36	38	39	41	41	41
MAURICEVILLE SUD	JASPER	SABINE	100	104	104	103	103	103
MINING	JASPER	NECHES	2	2	2	2	2	2
MINING	JASPER	SABINE	2	2	2	2	2	2
BEAUMONT	JEFFERSON	NECHES	9,853	9,713	9,574	9,434	9,341	9,341
BEAUMONT	JEFFERSON	NECHES-TRINITY	17,187	16,944	16,701	16,458	16,295	16,295
BEVIL OAKS	JEFFERSON	NECHES	137	133	128	124	121	121
CHINA	JEFFERSON	NECHES-TRINITY	165	157	151	145	140	136
COUNTY-OTHER	JEFFERSON	NECHES	13	17	20	23	26	31
COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	1,867	2,421	2,886	3,249	3,653	4,418
GROVES	JEFFERSON	NECHES	44	43	43	42	41	41
GROVES	JEFFERSON	NECHES-TRINITY	3,146	3,094	3,042	2,989	2,955	2,955

Region I Water User Group Demand
(Ac-ft per Year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
IRRIGATION	JEFFERSON	NECHES	7,839	7,839	7,839	7,839	7,839	7,839
IRRIGATION	JEFFERSON	NECHES-TRINITY	132,161	132,161	132,161	132,161	132,161	132,161
JEFFERSON COUNTY WCID #10	JEFFERSON	NECHES	243	266	285	299	316	353
JEFFERSON COUNTY WCID #10	JEFFERSON	NECHES-TRINITY	397	434	465	488	516	576
LIVESTOCK	JEFFERSON	NECHES	105	105	105	105	105	105
LIVESTOCK	JEFFERSON	NECHES-TRINITY	702	702	702	702	702	702
MANUFACTURING	JEFFERSON	NECHES	38,760	108,166	154,182	160,816	167,397	174,011
MANUFACTURING	JEFFERSON	NECHES-TRINITY	112,912	315,092	449,139	468,355	487,637	506,903
MEEKER MUD	JEFFERSON	NECHES	52	61	68	74	80	93
MEEKER MUD	JEFFERSON	NECHES-TRINITY	272	318	355	387	418	487
MINING	JEFFERSON	NECHES	67	69	71	72	74	75
MINING	JEFFERSON	NECHES-TRINITY	256	265	270	276	281	285
NEDERLAND	JEFFERSON	NECHES	159	165	170	172	177	187
NEDERLAND	JEFFERSON	NECHES-TRINITY	3,966	4,103	4,217	4,284	4,396	4,647
NOME	JEFFERSON	NECHES	90	97	102	107	112	122
NOME	JEFFERSON	NECHES-TRINITY	37	39	42	43	45	50
PORT ARTHUR	JEFFERSON	NECHES	59	58	56	55	54	54
PORT ARTHUR	JEFFERSON	NECHES-TRINITY	9,645	9,452	9,259	9,067	8,939	8,939
PORT NECHES	JEFFERSON	NECHES	909	909	913	908	920	960
PORT NECHES	JEFFERSON	NECHES-TRINITY	873	873	876	872	884	922
STEAM ELECTRIC POWER	JEFFERSON	NECHES	0	13,426	15,696	18,464	21,838	25,951
WEST JEFFERSON COUNTY MWD	JEFFERSON	NECHES-TRINITY	1,029	1,148	1,264	1,345	1,436	1,631
APPLEBY WSC	NACOGDOCHES	NECHES	763	945	1,117	1,311	1,678	2,074
COUNTY-OTHER	NACOGDOCHES	NECHES	1,120	1,199	1,265	1,350	1,541	1,758
CUSHING	NACOGDOCHES	NECHES	129	135	140	147	162	179
D&M WSC	NACOGDOCHES	NECHES	656	702	741	790	902	1,030
GARRISON	NACOGDOCHES	NECHES	149	147	144	141	139	139
IRRIGATION	NACOGDOCHES	NECHES	302	302	302	302	302	302
LILLY GROVE SUD	NACOGDOCHES	NECHES	423	533	641	752	982	1,224
LIVESTOCK	NACOGDOCHES	NECHES	1,719	1,954	2,227	2,544	2,911	3,332
MANUFACTURING	NACOGDOCHES	NECHES	2,288	2,553	2,786	3,016	3,214	3,468
MELROSE WSC	NACOGDOCHES	NECHES	386	414	436	465	531	606
MINING	NACOGDOCHES	NECHES	2,715	7,213	212	211	210	209
NACOGDOCHES	NACOGDOCHES	NECHES	7,625	8,423	9,218	9,939	11,352	12,540
STEAM ELECTRIC POWER	NACOGDOCHES	NECHES	4,828	6,911	8,079	9,504	11,241	13,358
SWIFT WSC	NACOGDOCHES	NECHES	483	567	640	730	903	1,093
WODEN WSC	NACOGDOCHES	NECHES	290	310	328	349	399	455
COUNTY-OTHER	NEWTON	SABINE	1,128	1,132	1,103	1,100	1,120	1,154
IRRIGATION	NEWTON	SABINE	367	367	367	367	367	367

Region I Water User Group Demand
(Ac-ft per Year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
LIVESTOCK	NEWTON	SABINE	110	110	110	110	110	110
MANUFACTURING	NEWTON	SABINE	678	793	899	1,006	1,103	1,196
MAURICEVILLE SUD	NEWTON	SABINE	37	37	37	37	38	39
MINING	NEWTON	NECHES	6	6	6	6	6	6
MINING	NEWTON	SABINE	26	26	26	26	26	26
NEWTON	NEWTON	SABINE	480	495	489	497	509	524
SOUTH NEWTON WSC	NEWTON	SABINE	257	259	253	253	257	265
STEAM ELECTRIC POWER	NEWTON	SABINE	5,924	14,132	16,522	19,436	22,987	27,317
BRIDGE CITY	ORANGE	NECHES	135	137	135	131	131	133
BRIDGE CITY	ORANGE	NECHES-TRINITY	127	129	126	123	123	125
BRIDGE CITY	ORANGE	SABINE	703	711	699	680	682	689
COUNTY-OTHER	ORANGE	NECHES	2,072	2,033	1,993	1,947	1,939	1,946
COUNTY-OTHER	ORANGE	NECHES-TRINITY	1	1	1	1	1	1
COUNTY-OTHER	ORANGE	SABINE	2,486	2,439	2,391	2,336	2,327	2,335
IRRIGATION	ORANGE	NECHES	2,032	2,032	2,032	2,032	2,032	2,032
IRRIGATION	ORANGE	SABINE	477	477	477	477	477	477
LIVESTOCK	ORANGE	NECHES	92	92	92	92	92	92
LIVESTOCK	ORANGE	SABINE	118	118	118	118	118	118
MANUFACTURING	ORANGE	NECHES	1,242	1,389	1,518	1,647	1,761	1,889
MANUFACTURING	ORANGE	SABINE	56,382	63,072	68,921	74,752	79,929	85,752
MAURICEVILLE SUD	ORANGE	SABINE	721	877	921	936	998	1,042
MINING	ORANGE	NECHES	7	8	8	8	8	8
MINING	ORANGE	SABINE	1	1	1	1	1	1
ORANGE	ORANGE	SABINE	3,801	3,738	3,675	3,613	3,571	3,571
PINE FOREST	ORANGE	NECHES	73	71	69	67	65	65
PINEHURST	ORANGE	SABINE	336	329	321	313	308	308
ROSE CITY	ORANGE	NECHES	84	83	81	79	78	78
SOUTH NEWTON WSC	ORANGE	SABINE	97	109	113	112	116	120
STEAM ELECTRIC POWER	ORANGE	NECHES	6,228	4,966	5,805	6,829	8,077	9,598
VIDOR	ORANGE	NECHES	1,303	1,295	1,276	1,249	1,250	1,258
VIDOR	ORANGE	SABINE	326	324	319	312	312	314
WEST ORANGE	ORANGE	SABINE	530	516	502	488	479	479
BECKVILLE	PANOLA	SABINE	133	133	132	131	131	132
CARTHAGE	PANOLA	SABINE	2,274	2,297	2,311	2,317	2,326	2,343
COUNTY-OTHER	PANOLA	CYPRESS	5	5	5	5	5	5
COUNTY-OTHER	PANOLA	SABINE	1,693	1,676	1,651	1,620	1,602	1,614
GILL WSC	PANOLA	SABINE	94	96	97	99	100	100
LIVESTOCK	PANOLA	CYPRESS	31	31	31	31	31	31
LIVESTOCK	PANOLA	SABINE	3,065	3,065	3,065	3,065	3,065	3,065

Region I Water User Group Demand
(Ac-ft per Year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
MANUFACTURING	PANOLA	SABINE	1,357	1,437	1,500	1,561	1,614	1,720
MINING	PANOLA	SABINE	3,756	4,271	4,587	4,905	5,228	5,536
TATUM	PANOLA	SABINE	29	28	28	28	27	28
CORRIGAN	POLK	NECHES	270	320	358	378	389	408
COUNTY-OTHER	POLK	NECHES	1,110	1,319	1,480	1,583	1,647	1,730
IRRIGATION	POLK	NECHES	135	135	135	135	135	135
LIVESTOCK	POLK	NECHES	202	202	202	202	202	202
MANUFACTURING	POLK	NECHES	619	725	825	930	1,026	1,110
COUNTY-OTHER	RUSK	NECHES	1,225	1,258	1,270	1,243	1,283	1,422
COUNTY-OTHER	RUSK	SABINE	1,435	1,475	1,489	1,457	1,504	1,666
EASTON	RUSK	SABINE	8	11	12	13	15	21
ELDERVILLE WSC	RUSK	SABINE	324	353	369	378	400	456
HENDERSON	RUSK	NECHES	2,164	2,145	2,119	2,088	2,077	2,105
HENDERSON	RUSK	SABINE	253	251	248	245	243	246
IRRIGATION	RUSK	NECHES	19	19	19	19	19	19
IRRIGATION	RUSK	SABINE	107	107	107	107	107	107
KILGORE	RUSK	SABINE	532	520	512	503	500	500
LIVESTOCK	RUSK	NECHES	655	665	676	689	704	718
LIVESTOCK	RUSK	SABINE	516	523	531	542	553	565
MANUFACTURING	RUSK	NECHES	78	86	93	99	103	111
MANUFACTURING	RUSK	SABINE	4	4	4	4	5	5
MINING	RUSK	NECHES	961	1,048	1,099	1,149	1,199	1,246
MINING	RUSK	SABINE	579	631	662	692	722	750
MOUNT ENTERPRISE	RUSK	NECHES	71	71	70	68	69	73
NEW LONDON	RUSK	NECHES	117	119	120	119	121	129
NEW LONDON	RUSK	SABINE	108	109	110	109	111	119
OVERTON	RUSK	NECHES	44	46	46	46	48	52
OVERTON	RUSK	SABINE	369	383	388	386	399	439
SOUTHERN UTILITIES COMPANY	RUSK	NECHES	71	74	74	75	77	85
STEAM ELECTRIC POWER	RUSK	SABINE	24,760	27,458	32,102	37,762	44,663	53,074
TATUM	RUSK	SABINE	122	118	115	112	110	110
WEST GREGG WSC	RUSK	SABINE	15	15	15	15	15	16
COUNTY-OTHER	SABINE	NECHES	359	368	374	380	387	399
COUNTY-OTHER	SABINE	SABINE	90	93	94	96	98	101
G-M WSC	SABINE	SABINE	665	668	662	655	666	686
HEMPHILL	SABINE	SABINE	371	382	389	397	406	418
LIVESTOCK	SABINE	NECHES	107	114	121	131	141	153
LIVESTOCK	SABINE	SABINE	560	596	638	685	741	801
MANUFACTURING	SABINE	NECHES	359	427	490	554	611	662

Region I Water User Group Demand
(Ac-ft per Year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
PINELAND	SABINE	NECHES	221	227	230	232	237	244
COUNTY-OTHER	SAN AUGUSTINE	NECHES	621	619	614	610	620	633
COUNTY-OTHER	SAN AUGUSTINE	SABINE	4	4	4	4	4	4
G-M WSC	SAN AUGUSTINE	SABINE	77	75	74	74	75	76
IRRIGATION	SAN AUGUSTINE	NECHES	196	196	196	196	196	196
IRRIGATION	SAN AUGUSTINE	SABINE	29	29	29	29	29	29
LIVESTOCK	SAN AUGUSTINE	NECHES	873	941	1,020	1,111	1,218	1,334
LIVESTOCK	SAN AUGUSTINE	SABINE	131	141	153	167	182	200
MANUFACTURING	SAN AUGUSTINE	NECHES	6	7	8	9	10	11
MINING	SAN AUGUSTINE	NECHES	1,500	7,000	0	0	0	0
SAN AUGUSTINE	SAN AUGUSTINE	NECHES	915	925	939	957	979	999
CENTER	SHELBY	SABINE	1,633	1,718	1,785	1,823	1,867	1,923
COUNTY-OTHER	SHELBY	NECHES	316	329	339	342	348	360
COUNTY-OTHER	SHELBY	SABINE	1,771	1,843	1,902	1,913	1,952	2,015
IRRIGATION	SHELBY	NECHES	9	10	11	12	13	15
IRRIGATION	SHELBY	SABINE	18	20	23	25	28	31
JOAQUIN	SHELBY	SABINE	148	155	158	160	163	168
LIVESTOCK	SHELBY	NECHES	679	828	1,009	1,230	1,499	1,828
LIVESTOCK	SHELBY	SABINE	3,567	4,348	5,301	6,461	7,877	9,602
MANUFACTURING	SHELBY	SABINE	1,360	1,508	1,637	1,766	1,880	2,019
MINING	SHELBY	NECHES	500	1,500	0	0	0	0
TENAHA	SHELBY	SABINE	191	187	184	180	178	178
TIMPSON	SHELBY	NECHES	2	2	2	2	2	2
TIMPSON	SHELBY	SABINE	177	179	179	178	179	182
ARP	SMITH	NECHES	173	178	183	188	200	218
BULLARD	SMITH	NECHES	309	338	366	395	447	518
COMMUNITY WATER COMPANY	SMITH	NECHES	137	188	211	232	271	327
COUNTY-OTHER	SMITH	NECHES	929	823	726	643	572	512
CRYSTAL SYSTEMS INC	SMITH	NECHES	65	71	77	82	93	108
DEAN WSC	SMITH	NECHES	538	582	629	673	761	889
IRRIGATION	SMITH	NECHES	566	595	626	657	689	723
JACKSON WSC	SMITH	NECHES	288	333	384	431	463	499
LINDALE	SMITH	NECHES	150	148	146	145	144	144
LINDALE RURAL WSC	SMITH	NECHES	438	484	531	577	662	780
LIVESTOCK	SMITH	NECHES	660	660	660	660	660	660
MANUFACTURING	SMITH	NECHES	3,846	4,297	4,697	5,081	5,407	5,854
MINING	SMITH	NECHES	183	262	295	351	391	424
NEW CHAPEL HILL	SMITH	NECHES	118	127	137	146	163	187
NOONDAY	SMITH	NECHES	102	105	107	110	117	127

Region I Water User Group Demand
(Ac-ft per Year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
OVERTON	SMITH	NECHES	11	11	11	12	12	13
R P M WSC	SMITH	NECHES	32	34	36	38	42	47
SOUTHERN UTILITIES COMPANY	SMITH	NECHES	6,058	6,296	6,507	6,750	7,402	8,363
TROUP	SMITH	NECHES	286	297	311	322	351	393
TYLER	SMITH	NECHES	25,528	26,385	27,211	28,007	29,771	32,253
WHITEHOUSE	SMITH	NECHES	982	1,070	1,153	1,240	1,405	1,636
COUNTY-OTHER	TRINITY	NECHES	585	619	623	640	663	688
GROVETON	TRINITY	NECHES	114	121	122	118	113	109
LIVESTOCK	TRINITY	NECHES	194	194	194	194	194	194
COLMESNEIL	TYLER	NECHES	72	80	84	84	83	83
COUNTY-OTHER	TYLER	NECHES	1,422	1,587	1,684	1,696	1,677	1,677
IRRIGATION	TYLER	NECHES	29	29	29	29	29	29
LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE CO	TYLER	NECHES	7	7	8	8	8	8
LIVESTOCK	TYLER	NECHES	274	274	274	274	274	274
MANUFACTURING	TYLER	NECHES	39	46	53	60	66	71
TYLER COUNTY WSC	TYLER	NECHES	575	633	665	663	652	652
WOODVILLE	TYLER	NECHES	661	750	802	818	814	814

Region I Wholesale Water Provider Demand
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	2010	2020	2030	2040	2050	2060
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	CHEROKEE	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	ARP	SMITH	NECHES	428	428	428	428	428	428
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	SMITH	NECHES	855	855	855	855	855	855
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	NACOGDOCHES	NECHES	428	428	428	428	428	428
ANGELINA & NECHES RIVER AUTHORITY	ALTO	CHEROKEE	NECHES	428	428	428	428	428	428
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	CHEROKEE	NECHES	3,848	3,848	3,848	3,848	3,848	3,848
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	JASPER	NECHES	60	65	70	70	70	70
ANGELINA & NECHES RIVER AUTHORITY	JACKSON WSC	SMITH	NECHES	855	855	855	855	855	855
ANGELINA & NECHES RIVER AUTHORITY	JACKSONVILLE	CHEROKEE	NECHES	4,275	4,275	4,275	4,275	4,275	4,275
ANGELINA & NECHES RIVER AUTHORITY	NACOGDOCHES	NACOGDOCHES	NECHES	8,551	8,551	8,551	8,551	8,551	8,551
ANGELINA & NECHES RIVER AUTHORITY	NEW LONDON	RUSK	SABINE	855	855	855	855	855	855
ANGELINA & NECHES RIVER AUTHORITY	NEW SUMMERFIELD	CHEROKEE	NECHES	2,565	2,565	2,565	2,565	2,565	2,565
ANGELINA & NECHES RIVER AUTHORITY	NORTH CHEROKEE WSC	CHEROKEE	NECHES	4,275	4,275	4,275	4,275	4,275	4,275
ANGELINA & NECHES RIVER AUTHORITY	RUSK	CHEROKEE	NECHES	4,275	4,275	4,275	4,275	4,275	4,275
ANGELINA & NECHES RIVER AUTHORITY	RUSK RURAL WSC	CHEROKEE	NECHES	855	855	855	855	855	855
ANGELINA & NECHES RIVER AUTHORITY	MANUFACTURING	ANGELINA	NECHES	8,551	8,551	8,551	8,551	8,551	8,551
ANGELINA & NECHES RIVER AUTHORITY	TROUP	SMITH	NECHES	4,275	4,275	4,275	4,275	4,275	4,275
ANGELINA & NECHES RIVER AUTHORITY	WHITEHOUSE	SMITH	NECHES	8,551	8,551	8,551	8,551	8,551	8,551
ANGELINA NACOGDOCHES WCID #1	COUNTY-OTHER	CHEROKEE	NECHES	0	0	0	0	0	0
ANGELINA NACOGDOCHES WCID #1	HENDERSON	RUSK	NECHES	2,242	0	0	0	0	0
ANGELINA NACOGDOCHES WCID #1	STEAM ELECTRIC POWER	CHEROKEE	NECHES	2,245	1,790	2,093	2,462	2,912	3,460
ANGELINA NACOGDOCHES WCID #1	STEAM ELECTRIC POWER	NACOGDOCHES	NECHES	2,240	6,721	6,721	6,721	0	0
ANGELINA NACOGDOCHES WCID #1	WHITEHOUSE	SMITH	NECHES	2,186	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	COUNTY-OTHER	HENDERSON	NECHES	0	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	ATHENS	HENDERSON	TRINITY	2,027	2,506	3,078	3,732	4,588	5,647
ATHENS MUNICIPAL WATER AUTHORITY	ATHENS	HENDERSON	NECHES	58	85	112	138	174	220
ATHENS MUNICIPAL WATER AUTHORITY	IRRIGATION	HENDERSON	NECHES	159	164	169	174	179	185
ATHENS MUNICIPAL WATER AUTHORITY	LIVESTOCK	HENDERSON	NECHES	3,023	3,023	3,023	3,023	3,023	3,023
ATHENS MUNICIPAL WATER AUTHORITY	MANUFACTURING	HENDERSON	TRINITY	100	106	120	136	155	176
BEAUMONT CITY OF	BEAUMONT	JEFFERSON	NECHES	9,853	9,713	9,574	9,434	9,341	9,341
BEAUMONT CITY OF	BEAUMONT	JEFFERSON	NECHES-TRINITY	17,187	16,944	16,701	16,458	16,295	16,295
BEAUMONT CITY OF	BEAUMONT	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
BEAUMONT CITY OF	COUNTY-OTHER	JEFFERSON	NECHES	13	17	20	23	26	31
BEAUMONT CITY OF	COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	1,679	2,177	2,595	2,922	3,285	3,973
BEAUMONT CITY OF	MANUFACTURING	JEFFERSON	NECHES	1,000	1,105	1,221	1,349	1,490	1,646
BEAUMONT CITY OF	MEEKER MUD	JEFFERSON	NECHES	3	4	4	5	5	8
CARTHAGE CITY OF	CARTHAGE	PANOLA	SABINE	0	0	0	0	0	0
CARTHAGE CITY OF	CARTHAGE	PANOLA	SABINE	2,274	2,297	2,311	2,317	2,326	2,343
CARTHAGE CITY OF	COUNTY-OTHER	PANOLA	CYPRESS	5	5	5	5	5	5
CARTHAGE CITY OF	COUNTY-OTHER	PANOLA	SABINE	1,482	1,482	1,482	1,482	1,482	1,482
CARTHAGE CITY OF	MANUFACTURING	PANOLA	SABINE	1,018	1,078	1,125	1,171	1,211	1,290
CENTER CITY OF	CENTER	SHELBY	SABINE	1,633	1,718	1,785	1,823	1,867	1,923
CENTER CITY OF	MANUFACTURING	SHELBY	SABINE	1,156	1,282	1,391	1,501	1,598	1,716
CENTER CITY OF	COUNTY-OTHER	SHELBY	SABINE	167	174	179	180	184	190

Region I Wholesale Water Provider Demand
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	2010	2020	2030	2040	2050	2060
CENTER CITY OF	COUNTY-OTHER	SHELBY	SABINE	21	22	22	23	23	24
HOUSTON COUNTY WCID #1	CONSOLIDATED WSC	HOUSTON	NECHES	255	255	255	255	255	255
HOUSTON COUNTY WCID #1	CONSOLIDATED WSC	ANDERSON	TRINITY	79	79	79	79	79	79
HOUSTON COUNTY WCID #1	CONSOLIDATED WSC	HOUSTON	TRINITY	674	674	674	674	674	674
HOUSTON COUNTY WCID #1	CONSOLIDATED WSC	ANDERSON	NECHES	23	23	23	23	23	23
HOUSTON COUNTY WCID #1	COUNTY-OTHER	HOUSTON	TRINITY	89	90	91	93	96	100
HOUSTON COUNTY WCID #1	CROCKETT	HOUSTON	TRINITY	1,841	1,841	1,841	1,841	1,841	1,841
HOUSTON COUNTY WCID #1	GRAPELAND	HOUSTON	TRINITY	405	405	405	405	405	405
HOUSTON COUNTY WCID #1	COUNTY-OTHER	HOUSTON	TRINITY	0	0	0	0	0	0
HOUSTON COUNTY WCID #1	LOVELADY	HOUSTON	TRINITY	77	77	77	77	77	77
HOUSTON COUNTY WCID #1	MANUFACTURING	HOUSTON	TRINITY	169	190	209	227	243	263
JACKSONVILLE CITY OF	BULLARD	SMITH	NECHES	10	10	10	10	10	10
JACKSONVILLE CITY OF	COUNTY-OTHER	CHEROKEE	NECHES	226	198	154	95	68	55
JACKSONVILLE CITY OF	CRAFT-TURNEY WSC	CHEROKEE	NECHES	515	614	742	908	995	1,078
JACKSONVILLE CITY OF	JACKSONVILLE	CHEROKEE	NECHES	3,502	3,637	3,741	3,827	3,948	4,111
JACKSONVILLE CITY OF	MANUFACTURING	CHEROKEE	NECHES	718	784	839	891	934	1,007
JACKSONVILLE CITY OF	NORTH CHEROKEE WSC	CHEROKEE	NECHES	387	439	482	519	560	616
LOWER NECHES VALLEY AUTHORITY	BEAUMONT	JEFFERSON	NECHES-TRINITY	31,360	31,360	31,360	31,360	31,360	31,360
LOWER NECHES VALLEY AUTHORITY	BOLIVAR PENINSULAR SUD	GALVESTON	NECHES-TRINITY	5,549	5,499	5,449	5,399	5,349	5,299
LOWER NECHES VALLEY AUTHORITY	COUNTY-OTHER	GALVESTON	NECHES-TRINITY	1	1	1	1	1	1
LOWER NECHES VALLEY AUTHORITY	COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	188	244	291	327	368	445
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JASPER	NECHES	43,982	67,484	77,166	70,824	63,898	56,360
LOWER NECHES VALLEY AUTHORITY	GROVES	JEFFERSON	NECHES	44	43	43	42	41	41
LOWER NECHES VALLEY AUTHORITY	GROVES	JEFFERSON	NECHES-TRINITY	3,146	3,094	3,042	2,989	2,955	2,955
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	CHAMBERS	NECHES-TRINITY	38,000	38,000	38,000	38,000	38,000	38,000
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	LIBERTY	NECHES	2,500	2,500	2,500	2,500	2,500	2,500
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	LIBERTY	NECHES-TRINITY	17,200	17,200	17,200	17,200	17,200	17,200
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	JEFFERSON	NECHES	11,648	11,648	11,648	11,648	11,648	11,648
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	JEFFERSON	NECHES-TRINITY	128,352	128,352	128,352	128,352	128,352	128,352
LOWER NECHES VALLEY AUTHORITY	JEFFERSON COUNTY WCID #10	JEFFERSON	NECHES	243	266	285	299	316	353
LOWER NECHES VALLEY AUTHORITY	JEFFERSON COUNTY WCID #10	JEFFERSON	NECHES-TRINITY	397	434	465	488	516	576
LOWER NECHES VALLEY AUTHORITY	COUNTY-OTHER	JEFFERSON	NECHES	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	COUNTY-OTHER	GALVESTON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JASPER	NECHES	20,189	23,571	26,084	28,281	29,928	29,991
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JEFFERSON	NECHES	32,485	101,169	146,463	75,680	158,234	164,124
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JEFFERSON	NECHES-TRINITY	111,547	313,622	447,553	466,461	485,782	504,892
LOWER NECHES VALLEY AUTHORITY	NEDERLAND	JEFFERSON	NECHES	159	165	170	172	177	187
LOWER NECHES VALLEY AUTHORITY	NEDERLAND	JEFFERSON	NECHES-TRINITY	3,966	4,103	4,217	4,284	4,396	4,647
LOWER NECHES VALLEY AUTHORITY	NOME	JEFFERSON	NECHES	90	97	102	107	112	122
LOWER NECHES VALLEY AUTHORITY	NOME	JEFFERSON	NECHES-TRINITY	37	39	42	43	45	50
LOWER NECHES VALLEY AUTHORITY	PORT ARTHUR	JEFFERSON	NECHES	59	58	56	55	54	54
LOWER NECHES VALLEY AUTHORITY	PORT ARTHUR	JEFFERSON	NECHES-TRINITY	9,645	9,452	9,259	9,067	8,939	8,939
LOWER NECHES VALLEY AUTHORITY	PORT NECHES	JEFFERSON	NECHES	909	909	913	908	920	960
LOWER NECHES VALLEY AUTHORITY	PORT NECHES	JEFFERSON	NECHES-TRINITY	873	873	876	872	884	992

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WWP Name	WUG Name	WUG County	WUG Basin	2010	2020	2030	2040	2050	2060
LOWER NECHES VALLEY AUTHORITY	TRINITY BAY CONSERVATION DISTRICT	CHAMBERS	NECHES-TRINITY	421	479	547	623	709	807
LOWER NECHES VALLEY AUTHORITY	TRINITY BAY CONSERVATION DISTRICT	CHAMBERS	TRINITY	192	219	249	284	324	370
LOWER NECHES VALLEY AUTHORITY	WEST JEFFERSON COUNTY MWD	JEFFERSON	NECHES-TRINITY	1,029	1,148	1,264	1,345	1,436	1,631
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JASPER	NECHES	50,000	50,000	50,000	50,000	50,000	50,000
LOWER NECHES VALLEY AUTHORITY	WOODVILLE	TYLER	NECHES	5,600	5,600	5,600	5,600	5,600	5,600
LUFKIN CITY OF	LUFKIN	ANGELINA	NECHES	7,546	8,444	9,446	10,565	11,951	13,599
LUFKIN CITY OF	COUNTY-OTHER	ANGELINA	NECHES	131	148	164	177	195	219
LUFKIN CITY OF	DIBOLL	ANGELINA	NECHES	1,940	1,940	1,940	1,940	1,940	1,940
LUFKIN CITY OF	HUNTINGTON	ANGELINA	NECHES	20	27	33	36	40	44
LUFKIN CITY OF	MANUFACTURING	ANGELINA	NECHES	9,550	17,255	18,981	20,879	22,966	25,263
LUFKIN CITY OF	REDLAND WSC	ANGELINA	NECHES	107	104	101	98	97	97
NACOGDOCHES CITY OF	APPLEBY WSC	NACOGDOCHES	NECHES	25	145	317	511	878	1,274
NACOGDOCHES CITY OF	NACOGDOCHES	NACOGDOCHES	NECHES	7,625	8,423	9,218	9,939	11,352	12,540
NACOGDOCHES CITY OF	D&M WSC	NACOGDOCHES	NECHES	406	452	491	540	652	780
NACOGDOCHES CITY OF	MANUFACTURING	NACOGDOCHES	NECHES	2,288	2,553	2,786	3,016	3,214	3,468
PANOLA COUNTY FWSD #1	CARTHAGE	PANOLA	SABINE	2,274	2,297	2,311	2,317	2,326	2,343
PANOLA COUNTY FWSD #1	COUNTY-OTHER	PANOLA	SABINE	1,487	1,487	1,487	1,487	1,487	1,487
PANOLA COUNTY FWSD #1	MANUFACTURING	PANOLA	SABINE	1,018	1,078	1,125	1,171	1,210	1,290
PANOLA COUNTY FWSD #1	MINING	PANOLA	SABINE	2,254	2,563	2,752	2,943	3,137	3,322
PANOLA COUNTY FWSD #1	COUNTY-OTHER	PANOLA	SABINE	0	0	0	0	0	0
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	578	646	714	782	850	918
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	5,327	5,954	6,581	7,208	7,835	8,460
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	78	87	96	105	114	124
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	129	144	159	174	189	205
PORT ARTHUR CITY OF	PORT ARTHUR	JEFFERSON	NECHES	59	58	56	55	54	54
PORT ARTHUR CITY OF	PORT ARTHUR	JEFFERSON	NECHES-TRINITY	9,645	9,452	9,259	9,067	8,939	8,939
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	24	27	30	33	36	38
PORT ARTHUR CITY OF	MEEKER MUD	JEFFERSON	NECHES	3	3	3	3	3	3
PORT ARTHUR CITY OF	COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	5	5	5	5	5	5
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	1	1	1	1	1	1
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	224	224	224	224	224	224
SABINE RIVER AUTHORITY	ABLES SPRINGS WSC	KAUFMAN	TRINITY	992	992	992	992	992	992
SABINE RIVER AUTHORITY	ABLES SPRINGS WSC	HUNT	SABINE	119	119	119	119	119	119
SABINE RIVER AUTHORITY	ABLES SPRINGS WSC	VAN ZANDT	SABINE	9	9	9	9	9	9
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	1,120	1,120	1,120	1,120	1,120	1,120
SABINE RIVER AUTHORITY	COUNTY-OTHER	SABINE	SABINE	81	81	81	81	81	81
SABINE RIVER AUTHORITY	CASH SUD	ROCKWALL	SABINE	42	58	62	40	33	26
SABINE RIVER AUTHORITY	CASH SUD	HOPKINS	SABINE	45	51	54	56	52	48
SABINE RIVER AUTHORITY	CASH SUD	HUNT	SABINE	5,429	5,366	5,325	5,315	5,302	5,291
SABINE RIVER AUTHORITY	CASH SUD	RAINS	SABINE	86	103	115	118	117	115
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	2,240	2,240	2,240	2,240	2,240	2,240
SABINE RIVER AUTHORITY	COMMERCE	HUNT	SULPHUR	8,094	8,033	7,973	7,913	7,852	7,792
SABINE RIVER AUTHORITY	DALLAS	DALLAS	TRINITY	315,479	314,111	312,742	311,375	310,006	308,637
SABINE RIVER AUTHORITY	EDGEWOOD	VAN ZANDT	SABINE	793	787	781	776	770	764

Region I Wholesale Water Provider Demand
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	2010	2020	2030	2040	2050	2060
SABINE RIVER AUTHORITY	EMORY	RAINS	SABINE	1,901	1,887	1,873	1,859	1,845	1,832
SABINE RIVER AUTHORITY	GREENVILLE	HUNT	SABINE	20,515	20,363	20,210	20,057	19,904	19,751
SABINE RIVER AUTHORITY	POINT	RAINS	SABINE	422	420	416	414	410	408
SABINE RIVER AUTHORITY	QUITMAN	WOOD	SABINE	1,026	1,019	1,012	1,004	997	990
SABINE RIVER AUTHORITY	TERRELL	KAUFMAN	TRINITY	10,081	10,081	10,081	10,081	10,081	10,081
SABINE RIVER AUTHORITY	WEST TAWAKONI	HUNT	SABINE	1,080	1,072	1,064	1,056	1,047	1,039
SABINE RIVER AUTHORITY	COMBINED CONSUMERS WSC	HUNT	SABINE	1,439	1,390	1,348	1,312	1,271	1,226
SABINE RIVER AUTHORITY	COMBINED CONSUMERS WSC	VAN ZANDT	SABINE	229	266	297	321	351	384
SABINE RIVER AUTHORITY	STEAM ELECTRIC POWER	NEWTON	SABINE	13,442	13,442	13,442	13,442	13,442	13,442
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	24,643	24,643	24,643	24,643	24,643	24,643
SABINE RIVER AUTHORITY	MANUFACTURING	HARRISON	SABINE	3,206	3,184	3,161	3,139	3,116	3,094
SABINE RIVER AUTHORITY	COUNTY-OTHER	SABINE	SABINE	22	22	22	22	22	22
SABINE RIVER AUTHORITY	STEAM ELECTRIC POWER	ORANGE	NECHES	4,481	4,481	4,481	4,481	4,481	4,481
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	280	280	280	280	280	280
SABINE RIVER AUTHORITY	HEMPHILL	SABINE	SABINE	1,841	1,841	1,841	1,841	1,841	1,841
SABINE RIVER AUTHORITY	HENDERSON	RUSK	NECHES	3,922	3,922	3,922	3,922	3,922	3,922
SABINE RIVER AUTHORITY	HENDERSON	RUSK	SABINE	459	459	459	459	459	459
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	1,120	1,120	1,120	1,120	1,120	1,120
SABINE RIVER AUTHORITY	COUNTY-OTHER	SHELBY	SABINE	147	147	147	147	147	147
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	17,922	17,922	17,922	17,922	17,922	17,922
SABINE RIVER AUTHORITY	IRRIGATION	ORANGE	SABINE	2,543	2,543	2,543	2,543	2,543	2,543
SABINE RIVER AUTHORITY	COUNTY-OTHER	GREGG	SABINE	560	556	552	548	544	540
SABINE RIVER AUTHORITY	KILGORE	GREGG	SABINE	5,038	5,002	4,966	4,931	4,896	4,861
SABINE RIVER AUTHORITY	KILGORE	RUSK	SABINE	672	672	672	672	672	672
SABINE RIVER AUTHORITY	LONGVIEW	GREGG	SABINE	17,588	17,464	17,341	17,218	17,095	16,971
SABINE RIVER AUTHORITY	LONGVIEW	HARRISON	SABINE	733	728	723	717	712	707
SABINE RIVER AUTHORITY	MACBEE SUD	HUNT	SABINE	109	109	109	112	178	281
SABINE RIVER AUTHORITY	MACBEE SUD	VAN ZANDT	SABINE	822	822	822	819	753	650
SABINE RIVER AUTHORITY	MACBEE SUD	VAN ZANDT	TRINITY	1,152	1,136	1,120	1,104	1,088	1,072
SABINE RIVER AUTHORITY	MACBEE SUD	KAUFMAN	SABINE	71	75	76	76	76	76
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	NECHES	4,481	4,481	4,481	4,481	4,481	4,481
SABINE RIVER AUTHORITY	COUNTY-OTHER	SABINE	SABINE	28	28	28	28	28	28
SABINE RIVER AUTHORITY	MINING	HARRISON	SABINE	10,993	10,915	10,838	10,761	10,684	10,607
SABINE RIVER AUTHORITY	ROSE CITY	ORANGE	NECHES	478	478	478	478	478	478
SABINE RIVER AUTHORITY	SOUTH TAWAKONI WSC	VAN ZANDT	SABINE	1,056	1,048	1,041	1,033	1,025	1,018
SABINE RIVER AUTHORITY	COUNTY-OTHER	NEWTON	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	COUNTY-OTHER	KAUFMAN	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	STEAM ELECTRIC POWER	NEWTON	SABINE	17,929	17,929	17,929	17,929	17,929	17,929
SABINE RIVER AUTHORITY	WILLS POINT	VAN ZANDT	SABINE	654	654	654	654	654	654
SABINE RIVER AUTHORITY	WILLS POINT	VAN ZANDT	TRINITY	1,458	1,443	1,427	1,412	1,396	1,381
TYLER CITY OF	COUNTY-OTHER	SMITH	NECHES	445	467	491	515	541	568
TYLER CITY OF	IRRIGATION	SMITH	NECHES	300	300	300	300	300	300
TYLER CITY OF	MANUFACTURING	SMITH	NECHES	2,885	3,223	3,523	3,811	4,055	4,391
TYLER CITY OF	SOUTHERN UTILITIES COMPANY	SMITH	NECHES	303	315	325	338	370	918

Region I Wholesale Water Provider Demand
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	2010	2020	2030	2040	2050	2060
TYLER CITY OF	TYLER	SMITH	SABINE	358	464	567	668	844	1,081
TYLER CITY OF	TYLER	SMITH	NECHES	25,528	26,385	27,211	28,007	29,771	32,253
TYLER CITY OF	WHITEHOUSE	SMITH	NECHES	687	749	807	868	984	1,145
UPPER NECHES MWD	DALLAS	DALLAS	TRINITY	114,337	114,337	114,337	114,337	114,337	114,337
UPPER NECHES MWD	PALESTINE	ANDERSON	TRINITY	28,000	28,000	28,000	28,000	28,000	28,000
UPPER NECHES MWD	TYLER	SMITH	NECHES	67,200	67,200	67,200	67,200	67,200	67,200
UPPER NECHES MWD	COUNTY-OTHER	SMITH	NECHES	93	82	73	64	57	51
UPPER NECHES MWD	COUNTY-OTHER	SMITH	NECHES	105	105	105	105	105	105
UPPER NECHES MWD	IRRIGATION	CHEROKEE	NECHES	300	300	300	300	300	300
UPPER NECHES MWD	COUNTY-OTHER	HENDERSON	NECHES	100	100	100	100	100	100
UPPER NECHES MWD	COUNTY-OTHER	ANDERSON	NECHES	0	0	0	0	0	0

Appendix 3-A

Environmental Flows Recommendations Report Executive Summary for the Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Area Stakeholder Committee Report

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This appendix contains the Executive Summary for the Environmental Flows Recommendations Report prepared by the Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Expert Science Team. The report was issued on November 30, 2009, and contains a comprehensive report on the Sabine and Neches River Basins and Sabine Lake Estuary.

In addition, this appendix contains the Draft Recommendation Report of the Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Area Stakeholder Committee. This draft report is dated May 4, 2010, and has been submitted to the TCEQ.

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EXECUTIVE SUMMARY

The Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Expert Science Team (Sabine-Neches BBEST) was appointed by the Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Area Stakeholders Committee (Sabine-Neches BBASC) under Senate Bill 3 (Texas Legislature 2007), the third in a series of three omnibus water bills related to the State of Texas meeting the future needs for water. Under its SB 3 charge, the Sabine-Neches BBEST used the "best available science" to develop environmental flow analyses and recommend flow regimes for the Sabine and Neches Basins and the Sabine-Neches Estuary. These recommendations are provided to the Sabine-Neches BBASC, Texas Environmental Flows Advisory Group (EFAG), and the Texas Commission on Environmental Quality (TCEQ).

The Sabine-Neches BBEST held twelve monthly meetings and several workshops beginning with its initial meeting on December 8, 2009. To accomplish this task the Sabine-Neches BBEST established subcommittees for:

- gaging
- hydrology
- biology
- water quality
- geomorphology
- Recommendations Report preparation.

Two consulting firms were retained to provide modeling and research in addition to extensive committee/subcommittee work. The meetings were an open process that benefited from participation and contributions from the resource agencies – TCEQ, Texas Water Development Board (TWDB) and Texas Parks and Wildlife Department (TPWD), environmental groups such as the National Wildlife Federation (NWF), and the public.

The Sabine-Neches BBEST believes the body of work presented and discussed in the Recommendations Report (Report) has enabled it to move the Texas environmental flows process forward and to address the charge to develop environmental flow analyses and recommend an environmental flow regime in a positive manner within the limited time frame and full recognition of the best science available. The Report is comprised of:

- a <u>Preamble</u>, which outlines the charge, goal and objectives;
- <u>Summary of Recommendations, Recognitions and Rationale</u>, which highlights the report findings;
- <u>Basins and Bay Descriptions and Current Conditions</u>, which describes the Sabine River Basin (Texas and Louisiana), the Neches River Basin, Sabine Lake Estuary (Sabine-Neches Estuary, Texas and Louisiana); Regional Water Planning (SB 1 ongoing process), and Sabine-Neches Study Area Unique Issues;
- <u>Texas Environmental Flows Science Advisory Committee</u> (SAC) which provided guidance documents for this process as well as overall direction, coordination, and consistency from the broader state perspective;

- Discipline Reports from the four disciplines – hydrology, biology, water quality and geomorphology;
- Development of Environmental Flows Recommendations/Recognitions/Unresolved Issues which includes instream flow regime application, environmental flow matrices for selected stream flow gages, and inflows to Sabine-Neches Estuary; and
- Appendices which includes the full body of work and references that the Report is based on.

The SAC, an objective body of experts tasked to advise and make recommendations to the Environmental Flows Advisory Group, provided valuable assistance to the Trinity-San Jacinto BBEST and Sabine-Neches BBEST as the two initial BBESTs. To date, the SAC, composed of members with expertise in a number of technical fields including hydrology, hydraulics, water resources, aquatic and terrestrial biology, geomorphology, geology, water quality, and computer modeling, has developed six technical guidance documents for BBEST use. These are as follows:

- Geographic Scope of Instream Flow Recommendations;
- Use of Hydrologic Data in the Development of Instream Flow Recommendations for the Environmental Flows Allocation Process and the Hydrology-Based Environmental Flow Regime (HEFR);
- Fluvial Sediment Transport as an Overlay to Instream Flow Recommendations for the Environmental Flows Allocation Process;
- Methodologies for Establishing a Freshwater Inflow Regime for Texas Estuaries Within the Context of the Senate Bill 3 Environmental Flows Process;
- Nutrient and Water Quality Overlay on Hydrology-Based Instream Flow Recommendations; and
- Essential Steps for Biological Overlays in Developing Senate Bill 3 Instream Flow Recommendations.

Unfortunately, the Sabine-Neches BBEST was unable to take full advantage of all guidance documents since the SAC's development timeline coincided with the Sabine-Neches BBEST timeline. However, the SAC member performing as liaison to the Sabine-Neches BBEST assisted the group by providing the initial drafts of works in progress to allow the process to move forward. This resulted in an evolving process through the twelve months with the Report reflecting a transition of understanding from SAC guidance to the Sabine-Neches BBEST, to its consultants' work, its subcommittees' reports, input from the resource agencies, and the NWF studies. This input and work influenced the understanding and progress along the twelve month timeline. The final Report reflects the evolving and transitional understanding as the year unfolded and additional information and data was brought into the process.

Decision Tree – To help follow this process from start to finish, the Sabine-Neches BBEST developed a DECISION TREE (Figure 4, page 8). The Decision Tree traces the decisions made throughout the process. The decision tree was instrumental in tracking decisions and pathways and the concept should be of great value to future BBESTs.

During the course of the past year, the Sabine-Neches BBEST recognized its recommendation charge required further clarity. Taking its charge from the "theoretical" to the "practical", the Sabine-Neches BBEST was able to make some specific environmental flow recommendations, while in other cases (for example overbank flows), the group agreed to recognize (recognition) the ecological value of such flows but not recommend them. The Sabine-Neches BBEST was able to move forward with the environmental flow process by agreeing that some issues, due to the severe time constraint and limitations of available science would remain 'unresolved issues'. These unresolved issues would need 'future studies' and, ultimately, as envisioned by the SB 3 process, 'adaptive management' to resolve. Thus, over time, the path forward became:

1. Recommendations;
2. Recognitions;
3. Unresolved Issues;
4. Future Studies; and
5. Adaptive Management.

Recommendations and Recognitions

The following recommendations and recognitions are presented in the Report with qualifying language and in some cases remain unresolved issues that will need future study and adaptive management to determine if particular flow components need to be altered. The recommendations and recognitions are presented in the Report with supporting rationale based on information and data summarized from a substantial body of work in the appendices and noted references. They are summarized as follows:

Recommendations:

1. Recommendation 1: Definition of a Sound Ecological Environment.
   The Sabine-Neches BBEST recommends the SAC definition that it adopted (see Section 1.2.4, page 11) for sound ecological environment.
2. Recommendation 2: The Current Conditions of the Sabine and Neches Rivers and the Sabine-Neches Estuary are Sound.
3. Recommendation 3: Acknowledge that Flows in the Sabine and Neches Rivers and Inflow to the Sabine-Neches Estuary will Change Over Time.
4. Recommendation 4: Future Study, Data Gathering, and Adaptive Management are Necessary to Determine Whether or not Changes in Environmental Flows will Maintain a Sound Ecological Environment.
5. Recommendation 5: Applicable Hydrologic Conditions for the Entire Season are Defined on the Basis of an Assessment of Hydrologic Conditions of Storage in Selected Reservoirs at the Beginning of the First Day of the Season Thereby Recognizing Both Drought Persistence and Practical Operations.
6. Recommendation 6: Subsistence Flows.
   The Sabine-Neches BBEST recommends adoption of the seasonal subsistence flows from MBFIT /HEFR, unless:
   i. the seasonal value is less than the summer value in which case the summer value is adopted by default, and

ii. MBFIT/HEFR failed to calculate a value (this occurred usually for winter) in which case the lowest recorded flow value for that season at that gage was adopted by default.

Translation of seasonal subsistence flows into environmental flow standards and permit conditions should not result in more frequent occurrence of flows less than the recommended seasonal subsistence values as a result of the issuance of new surface water appropriations or amendments.

7. Recommendation 7: Base flows.

   Seasonal base flows represent thresholds for environmental protection based on current scientific understanding of fluvial and estuarine ecosystems. As new studies and monitoring information become available, these base flow thresholds may be revised.

8. Recommendation 8: High Flow Pulses.

   Seasonal high flow pulses have recognized ecological benefits and are recommended for protection with certain reservations associated with environmental and operational liability risks.

9. Recommendation 9: Fluvial Matrices Inflow Recommendations are Adequate to Maintain a Sound Ecological Environment in the Sabine-Neches Estuary.

   Recognizing that the Sabine-Neches Estuary is a system in transition (Tatum 2009) and that the Sabine-Neches Estuary receives the freshwater inflows determined by the flow component recommendations for the Sabine-Ruliff, Neches-Evadale, and Village Creek gages (as well as other inflows), the Sabine-Neches BBEST recommends that these inflows are adequate to maintain a sound ecological environment in the Sabine-Neches Estuary.

Recognitions

1. Recognition 1: Overbank Flows Have Recognized Ecological Benefits but are not Recommended.

   Overbank flows may cause extensive damage to private property and endanger the public. Therefore the Sabine-Neches BBEST recognizes the ecological benefits of these events, but cannot recommend such events be produced.

2. Recognition 2: Toledo Bend Reservoir FERC Relicensing.

   The relicensing of the Toledo Bend Project is ongoing at this time. The relicensing will recognize the Project's primary use as a water supply project with the capability of generating hydroelectric power. Since no major changes in operations are planned, a maintenance flow will continue to be maintained from the spillway.

3. Recognition 3: Sabine River Compact.

   The major purposes of the Sabine River Compact are to provide for the equitable apportionment between the States of Louisiana and Texas of the waters of the Sabine River and its tributaries. Texas retains free and unrestricted use of the water of the Sabine River and its tributaries above the Stateline, subject only to the provisions that the minimum flow of 36 cfs must be maintained at the Stateline. All free water (free water means all waters other than stored water) and stored water in the Stateline reach, without reference to origin, will be divided equally between the two states.

4. Recognition 4: Cutoff Bayou.
   Environmental flows as well as the diversions for the water supply canal system in Texas are adversely affected by migration of channel flow to the Old River Channel in Louisiana during low and average flow conditions.

Basins and Bay Descriptions and Current Conditions

The Study Area defined for the Sabine-Neches BBEST is the Sabine River Basin and the Neches River Basin with each having a watershed of approximately 10,000 square miles with the total drainage of some 20,000 square miles being received by the Sabine-Neches Estuary. Detail descriptions and maps are found in the Report and supporting appendices and references. SB 1 Regional Water Planning for this area is presented in Regions I, D and C plans since the geographic footprint extends into all three regions. SB 2, or Texas Instream Flow Program (TIFP), studies include only the lower Sabine River from Toledo Bend Reservoir to tidal. (The State of Louisiana owns half the flow in this stateline reach, but does not have a program similar to SB 2). Unique aspects of the Study Area include:

1. Texas/Louisiana (stateline flows, water supply reservoir and estuary);
2. Texas State Water Quality Flows (Texas – 7Q2/Louisiana – 7Q10);
3. SB 2 priority study – lower Sabine River;
4. Toledo Bend Reservoir Project Joint Operations – Federal Energy Regulatory Commission relicense of Toledo Bend hydropower facility;
5. Sabine River Compact which provides for equitable apportionment of waters between Texas and Louisiana;
6. Lower Neches River Saltwater Barrier - minimum flow requirement;
7. Cutoff Bayou – migration of water to Louisiana's Old Sabine River channel affecting environmental flows and water supply users in Texas; and
8. USACE proposed deepening of existing ship channel through the Sabine-Neches Estuary to upstream ports.

Discipline Reports

The Sabine-Neches BBEST Subcommittees submitted reports –on the disciplines of hydrology, biology, water quality and geomorphology – key components identified by the TIFP Technical Overview.

Hydrology – The Hydrology Subcommittee benefited from outside consultant work which prepared three memoranda:

1. Analysis of Sabine-Neches BBEST Stream Gages;
2. Hydrology-Based Environmental Flow Regime (HEFR) Analyses for Sabine-Neches BBEST; and
3. Water Availability Analyses for Sabine-Neches BBEST.

The subcommittee worked with the consultant in the preparation of these memos and used this baseline work to develop flow regime matrices for each of the selected gages for use by the other disciplines.

Biology – The Biology Subcommittee assisted in the selection of representative focal species for the two river basins and the estuary, and also worked with an outside consultant to prepare reports on Fluvial Focal Species and Estuarine Focal Species. The flow regime matrix produced by the HEFR statistical analyses of the historical stream gage records was used to evaluate the available biological information for the focal species related to subsistence flows, base flows, high flow pulses, and overbank flows. Using SAC guidance, the estuarine ecosystem evaluation was enhanced with the NWF analysis of habitat suitability for key estuarine species under alternative flow regimes. Changes to the estuary including the ship channel, intracoastal waterway, and secondary channels into the marshes were discussed along with a need for habitat restoration in marshes in Texas and Louisiana. Adaptive management as envisioned by the SB 3 process was considered along with the need for future studies to address the unresolved issues in the Report.

Geomorphology (Sediment Transport) – The Geomorphology Subcommittee, utilizing SAC guidance, worked with the TWDB to address sediment transport in the Study Area. The TWDB has conducted studies of sediment transport and geomorphologic characterization within Texas river systems and most recently has worked with Dr. Jonathan Phillips of the University of Kentucky to conduct studies in the lower Sabine River as part of the SB 2 study. TWDB modeling was undertaken for each of the gages as well to determine how these systems are functioning. Estuary sediment delivery was also considered.

Water Quality – The Water Quality Subcommittee evaluated water quality as an overlay application in environmental flows. Water quality is an important aspect of environmental flow recommendation development. Available water quality was compiled and evaluated for the study area along with water quality standards, flow and water quality relationships, and the integration of water quality into environmental flow recommendations.

Development of Environmental Flows Recommendations/ Recognitions/ Unresolved Issues

As illustrated in the Report's Decision Tree (Figure 4, page 8), the decision process and statistical analyses created, in effect, a statistical river which resulted in HEFR output matrices for each of the twelve gages (six in the Neches Basin and six in the Sabine Basin). These are listed with descriptions of each location and the corresponding matrix (for example – HEFR Matrix for Big Sandy Creek near Big Sandy) which presents the numbers associated with these decisions on a seasonal basis (Sabine-Neches BBEST selected Jan-Mar for winter, Apr-Jun for spring, and so on) for subsistence, base, high flow pulses and overbank flows with qualifying language regarding the interpretation of these flow components. For base flows, seasonal numbers were generated for dry, average and wet conditions which were arbitrarily chosen to be 25^{th} /50^{th} /75^{th} percentiles.

The Sabine-Neches BBEST developed an example application of a flow regime to focus on key elements of a HEFR output matrix and considerations in order to understand how such flow regimes might be applied to new surface water appropriations and/or diversions. The group's understanding of potential flow regime application is summarized in a series of examples for Big Sandy Creek near Big Sandy, Texas.

The Sabine-Neches Estuary current status is summarized from the discipline reports, appendices, and reference documents. The SAC guidance, Sabine Lake history, State Methodology, percent inflow schematic documenting inflows (from the Sabine River, the Neches River, and coastal inflows), and HEFR as an estuary inflows recommendation tool are presented. The USACE's project to deepen the ship channel includes extensive studies. Hydrodynamic salinity modeling, water supply planning using the 2007 Texas Water Plan (Texas Water Development Board. 2007) data modeling current and future water use (50 year) conditions, and marsh habitat mitigation/restoration in Texas and Louisiana are included.

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Draft Recommendations Report

May 4, 2010

SABINE AND NECHES RIVERS AND SABINE LAKE BAY BASIN AND BAY AREA STAKEHOLDER COMMITTEE

Sabine-Neches BBASC Draft Recommendations Report Table of Contents

Statutory Background

- Senate Bill 3 is the third of three omnibus water bills related to the State of Texas meeting the future needs for water
  - Senate Bill 1 (1997)
    - Established a bottom-up approach to water resource planning
  - Senate Bill 2 (2001)
    - Addresses groundwater issues
    - Established the *Texas Instream Flows Program* to develop the information to determine the needs of water for the environment
  - Senate Bill 3 (2007) – 80th Regular Session of the Texas Legislature

Senate Bill 3

- Prior to SB 3, balancing the effect of authorizing a new use of water with the need for that water to maintain a sound ecological system was done on a case-by-case basis in water rights permitting
- ***Consequence**: made water resources planning under SB 1 difficult – the effect of a water management strategy on the environment is not known at the planning stage*
- SB 3 was intended to address this by ...

Intent of Senate Bill 3

- Senate Bill 3 was intended to create a basin-by-basin process for developing "environmental flow standards"
  - to provide the appropriate amount of instream flows and freshwater inflows
  - by balancing the environmental need with the need for water for humans and other purposes.

Sabine-Neches BBASC Charge

- Review the Sabine-Neches BBEST environmental flow recommendations
- Weigh the environmental need for water with needs for other purposes, including human needs
- Make recommendations on "environmental flow standards" for the Bay-Basin complex

Study Area

- Defined as the
  - Sabine River Basin (approximately 10,000 sq. miles)
  - Neches River Basin (approximately 10,000 sq. miles)
  - Sabine-Neches Estuary (Sabine Lake)

Comments on Sabine-Neches BBEST Environmental Flows Recommendations

- Fundamental Comment
  - While SB 3 requires the BBASCs to weigh the environmental need for flows with the need for water for other purposes,
  - the Sabine-Neches BBEST developed a flow regime based on the Hydrology-Based Environmental Flow Regime (HEFR).
  - *The result is an environmental flow regime that mimics historical flows which may or may not represent the least amount of water that can be reserved for the environment and still have a sound ecological system.*

Comment: Sabine-Neches BBASC *agrees* with the Sabine-Neches BBEST that

- The current conditions of the Sabine and Neches Rivers and the Sabine Lake Estuary are sound;
- The flows in the Sabine and Neches Rivers and inflows to the Sabine Lake Estuary will change over time; and
- Future study, data gathering and adaptive management are necessary to determine whether or not changes in environmental flows will maintain a sound ecological environment.

Comment: Sabine-Neches BBASC *disagrees* with the Sabine-Neches BBEST in that

- The Sabine-Neches BBEST's definition of a sound ecological system does not focus on the current makeup of important species and does not adequately cover all of the important habitat types in the study area;
- The flow regime produced by the Sabine-Neches BBEST is more reflective of the existing flows than environmental need for flows; and
- Estuary soundness can best be addressed through physical changes to reduce saltwater intrusion into the surrounding tidal wetlands rather than imposing the HEFR-created flow regimes from the most downstream gages.

Impact of Sabine-Neches BBEST Flow Regime

- The Sabine-Neches BBEST environmental flow recommendations as applied to reservoir projects with new and/or amended permits would require releasing massive amounts of water that might otherwise be stored for future use within the project, resulting in:
  - significant affect on reservoir water levels and availability of firm yield for water supply;
  - more frequent triggering of drought contingency restrictions;
  - adverse impacts on reservoir recreation;
  - thwarting of economic development; and
  - negative affects on reservoir fisheries.

Consideration of Water Needs for Other Uses

- Water Supply
- Economic Value of Reservoir Recreation
- Reservoir Fishery Resources

Water Supply

- The Sabine-Neches BBASC study area contains substantial water resources that are important existing and projected water supplies.
- The flow regime derived using the default HEFR analysis would substantially reduce water supply (depending upon the assumptions, by as much as 70% of the Texas yield of Toledo Bend Reservoir, and as much as 50% of new reservoir projects).
  - This would reduce the economic viability of these basins, significantly reducing the long-term ability to provide for the future needs of the State of Texas.

Economic Value of Reservoir Recreation

- The Sabine-Neches BBEST flow regime recommendations, if adopted by TCEQ as environmental flow standards, would severely impact lake levels for those reservoirs requiring new and amended permits.
- The harm to Sabine and Neches Basins reservoir recreation and the resulting economic consequences, both local and state, under the estimated frequency of low water levels to accommodate the Sabine-Neches BBEST recommendations has not been studied but these consequences could be significant.
- The economic consequences could include depressed waterfront property values, decreased tourism and the resulting trickledown effect to local businesses, jobs, and the local tax base.
- *The potential economic impact of environmental flow standards on reservoirs should be studied before environmental flow standards are enacted.*

Reservoir Fishery Resources

- A sound ecological environment is one that supports a healthy diversity of fish and aquatic life in a holistic approach that includes rivers, tributaries, lakes, and estuaries.
- Reservoirs should be included, along with rivers and estuaries when assessing environmental health.

Other Factors (some unique in the Sabine and Neches Basins)

- Sabine River Compact;
- The Sabine River is shared with Louisiana;
- Federal Energy Regulatory Commission (FERC) requires relicensing of the Toledo Bend Project by 2013;
- SB 2 instream flow studies are underway in the Lower Sabine Basin;
- Legal Liability; continued ...

Other Factors, continued

- U.S. Army Corps of Engineers (USACE) Sabine-Neches Waterway (SNWW) Channel Improvement Project is underway;
- Cutoff Bayou (change in the proportion of flows to Louisiana and Texas in the Lower Sabine River);
- Lower Neches Saltwater Barrier; and
- Proposed Lower Sabine Saltwater Barrier.

Recommendations

- Based upon its review of the Sabine-Neches BBEST environmental flow analyses and environmental flow recommendations,
- and considering them in conjunction with other factors ,
- the Sabine-Neches BBASC makes the following recommendations to the Environmental Flows Advisory Group and the Texas Commission on Environmental Quality:

Recommendation 1

- *The BBASC recommends the following definition for balancing the needs of Texas citizens with a sound ecological environment for the Sabine and Neches River Basins and Sabine Lake*
- A sound ecological environment is one that:
  - supports a healthy diversity of fish and other aquatic life;
  - sustains a full complement of important species;
  - provides all major aquatic habitat types including rivers and streams, reservoirs, and estuaries;
  - sustains key ecosystem processes; and
  - maintains water quality adequate for aquatic life.

Recommendation 2

- *Neither environmental flow standards nor environmental flow set asides should be established until more information is available to determine the amount of water needed to support a sound environment.*

Recommendation 3

- *The Sabine-Neches BBASC recommends that efforts be undertaken to initiate and complete the instream flow studies required under SB 2 (2001) in order to develop the type of data required to better understand the amount of instream flow needed for a sound ecological system in order to balance the environmental need for water with other needs for water as directed by SB 3 (2007).*
- *The SB 2 studies should include the upper Sabine River Basin and Neches River Basin, in addition to the ongoing Lower Sabine River Priority Instream Flow Study.*

Recommendation 4

- *The Sabine-Neches BBASC recommends continued efforts in Texas, coordinated with Louisiana, to protect and restore Sabine Lake Estuary wetlands identified by the USACE.*

Recommendation 5

- *The Sabine-Neches BBASC and Sabine-Neches BBEST should proceed with the development of a Work Plan that:*
  - *Establishes a five-year review cycle of the basin and bay environmental flow analyses and environmental flow regime recommendations, integrated with the SB 1 Regional Planning five-year cycle;*
  - *Suggests adjustments to the SB 2 instream flow program to obtain information useful to the SB 3 process; and*
  - *Prescribes specific monitoring, studies, and activities that are closely aligned with existing programs as much as possible (e.g. Texas Clean Rivers Program).*

Recommendation 6

- *TCEQ along with the Sabine-Neches BBASC and Sabine-Neches BBEST should address the implementation of environmental flow standards and set-asides, in advance of weighing the environmental flow needs against the need for water for other purposes.*

Recommendation 7

- *The Sabine-Neches BBASC recommends that no requirement to produce overbank flows or high flow pulses be imposed on a reservoir owner until a liability shield is in place.*

Conclusion

- The Sabine-Neches River Basins and Sabine Lake Estuary have abundant uncontrolled runoff that provides plentiful and variable environmental flows.
- Texas has a strong, vibrant economy for which surface water supplies play a major role.
- *Given that Texas' population is projected to double within the 50-year SB 1 regional planning horizon, prudent water resource management suggests further studies need to be undertaken to address the gaps in our knowledge regarding environmental needs to make an informed decision in the SB 3 balancing exercise.*

Appendix 3-B

Source Data and Water Supplies from the Data Web Interface

The following appendix includes a copy of the data from the TWDB Data Web Interface. This appendix provides a summary of water supply source availability and a summary of supplies for WUGs and WWPs categorized by county and river basin.

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Region I Source Availability
(Ac-ft per Year)

Source Name	County	Basin	2010	2020	2030	2040	2050	2060
CARRIZO-WILCOX AQUIFER	ANDERSON	NECHES	5,266	5,266	5,266	5,266	5,266	5,266
CARRIZO-WILCOX AQUIFER	ANDERSON	TRINITY	4,564	4,564	4,564	4,564	4,564	4,564
LIVESTOCK LOCAL SUPPLY	ANDERSON	NECHES	599	599	599	599	599	599
LIVESTOCK LOCAL SUPPLY	ANDERSON	TRINITY	684	684	684	684	684	684
NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	ANDERSON	NECHES	197	197	197	197	197	197
OTHER AQUIFER	ANDERSON	NECHES	85	85	85	85	85	85
OTHER AQUIFER	ANDERSON	TRINITY	195	195	195	195	195	195
QUEEN CITY AQUIFER	ANDERSON	NECHES	17,252	17,252	17,252	17,252	17,252	17,252
QUEEN CITY AQUIFER	ANDERSON	TRINITY	1,068	1,068	1,068	1,068	1,068	1,068
SPARTA AQUIFER	ANDERSON	NECHES	353	353	353	353	353	353
SPARTA AQUIFER	ANDERSON	TRINITY	247	247	247	247	247	247
TRINITY COMBINED RUN-OF-RIVER IRRIGATION	ANDERSON	TRINITY	1,060	1,060	1,060	1,060	1,060	1,060
CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	28,330	28,330	28,330	28,330	28,330	28,330
DIRECT REUSE	ANGELINA	NECHES	1,265	1,265	1,265	1,265	1,265	1,265
LIVESTOCK LOCAL SUPPLY	ANGELINA	NECHES	347	347	347	347	347	347
NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	ANGELINA	NECHES	17	17	17	17	17	17
NECHES RIVER RUN-OF-RIVER MANUFACTURING	ANGELINA	NECHES	57	57	57	57	57	57
OTHER AQUIFER	ANGELINA	NECHES	1,450	1,450	1,450	1,450	1,450	1,450
QUEEN CITY AQUIFER	ANGELINA	NECHES	1,060	1,060	1,060	1,060	1,060	1,060
SPARTA AQUIFER	ANGELINA	NECHES	670	670	670	670	670	670
YEGUA-JACKSON AQUIFER	ANGELINA	NECHES	6,472	6,472	6,472	6,472	6,472	6,472
CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	10,870	10,870	10,870	10,870	10,870	10,870
LIVESTOCK LOCAL SUPPLY	CHEROKEE	NECHES	1,059	1,059	1,059	1,059	1,059	1,059
NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	CHEROKEE	NECHES	182	182	182	182	182	182
OTHER LOCAL SUPPLY	CHEROKEE	NECHES	2	2	2	2	2	2
QUEEN CITY AQUIFER	CHEROKEE	NECHES	21,850	21,850	21,850	21,850	21,850	21,850
SPARTA AQUIFER	CHEROKEE	NECHES	350	350	350	350	350	350
GULF COAST AQUIFER	HARDIN	NECHES	23,480	23,480	23,480	23,479	23,479	23,478
GULF COAST AQUIFER	HARDIN	TRINITY	20	20	20	21	21	22
LIVESTOCK LOCAL SUPPLY	HARDIN	NECHES	139	139	139	139	139	139
LIVESTOCK LOCAL SUPPLY	HARDIN	TRINITY	2	2	2	2	2	2
NECHES RIVER RUN-OF-RIVER IRRIGATION	HARDIN	NECHES	57	57	57	57	57	57
CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	4,200	4,200	4,200	4,200	4,200	4,200
INDIRECT REUSE	HENDERSON	NECHES	2,872	2,872	2,872	2,872	2,872	2,872
LIVESTOCK LOCAL SUPPLY	HENDERSON	NECHES	279	279	279	279	279	279
QUEEN CITY AQUIFER	HENDERSON	NECHES	14,870	14,870	14,870	14,870	14,870	14,870
CARRIZO-WILCOX AQUIFER	HOUSTON	NECHES	1,939	1,939	1,939	1,939	1,939	1,939
CARRIZO-WILCOX AQUIFER	HOUSTON	TRINITY	3,281	3,281	3,281	3,281	3,281	3,281
LIVESTOCK LOCAL SUPPLY	HOUSTON	NECHES	388	388	388	388	388	388
LIVESTOCK LOCAL SUPPLY	HOUSTON	TRINITY	783	783	783	783	783	783
NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	HOUSTON	NECHES	287	287	287	287	287	287
OTHER AQUIFER	HOUSTON	NECHES	400	400	400	400	400	400

Region I Source Availability
(Ac-ft per Year)

Source Name	County	Basin	2010	2020	2030	2040	2050	2060
OTHER AQUIFER	HOUSTON	TRINITY	980	980	980	980	980	980
QUEEN CITY AQUIFER	HOUSTON	NECHES	251	251	251	251	251	251
QUEEN CITY AQUIFER	HOUSTON	TRINITY	149	149	149	149	149	149
SPARTA AQUIFER	HOUSTON	NECHES	339	339	339	339	339	339
SPARTA AQUIFER	HOUSTON	TRINITY	531	531	531	531	531	531
TRINITY COMBINED RUN-OF-RIVER IRRIGATION	HOUSTON	TRINITY	1,783	1,783	1,783	1,783	1,783	1,783
YEGUA-JACKSON AQUIFER	HOUSTON	NECHES	552	552	552	552	552	552
YEGUA-JACKSON AQUIFER	HOUSTON	TRINITY	828	828	828	828	828	828
GULF COAST AQUIFER	JASPER	NECHES	28,000	28,000	28,000	28,000	28,000	28,000
GULF COAST AQUIFER	JASPER	SABINE	24,000	24,000	24,000	24,000	24,000	24,000
LIVESTOCK LOCAL SUPPLY	JASPER	NECHES	115	115	115	115	115	115
LIVESTOCK LOCAL SUPPLY	JASPER	SABINE	75	75	75	75	75	75
NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	JASPER	NECHES	127	127	127	127	127	127
NECHES RIVER RUN-OF-RIVER MANUFACTURING	JASPER	NECHES	604	604	604	604	604	604
NECHES RIVER RUN-OF-RIVER MANUFACTURING	JASPER	NECHES	12	12	12	12	12	12
NECHES RIVER RUN-OF-RIVER PINE ISLAND BAYOU	JASPER	NECHES	381,876	381,876	381,876	381,876	381,876	381,876
OTHER AQUIFER	JASPER	NECHES	3,000	3,000	3,000	3,000	3,000	3,000
OTHER AQUIFER	JASPER	SABINE	3,000	3,000	3,000	3,000	3,000	3,000
GULF COAST AQUIFER	JEFFERSON	NECHES	780	780	780	780	780	780
GULF COAST AQUIFER	JEFFERSON	NECHES-TRINITY	1,720	1,720	1,720	1,720	1,720	1,720
INDIRECT REUSE IRRIGATION	JEFFERSON	NECHES-TRINITY	13,687	13,687	13,687	13,687	13,687	13,687
LIVESTOCK LOCAL SUPPLY	JEFFERSON	NECHES	43	43	43	43	43	43
LIVESTOCK LOCAL SUPPLY	JEFFERSON	NECHES-TRINITY	280	280	280	280	280	280
NECHES RIVER RUN-OF-RIVER	JEFFERSON	NECHES	32,111	32,111	32,111	32,111	32,111	32,111
NECHES RIVER RUN-OF-RIVER SALINE	JEFFERSON	NECHES	434,400	434,400	434,400	434,400	434,400	434,400
NECHES RIVER RUN-OF-RIVER SALINE	JEFFERSON	NECHES	4,300	4,300	4,300	4,300	4,300	4,300
NECHES RIVER RUN-OF-RIVER SALINE	JEFFERSON	NECHES	17,922	17,922	17,922	17,922	17,922	17,922
NECHES RIVER RUN-OF-RIVER SALINE	JEFFERSON	NECHES	268	268	268	268	268	268
NECHES RIVER RUN-OF-RIVER SALINE	JEFFERSON	NECHES	12,900	12,900	12,900	12,900	12,900	12,900
NECHES RIVER RUN-OF-RIVER SALINE	JEFFERSON	NECHES	279,131	279,131	279,131	279,131	279,131	279,131
NECHES RIVER RUN-OF-RIVER SALINE	JEFFERSON	NECHES	11	11	11	11	11	11
NECHES RIVER RUN-OF-RIVER SALINE	JEFFERSON	NECHES	40	40	40	40	40	40
NECHES RIVER RUN-OF-RIVER SALINE	JEFFERSON	NECHES	2,700	2,700	2,700	2,700	2,700	2,700
NECHES-TRINITY COMBINED RUN-OF-RIVER IRRIGATION	JEFFERSON	NECHES-TRINITY	44,286	44,286	44,286	44,286	44,286	44,286
NECHES-TRINITY RIVER COMBINED RUN-OF-RIVER MAN	JEFFERSON	NECHES-TRINITY	680	680	680	680	680	680
NECHES-TRINITY RIVER COMBINED RUN-OF-RIVER MINI	JEFFERSON	NECHES-TRINITY	34	34	34	34	34	34
NECHES-TRINITY RIVER RUN-OF-RIVER IRRIGATION	JEFFERSON	NECHES-TRINITY	5,139	5,139	5,139	5,139	5,139	5,139
NECHES-TRINITY RIVER RUN-OF-RIVER IRRIGATION	JEFFERSON	NECHES-TRINITY	5,321	5,321	5,321	5,321	5,321	5,321
NECHES-TRINITY RIVER RUN-OF-RIVER MANUFACTURIN	JEFFERSON	NECHES-TRINITY	480	480	480	480	480	480
OTHER LOCAL SUPPLY	JEFFERSON	NECHES	74	74	74	74	74	74
OTHER LOCAL SUPPLY	JEFFERSON	NECHES-TRINITY	168	168	168	168	168	168
CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	31,140	31,140	31,140	31,140	31,140	31,140

Region I Source Availability
(Ac-ft per Year)

Source Name	County	Basin	2010	2020	2030	2040	2050	2060
LAKE NACONICHE LAKE/RESERVOIR	NACOGDOCHES	NECHES	3,239	3,239	3,239	3,239	3,239	3,239
LIVESTOCK LOCAL SUPPLY	NACOGDOCHES	NECHES	910	910	910	910	910	910
NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	NACOGDOCHES	NECHES	136	136	136	136	136	136
NECHES RIVER RUN-OF-RIVER MANUFACTURING	NACOGDOCHES	NECHES	2	2	2	2	2	2
OTHER AQUIFER	NACOGDOCHES	NECHES	80	80	80	80	80	80
OTHER LOCAL SUPPLY	NACOGDOCHES	NECHES	220	220	220	220	220	220
QUEEN CITY AQUIFER	NACOGDOCHES	NECHES	4,860	4,860	4,860	4,860	4,860	4,860
SPARTA AQUIFER	NACOGDOCHES	NECHES	400	400	400	400	400	400
YEGUA-JACKSON AQUIFER	NACOGDOCHES	NECHES	60	60	60	60	60	60
GULF COAST AQUIFER	NEWTON	NECHES	192	192	192	192	192	192
GULF COAST AQUIFER	NEWTON	SABINE	28,808	28,808	28,808	28,808	28,808	28,808
LIVESTOCK LOCAL SUPPLY	NEWTON	SABINE	66	66	66	66	66	66
OTHER AQUIFER	NEWTON	SABINE	1,500	1,500	1,500	1,500	1,500	1,500
OTHER LOCAL SUPPLY	NEWTON	SABINE	28	28	28	28	28	28
SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	147,100	147,100	147,100	147,100	147,100	147,100
SABINE RIVER RUN-OF-RIVER IRRIGATION	NEWTON	SABINE	50	50	50	50	50	50
SABINE RIVER RUN-OF-RIVER MANUFACTURING	NEWTON	SABINE	135	135	135	135	135	135
DIRECT REUSE	ORANGE	SABINE	15	15	15	15	15	15
GULF COAST AQUIFER	ORANGE	NECHES	4,559	4,559	4,559	4,559	4,559	4,559
GULF COAST AQUIFER	ORANGE	SABINE	15,441	15,441	15,441	15,441	15,441	15,441
LIVESTOCK LOCAL SUPPLY	ORANGE	NECHES	56	56	56	56	56	56
LIVESTOCK LOCAL SUPPLY	ORANGE	SABINE	70	70	70	70	70	70
NECHES RIVER RUN-OF-RIVER SALINE	ORANGE	NECHES	100	100	100	100	100	100
NECHES RIVER RUN-OF-RIVER SALINE	ORANGE	NECHES	17,210	17,210	17,210	17,210	17,210	17,210
OTHER LOCAL SUPPLY	ORANGE	SABINE	1	1	1	1	1	1
SABINE RIVER RUN-OF-RIVER IRRIGATION	ORANGE	SABINE	28	28	28	28	28	28
SABINE RIVER RUN-OF-RIVER SALINE	ORANGE	SABINE	267,000	267,000	267,000	267,000	267,000	267,000
CARRIZO-WILCOX AQUIFER	PANOLA	CYPRESS	27	27	27	27	27	27
CARRIZO-WILCOX AQUIFER	PANOLA	SABINE	10,343	10,343	10,343	10,343	10,343	10,343
LIVESTOCK LOCAL SUPPLY	PANOLA	CYPRESS	30	30	30	30	30	30
LIVESTOCK LOCAL SUPPLY	PANOLA	SABINE	1,828	1,828	1,828	1,828	1,828	1,828
SABINE RIVER COMBINED RUN-OF-RIVER IRRIGATION	PANOLA	SABINE	191	191	191	191	191	191
SABINE RIVER RUN-OF-RIVER MANUFACTURING	PANOLA	SABINE	129	129	129	129	129	129
SABINE RIVER RUN-OF-RIVER MANUFACTURING	PANOLA	SABINE	114	114	114	114	114	114
SABINE RIVER RUN-OF-RIVER MINING	PANOLA	SABINE	167	167	167	167	167	167
GULF COAST AQUIFER	POLK	NECHES	13,500	13,500	13,500	13,500	13,500	13,500
LIVESTOCK LOCAL SUPPLY	POLK	NECHES	122	122	122	122	122	122
OTHER AQUIFER	POLK	NECHES	1,450	1,450	1,450	1,450	1,450	1,450
YEGUA-JACKSON AQUIFER	POLK	NECHES	360	360	360	360	360	360
ATHENS LAKE/RESERVOIR	RESERVOIR	NECHES	6,064	5,983	5,903	5,822	5,741	5,660
BELLWOOD LAKE/RESERVOIR	RESERVOIR	NECHES	950	950	950	950	950	950
CENTER LAKE/RESERVOIR	RESERVOIR	SABINE	754	754	754	754	754	754

Region I Source Availability
(Ac-ft per Year)

Source Name	County	Basin	2010	2020	2030	2040	2050	2060
CHEROKEE LAKE/RESERVOIR	RESERVOIR	SABINE	28,885	28,650	28,415	28,180	27,945	27,710
COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	3,500	3,500	3,500	3,500	3,500	3,500
JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	6,200	6,200	6,200	6,200	6,200	6,200
KURTH LAKE/RESERVOIR	RESERVOIR	NECHES	18,421	18,417	18,413	18,408	18,404	18,400
MARTIN LAKE/RESERVOIR	RESERVOIR	SABINE	25,000	25,000	25,000	25,000	25,000	25,000
MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	21,792	21,203	20,615	20,027	19,438	18,850
NACOGDOCHES LAKE/RESERVOIR	RESERVOIR	NECHES	17,067	16,683	16,300	15,917	15,533	15,150
PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	207,458	205,417	203,375	201,333	199,292	197,250
PINKSTON LAKE/RESERVOIR	RESERVOIR	NECHES	3,800	3,800	3,800	3,800	3,800	3,800
RUSK CITY LAKE/RESERVOIR	RESERVOIR	NECHES	64	63	63	62	61	60
SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	820,000	820,000	820,000	820,000	820,000	820,000
SAN AUGUSTINE LAKE/RESERVOIR	RESERVOIR	NECHES	1,285	1,285	1,285	1,285	1,285	1,285
STRIKER LAKE/RESERVOIR	RESERVOIR	NECHES	20,183	19,357	18,530	17,703	16,877	16,050
TIMPSON LAKE/RESERVOIR	RESERVOIR	NECHES	350	350	350	350	350	350
TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	750,000	750,000	750,000	750,000	750,000	750,000
TYLER LAKE/RESERVOIR	RESERVOIR	NECHES	30,925	30,900	30,875	30,850	30,825	30,800
TOLEDO BEND LAKE/RESERVOIR LOUISIANA PORTION	RESERVOIR - LOUISI	SABINE - LOUISIANA	235	235	235	235	235	235
CARRIZO-WILCOX AQUIFER	RUSK	NECHES	10,271	10,271	10,271	10,271	10,271	10,271
CARRIZO-WILCOX AQUIFER	RUSK	SABINE	10,019	10,019	10,019	10,019	10,019	10,019
LIVESTOCK LOCAL SUPPLY	RUSK	NECHES	386	386	386	386	386	386
LIVESTOCK LOCAL SUPPLY	RUSK	SABINE	308	308	308	308	308	308
NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	RUSK	NECHES	86	86	86	86	86	86
NECHES RIVER COMBINED RUN-OF-RIVER MANUFACTUI	RUSK	NECHES	2	2	2	2	2	2
OTHER LOCAL SUPPLY	RUSK	SABINE	287	287	287	287	287	287
QUEEN CITY AQUIFER	RUSK	NECHES	1,695	1,695	1,695	1,695	1,695	1,695
QUEEN CITY AQUIFER	RUSK	SABINE	2,555	2,555	2,555	2,555	2,555	2,555
SABINE RIVER COMBINED RUN-OF-RIVER IRRIGATION	RUSK	SABINE	127	127	127	127	127	127
SABINE RIVER RUN-OF-RIVER MUNICIPAL	RUSK	SABINE	10	10	10	10	10	10
CARRIZO-WILCOX AQUIFER	SABINE	NECHES	6,048	6,048	6,048	6,048	6,048	6,048
CARRIZO-WILCOX AQUIFER	SABINE	SABINE	662	662	662	662	662	662
DIRECT REUSE MANUFACTURING	SABINE	SABINE	20	20	20	20	20	20
GULF COAST AQUIFER	SABINE	NECHES	97	97	97	97	97	97
GULF COAST AQUIFER	SABINE	SABINE	1,003	1,003	1,003	1,003	1,003	1,003
LIVESTOCK LOCAL SUPPLY	SABINE	NECHES	59	59	59	59	59	59
LIVESTOCK LOCAL SUPPLY	SABINE	SABINE	320	320	320	320	320	320
NECHES RIVER RUN-OF-RIVER MANUFACTURING	SABINE	NECHES	182	182	182	182	182	182
OTHER AQUIFER	SABINE	NECHES	115	115	115	115	115	115
OTHER AQUIFER	SABINE	SABINE	85	85	85	85	85	85
SPARTA AQUIFER	SABINE	NECHES	70	70	70	70	70	70
SPARTA AQUIFER	SABINE	SABINE	220	220	220	220	220	220
YEGUA-JACKSON AQUIFER	SABINE	NECHES	310	310	310	310	310	310

Region I Source Availability
(Ac-ft per Year)

Source Name	County	Basin	2010	2020	2030	2040	2050	2060
YEGUA-JACKSON AQUIFER	SABINE	SABINE	790	790	790	790	790	790
CARRIZO-WILCOX AQUIFER	SAN AUGUSTINE	NECHES	1,052	1,052	1,052	1,052	1,052	1,052
CARRIZO-WILCOX AQUIFER	SAN AUGUSTINE	SABINE	638	638	638	638	638	638
LIVESTOCK LOCAL SUPPLY	SAN AUGUSTINE	NECHES	490	490	490	490	490	490
LIVESTOCK LOCAL SUPPLY	SAN AUGUSTINE	SABINE	71	71	71	71	71	71
OTHER AQUIFER	SAN AUGUSTINE	NECHES	60	60	60	60	60	60
SPARTA AQUIFER	SAN AUGUSTINE	NECHES	160	160	160	160	160	160
SPARTA AQUIFER	SAN AUGUSTINE	SABINE	40	40	40	40	40	40
YEGUA-JACKSON AQUIFER	SAN AUGUSTINE	NECHES	540	540	540	540	540	540
CARRIZO-WILCOX AQUIFER	SHELBY	NECHES	5,346	5,346	5,346	5,346	5,346	5,346
CARRIZO-WILCOX AQUIFER	SHELBY	SABINE	7,404	7,404	7,404	7,404	7,404	7,404
DIRECT REUSE IRRIGATION/MANUFACTURING	SHELBY	SABINE	218	233	246	259	270	284
LIVESTOCK LOCAL SUPPLY	SHELBY	NECHES	334	334	334	334	334	334
LIVESTOCK LOCAL SUPPLY	SHELBY	SABINE	1,755	1,755	1,755	1,755	1,755	1,755
CARRIZO-WILCOX AQUIFER	SMITH	NECHES	18,400	18,400	18,400	18,400	18,400	18,400
LIVESTOCK LOCAL SUPPLY	SMITH	NECHES	416	416	416	416	416	416
NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	SMITH	NECHES	50	50	50	50	50	50
OTHER AQUIFER	SMITH	NECHES	80	80	80	80	80	80
QUEEN CITY AQUIFER	SMITH	NECHES	17,280	17,280	17,280	17,280	17,280	17,280
CARRIZO-WILCOX AQUIFER	TRINITY	NECHES	2,161	2,161	2,161	2,161	2,161	2,161
GULF COAST AQUIFER	TRINITY	NECHES	100	100	100	100	100	100
LIVESTOCK LOCAL SUPPLY	TRINITY	NECHES	135	135	135	135	135	135
NECHES RIVER RUN-OF-RIVER IRRIGATION	TRINITY	NECHES	62	62	62	62	62	62
OTHER AQUIFER	TRINITY	NECHES	280	280	280	280	280	280
SPARTA AQUIFER	TRINITY	NECHES	600	600	600	600	600	600
YEGUA-JACKSON AQUIFER	TRINITY	NECHES	740	740	740	740	740	740
GULF COAST AQUIFER	TYLER	NECHES	30,300	30,300	30,300	30,300	30,300	30,300
LIVESTOCK LOCAL SUPPLY	TYLER	NECHES	165	165	165	165	165	165
NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	TYLER	NECHES	123	123	123	123	123	123
OTHER AQUIFER	TYLER	NECHES	1,620	1,620	1,620	1,620	1,620	1,620
YEGUA-JACKSON AQUIFER	TYLER	NECHES	180	180	180	180	180	180

Region I Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
BRUSHY CREEK WSC	ANDERSON	NECHES	CARRIZO-WILCOX AQUIFER	ANDERSON	NECHES	205	205	205	205	205	205
BRUSHY CREEK WSC	ANDERSON	TRINITY	CARRIZO-WILCOX AQUIFER	ANDERSON	NECHES	169	169	169	169	169	169
CONSOLIDATED WSC	ANDERSON	NECHES	CARRIZO-WILCOX AQUIFER	HOUSTON	TRINITY	15	15	15	15	15	15
CONSOLIDATED WSC	ANDERSON	NECHES	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	23	24	24	23	24	24
CONSOLIDATED WSC	ANDERSON	TRINITY	CARRIZO-WILCOX AQUIFER	HOUSTON	TRINITY	51	51	51	51	51	51
CONSOLIDATED WSC	ANDERSON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	79	78	78	79	78	78
COUNTY-OTHER	ANDERSON	NECHES	CARRIZO-WILCOX AQUIFER	ANDERSON	NECHES	500	500	500	500	500	500
COUNTY-OTHER	ANDERSON	NECHES	OTHER AQUIFER	ANDERSON	NECHES	32	32	32	32	32	32
COUNTY-OTHER	ANDERSON	NECHES	QUEEN CITY AQUIFER	ANDERSON	NECHES	239	239	239	239	239	239
COUNTY-OTHER	ANDERSON	NECHES	SPARTA AQUIFER	ANDERSON	NECHES	88	88	88	88	88	88
COUNTY-OTHER	ANDERSON	TRINITY	CARRIZO-WILCOX AQUIFER	ANDERSON	NECHES	2,000	2,000	2,000	2,000	2,000	2,000
COUNTY-OTHER	ANDERSON	TRINITY	CARRIZO-WILCOX AQUIFER	ANDERSON	TRINITY	2,731	2,731	2,731	2,731	2,731	2,731
COUNTY-OTHER	ANDERSON	TRINITY	OTHER AQUIFER	ANDERSON	TRINITY	45	45	45	45	45	45
COUNTY-OTHER	ANDERSON	TRINITY	QUEEN CITY AQUIFER	ANDERSON	TRINITY	336	336	336	336	336	336
COUNTY-OTHER	ANDERSON	TRINITY	SPARTA AQUIFER	ANDERSON	TRINITY	124	124	124	124	124	124
ELKHART	ANDERSON	TRINITY	CARRIZO-WILCOX AQUIFER	ANDERSON	TRINITY	428	428	428	428	428	428
FOUR PINE WSC	ANDERSON	TRINITY	CARRIZO-WILCOX AQUIFER	ANDERSON	TRINITY	549	549	549	549	549	549
FRANKSTON	ANDERSON	NECHES	CARRIZO-WILCOX AQUIFER	ANDERSON	NECHES	558	558	558	558	558	558
IRRIGATION	ANDERSON	NECHES	CARRIZO-WILCOX AQUIFER	ANDERSON	NECHES	30	30	30	30	30	30
IRRIGATION	ANDERSON	NECHES	NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	ANDERSON	NECHES	197	197	197	197	197	197
IRRIGATION	ANDERSON	NECHES	QUEEN CITY AQUIFER	ANDERSON	NECHES	3	3	3	3	3	3
IRRIGATION	ANDERSON	TRINITY	CARRIZO-WILCOX AQUIFER	ANDERSON	TRINITY	356	356	356	356	356	356
IRRIGATION	ANDERSON	TRINITY	TRINITY COMBINED RUN-OF-RIVER IRRIGATION	ANDERSON	TRINITY	1,060	1,060	1,060	1,060	1,060	1,060
LIVESTOCK	ANDERSON	NECHES	LIVESTOCK LOCAL SUPPLY	ANDERSON	NECHES	599	599	599	599	599	599
LIVESTOCK	ANDERSON	NECHES	QUEEN CITY AQUIFER	ANDERSON	NECHES	200	200	200	200	200	200
LIVESTOCK	ANDERSON	NECHES	SPARTA AQUIFER	ANDERSON	NECHES	75	75	75	75	75	75
LIVESTOCK	ANDERSON	TRINITY	CARRIZO-WILCOX AQUIFER	ANDERSON	TRINITY	244	244	244	244	244	244
LIVESTOCK	ANDERSON	TRINITY	LIVESTOCK LOCAL SUPPLY	ANDERSON	TRINITY	684	684	684	684	684	684
LIVESTOCK	ANDERSON	TRINITY	OTHER AQUIFER	ANDERSON	TRINITY	29	29	29	29	29	29
LIVESTOCK	ANDERSON	TRINITY	QUEEN CITY AQUIFER	ANDERSON	TRINITY	218	218	218	218	218	218
LIVESTOCK	ANDERSON	TRINITY	SPARTA AQUIFER	ANDERSON	TRINITY	80	80	80	80	80	80
MINING	ANDERSON	NECHES	CARRIZO-WILCOX AQUIFER	ANDERSON	NECHES	505	505	505	505	505	505
MINING	ANDERSON	TRINITY	CARRIZO-WILCOX AQUIFER	ANDERSON	TRINITY	33	33	33	33	33	33
PALESTINE	ANDERSON	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	2,278	2,278	2,278	2,278	2,278	2,278
PALESTINE	ANDERSON	TRINITY	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	2,053	2,053	2,053	2,053	2,053	2,053
WALSTON SPRINGS WSC	ANDERSON	NECHES	CARRIZO-WILCOX AQUIFER	ANDERSON	NECHES	833	833	833	833	833	833
ANGELINA WSC	ANGELINA	NECHES	YEGUA-JACKSON AQUIFER	ANGELINA	NECHES	674	674	674	674	674	674
CENTRAL WCID OF ANGELINA COUNTY	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	874	874	874	874	874	874
COUNTY-OTHER	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	615	600	598	597	597	598
COUNTY-OTHER	ANGELINA	NECHES	YEGUA-JACKSON AQUIFER	ANGELINA	NECHES	1,357	1,357	1,357	1,357	1,357	1,357
DIBOLL	ANGELINA	NECHES	YEGUA-JACKSON AQUIFER	ANGELINA	NECHES	936	936	936	936	936	936
FOUR WAY WSC	ANGELINA	NECHES	YEGUA-JACKSON AQUIFER	ANGELINA	NECHES	1,372	1,372	1,372	1,372	1,372	1,372
HUDSON	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	808	808	808	808	808	808
HUDSON WSC	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	991	991	991	991	991	991
HUNTINGTON	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	11	11	12	12	12	12
HUNTINGTON	ANGELINA	NECHES	YEGUA-JACKSON AQUIFER	ANGELINA	NECHES	625	625	625	625	625	625
IRRIGATION	ANGELINA	NECHES	OTHER AQUIFER	ANGELINA	NECHES	38	38	38	38	38	38

Region I Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
LIVESTOCK	ANGELINA	NECHES	LIVESTOCK LOCAL SUPPLY	ANGELINA	NECHES	347	347	347	347	347	347
LIVESTOCK	ANGELINA	NECHES	OTHER AQUIFER	ANGELINA	NECHES	155	155	155	155	155	155
LIVESTOCK	ANGELINA	NECHES	QUEEN CITY AQUIFER	ANGELINA	NECHES	79	79	79	79	79	79
LIVESTOCK	ANGELINA	NECHES	SPARTA AQUIFER	ANGELINA	NECHES	79	79	79	79	79	79
LUFKIN	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	4,302	3,327	3,389	3,449	3,535	3,634
MANUFACTURING	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	9,345	10,699	10,709	10,716	10,693	10,651
MANUFACTURING	ANGELINA	NECHES	DIRECT REUSE	ANGELINA	NECHES	1,265	1,265	1,265	1,265	1,265	1,265
MANUFACTURING	ANGELINA	NECHES	KURTH LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
MANUFACTURING	ANGELINA	NECHES	OTHER AQUIFER	ANGELINA	NECHES	1,023	1,023	1,023	1,023	1,023	1,023
MANUFACTURING	ANGELINA	NECHES	STRIKER LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
MINING	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	28	28	28	28	28	28
REDLAND WSC	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	840	840	840	840	840	840
ZAVALLA	ANGELINA	NECHES	OTHER AQUIFER	ANGELINA	NECHES	193	193	193	193	193	193
ALTO	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	549	549	549	549	549	549
ALTO RURAL WSC	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	756	756	756	756	756	756
BULLARD	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	13	13	13	13	13	14
COUNTY-OTHER	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	1,563	1,563	1,563	1,563	1,563	1,563
COUNTY-OTHER	CHEROKEE	NECHES	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	218	180	134	78	54	41
COUNTY-OTHER	CHEROKEE	NECHES	QUEEN CITY AQUIFER	CHEROKEE	NECHES	81	81	81	81	81	81
COUNTY-OTHER	CHEROKEE	NECHES	SPARTA AQUIFER	CHEROKEE	NECHES	12	12	12	12	12	12
CRAFT-TURNEY WSC	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	213	240	276	322	339	348
CRAFT-TURNEY WSC	CHEROKEE	NECHES	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	497	559	643	752	790	811
IRRIGATION	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	51	51	51	51	51	51
IRRIGATION	CHEROKEE	NECHES	NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	CHEROKEE	NECHES	182	182	182	182	182	182
IRRIGATION	CHEROKEE	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	296	293	290	287	285	282
IRRIGATION	CHEROKEE	NECHES	QUEEN CITY AQUIFER	CHEROKEE	NECHES	51	51	51	51	51	51
IRRIGATION	CHEROKEE	NECHES	SPARTA AQUIFER	CHEROKEE	NECHES	3	3	3	3	3	3
JACKSONVILLE	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	1,450	1,420	1,390	1,358	1,344	1,326
JACKSONVILLE	CHEROKEE	NECHES	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	3,381	3,311	3,243	3,168	3,135	3,093
LIVESTOCK	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	566	566	566	566	566	566
LIVESTOCK	CHEROKEE	NECHES	LIVESTOCK LOCAL SUPPLY	CHEROKEE	NECHES	1,059	1,059	1,059	1,059	1,059	1,059
LIVESTOCK	CHEROKEE	NECHES	QUEEN CITY AQUIFER	CHEROKEE	NECHES	566	566	566	566	566	566
LIVESTOCK	CHEROKEE	NECHES	SPARTA AQUIFER	CHEROKEE	NECHES	186	186	186	186	186	186
MANUFACTURING	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	297	306	312	316	318	325
MANUFACTURING	CHEROKEE	NECHES	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	693	714	727	738	742	758
MINING	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	101	101	101	101	101	101
MINING	CHEROKEE	NECHES	OTHER LOCAL SUPPLY	CHEROKEE	NECHES	2	2	2	2	2	2
NEW SUMMERFIELD	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	262	262	262	262	262	262
NORTH CHEROKEE WSC	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	160	171	179	184	191	199
NORTH CHEROKEE WSC	CHEROKEE	NECHES	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	374	400	418	430	445	463
RUSK	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	1,315	1,316	1,317	1,317	1,318	1,319
RUSK	CHEROKEE	NECHES	RUSK CITY LAKE/RESERVOIR	RESERVOIR	NECHES	64	63	63	62	61	60
RUSK RURAL WSC	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	537	537	537	537	537	537
SOUTHERN UTILITIES COMPANY	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	574	603	633	665	698	733
STEAM ELECTRIC POWER	CHEROKEE	NECHES	STRIKER LAKE/RESERVOIR	RESERVOIR	NECHES	2,245	1,790	2,093	2,462	2,912	3,460
TROUP	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	8	8	8	8	8	8
WELLS	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	359	359	359	359	359	359
COUNTY-OTHER	HARDIN	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	1,680	1,680	1,680	1,680	1,680	1,680

Region I Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
COUNTY-OTHER	HARDIN	TRINITY	GULF COAST AQUIFER	HARDIN	TRINITY	20	20	20	20	20	20
IRRIGATION	HARDIN	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	2,500	2,500	2,500	2,500	2,500	2,500
KOUNTZE	HARDIN	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	729	729	729	729	729	729
LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY	HARDIN	TRINITY	GULF COAST AQUIFER	HARDIN	NECHES	8	8	8	8	8	8
LIVESTOCK	HARDIN	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	18	18	18	18	18	18
LIVESTOCK	HARDIN	NECHES	LIVESTOCK LOCAL SUPPLY	HARDIN	NECHES	139	139	139	139	139	139
LIVESTOCK	HARDIN	TRINITY	LIVESTOCK LOCAL SUPPLY	HARDIN	TRINITY	2	2	2	2	2	2
LUMBERTON	HARDIN	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	1,700	1,700	1,700	1,700	1,700	1,675
LUMBERTON MUD	HARDIN	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	2,981	2,981	2,981	2,981	2,981	2,981
MANUFACTURING	HARDIN	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	119	119	119	119	119	119
MINING	HARDIN	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	28	28	28	28	28	28
NORTH HARDIN WSC	HARDIN	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	1,399	1,399	1,399	1,399	1,399	1,399
SILSBEE	HARDIN	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	1,608	1,608	1,608	1,608	1,608	1,608
SOUR LAKE	HARDIN	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	766	766	766	766	766	766
WEST HARDIN WSC	HARDIN	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	599	599	599	599	599	599
ATHENS	HENDERSON	NECHES	ATHENS LAKE/RESERVOIR	RESERVOIR	NECHES	62	33	42	50	57	65
ATHENS	HENDERSON	NECHES	CARRIZO-WILCOX AQUIFER	HENDERSON	TRINITY	19	22	24	25	25	26
BERRYVILLE	HENDERSON	NECHES	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	179	179	179	179	179	179
BETHEL-ASH WSC	HENDERSON	NECHES	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	650	650	650	650	650	650
BROWNSBORO	HENDERSON	NECHES	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	300	300	300	300	300	300
BRUSHY CREEK WSC	HENDERSON	NECHES	CARRIZO-WILCOX AQUIFER	ANDERSON	NECHES	209	209	209	209	209	209
CHANDLER	HENDERSON	NECHES	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	739	739	739	739	739	739
COUNTY-OTHER	HENDERSON	NECHES	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	1,747	1,747	1,747	1,747	1,747	1,747
COUNTY-OTHER	HENDERSON	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	99	98	97	96	95	94
COUNTY-OTHER	HENDERSON	NECHES	QUEEN CITY AQUIFER	HENDERSON	NECHES	840	840	840	840	840	840
IRRIGATION	HENDERSON	NECHES	ATHENS LAKE/RESERVOIR	RESERVOIR	NECHES	171	94	86	79	71	64
LIVESTOCK	HENDERSON	NECHES	ATHENS LAKE/RESERVOIR	RESERVOIR	NECHES	380	1,735	1,546	1,376	1,203	1,040
LIVESTOCK	HENDERSON	NECHES	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	97	97	97	97	97	97
LIVESTOCK	HENDERSON	NECHES	INDIRECT REUSE	HENDERSON	NECHES	2,872	0	0	0	0	0
LIVESTOCK	HENDERSON	NECHES	LIVESTOCK LOCAL SUPPLY	HENDERSON	NECHES	248	248	248	248	248	248
LIVESTOCK	HENDERSON	NECHES	QUEEN CITY AQUIFER	HENDERSON	NECHES	485	485	485	485	485	485
MANUFACTURING	HENDERSON	NECHES	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	12	14	16	18	20	22
MINING	HENDERSON	NECHES	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	27	27	27	27	27	27
MURCHISON	HENDERSON	NECHES	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	251	251	251	251	251	251
R P M WSC	HENDERSON	NECHES	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	122	122	122	122	122	122
CONSOLIDATED WSC	HOUSTON	NECHES	CARRIZO-WILCOX AQUIFER	HOUSTON	TRINITY	166	166	166	166	166	166
CONSOLIDATED WSC	HOUSTON	NECHES	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	255	255	255	255	255	255
CONSOLIDATED WSC	HOUSTON	TRINITY	CARRIZO-WILCOX AQUIFER	HOUSTON	TRINITY	427	427	427	427	427	427
CONSOLIDATED WSC	HOUSTON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	655	655	655	655	655	655
COUNTY-OTHER	HOUSTON	NECHES	CARRIZO-WILCOX AQUIFER	HOUSTON	NECHES	144	144	144	144	144	144
COUNTY-OTHER	HOUSTON	NECHES	OTHER AQUIFER	HOUSTON	NECHES	197	197	197	197	197	197
COUNTY-OTHER	HOUSTON	NECHES	QUEEN CITY AQUIFER	HOUSTON	NECHES	164	164	164	164	164	164
COUNTY-OTHER	HOUSTON	NECHES	SPARTA AQUIFER	HOUSTON	NECHES	100	100	100	100	100	100
COUNTY-OTHER	HOUSTON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	84	83	84	85	87	90
COUNTY-OTHER	HOUSTON	TRINITY	OTHER AQUIFER	HOUSTON	TRINITY	352	352	352	352	352	352
CROCKETT	HOUSTON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	1,731	1,716	1,702	1,689	1,676	1,661
GRAPELAND	HOUSTON	NECHES	CARRIZO-WILCOX AQUIFER	HOUSTON	NECHES	255	255	255	255	255	255
GRAPELAND	HOUSTON	TRINITY	CARRIZO-WILCOX AQUIFER	HOUSTON	NECHES	255	255	255	255	255	255

Region I Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
GRAPELAND	HOUSTON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	381	377	374	372	369	365
IRRIGATION	HOUSTON	NECHES	NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	HOUSTON	NECHES	287	287	287	287	287	287
IRRIGATION	HOUSTON	NECHES	QUEEN CITY AQUIFER	HOUSTON	NECHES	11	11	11	11	11	11
IRRIGATION	HOUSTON	NECHES	SPARTA AQUIFER	HOUSTON	NECHES	14	14	14	14	14	14
IRRIGATION	HOUSTON	TRINITY	CARRIZO-WILCOX AQUIFER	HOUSTON	TRINITY	51	51	51	51	51	51
IRRIGATION	HOUSTON	TRINITY	QUEEN CITY AQUIFER	HOUSTON	TRINITY	101	101	101	101	101	101
IRRIGATION	HOUSTON	TRINITY	SPARTA AQUIFER	HOUSTON	TRINITY	110	110	110	110	110	110
IRRIGATION	HOUSTON	TRINITY	TRINITY COMBINED RUN-OF-RIVER IRRIGATION	HOUSTON	TRINITY	1,783	1,783	1,783	1,783	1,783	1,783
LIVESTOCK	HOUSTON	NECHES	CARRIZO-WILCOX AQUIFER	HOUSTON	NECHES	11	11	11	11	11	11
LIVESTOCK	HOUSTON	NECHES	LIVESTOCK LOCAL SUPPLY	HOUSTON	NECHES	388	388	388	388	388	388
LIVESTOCK	HOUSTON	NECHES	QUEEN CITY AQUIFER	HOUSTON	NECHES	68	68	68	68	68	68
LIVESTOCK	HOUSTON	NECHES	SPARTA AQUIFER	HOUSTON	NECHES	159	159	159	159	159	159
LIVESTOCK	HOUSTON	TRINITY	CARRIZO-WILCOX AQUIFER	HOUSTON	TRINITY	75	75	75	75	75	75
LIVESTOCK	HOUSTON	TRINITY	LIVESTOCK LOCAL SUPPLY	HOUSTON	TRINITY	783	783	783	783	783	783
LIVESTOCK	HOUSTON	TRINITY	OTHER AQUIFER	HOUSTON	TRINITY	246	246	246	246	246	246
LIVESTOCK	HOUSTON	TRINITY	QUEEN CITY AQUIFER	HOUSTON	TRINITY	44	44	44	44	44	44
LIVESTOCK	HOUSTON	TRINITY	SPARTA AQUIFER	HOUSTON	TRINITY	306	306	306	306	306	306
LOVELADY	HOUSTON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	51	51	51	51	51	51
LOVELADY	HOUSTON	TRINITY	YEGUA-JACKSON AQUIFER	HOUSTON	TRINITY	197	197	197	197	197	197
MANUFACTURING	HOUSTON	NECHES	CARRIZO-WILCOX AQUIFER	HOUSTON	NECHES	11	11	11	11	11	11
MANUFACTURING	HOUSTON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	159	177	193	208	221	237
MINING	HOUSTON	NECHES	OTHER AQUIFER	HOUSTON	NECHES	94	94	94	94	94	94
MINING	HOUSTON	TRINITY	OTHER AQUIFER	HOUSTON	TRINITY	85	85	85	85	85	85
MINING	HOUSTON	TRINITY	SPARTA AQUIFER	HOUSTON	TRINITY	48	48	48	48	48	48
COUNTY-OTHER	JASPER	NECHES	GULF COAST AQUIFER	JASPER	NECHES	1,500	1,500	1,500	1,500	1,500	1,500
COUNTY-OTHER	JASPER	SABINE	GULF COAST AQUIFER	JASPER	SABINE	941	941	941	941	941	941
JASPER	JASPER	NECHES	GULF COAST AQUIFER	JASPER	NECHES	4,534	4,534	4,534	4,534	4,534	4,534
JASPER COUNTY WCID #1	JASPER	SABINE	GULF COAST AQUIFER	JASPER	SABINE	555	555	555	555	555	555
KIRBYVILLE	JASPER	SABINE	GULF COAST AQUIFER	JASPER	SABINE	600	600	600	600	600	600
LIVESTOCK	JASPER	NECHES	GULF COAST AQUIFER	JASPER	NECHES	84	84	84	84	84	84
LIVESTOCK	JASPER	NECHES	LIVESTOCK LOCAL SUPPLY	JASPER	NECHES	115	115	115	115	115	115
LIVESTOCK	JASPER	SABINE	GULF COAST AQUIFER	JASPER	SABINE	52	52	52	52	52	52
LIVESTOCK	JASPER	SABINE	LIVESTOCK LOCAL SUPPLY	JASPER	SABINE	75	75	75	75	75	75
MANUFACTURING	JASPER	NECHES	GULF COAST AQUIFER	JASPER	NECHES	21,711	21,711	21,711	21,711	21,711	21,711
MANUFACTURING	JASPER	NECHES	GULF COAST AQUIFER	JASPER	SABINE	21,715	21,714	21,713	21,711	21,711	21,711
MANUFACTURING	JASPER	NECHES	NECHES RIVER RUN-OF-RIVER MANUFACTURING	JASPER	NECHES	604	604	604	604	604	604
MANUFACTURING	JASPER	NECHES	NECHES RIVER RUN-OF-RIVER MANUFACTURING	JASPER	NECHES	12	12	12	12	12	12
MANUFACTURING	JASPER	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	20,189	23,571	26,084	28,281	29,928	29,991
MANUFACTURING	JASPER	SABINE	GULF COAST AQUIFER	JASPER	SABINE	36	38	39	41	41	41
MAURICEVILLE SUD	JASPER	SABINE	GULF COAST AQUIFER	ORANGE	SABINE	108	108	108	108	108	108
MINING	JASPER	NECHES	GULF COAST AQUIFER	JASPER	NECHES	2	2	2	2	2	2
MINING	JASPER	SABINE	GULF COAST AQUIFER	JASPER	SABINE	2	2	2	2	2	2
BEAUMONT	JEFFERSON	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	3,250	3,250	3,250	3,250	3,250	3,250
BEAUMONT	JEFFERSON	NECHES	NECHES RIVER RUN-OF-RIVER	JEFFERSON	NECHES	7,187	6,966	6,770	6,603	6,418	6,108

Region I Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
BEAUMONT	JEFFERSON	NECHES-TRINITY	GULF COAST AQUIFER	HARDIN	NECHES	5,750	5,750	5,750	5,750	5,750	5,750
BEAUMONT	JEFFERSON	NECHES-TRINITY	NECHES RIVER RUN-OF-RIVER	JEFFERSON	NECHES	12,537	12,151	11,809	11,519	11,196	10,654
BEVIL OAKS	JEFFERSON	NECHES	GULF COAST AQUIFER	JEFFERSON	NECHES	404	404	404	404	404	404
CHINA	JEFFERSON	NECHES-TRINITY	GULF COAST AQUIFER	JEFFERSON	NECHES-TRINITY	357	357	357	357	357	357
COUNTY-OTHER	JEFFERSON	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	13	17	20	23	26	31
COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	GULF COAST AQUIFER	HARDIN	NECHES	0	0	0	0	0	0
COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	NECHES RIVER RUN-OF-RIVER	JEFFERSON	NECHES	1,679	2,177	2,595	2,922	3,285	3,973
COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	188	244	291	327	368	445
GROVES	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	44	43	43	42	41	41
GROVES	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	3,146	3,094	3,042	2,989	2,955	2,955
IRRIGATION	JEFFERSON	NECHES	NECHES RIVER RUN-OF-RIVER PINE ISLAND BAYOU	JASPER	NECHES	11,648	11,648	11,648	11,648	11,648	11,648
IRRIGATION	JEFFERSON	NECHES-TRINITY	INDIRECT REUSE IRRIGATION	JEFFERSON	NECHES-TRINITY	13,687	13,687	13,687	13,687	13,687	13,687
IRRIGATION	JEFFERSON	NECHES-TRINITY	NECHES RIVER RUN-OF-RIVER PINE ISLAND BAYOU	JASPER	NECHES	128,352	128,352	128,352	122,622	112,622	102,622
IRRIGATION	JEFFERSON	NECHES-TRINITY	NECHES-TRINITY COMBINED RUN-OF-RIVER IRRIGATION	JEFFERSON	NECHES-TRINITY	44,286	44,286	44,286	44,286	44,286	44,286
IRRIGATION	JEFFERSON	NECHES-TRINITY	NECHES-TRINITY RIVER RUN-OF-RIVER IRRIGATION	JEFFERSON	NECHES-TRINITY	5,139	5,139	5,139	5,139	5,139	5,139
IRRIGATION	JEFFERSON	NECHES-TRINITY	NECHES-TRINITY RIVER RUN-OF-RIVER IRRIGATION	JEFFERSON	NECHES-TRINITY	5,321	5,321	5,321	5,321	5,321	5,321
IRRIGATION	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	0	0	0	5,730	15,730	25,730
JEFFERSON COUNTY WCID #10	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	243	266	285	299	316	353
JEFFERSON COUNTY WCID #10	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	397	434	465	488	516	576
LIVESTOCK	JEFFERSON	NECHES	GULF COAST AQUIFER	JEFFERSON	NECHES	84	84	84	84	84	84
LIVESTOCK	JEFFERSON	NECHES	LIVESTOCK LOCAL SUPPLY	JEFFERSON	NECHES	43	43	43	43	43	43
LIVESTOCK	JEFFERSON	NECHES-TRINITY	GULF COAST AQUIFER	JEFFERSON	NECHES-TRINITY	430	430	430	430	430	430
LIVESTOCK	JEFFERSON	NECHES-TRINITY	LIVESTOCK LOCAL SUPPLY	JEFFERSON	NECHES-TRINITY	280	280	280	280	280	280
MANUFACTURING	JEFFERSON	NECHES	GULF COAST AQUIFER	JEFFERSON	NECHES	135	135	135	135	135	135
MANUFACTURING	JEFFERSON	NECHES	NECHES RIVER RUN-OF-RIVER SALINE	JEFFERSON	NECHES	0	0	0	0	0	0
MANUFACTURING	JEFFERSON	NECHES	NECHES RIVER RUN-OF-RIVER SALINE	JEFFERSON	NECHES	0	0	0	0	0	0
MANUFACTURING	JEFFERSON	NECHES	NECHES RIVER RUN-OF-RIVER SALINE	JEFFERSON	NECHES	0	0	0	0	0	0
MANUFACTURING	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	38,625	108,031	154,047	160,681	167,262	173,876
MANUFACTURING	JEFFERSON	NECHES-TRINITY	GULF COAST AQUIFER	JEFFERSON	NECHES-TRINITY	278	278	278	278	278	278

Region I Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
MANUFACTURING	JEFFERSON	NECHES-TRINITY	NECHES RIVER RUN-OF-RIVER	JEFFERSON	NECHES	1,000	1,105	1,221	1,349	1,490	1,646
MANUFACTURING	JEFFERSON	NECHES-TRINITY	NECHES RIVER RUN-OF-RIVER PINE ISLAND BAYOU	JASPER	NECHES	72,016	165,916	237,606	247,606	257,606	267,606
MANUFACTURING	JEFFERSON	NECHES-TRINITY	NECHES-TRINITY RIVER COMBINED RUN-OF-RIVER MANUFACTURING	JEFFERSON	NECHES-TRINITY	680	680	680	680	680	680
MANUFACTURING	JEFFERSON	NECHES-TRINITY	NECHES-TRINITY RIVER RUN-OF-RIVER MANUFACTURING	JEFFERSON	NECHES-TRINITY	480	480	480	480	480	480
MANUFACTURING	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	39,531	147,706	209,947	218,855	228,176	237,286
MEEKER MUD	JEFFERSON	NECHES	GULF COAST AQUIFER	JEFFERSON	NECHES-TRINITY	52	61	68	74	80	93
MEEKER MUD	JEFFERSON	NECHES-TRINITY	GULF COAST AQUIFER	JEFFERSON	NECHES-TRINITY	520	511	504	498	492	479
MEEKER MUD	JEFFERSON	NECHES-TRINITY	NECHES RIVER RUN-OF-RIVER	JEFFERSON	NECHES	3	4	4	5	5	8
MINING	JEFFERSON	NECHES	GULF COAST AQUIFER	JEFFERSON	NECHES	1	1	1	1	1	1
MINING	JEFFERSON	NECHES	OTHER LOCAL SUPPLY	JEFFERSON	NECHES	74	74	74	74	74	74
MINING	JEFFERSON	NECHES-TRINITY	GULF COAST AQUIFER	JEFFERSON	NECHES-TRINITY	74	74	74	74	74	74
MINING	JEFFERSON	NECHES-TRINITY	NECHES-TRINITY RIVER COMBINED RUN-OF-RIVER MINING	JEFFERSON	NECHES-TRINITY	34	34	34	34	34	34
MINING	JEFFERSON	NECHES-TRINITY	OTHER LOCAL SUPPLY	JEFFERSON	NECHES-TRINITY	168	168	168	168	168	168
NEDERLAND	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	159	165	170	172	177	187
NEDERLAND	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	3,966	4,103	4,217	4,284	4,396	4,647
NOME	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	90	97	102	107	112	122
NOME	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	37	39	42	43	45	50
PORT ARTHUR	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	59	58	56	55	54	54
PORT ARTHUR	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	9,645	9,452	9,259	9,067	8,939	8,939
PORT NECHES	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	909	909	913	908	920	960
PORT NECHES	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	873	873	876	872	884	922
WEST JEFFERSON COUNTY MWD	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	1,029	1,148	1,264	1,345	1,436	1,631
APPLEBY WSC	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	851	870	898	930	993	1,063
APPLEBY WSC	NACOGDOCHES	NECHES	NACOGDOCHES LAKE/RESERVOIR	RESERVOIR	NECHES	21	122	266	428	732	1,058
COUNTY-OTHER	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	2,418	2,418	2,418	2,418	2,418	2,418
COUNTY-OTHER	NACOGDOCHES	NECHES	NACOGDOCHES LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
COUNTY-OTHER	NACOGDOCHES	NECHES	OTHER AQUIFER	NACOGDOCHES	NECHES	9	9	9	9	9	9
COUNTY-OTHER	NACOGDOCHES	NECHES	QUEEN CITY AQUIFER	NACOGDOCHES	NECHES	25	25	25	25	25	25
COUNTY-OTHER	NACOGDOCHES	NECHES	SPARTA AQUIFER	NACOGDOCHES	NECHES	29	29	29	29	29	29
CUSHING	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	237	237	237	237	237	237
D&M WSC	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	312	321	307	267	250	250

Region I Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
D&M WSC	NACOGDOCHES	NECHES	NACOGDOCHES LAKE/RESERVOIR	RESERVOIR	NECHES	344	381	413	453	470	470
GARRISON	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	565	565	565	565	565	565
IRRIGATION	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	1,396	1,396	1,396	1,396	1,396	1,396
IRRIGATION	NACOGDOCHES	NECHES	NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	NACOGDOCHES	NECHES	136	136	136	136	136	136
LILLY GROVE SUD	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	761	761	761	761	761	761
LIVESTOCK	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	590	590	590	590	590	590
LIVESTOCK	NACOGDOCHES	NECHES	LIVESTOCK LOCAL SUPPLY	NACOGDOCHES	NECHES	910	910	910	910	910	910
LIVESTOCK	NACOGDOCHES	NECHES	OTHER AQUIFER	NACOGDOCHES	NECHES	69	69	69	69	69	69
LIVESTOCK	NACOGDOCHES	NECHES	QUEEN CITY AQUIFER	NACOGDOCHES	NECHES	195	195	195	195	195	195
LIVESTOCK	NACOGDOCHES	NECHES	SPARTA AQUIFER	NACOGDOCHES	NECHES	221	221	221	221	221	221
MANUFACTURING	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	352	400	445	492	535	589
MANUFACTURING	NACOGDOCHES	NECHES	NACOGDOCHES LAKE/RESERVOIR	RESERVOIR	NECHES	1,936	2,153	2,341	2,524	2,679	2,879
MELROSE WSC	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	827	827	827	827	827	827
MINING	NACOGDOCHES	NECHES	OTHER LOCAL SUPPLY	NACOGDOCHES	NECHES	220	220	220	220	220	220
NACOGDOCHES	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	2,682	2,606	2,526	2,437	2,311	2,162
NACOGDOCHES	NACOGDOCHES	NECHES	NACOGDOCHES LAKE/RESERVOIR	RESERVOIR	NECHES	14,766	14,027	13,280	12,512	11,578	10,566
STEAM ELECTRIC POWER	NACOGDOCHES	NECHES	STRIKER LAKE/RESERVOIR	RESERVOIR	NECHES	2,240	6,721	6,721	6,721	0	0
SWIFT WSC	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	666	666	666	666	666	666
WODEN WSC	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	818	818	818	818	818	818
COUNTY-OTHER	NEWTON	SABINE	GULF COAST AQUIFER	NEWTON	NECHES	2	2	2	2	2	2
COUNTY-OTHER	NEWTON	SABINE	GULF COAST AQUIFER	NEWTON	SABINE	1,376	1,376	1,376	1,376	1,376	1,376
IRRIGATION	NEWTON	SABINE	GULF COAST AQUIFER	NEWTON	SABINE	2,234	2,234	2,234	2,234	2,234	2,234
IRRIGATION	NEWTON	SABINE	SABINE RIVER RUN-OF-RIVER IRRIGATION	NEWTON	SABINE	50	50	50	50	50	50
LIVESTOCK	NEWTON	SABINE	GULF COAST AQUIFER	NEWTON	SABINE	58	58	58	58	58	58
LIVESTOCK	NEWTON	SABINE	LIVESTOCK LOCAL SUPPLY	NEWTON	SABINE	66	66	66	66	66	66
MANUFACTURING	NEWTON	SABINE	GULF COAST AQUIFER	NEWTON	SABINE	394	394	394	394	394	394
MANUFACTURING	NEWTON	SABINE	SABINE RIVER RUN-OF-RIVER MANUFACTURING	NEWTON	SABINE	135	135	135	135	135	135
MAURICEVILLE SUD	NEWTON	SABINE	GULF COAST AQUIFER	ORANGE	SABINE	39	39	39	39	39	39
MINING	NEWTON	NECHES	GULF COAST AQUIFER	NEWTON	NECHES	8	8	8	8	8	8
MINING	NEWTON	SABINE	OTHER LOCAL SUPPLY	NEWTON	SABINE	28	28	28	28	28	28
NEWTON	NEWTON	SABINE	GULF COAST AQUIFER	NEWTON	SABINE	686	686	686	686	686	686
SOUTH NEWTON WSC	NEWTON	SABINE	GULF COAST AQUIFER	NEWTON	SABINE	653	653	653	653	653	653
STEAM ELECTRIC POWER	NEWTON	SABINE	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	14,179	14,179	14,179	14,179	14,179	14,179
BRIDGE CITY	ORANGE	NECHES	GULF COAST AQUIFER	ORANGE	SABINE	178	178	178	178	178	178
BRIDGE CITY	ORANGE	NECHES-TRINITY	GULF COAST AQUIFER	ORANGE	SABINE	167	167	167	167	167	167
BRIDGE CITY	ORANGE	SABINE	GULF COAST AQUIFER	ORANGE	SABINE	922	922	922	922	922	922
COUNTY-OTHER	ORANGE	NECHES	GULF COAST AQUIFER	ORANGE	NECHES	1,940	1,940	1,940	1,940	1,940	1,940
COUNTY-OTHER	ORANGE	NECHES-TRINITY	GULF COAST AQUIFER	ORANGE	NECHES	1	1	1	1	1	1
COUNTY-OTHER	ORANGE	SABINE	GULF COAST AQUIFER	ORANGE	SABINE	2,530	2,530	2,530	2,530	2,530	2,530
IRRIGATION	ORANGE	NECHES	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	2,035	2,035	2,035	2,035	2,035	2,035
IRRIGATION	ORANGE	SABINE	DIRECT REUSE	ORANGE	SABINE	15	15	15	15	15	15
IRRIGATION	ORANGE	SABINE	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	465	465	465	465	465	465
IRRIGATION	ORANGE	SABINE	SABINE RIVER RUN-OF-RIVER IRRIGATION	ORANGE	SABINE	28	28	28	28	28	28
LIVESTOCK	ORANGE	NECHES	GULF COAST AQUIFER	ORANGE	NECHES	36	36	36	36	36	36

Region I Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
LIVESTOCK	ORANGE	NECHES	LIVESTOCK LOCAL SUPPLY	ORANGE	NECHES	56	56	56	56	56	56
LIVESTOCK	ORANGE	SABINE	GULF COAST AQUIFER	ORANGE	SABINE	52	52	52	52	52	52
LIVESTOCK	ORANGE	SABINE	LIVESTOCK LOCAL SUPPLY	ORANGE	SABINE	70	70	70	70	70	70
MANUFACTURING	ORANGE	NECHES	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	4,481	4,481	4,481	4,481	4,481	4,481
MANUFACTURING	ORANGE	SABINE	GULF COAST AQUIFER	ORANGE	SABINE	4,076	4,076	4,076	4,076	4,076	4,076
MANUFACTURING	ORANGE	SABINE	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	53,990	53,990	53,990	53,990	53,990	53,990
MAURICEVILLE SUD	ORANGE	SABINE	GULF COAST AQUIFER	ORANGE	SABINE	840	840	840	840	840	840
MINING	ORANGE	NECHES	GULF COAST AQUIFER	ORANGE	NECHES	8	8	8	8	8	8
MINING	ORANGE	SABINE	OTHER LOCAL SUPPLY	ORANGE	SABINE	1	1	1	1	1	1
ORANGE	ORANGE	SABINE	GULF COAST AQUIFER	ORANGE	SABINE	4,091	4,091	4,091	4,091	4,091	4,091
PINE FOREST	ORANGE	NECHES	GULF COAST AQUIFER	ORANGE	NECHES	128	128	128	128	128	128
PINEHURST	ORANGE	SABINE	GULF COAST AQUIFER	ORANGE	SABINE	690	690	690	690	690	690
ROSE CITY	ORANGE	NECHES	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	303	303	303	303	303	303
SOUTH NEWTON WSC	ORANGE	SABINE	GULF COAST AQUIFER	ORANGE	SABINE	194	194	194	194	194	194
STEAM ELECTRIC POWER	ORANGE	NECHES	GULF COAST AQUIFER	ORANGE	NECHES	1,085	1,085	1,085	1,085	1,085	1,085
STEAM ELECTRIC POWER	ORANGE	NECHES	NECHES RIVER RUN-OF-RIVER SALINE	ORANGE	NECHES	17,210	17,210	17,210	17,210	17,210	17,210
VIDOR	ORANGE	NECHES	GULF COAST AQUIFER	ORANGE	NECHES	1,361	1,361	1,361	1,361	1,361	1,361
VIDOR	ORANGE	SABINE	GULF COAST AQUIFER	ORANGE	SABINE	626	626	626	626	626	626
WEST ORANGE	ORANGE	SABINE	GULF COAST AQUIFER	ORANGE	SABINE	905	905	905	905	905	905
BECKVILLE	PANOLA	SABINE	CARRIZO-WILCOX AQUIFER	PANOLA	SABINE	581	581	581	581	581	581
CARTHAGE	PANOLA	SABINE	CARRIZO-WILCOX AQUIFER	PANOLA	SABINE	404	398	393	389	385	376
CARTHAGE	PANOLA	SABINE	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	3,552	3,498	3,456	3,415	3,379	3,308
COUNTY-OTHER	PANOLA	CYPRESS	CARRIZO-WILCOX AQUIFER	PANOLA	SABINE	5	5	5	5	5	5
COUNTY-OTHER	PANOLA	SABINE	CARRIZO-WILCOX AQUIFER	PANOLA	SABINE	1,351	1,354	1,359	1,363	1,367	1,372
COUNTY-OTHER	PANOLA	SABINE	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	1,331	1,328	1,323	1,319	1,315	1,310
GILL WSC	PANOLA	SABINE	CARRIZO-WILCOX AQUIFER	PANOLA	SABINE	113	113	113	113	113	113
LIVESTOCK	PANOLA	CYPRESS	CARRIZO-WILCOX AQUIFER	PANOLA	CYPRESS	1	1	1	1	1	1
LIVESTOCK	PANOLA	CYPRESS	LIVESTOCK LOCAL SUPPLY	PANOLA	CYPRESS	30	30	30	30	30	30
LIVESTOCK	PANOLA	SABINE	CARRIZO-WILCOX AQUIFER	PANOLA	SABINE	1,519	1,519	1,519	1,519	1,519	1,519
LIVESTOCK	PANOLA	SABINE	LIVESTOCK LOCAL SUPPLY	PANOLA	SABINE	1,828	1,828	1,828	1,828	1,828	1,828
MANUFACTURING	PANOLA	SABINE	CARRIZO-WILCOX AQUIFER	PANOLA	SABINE	107	116	124	132	140	154
MANUFACTURING	PANOLA	SABINE	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	911	962	1,001	1,039	1,070	1,136
MANUFACTURING	PANOLA	SABINE	SABINE RIVER RUN-OF-RIVER MANUFACTURING	PANOLA	SABINE	129	129	129	129	129	129
MANUFACTURING	PANOLA	SABINE	SABINE RIVER RUN-OF-RIVER MANUFACTURING	PANOLA	SABINE	114	114	114	114	114	114
MINING	PANOLA	SABINE	CARRIZO-WILCOX AQUIFER	PANOLA	SABINE	2,434	2,434	2,434	2,434	2,434	2,434
MINING	PANOLA	SABINE	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	2,254	2,563	2,752	2,943	3,137	3,322
TATUM	PANOLA	SABINE	CARRIZO-WILCOX AQUIFER	RUSK	SABINE	94	94	94	94	94	94
CORRIGAN	POLK	NECHES	OTHER AQUIFER	POLK	NECHES	554	554	554	554	554	554
COUNTY-OTHER	POLK	NECHES	GULF COAST AQUIFER	POLK	NECHES	736	736	736	736	736	736
COUNTY-OTHER	POLK	NECHES	OTHER AQUIFER	POLK	NECHES	166	166	166	166	166	166
IRRIGATION	POLK	NECHES	GULF COAST AQUIFER	POLK	NECHES	286	286	286	286	286	286
LIVESTOCK	POLK	NECHES	GULF COAST AQUIFER	POLK	NECHES	81	81	81	81	81	81
LIVESTOCK	POLK	NECHES	LIVESTOCK LOCAL SUPPLY	POLK	NECHES	122	122	122	122	122	122
LIVESTOCK	POLK	NECHES	OTHER AQUIFER	POLK	NECHES	20	20	20	20	20	20
MANUFACTURING	POLK	NECHES	GULF COAST AQUIFER	POLK	NECHES	93	93	93	93	93	93
MANUFACTURING	POLK	NECHES	OTHER AQUIFER	POLK	NECHES	568	568	568	568	568	568
COUNTY-OTHER	RUSK	NECHES	CARRIZO-WILCOX AQUIFER	RUSK	NECHES	1,507	1,507	1,507	1,507	1,507	1,507
COUNTY-OTHER	RUSK	NECHES	QUEEN CITY AQUIFER	RUSK	NECHES	12	12	12	12	12	12

Region I Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
COUNTY-OTHER	RUSK	SABINE	CARRIZO-WILCOX AQUIFER	RUSK	SABINE	1,687	1,687	1,687	1,687	1,687	1,687
COUNTY-OTHER	RUSK	SABINE	QUEEN CITY AQUIFER	RUSK	SABINE	13	13	13	13	13	13
EASTON	RUSK	SABINE	CHEROKEE LAKE/RESERVOIR	RESERVOIR	SABINE	61	83	96	102	120	163
ELDERVILLE WSC	RUSK	SABINE	CARRIZO-WILCOX AQUIFER	GREGG	SABINE	107	107	107	107	107	107
ELDERVILLE WSC	RUSK	SABINE	CHEROKEE LAKE/RESERVOIR	RESERVOIR	SABINE	286	303	320	337	354	369
HENDERSON	RUSK	NECHES	CARRIZO-WILCOX AQUIFER	RUSK	NECHES	2,432	2,432	2,432	2,432	2,432	2,432
HENDERSON	RUSK	NECHES	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	3,922	3,922	3,922	3,921	3,922	3,922
HENDERSON	RUSK	SABINE	CARRIZO-WILCOX AQUIFER	RUSK	NECHES	305	305	305	305	305	305
HENDERSON	RUSK	SABINE	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	459	459	459	460	459	458
IRRIGATION	RUSK	NECHES	CARRIZO-WILCOX AQUIFER	RUSK	NECHES	93	93	93	93	93	93
IRRIGATION	RUSK	SABINE	CARRIZO-WILCOX AQUIFER	RUSK	SABINE	96	96	96	96	96	96
IRRIGATION	RUSK	SABINE	SABINE RIVER COMBINED RUN-OF-RIVER IRRIGATION	RUSK	SABINE	127	127	127	127	127	127
KILGORE	RUSK	SABINE	CARRIZO-WILCOX AQUIFER	GREGG	SABINE	460	441	423	404	382	354
KILGORE	RUSK	SABINE	SABINE RIVER RUN-OF-RIVER	WOOD	SABINE	303	290	278	266	251	233
LIVESTOCK	RUSK	NECHES	CARRIZO-WILCOX AQUIFER	RUSK	NECHES	323	323	323	323	323	323
LIVESTOCK	RUSK	NECHES	LIVESTOCK LOCAL SUPPLY	RUSK	NECHES	386	386	386	386	386	386
LIVESTOCK	RUSK	NECHES	QUEEN CITY AQUIFER	RUSK	NECHES	35	35	35	35	35	35
LIVESTOCK	RUSK	SABINE	CARRIZO-WILCOX AQUIFER	RUSK	SABINE	286	286	286	286	286	286
LIVESTOCK	RUSK	SABINE	LIVESTOCK LOCAL SUPPLY	RUSK	SABINE	308	308	308	308	308	308
MANUFACTURING	RUSK	NECHES	CARRIZO-WILCOX AQUIFER	RUSK	NECHES	121	121	121	121	121	121
MANUFACTURING	RUSK	NECHES	NECHES RIVER COMBINED RUN-OF-RIVER MANUFACTURING	RUSK	NECHES	2	2	2	2	2	2
MANUFACTURING	RUSK	SABINE	CARRIZO-WILCOX AQUIFER	RUSK	SABINE	10	10	10	10	10	10
MINING	RUSK	NECHES	CARRIZO-WILCOX AQUIFER	RUSK	NECHES	1,130	1,130	1,130	1,130	1,130	1,130
MINING	RUSK	NECHES	QUEEN CITY AQUIFER	RUSK	NECHES	124	124	124	124	124	124
MINING	RUSK	SABINE	CARRIZO-WILCOX AQUIFER	RUSK	SABINE	375	375	375	375	375	375
MINING	RUSK	SABINE	OTHER LOCAL SUPPLY	RUSK	SABINE	287	287	287	287	287	287
MOUNT ENTERPRISE	RUSK	NECHES	CARRIZO-WILCOX AQUIFER	RUSK	NECHES	371	371	371	371	371	371
NEW LONDON	RUSK	NECHES	CARRIZO-WILCOX AQUIFER	RUSK	SABINE	434	436	436	436	435	434
NEW LONDON	RUSK	SABINE	CARRIZO-WILCOX AQUIFER	RUSK	SABINE	401	399	399	399	400	401
OVERTON	RUSK	NECHES	CARRIZO-WILCOX AQUIFER	RUSK	NECHES	68	69	68	68	69	68
OVERTON	RUSK	SABINE	CARRIZO-WILCOX AQUIFER	RUSK	SABINE	548	547	548	546	544	543
SOUTHERN UTILITIES COMPANY	RUSK	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	95	95	95	95	95	95
STEAM ELECTRIC POWER	RUSK	SABINE	CARRIZO-WILCOX AQUIFER	RUSK	SABINE	240	240	240	240	240	240
STEAM ELECTRIC POWER	RUSK	SABINE	MARTIN LAKE/RESERVOIR	RESERVOIR	SABINE	25,000	25,000	25,000	25,000	25,000	25,000
STEAM ELECTRIC POWER	RUSK	SABINE	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	17,922	17,922	17,922	17,922	17,922	17,922
TATUM	RUSK	SABINE	CARRIZO-WILCOX AQUIFER	RUSK	SABINE	374	374	374	374	374	374
WEST GREGG WSC	RUSK	SABINE	CARRIZO-WILCOX AQUIFER	GREGG	SABINE	15	15	15	15	15	16
COUNTY-OTHER	SABINE	NECHES	CARRIZO-WILCOX AQUIFER	SABINE	NECHES	58	58	58	58	58	58
COUNTY-OTHER	SABINE	NECHES	GULF COAST AQUIFER	JASPER	NECHES	70	70	70	70	70	70
COUNTY-OTHER	SABINE	NECHES	OTHER AQUIFER	SABINE	NECHES	20	20	20	20	20	20
COUNTY-OTHER	SABINE	NECHES	SPARTA AQUIFER	SABINE	NECHES	58	58	58	58	58	58
COUNTY-OTHER	SABINE	NECHES	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	150	150	150	150	150	150
COUNTY-OTHER	SABINE	SABINE	CARRIZO-WILCOX AQUIFER	SABINE	SABINE	84	84	84	84	84	84
COUNTY-OTHER	SABINE	SABINE	OTHER AQUIFER	SABINE	SABINE	19	19	19	19	19	19
COUNTY-OTHER	SABINE	SABINE	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	86	86	86	86	86	86
G-M WSC	SABINE	SABINE	CARRIZO-WILCOX AQUIFER	SABINE	SABINE	19	19	19	19	19	19
G-M WSC	SABINE	SABINE	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	676	676	676	676	676	676

Region I Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
HEMPHILL	SABINE	SABINE	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	1,088	1,088	1,088	1,088	1,088	1,088
LIVESTOCK	SABINE	NECHES	CARRIZO-WILCOX AQUIFER	SABINE	NECHES	10	10	10	10	10	10
LIVESTOCK	SABINE	NECHES	LIVESTOCK LOCAL SUPPLY	SABINE	NECHES	59	59	59	59	59	59
LIVESTOCK	SABINE	NECHES	OTHER AQUIFER	SABINE	NECHES	20	20	20	20	20	20
LIVESTOCK	SABINE	NECHES	SPARTA AQUIFER	SABINE	NECHES	10	10	10	10	10	10
LIVESTOCK	SABINE	SABINE	CARRIZO-WILCOX AQUIFER	SABINE	SABINE	105	105	105	105	105	105
LIVESTOCK	SABINE	SABINE	LIVESTOCK LOCAL SUPPLY	SABINE	SABINE	320	320	320	320	320	320
LIVESTOCK	SABINE	SABINE	OTHER AQUIFER	SABINE	SABINE	53	53	53	53	53	53
LIVESTOCK	SABINE	SABINE	SPARTA AQUIFER	SABINE	SABINE	53	53	53	53	53	53
MANUFACTURING	SABINE	NECHES	DIRECT REUSE MANUFACTURING	SABINE	SABINE	20	20	20	20	20	20
MANUFACTURING	SABINE	NECHES	NECHES RIVER RUN-OF-RIVER MANUFACTURING	SABINE	NECHES	182	182	182	182	182	182
MANUFACTURING	SABINE	NECHES	YEGUA-JACKSON AQUIFER	SABINE	SABINE	640	640	640	640	640	640
PINELAND	SABINE	NECHES	YEGUA-JACKSON AQUIFER	SABINE	NECHES	301	301	301	301	301	301
COUNTY-OTHER	SAN AUGUSTINE	NECHES	CARRIZO-WILCOX AQUIFER	SAN AUGUSTINE	NECHES	175	175	175	175	175	175
COUNTY-OTHER	SAN AUGUSTINE	NECHES	SAN AUGUSTINE LAKE/RESERVOIR	RESERVOIR	NECHES	160	160	160	160	160	160
COUNTY-OTHER	SAN AUGUSTINE	NECHES	SPARTA AQUIFER	SAN AUGUSTINE	NECHES	47	47	47	47	47	47
COUNTY-OTHER	SAN AUGUSTINE	NECHES	YEGUA-JACKSON AQUIFER	SAN AUGUSTINE	NECHES	316	316	316	316	316	316
COUNTY-OTHER	SAN AUGUSTINE	SABINE	SAN AUGUSTINE LAKE/RESERVOIR	RESERVOIR	NECHES	4	4	4	4	4	4
G-M WSC	SAN AUGUSTINE	SABINE	CARRIZO-WILCOX AQUIFER	SAN AUGUSTINE	SABINE	15	15	15	15	15	15
G-M WSC	SAN AUGUSTINE	SABINE	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	77	77	77	77	77	77
IRRIGATION	SAN AUGUSTINE	NECHES	CARRIZO-WILCOX AQUIFER	SAN AUGUSTINE	NECHES	96	96	96	96	96	96
IRRIGATION	SAN AUGUSTINE	SABINE	SPARTA AQUIFER	SAN AUGUSTINE	SABINE	39	39	39	39	39	39
LIVESTOCK	SAN AUGUSTINE	NECHES	CARRIZO-WILCOX AQUIFER	SAN AUGUSTINE	NECHES	76	76	76	76	76	76
LIVESTOCK	SAN AUGUSTINE	NECHES	LIVESTOCK LOCAL SUPPLY	SAN AUGUSTINE	NECHES	490	490	490	490	490	490
LIVESTOCK	SAN AUGUSTINE	NECHES	SPARTA AQUIFER	SAN AUGUSTINE	NECHES	70	70	70	70	70	70
LIVESTOCK	SAN AUGUSTINE	NECHES	YEGUA-JACKSON AQUIFER	SAN AUGUSTINE	NECHES	160	160	160	160	160	160
LIVESTOCK	SAN AUGUSTINE	SABINE	CARRIZO-WILCOX AQUIFER	SAN AUGUSTINE	SABINE	46	46	46	46	46	46
LIVESTOCK	SAN AUGUSTINE	SABINE	LIVESTOCK LOCAL SUPPLY	SAN AUGUSTINE	SABINE	71	71	71	71	71	71
MANUFACTURING	SAN AUGUSTINE	NECHES	CARRIZO-WILCOX AQUIFER	SAN AUGUSTINE	NECHES	9	9	9	9	9	9
SAN AUGUSTINE	SAN AUGUSTINE	NECHES	SAN AUGUSTINE LAKE/RESERVOIR	RESERVOIR	NECHES	1,082	1,082	1,082	1,082	1,082	1,082
CENTER	SHELBY	SABINE	CENTER LAKE/RESERVOIR	RESERVOIR	SABINE	542	520	502	482	466	446
CENTER	SHELBY	SABINE	PINKSTON LAKE/RESERVOIR	RESERVOIR	NECHES	2,668	2,556	2,460	2,367	2,283	2,178
COUNTY-OTHER	SHELBY	NECHES	CARRIZO-WILCOX AQUIFER	SHELBY	NECHES	246	246	246	246	246	246
COUNTY-OTHER	SHELBY	NECHES	TIMPSON LAKE/RESERVOIR	RESERVOIR	NECHES	350	350	350	350	350	350
COUNTY-OTHER	SHELBY	SABINE	CARRIZO-WILCOX AQUIFER	SHELBY	SABINE	1,142	1,142	1,142	1,142	1,142	1,142
COUNTY-OTHER	SHELBY	SABINE	CENTER LAKE/RESERVOIR	RESERVOIR	SABINE	21	22	22	23	23	24
COUNTY-OTHER	SHELBY	SABINE	PINKSTON LAKE/RESERVOIR	RESERVOIR	NECHES	167	174	179	180	184	190
COUNTY-OTHER	SHELBY	SABINE	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	280	280	280	280	280	280
COUNTY-OTHER	SHELBY	SABINE	TOLEDO BEND LAKE/RESERVOIR LOUISIANA PORTION	RESERVOIR - LOUISIANA	SABINE - LOUISIANA	35	35	35	35	35	35
IRRIGATION	SHELBY	NECHES	CARRIZO-WILCOX AQUIFER	SHELBY	NECHES	16	16	16	16	16	16
IRRIGATION	SHELBY	SABINE	CARRIZO-WILCOX AQUIFER	SHELBY	SABINE	24	24	24	24	24	24
IRRIGATION	SHELBY	SABINE	DIRECT REUSE IRRIGATION/MANUFACTURING	SHELBY	SABINE	82	82	82	82	82	82
JOAQUIN	SHELBY	SABINE	TOLEDO BEND LAKE/RESERVOIR LOUISIANA PORTION	RESERVOIR - LOUISIANA	SABINE - LOUISIANA	200	200	200	200	200	200
LIVESTOCK	SHELBY	NECHES	CARRIZO-WILCOX AQUIFER	SHELBY	NECHES	31	31	31	31	31	31
LIVESTOCK	SHELBY	NECHES	LIVESTOCK LOCAL SUPPLY	SHELBY	NECHES	334	334	334	334	334	334
LIVESTOCK	SHELBY	SABINE	CARRIZO-WILCOX AQUIFER	SHELBY	SABINE	1,349	1,349	1,349	1,349	1,349	1,349

Region I Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
LIVESTOCK	SHELBY	SABINE	LIVESTOCK LOCAL SUPPLY	SHELBY	SABINE	1,755	1,755	1,755	1,755	1,755	1,755
MANUFACTURING	SHELBY	SABINE	CARRIZO-WILCOX AQUIFER	SHELBY	SABINE	89	89	89	89	89	89
MANUFACTURING	SHELBY	SABINE	CENTER LAKE/RESERVOIR	RESERVOIR	SABINE	191	212	230	249	265	284
MANUFACTURING	SHELBY	SABINE	DIRECT REUSE IRRIGATION/MANUFACTURING	SHELBY	SABINE	136	151	164	177	188	202
MANUFACTURING	SHELBY	SABINE	PINKSTON LAKE/RESERVOIR	RESERVOIR	NECHES	965	1,070	1,161	1,253	1,333	1,432
TENAHA	SHELBY	SABINE	CARRIZO-WILCOX AQUIFER	SHELBY	SABINE	335	335	335	335	335	335
TIMPSON	SHELBY	NECHES	CARRIZO-WILCOX AQUIFER	SHELBY	SABINE	5	5	5	5	5	5
TIMPSON	SHELBY	SABINE	CARRIZO-WILCOX AQUIFER	SHELBY	SABINE	467	467	467	467	467	467
ARP	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	297	297	297	297	297	297
BULLARD	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	312	312	312	312	312	312
BULLARD	SMITH	NECHES	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	14	13	12	12	11	11
COMMUNITY WATER COMPANY	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	100	100	100	100	100	100
COUNTY-OTHER	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	990	891	802	722	650	585
COUNTY-OTHER	SMITH	NECHES	QUEEN CITY AQUIFER	SMITH	NECHES	17	17	17	17	17	17
CRYSTAL SYSTEMS INC	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	SABINE	65	71	77	82	93	108
DEAN WSC	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	976	976	976	976	976	976
IRRIGATION	SMITH	NECHES	BELLWOOD LAKE/RESERVOIR	RESERVOIR	NECHES	300	300	300	300	300	300
IRRIGATION	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	59	59	59	59	59	59
IRRIGATION	SMITH	NECHES	NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	SMITH	NECHES	50	50	50	50	50	50
IRRIGATION	SMITH	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	104	103	102	101	100	99
IRRIGATION	SMITH	NECHES	QUEEN CITY AQUIFER	SMITH	NECHES	47	47	47	47	47	47
JACKSON WSC	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	341	344	346	348	345	342
LINDALE	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	219	148	146	145	144	144
LINDALE RURAL WSC	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	716	714	712	711	709	707
LIVESTOCK	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	37	37	37	37	37	37
LIVESTOCK	SMITH	NECHES	LIVESTOCK LOCAL SUPPLY	SMITH	NECHES	416	416	416	416	416	416
LIVESTOCK	SMITH	NECHES	QUEEN CITY AQUIFER	SMITH	NECHES	253	253	253	253	253	253
MANUFACTURING	SMITH	NECHES	BELLWOOD LAKE/RESERVOIR	RESERVOIR	NECHES	650	650	650	650	650	650
MANUFACTURING	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	737	770	799	827	851	883
MANUFACTURING	SMITH	NECHES	OTHER AQUIFER	SMITH	NECHES	62	62	62	62	62	62
MANUFACTURING	SMITH	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	1,085	1,212	1,325	1,434	1,526	1,652
MANUFACTURING	SMITH	NECHES	TYLER LAKE/RESERVOIR	RESERVOIR	NECHES	1,519	1,697	1,855	2,007	2,136	2,312
MINING	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	109	109	109	109	109	109
MINING	SMITH	NECHES	QUEEN CITY AQUIFER	SMITH	NECHES	27	27	27	27	27	27
NEW CHAPEL HILL	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	118	127	137	146	163	187
NOONDAY	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	102	105	107	110	117	127
OVERTON	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	RUSK	SABINE	11	11	11	12	12	13
R P M WSC	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	50	50	50	50	50	50
SOUTHERN UTILITIES COMPANY	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	7,811	7,775	7,736	7,697	7,649	7,644
SOUTHERN UTILITIES COMPANY	SMITH	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	114	118	122	127	139	345
SOUTHERN UTILITIES COMPANY	SMITH	NECHES	TYLER LAKE/RESERVOIR	RESERVOIR	NECHES	160	166	171	178	195	484
TROUP	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	432	432	432	432	432	432
TYLER	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	3,886	3,833	3,785	3,738	3,680	3,553
TYLER	SMITH	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	15,055	14,852	14,666	14,482	14,259	13,767

Region I Water User Group Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
TYLER	SMITH	NECHES	TYLER LAKE/RESERVOIR	RESERVOIR	NECHES	21,077	20,793	20,532	20,276	19,963	19,273
WHITEHOUSE	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	334	340	345	351	362	378
WHITEHOUSE	SMITH	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	259	282	304	327	370	431
WHITEHOUSE	SMITH	NECHES	TYLER LAKE/RESERVOIR	RESERVOIR	NECHES	362	394	425	457	518	603
COUNTY-OTHER	TRINITY	NECHES	GULF COAST AQUIFER	TRINITY	NECHES	96	96	96	96	96	96
COUNTY-OTHER	TRINITY	NECHES	OTHER AQUIFER	TRINITY	NECHES	272	272	272	272	272	272
COUNTY-OTHER	TRINITY	NECHES	YEGUA-JACKSON AQUIFER	TRINITY	NECHES	263	263	263	263	263	263
GROVETON	TRINITY	NECHES	LIVINGSTON-WALLISVILLE LAKE/RESERVOIR SYSTEM	RESERVOIR	TRINITY	114	121	122	118	113	109
LIVESTOCK	TRINITY	NECHES	LIVESTOCK LOCAL SUPPLY	TRINITY	NECHES	135	135	135	135	135	135
LIVESTOCK	TRINITY	NECHES	YEGUA-JACKSON AQUIFER	TRINITY	NECHES	141	141	141	141	141	141
COLMESNEIL	TYLER	NECHES	GULF COAST AQUIFER	TYLER	NECHES	371	371	371	371	371	371
COUNTY-OTHER	TYLER	NECHES	GULF COAST AQUIFER	TYLER	NECHES	1,445	1,445	1,445	1,445	1,445	1,445
IRRIGATION	TYLER	NECHES	GULF COAST AQUIFER	TYLER	NECHES	4	4	4	4	4	4
IRRIGATION	TYLER	NECHES	NECHES RIVER COMBINED RUN-OF-RIVER IRRIGATION	TYLER	NECHES	123	123	123	123	123	123
LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY	TYLER	NECHES	GULF COAST AQUIFER	TYLER	NECHES	8	8	8	8	8	8
LIVESTOCK	TYLER	NECHES	GULF COAST AQUIFER	TYLER	NECHES	146	146	146	146	146	146
LIVESTOCK	TYLER	NECHES	LIVESTOCK LOCAL SUPPLY	TYLER	NECHES	165	165	165	165	165	165
MANUFACTURING	TYLER	NECHES	GULF COAST AQUIFER	TYLER	NECHES	73	73	73	73	73	73
TYLER COUNTY WSC	TYLER	NECHES	GULF COAST AQUIFER	TYLER	NECHES	1,072	1,072	1,072	1,072	1,072	1,072
WOODVILLE	TYLER	NECHES	GULF COAST AQUIFER	TYLER	NECHES	1,921	1,921	1,921	1,921	1,921	1,921

Region I Wholesale Water Provider Supplies
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	CHEROKEE	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	ARP	SMITH	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	SMITH	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	NACOGDOCHES	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	ALTO	CHEROKEE	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	CHEROKEE	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	JASPER	NECHES	GULF COAST AQUIFER	JASPER	NECHES	60	65	70	70	70	70
ANGELINA & NECHES RIVER AUTHORITY	JACKSON WSC	SMITH	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	JACKSONVILLE	CHEROKEE	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	NACOGDOCHES	NACOGDOCHES	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	NEW LONDON	RUSK	SABINE	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	NEW SUMMERFIELD	CHEROKEE	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	NORTH CHEROKEE WSC	CHEROKEE	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	RUSK	CHEROKEE	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	RUSK RURAL WSC	CHEROKEE	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	MANUFACTURING	ANGELINA	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	TROUP	SMITH	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	WHITEHOUSE	SMITH	NECHES	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
ANGELINA NACOGDOCHES WCID #1	COUNTY-OTHER	CHEROKEE	NECHES	STRIKER LAKE/RESERVOIR	RESERVOIR	NECHES	11,270	10,846	9,716	8,520	13,965	12,590
ANGELINA NACOGDOCHES WCID #1	HENDERSON	RUSK	NECHES	STRIKER LAKE/RESERVOIR	RESERVOIR	NECHES	2,242	0	0	0	0	0
ANGELINA NACOGDOCHES WCID #1	STEAM ELECTRIC POWER	CHEROKEE	NECHES	STRIKER LAKE/RESERVOIR	RESERVOIR	NECHES	2,245	1,790	2,093	2,462	2,912	3,460
ANGELINA NACOGDOCHES WCID #1	STEAM ELECTRIC POWER	NACOGDOCHES	NECHES	STRIKER LAKE/RESERVOIR	RESERVOIR	NECHES	2,240	6,721	6,721	6,721	0	0
ANGELINA NACOGDOCHES WCID #1	WHITEHOUSE	SMITH	NECHES	STRIKER LAKE/RESERVOIR	RESERVOIR	NECHES	2,186	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	COUNTY-OTHER	HENDERSON	NECHES	ATHENS LAKE/RESERVOIR	RESERVOIR	NECHES	160	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	ATHENS	HENDERSON	TRINITY	ATHENS LAKE/RESERVOIR	RESERVOIR	NECHES	2,027	977	1,165	1,333	1,507	1,670
ATHENS MUNICIPAL WATER AUTHORITY	ATHENS	HENDERSON	NECHES	ATHENS LAKE/RESERVOIR	RESERVOIR	NECHES	62	33	42	50	57	65
ATHENS MUNICIPAL WATER AUTHORITY	IRRIGATION	HENDERSON	NECHES	ATHENS LAKE/RESERVOIR	RESERVOIR	NECHES	171	94	86	79	71	64
ATHENS MUNICIPAL WATER AUTHORITY	LIVESTOCK	HENDERSON	NECHES	ATHENS LAKE/RESERVOIR	RESERVOIR	NECHES	380	1,735	1,546	1,376	1,203	1,040
ATHENS MUNICIPAL WATER AUTHORITY	LIVESTOCK	HENDERSON	NECHES	INDIRECT REUSE	HENDERSON	NECHES	2,872	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	MANUFACTURING	HENDERSON	TRINITY	ATHENS LAKE/RESERVOIR	RESERVOIR	NECHES	100	61	61	62	62	61
BEAUMONT CITY OF	BEAUMONT	JEFFERSON	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	3,300	3,300	3,300	3,300	3,300	3,300
BEAUMONT CITY OF	BEAUMONT	JEFFERSON	NECHES	NECHES RIVER RUN-OF-RIVER	JEFFERSON	NECHES	7,187	6,966	6,770	6,603	6,418	6,108
BEAUMONT CITY OF	BEAUMONT	JEFFERSON	NECHES-TRINITY	GULF COAST AQUIFER	HARDIN	NECHES	5,700	5,700	5,700	5,700	5,700	5,700
BEAUMONT CITY OF	BEAUMONT	JEFFERSON	NECHES-TRINITY	NECHES RIVER RUN-OF-RIVER	JEFFERSON	NECHES	12,537	12,151	11,809	11,519	11,196	10,654
BEAUMONT CITY OF	BEAUMONT	JEFFERSON	NECHES-TRINITY	NECHES RIVER RUN-OF-RIVER	JEFFERSON	NECHES	9,692	9,691	9,692	9,690	9,691	9,691
BEAUMONT CITY OF	COUNTY-OTHER	JEFFERSON	NECHES	GULF COAST AQUIFER	HARDIN	NECHES	0	0	0	0	0	0
BEAUMONT CITY OF	COUNTY-OTHER	JEFFERSON	NECHES	NECHES RIVER RUN-OF-RIVER	JEFFERSON	NECHES	13	17	20	23	26	31
BEAUMONT CITY OF	COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	GULF COAST AQUIFER	HARDIN	NECHES	0	0	0	0	0	0
BEAUMONT CITY OF	COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	NECHES RIVER RUN-OF-RIVER	JEFFERSON	NECHES	1,679	2,177	2,595	2,922	3,285	3,973
BEAUMONT CITY OF	MANUFACTURING	JEFFERSON	NECHES	NECHES RIVER RUN-OF-RIVER	JEFFERSON	NECHES	1,000	1,105	1,221	1,349	1,490	1,646
BEAUMONT CITY OF	MEEKER MUD	JEFFERSON	NECHES	NECHES RIVER RUN-OF-RIVER	JEFFERSON	NECHES	3	4	4	5	5	8
CARTHAGE CITY OF	CARTHAGE	PANOLA	SABINE	CARRIZO-WILCOX AQUIFER	PANOLA	SABINE	951	951	948	948	946	946
CARTHAGE CITY OF	CARTHAGE	PANOLA	SABINE	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	7,030	6,646	6,275	5,908	5,541	5,154
CARTHAGE CITY OF	CARTHAGE	PANOLA	SABINE	CARRIZO-WILCOX AQUIFER	PANOLA	SABINE	423	420	418	414	412	407
CARTHAGE CITY OF	CARTHAGE	PANOLA	SABINE	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	3,711	3,685	3,661	3,633	3,611	3,569
CARTHAGE CITY OF	COUNTY-OTHER	PANOLA	CYPRESS	CARRIZO-WILCOX AQUIFER	PANOLA	SABINE	5	5	5	5	5	5
CARTHAGE CITY OF	COUNTY-OTHER	PANOLA	SABINE	CARRIZO-WILCOX AQUIFER	PANOLA	SABINE	151	154	159	163	167	172
CARTHAGE CITY OF	COUNTY-OTHER	PANOLA	SABINE	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	1,331	1,328	1,323	1,319	1,315	1,310
CARTHAGE CITY OF	MANUFACTURING	PANOLA	SABINE	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	1,018	1,078	1,125	1,171	1,211	1,290
CENTER CITY OF	CENTER	SHELBY	SABINE	CENTER LAKE/RESERVOIR	RESERVOIR	SABINE	542	520	502	482	466	446
CENTER CITY OF	CENTER	SHELBY	SABINE	PINKSTON LAKE/RESERVOIR	RESERVOIR	NECHES	2,668	2,556	2,460	2,367	2,283	2,178
CENTER CITY OF	MANUFACTURING	SHELBY	SABINE	CENTER LAKE/RESERVOIR	RESERVOIR	SABINE	191	212	230	249	265	284
CENTER CITY OF	MANUFACTURING	SHELBY	SABINE	PINKSTON LAKE/RESERVOIR	RESERVOIR	NECHES	965	1,070	1,161	1,253	1,333	1,432

Region I Wholesale Water Provider Supplies
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
CENTER CITY OF	COUNTY-OTHER	SHELBY	SABINE	PINKSTON LAKE/RESERVOIR	RESERVOIR	NECHES	167	174	179	180	184	190
CENTER CITY OF	COUNTY-OTHER	SHELBY	SABINE	CENTER LAKE/RESERVOIR	RESERVOIR	SABINE	21	22	22	23	23	24
HOUSTON COUNTY WCID #1	CONSOLIDATED WSC	HOUSTON	NECHES	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	255	255	255	255	255	255
HOUSTON COUNTY WCID #1	CONSOLIDATED WSC	ANDERSON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	79	79	79	79	79	79
HOUSTON COUNTY WCID #1	CONSOLIDATED WSC	HOUSTON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	655	655	655	655	655	655
HOUSTON COUNTY WCID #1	CONSOLIDATED WSC	ANDERSON	NECHES	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	23	23	23	23	23	23
HOUSTON COUNTY WCID #1	COUNTY-OTHER	HOUSTON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	84	83	84	85	87	90
HOUSTON COUNTY WCID #1	CROCKETT	HOUSTON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	1,731	1,716	1,702	1,689	1,676	1,661
HOUSTON COUNTY WCID #1	GRAPELAND	HOUSTON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	381	377	374	372	369	365
HOUSTON COUNTY WCID #1	COUNTY-OTHER	HOUSTON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	82	84	84	83	84	84
HOUSTON COUNTY WCID #1	LOVELADY	HOUSTON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	51	51	51	51	51	51
HOUSTON COUNTY WCID #1	MANUFACTURING	HOUSTON	TRINITY	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	159	177	193	208	221	237
JACKSONVILLE CITY OF	BULLARD	SMITH	NECHES	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	14	13	12	12	11	11
JACKSONVILLE CITY OF	COUNTY-OTHER	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	93	77	57	34	23	18
JACKSONVILLE CITY OF	COUNTY-OTHER	CHEROKEE	NECHES	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	218	180	134	78	54	41
JACKSONVILLE CITY OF	CRAFT-TURNEY WSC	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	218	244	280	326	342	350
JACKSONVILLE CITY OF	CRAFT-TURNEY WSC	CHEROKEE	NECHES	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	493	555	639	747	786	807
JACKSONVILLE CITY OF	JACKSONVILLE	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	1,450	1,420	1,390	1,358	1,344	1,326
JACKSONVILLE CITY OF	JACKSONVILLE	CHEROKEE	NECHES	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	3,381	3,311	3,243	3,168	3,135	3,093
JACKSONVILLE CITY OF	MANUFACTURING	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	297	306	312	316	318	325
JACKSONVILLE CITY OF	MANUFACTURING	CHEROKEE	NECHES	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	693	714	727	738	742	758
JACKSONVILLE CITY OF	NORTH CHEROKEE WSC	CHEROKEE	NECHES	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	160	171	179	184	191	199
JACKSONVILLE CITY OF	NORTH CHEROKEE WSC	CHEROKEE	NECHES	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	374	400	418	430	445	463
LOWER NECHES VALLEY AUTHORITY	BEAUMONT	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	31,360	31,360	31,360	31,360	31,360	31,360
LOWER NECHES VALLEY AUTHORITY	BOLIVAR PENINSULAR SUD	GALVESTON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	5,549	5,499	5,449	5,399	5,349	5,299
LOWER NECHES VALLEY AUTHORITY	COUNTY-OTHER	GALVESTON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	1	1	1	1	1	1
LOWER NECHES VALLEY AUTHORITY	COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	188	244	291	327	368	445
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JASPER	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	43,982	67,484	77,166	70,824	63,898	56,360
LOWER NECHES VALLEY AUTHORITY	GROVES	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	44	43	43	42	41	41
LOWER NECHES VALLEY AUTHORITY	GROVES	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	3,146	3,094	3,042	2,989	2,955	2,955
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	CHAMBERS	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	38,000	38,000	38,000	38,000	38,000	38,000
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	LIBERTY	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	2,500	2,500	2,500	2,500	2,500	2,500
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	LIBERTY	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	17,200	17,200	17,200	17,200	17,200	17,200

Region I Wholesale Water Provider Supplies
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	JEFFERSON	NECHES	NECHES RIVER RUN-OF-RIVER PINE ISLAND BAYOU	JASPER	NECHES	11,648	11,648	11,648	11,648	11,648	11,648
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	JEFFERSON	NECHES-TRINITY	NECHES RIVER RUN-OF-RIVER PINE ISLAND BAYOU	JASPER	NECHES	128,352	128,352	128,352	122,622	112,622	102,622
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	0	0	0	5,730	15,730	25,730
LOWER NECHES VALLEY AUTHORITY	JEFFERSON COUNTY WCID	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	243	266	285	299	316	353
LOWER NECHES VALLEY AUTHORITY	JEFFERSON COUNTY WCID	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	397	434	465	488	516	576
LOWER NECHES VALLEY AUTHORITY	COUNTY-OTHER	JEFFERSON	NECHES	NECHES RIVER RUN-OF-RIVER PINE ISLAND BAYOU	JASPER	NECHES	169,860	75,960	4,270	0	0	0
LOWER NECHES VALLEY AUTHORITY	COUNTY-OTHER	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	484,205	280,287	160,409	220,665	123,832	105,420
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JASPER	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	20,189	23,571	26,084	28,281	29,928	29,991
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	32,485	101,169	146,463	75,680	158,234	164,124
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JEFFERSON	NECHES-TRINITY	NECHES RIVER RUN-OF-RIVER PINE ISLAND BAYOU	JASPER	NECHES	72,016	165,916	237,606	247,606	257,606	267,606
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	39,531	147,706	209,947	218,855	228,176	237,286
LOWER NECHES VALLEY AUTHORITY	NEDERLAND	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	159	165	170	172	177	187
LOWER NECHES VALLEY AUTHORITY	NEDERLAND	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	3,966	4,103	4,217	4,284	4,396	4,647
LOWER NECHES VALLEY AUTHORITY	NOME	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	90	97	102	107	112	122
LOWER NECHES VALLEY AUTHORITY	NOME	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	37	39	42	43	45	50
LOWER NECHES VALLEY AUTHORITY	PORT ARTHUR	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	59	58	56	55	54	54
LOWER NECHES VALLEY AUTHORITY	PORT ARTHUR	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	9,645	9,452	9,259	9,067	8,939	8,939
LOWER NECHES VALLEY AUTHORITY	PORT NECHES	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	909	909	913	908	920	960
LOWER NECHES VALLEY AUTHORITY	PORT NECHES	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	873	873	876	872	884	992
LOWER NECHES VALLEY AUTHORITY	TRINITY BAY CONSERVATIO	CHAMBERS	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	421	479	547	623	709	807
LOWER NECHES VALLEY AUTHORITY	TRINITY BAY CONSERVATIO	CHAMBERS	TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	192	219	249	284	324	370
LOWER NECHES VALLEY AUTHORITY	WEST JEFFERSON COUNTY	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	1,029	1,148	1,264	1,345	1,436	1,631
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JASPER	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	50,000	50,000	50,000	50,000	50,000	50,000
LOWER NECHES VALLEY AUTHORITY	WOODVILLE	TYLER	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	5,600	5,600	5,600	5,600	5,600	5,600
LUFKIN CITY OF	LUFKIN	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	4,302	3,327	3,389	3,449	3,535	3,634
LUFKIN CITY OF	COUNTY-OTHER	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	75	58	59	58	58	59
LUFKIN CITY OF	DIBOLL	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	1,106	764	696	633	574	518
LUFKIN CITY OF	HUNTINGTON	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	11	11	12	12	12	12
LUFKIN CITY OF	MANUFACTURING	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	5,445	6,799	6,809	6,816	6,793	6,751
LUFKIN CITY OF	REDLAND WSC	ANGELINA	NECHES	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	61	41	36	32	29	26
NACOGDOCHES CITY OF	APPLEBY WSC	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	4	23	51	83	146	216
NACOGDOCHES CITY OF	APPLEBY WSC	NACOGDOCHES	NECHES	NACOGDOCHES LAKE/RESERVOIR	RESERVOIR	NECHES	21	122	266	428	732	1,058
NACOGDOCHES CITY OF	NACOGDOCHES	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	2,682	2,606	2,526	2,437	2,311	2,162
NACOGDOCHES CITY OF	NACOGDOCHES	NACOGDOCHES	NECHES	NACOGDOCHES LAKE/RESERVOIR	RESERVOIR	NECHES	14,766	14,027	13,280	12,512	11,578	10,566

WWP Name	WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
NACOGDOCHES CITY OF	D&M WSC	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	62	71	78	88	108	133
NACOGDOCHES CITY OF	D&M WSC	NACOGDOCHES	NECHES	NACOGDOCHES LAKE/RESERVOIR	RESERVOIR	NECHES	344	381	413	452	544	647
NACOGDOCHES CITY OF	MANUFACTURING	NACOGDOCHES	NECHES	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	352	400	445	492	535	589
NACOGDOCHES CITY OF	MANUFACTURING	NACOGDOCHES	NECHES	NACOGDOCHES LAKE/RESERVOIR	RESERVOIR	NECHES	1,936	2,153	2,341	2,524	2,679	2,879
PANOLA COUNTY FWSD #1	CARTHAGE	PANOLA	SABINE	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	10,585	10,172	9,772	9,373	8,981	8,546
PANOLA COUNTY FWSD #1	COUNTY-OTHER	PANOLA	SABINE	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	1,487	1,487	1,487	1,487	1,487	1,487
PANOLA COUNTY FWSD #1	MANUFACTURING	PANOLA	SABINE	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	1,018	1,078	1,125	1,171	1,210	1,290
PANOLA COUNTY FWSD #1	MINING	PANOLA	SABINE	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	2,254	2,563	2,752	2,943	3,137	3,322
PANOLA COUNTY FWSD #1	COUNTY-OTHER	PANOLA	SABINE	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	6,448	5,903	5,479	5,053	4,623	4,205
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	578	646	714	782	850	918
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	5,327	5,954	6,581	7,208	7,835	8,460
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	78	87	96	105	114	124
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	129	144	159	174	189	205
PORT ARTHUR CITY OF	PORT ARTHUR	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	59	58	56	55	54	54
PORT ARTHUR CITY OF	PORT ARTHUR	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	9,645	9,452	9,259	9,067	8,939	8,939
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	24	27	30	33	36	38
PORT ARTHUR CITY OF	MEEKER MUD	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	3	3	3	3	3	3
PORT ARTHUR CITY OF	COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	5	5	5	5	5	5
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	1	1	1	1	1	1
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	224	224	224	224	224	224
SABINE RIVER AUTHORITY	ABLES SPRINGS WSC	KAUFMAN	TRINITY	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	965	965	959	946	918	887
SABINE RIVER AUTHORITY	ABLES SPRINGS WSC	HUNT	SABINE	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	119	119	119	119	119	119
SABINE RIVER AUTHORITY	ABLES SPRINGS WSC	VAN ZANDT	SABINE	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	9	9	9	9	9	9
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	1,120	1,120	1,120	1,120	1,120	1,120
SABINE RIVER AUTHORITY	COUNTY-OTHER	SABINE	SABINE	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	81	81	81	81	81	81
SABINE RIVER AUTHORITY	CASH SUD	ROCKWALL	SABINE	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	42	58	62	40	33	26
SABINE RIVER AUTHORITY	CASH SUD	HOPKINS	SABINE	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	45	51	54	56	52	48
SABINE RIVER AUTHORITY	CASH SUD	HUNT	SABINE	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	3,980	3,963	3,949	3,929	3,911	3,894
SABINE RIVER AUTHORITY	CASH SUD	HUNT	SABINE	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	1,449	1,403	1,376	1,386	1,391	1,397
SABINE RIVER AUTHORITY	CASH SUD	RAINS	SABINE	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	86	103	115	118	117	115
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	2,240	2,240	2,240	2,240	2,240	2,240
SABINE RIVER AUTHORITY	COMMERCE	HUNT	SULPHUR	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	8,094	8,033	7,973	7,913	7,852	7,792
SABINE RIVER AUTHORITY	DALLAS	DALLAS	TRINITY	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	120,791	119,943	119,095	118,246	117,398	116,550
SABINE RIVER AUTHORITY	DALLAS	DALLAS	TRINITY	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	183,619	182,251	180,882	179,515	178,146	176,777
SABINE RIVER AUTHORITY	EDGEWOOD	VAN ZANDT	SABINE	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	793	787	781	776	770	764
SABINE RIVER AUTHORITY	EMORY	RAINS	SABINE	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	845	839	832	826	820	814

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WWP Name	WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
SABINE RIVER AUTHORITY	EMORY	RAINS	SABINE	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	1,056	1,048	1,041	1,033	1,025	1,018
SABINE RIVER AUTHORITY	GREENVILLE	HUNT	SABINE	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	20,515	20,363	20,210	20,057	19,904	19,751
SABINE RIVER AUTHORITY	POINT	RAINS	SABINE	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	211	210	208	207	205	204
SABINE RIVER AUTHORITY	POINT	RAINS	SABINE	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	211	210	208	207	205	204
SABINE RIVER AUTHORITY	QUITMAN	WOOD	SABINE	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	1,026	1,019	1,012	1,004	997	990
SABINE RIVER AUTHORITY	TERRELL	KAUFMAN	TRINITY	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	431	437	438	444	444	449
SABINE RIVER AUTHORITY	TERRELL	KAUFMAN	TRINITY	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	9,287	9,209	9,135	9,057	8,984	8,907
SABINE RIVER AUTHORITY	WEST TAWAKONI	HUNT	SABINE	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	1,080	1,072	1,064	1,056	1,047	1,039
SABINE RIVER AUTHORITY	COMBINED CONSUMERS W	HUNT	SABINE	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	1,439	1,390	1,348	1,312	1,271	1,226
SABINE RIVER AUTHORITY	COMBINED CONSUMERS W	VAN ZANDT	SABINE	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	229	266	297	321	351	384
SABINE RIVER AUTHORITY	STEAM ELECTRIC POWER	NEWTON	SABINE	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	13,442	13,442	13,442	13,442	13,442	13,442
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	24,643	24,643	24,643	24,643	24,643	24,643
SABINE RIVER AUTHORITY	MANUFACTURING	HARRISON	SABINE	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	3,206	3,184	3,161	3,139	3,116	3,094
SABINE RIVER AUTHORITY	COUNTY-OTHER	SABINE	SABINE	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	22	22	22	22	22	22
SABINE RIVER AUTHORITY	STEAM ELECTRIC POWER	ORANGE	NECHES	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	4,481	4,481	4,481	4,481	4,481	4,481
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	280	280	280	280	280	280
SABINE RIVER AUTHORITY	HEMPHILL	SABINE	SABINE	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	1,841	1,841	1,841	1,841	1,841	1,841
SABINE RIVER AUTHORITY	HENDERSON	RUSK	NECHES	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	3,922	3,922	3,922	3,922	3,922	3,922
SABINE RIVER AUTHORITY	HENDERSON	RUSK	SABINE	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	459	459	459	459	459	459
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	1,120	1,120	1,120	1,120	1,120	1,120
SABINE RIVER AUTHORITY	COUNTY-OTHER	SHELBY	SABINE	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	147	147	147	147	147	147
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	17,922	17,922	17,922	17,922	17,922	17,922
SABINE RIVER AUTHORITY	IRRIGATION	ORANGE	SABINE	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	2,543	2,543	2,543	2,543	2,543	2,543
SABINE RIVER AUTHORITY	COUNTY-OTHER	GREGG	SABINE	SABINE RIVER RUN-OF-RIVER	WOOD	SABINE	560	556	552	548	544	540
SABINE RIVER AUTHORITY	KILGORE	GREGG	SABINE	SABINE RIVER RUN-OF-RIVER	WOOD	SABINE	3,849	3,853	3,857	3,861	3,865	3,869
SABINE RIVER AUTHORITY	KILGORE	RUSK	SABINE	SABINE RIVER RUN-OF-RIVER	WOOD	SABINE	672	672	672	672	672	672
SABINE RIVER AUTHORITY	LONGVIEW	GREGG	SABINE	SABINE RIVER RUN-OF-RIVER	GREGG	SABINE	17,588	17,464	17,341	17,218	17,095	16,971
SABINE RIVER AUTHORITY	LONGVIEW	HARRISON	SABINE	SABINE RIVER RUN-OF-RIVER	GREGG	SABINE	733	728	723	717	712	707
SABINE RIVER AUTHORITY	MACBEE SUD	HUNT	SABINE	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	109	109	109	112	178	281
SABINE RIVER AUTHORITY	MACBEE SUD	VAN ZANDT	SABINE	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	822	822	822	819	753	650
SABINE RIVER AUTHORITY	MACBEE SUD	VAN ZANDT	TRINITY	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	1,152	1,136	1,120	1,104	1,088	1,072
SABINE RIVER AUTHORITY	MACBEE SUD	KAUFMAN	SABINE	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	71	75	80	86	91	95
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	NECHES	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	4,481	4,481	4,481	4,481	4,481	4,481
SABINE RIVER AUTHORITY	COUNTY-OTHER	SABINE	SABINE	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	28	28	28	28	28	28
SABINE RIVER AUTHORITY	MINING	HARRISON	SABINE	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	10,993	10,915	10,838	10,761	10,684	10,607

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WWP Name	WUG Name	WUG County	WUG Basin	Source Name	Source County	Source Basin	2010	2020	2030	2040	2050	2060
SABINE RIVER AUTHORITY	ROSE CITY	ORANGE	NECHES	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	478	478	478	478	478	478
SABINE RIVER AUTHORITY	SOUTH TAWAKONI WSC	VAN ZANDT	SABINE	FORK LAKE/RESERVOIR	RESERVOIR	SABINE	1,056	1,048	1,041	1,033	1,025	1,018
SABINE RIVER AUTHORITY	COUNTY-OTHER	NEWTON	SABINE	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	74,026	74,026	74,026	74,026	74,026	74,026
SABINE RIVER AUTHORITY	COUNTY-OTHER	NEWTON	SABINE	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	729,952	729,952	729,952	729,952	729,952	729,952
SABINE RIVER AUTHORITY	STEAM ELECTRIC POWER	NEWTON	SABINE	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	17,929	17,929	17,929	17,929	17,929	17,929
SABINE RIVER AUTHORITY	WILLS POINT	VAN ZANDT	SABINE	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	654	654	654	654	654	654
SABINE RIVER AUTHORITY	WILLS POINT	VAN ZANDT	TRINITY	TAWAKONI LAKE/RESERVOIR	RESERVOIR	SABINE	1,458	1,443	1,427	1,412	1,396	1,381
TYLER CITY OF	COUNTY-OTHER	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	445	467	491	515	541	568
TYLER CITY OF	COUNTY-OTHER	SMITH	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
TYLER CITY OF	COUNTY-OTHER	SMITH	NECHES	TYLER LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
TYLER CITY OF	IRRIGATION	SMITH	NECHES	BELLWOOD LAKE/RESERVOIR	RESERVOIR	NECHES	300	300	300	300	300	300
TYLER CITY OF	MANUFACTURING	SMITH	NECHES	BELLWOOD LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0
TYLER CITY OF	MANUFACTURING	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	281	314	343	370	393	426
TYLER CITY OF	MANUFACTURING	SMITH	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	1,085	1,212	1,325	1,434	1,526	1,652
TYLER CITY OF	MANUFACTURING	SMITH	NECHES	TYLER LAKE/RESERVOIR	RESERVOIR	NECHES	1,519	1,697	1,855	2,007	2,136	2,313
TYLER CITY OF	SOUTHERN UTILITIES COMP	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	29	31	32	33	36	89
TYLER CITY OF	SOUTHERN UTILITIES COMP	SMITH	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	114	118	122	127	139	345
TYLER CITY OF	SOUTHERN UTILITIES COMP	SMITH	NECHES	TYLER LAKE/RESERVOIR	RESERVOIR	NECHES	160	166	171	178	195	484
TYLER CITY OF	TYLER	SMITH	SABINE	TYLER LAKE/RESERVOIR	RESERVOIR	NECHES	358	464	567	668	844	1,081
TYLER CITY OF	TYLER	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	3,886	3,833	3,785	3,738	3,680	3,553
TYLER CITY OF	TYLER	SMITH	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	15,055	14,852	14,666	14,482	14,259	13,767
TYLER CITY OF	TYLER	SMITH	NECHES	TYLER LAKE/RESERVOIR	RESERVOIR	NECHES	21,077	20,793	20,532	20,276	19,963	19,273
TYLER CITY OF	WHITEHOUSE	SMITH	NECHES	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	66	73	78	84	96	111
TYLER CITY OF	WHITEHOUSE	SMITH	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	259	282	304	327	370	431
TYLER CITY OF	WHITEHOUSE	SMITH	NECHES	TYLER LAKE/RESERVOIR	RESERVOIR	NECHES	362	394	425	457	518	603
UPPER NECHES MWD	DALLAS	DALLAS	TRINITY	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	112,881	111,776	110,670	109,563	108,455	107,347
UPPER NECHES MWD	PALESTINE	ANDERSON	TRINITY	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	27,643	27,373	27,102	26,831	26,560	26,288
UPPER NECHES MWD	TYLER	SMITH	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	66,344	65,694	65,045	64,394	63,743	63,092
UPPER NECHES MWD	COUNTY-OTHER	SMITH	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	91	80	69	61	54	48
UPPER NECHES MWD	COUNTY-OTHER	SMITH	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	104	103	102	101	100	99
UPPER NECHES MWD	IRRIGATION	CHEROKEE	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	296	293	290	287	285	282
UPPER NECHES MWD	COUNTY-OTHER	HENDERSON	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	99	98	97	96	95	94
UPPER NECHES MWD	COUNTY-OTHER	ANDERSON	NECHES	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	0	0	0	0	0	0

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Appendix 4A-A

Comparison of Supply and Demand by Wholesale Water Provider

This appendix provides a summary of supply versus demand by WWP for the ETRWPA. The summaries include current customer demand for each WWP by decade through 2060. Demand is then subtracted from current supplies to assess water availability.

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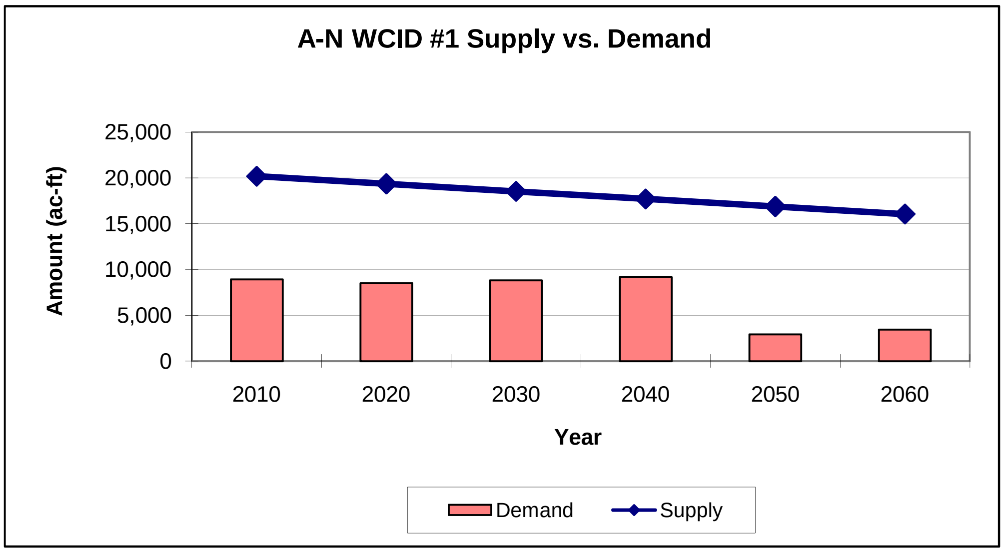
A-N WCID #1
(Units: Acre-Feet per Year)

WUGs	Recipient	2010	2020	2030	2040	2050	2060
Steam Electric Power	Luminant	2,245	1,790	2,093	2,462	2,912	3,460
Steam Electric Power	Nacogdoches Power	2,240	6,721	6,721	6,721	0	0
Whitehouse	Whitehouse	2,186	0	0	0	0	0
Henderson	Henderson	2,242	0	0	0	0	0
Total Demand		**8,913**	**8,511**	**8,814**	**9,183**	**2,912**	**3,460**

Current Supplies	Notes	2010	2020	2030	2040	2050	2060
Lake Striker	*owned by A-N WCID, wr for 20,600 ac-ft	20,183	19,357	18,530	17,703	16,877	16,050
Total Supplies		**20,183**	**19,357**	**18,530**	**17,703**	**16,877**	**16,050**

Supplies Less Current Customer Demand		**11,270**	**10,846**	**9,716**	**8,520**	**13,965**	**12,590**



ANRA
(Units: Acre-Feet per Year)

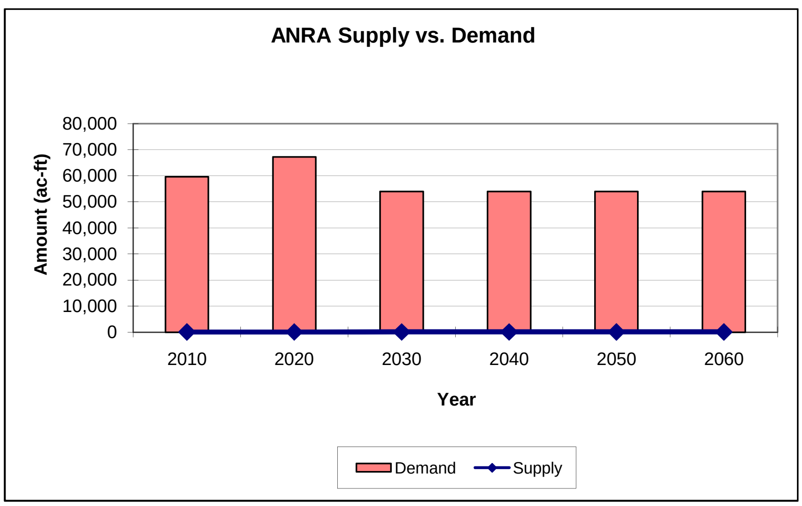
Current Customers	Recipient	% Yield	Contract Amount	2010	2020	2030	2040	2050	2060
Angelina County Manufacturing (Temple Inland)	Temple Inland	10.0%	8,551	8,551	8,551	8,551	8,551	8,551	8,551
Cherokee County-Other	Afton Grove WSC, Stryker Lake WSC, Cherokee County	4.5%	3,848	3,848	3,848	3,848	3,848	3,848	3,848
City of Jacksonville	Jacksonville	5.0%	4,275	4,275	4,275	4,275	4,275	4,275	4,275
City of New Summerfield	New Summerfield	3.0%	2,565	2,565	2,565	2,565	2,565	2,565	2,565
North Cherokee WSC	North Cherokee WSC	5.0%	4,275	4,275	4,275	4,275	4,275	4,275	4,275
City of Rusk	Rusk	5.0%	4,275	4,275	4,275	4,275	4,275	4,275	4,275
Rusk Rural WSC	Rusk Rural WSC	1.0%	855	855	855	855	855	855	855
Nacogdoches County-Other	Caro WSC	0.5%	428	428	428	428	428	428	428
City of Nacogdoches	Nacogdoches	10.0%	8,551	8,551	8,551	8,551	8,551	8,551	8,551
City of New London	New London	1.0%	855	855	855	855	855	855	855
City of Troup	Troup	5.0%	4,275	4,275	4,275	4,275	4,275	4,275	4,275
City of Arp	Arp	0.5%	428	428	428	428	428	428	428
Smith County-Other	Blackjack WSC	1.0%	855	855	855	855	855	855	855
Jackson WSC	Jackson WSC	1.0%	855	855	855	855	855	855	855
City of Whitehouse	Whitehouse	10.0%	8,551	8,551	8,551	8,551	8,551	8,551	8,551
City of Alto	City of Alto	0.5%	428	428	428	428	428	428	428
Jasper County Other	Holmwood Utility	NA	NA	60	65	70	70	70	70
Total Demand				**53,930**	**53,935**	**53,940**	**53,940**	**53,940**	**53,940**

Potential Future Customers	Recipient								
Angelina County Mining	Mining			2,000	4,000	0	0	0	0
Cherokee County Mining	Mining			500	1,500	0	0	0	0
Nacogdoches County Mining	Mining			2,500	7,000	0	0	0	0
Shelby County Mining	Mining			250	250	0	0	0	0
San Augustine County Mining	Mining			500	500	0	0	0	0
Total Potential Future Customers				**5,750**	**13,250**	**0**	**0**	**0**	**0**

Total Demand Current and Future Customers				**59,680**	**67,185**	**53,940**	**53,940**	**53,940**	**53,940**

Current Supplies				2010	2020	2030	2040	2050	2060
Lake Columbia				0	0	0	0	0	0
Jasper Aquifer				60	65	70	70	70	70
Total Supplies				**60**	**65**	**70**	**70**	**70**	**70**

Supplies Less Current Customer Demand				**-53,870**	**-53,870**	**-53,870**	**-53,870**	**-53,870**	**-53,870**
Supplies Less Current and Potential Customer Demand				**-59,620**	**-67,120**	**-53,870**	**-53,870**	**-53,870**	**-53,870**

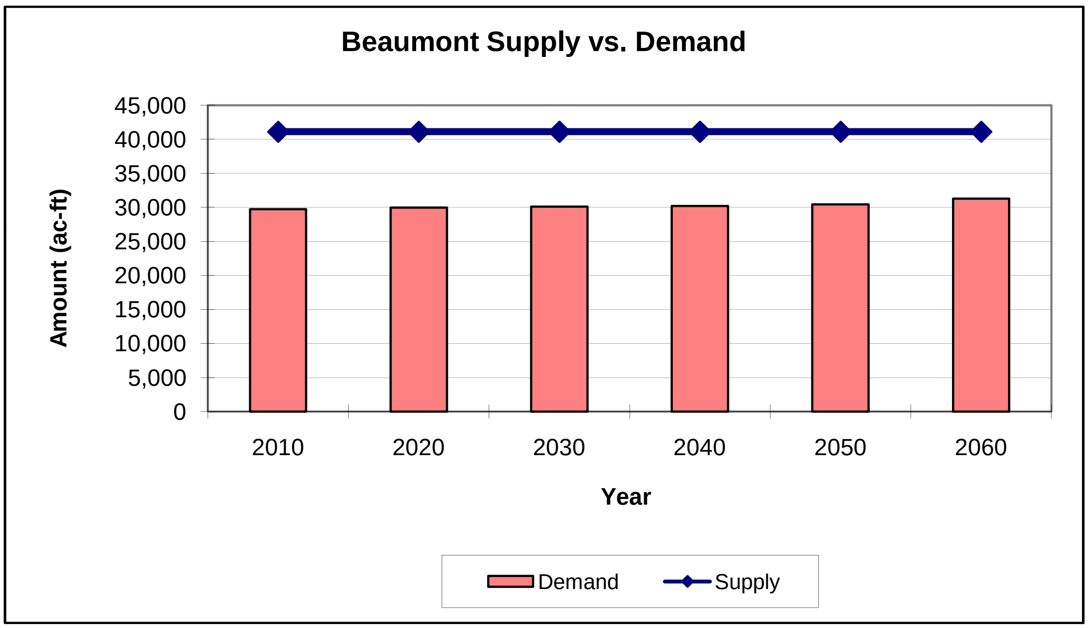


Beaumont
(Units: Acre-Feet per Year)

WUGs	Recipient	2010	2020	2030	2040	2050	2060
City of Beaumont	Beaumont	27,040	26,657	26,275	25,892	25,636	25,636
Jefferson County-Other	County-Other	1,692	2,194	2,615	2,945	3,311	4,004
Jefferson County Manufacturing	Manufacturing	1,000	1,105	1,221	1,349	1,490	1,646
Meeker MUD	Meeker MUD	3	4	4	5	5	8
Total Demand		**29,735**	**29,960**	**30,116**	**30,190**	**30,442**	**31,294**

Current Supplies	Recipient	2010	2020	2030	2040	2050	2060
Municipal Run-of-River	Municipal	29,305	29,305	29,305	29,305	29,305	29,305
Industrial Run-of-River	Industrial	2,806	2,806	2,806	2,806	2,806	2,806
Gulf Coast Aquifer		9,000	9,000	9,000	9,000	9,000	9,000
Total Supplies		**41,111**	**41,111**	**41,111**	**41,111**	**41,111**	**41,111**

Treated Supplies Less Current Customer Demand		**11,376**	**11,151**	**10,995**	**10,921**	**10,669**	**9,817**



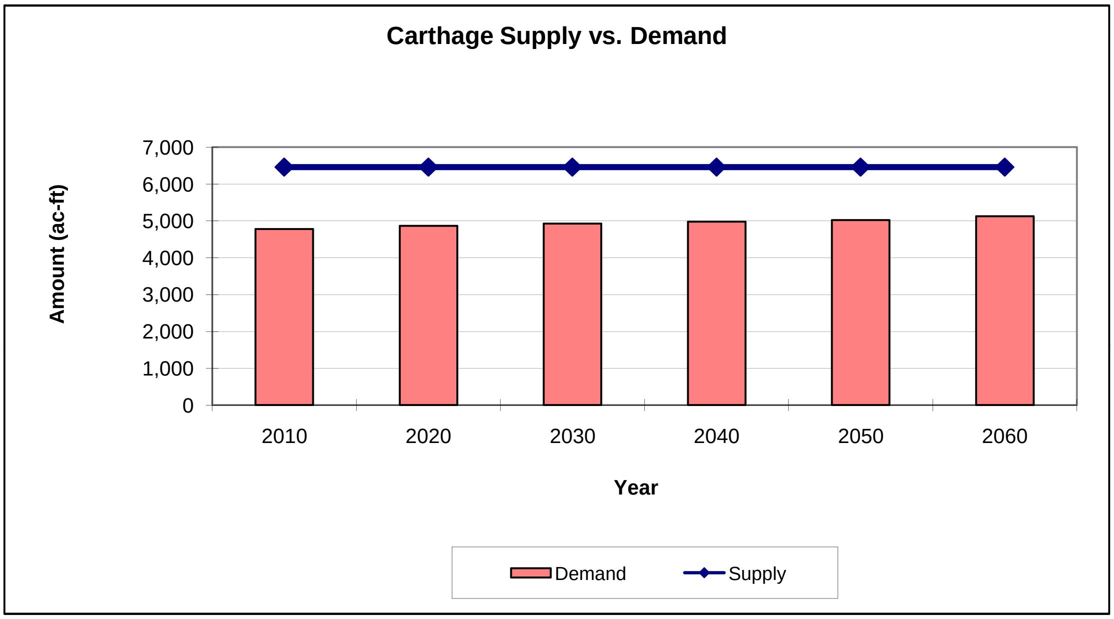
Carthage
(Units: Acre-Feet per Year)

WUGs	Recipient	2010	2020	2030	2040	2050	2060
City of Carthage	City of Carthage	2,274	2,297	2,311	2,317	2,326	2,343
Panola County-Other	County-Other	1,487	1,487	1,487	1,487	1,487	1,487
Panola County Manufacturing	Manufacturing	1,018	1,078	1,125	1,171	1,211	1,290
Total Demand		**4,779**	**4,862**	**4,923**	**4,975**	**5,024**	**5,120**

Current Supplies		2010	2020	2030	2040	2050	2060
Groundwater	Carrizo-Wilcox (Sabine Basin)	1,530	1,530	1,530	1,530	1,530	1,530
Lake Murvaul (PCFWD)		13,443	13,443	13,443	13,443	13,443	13,443
Total Supplies		**14,973**	**14,973**	**14,973**	**14,973**	**14,973**	**14,973**

Water Treatment Capacity		**6,461**	**6,461**	**6,461**	**6,461**	**6,461**	**6,461**

Supplies Less Current Customer Demand		**10,194**	**10,111**	**10,050**	**9,998**	**9,950**	**9,853**

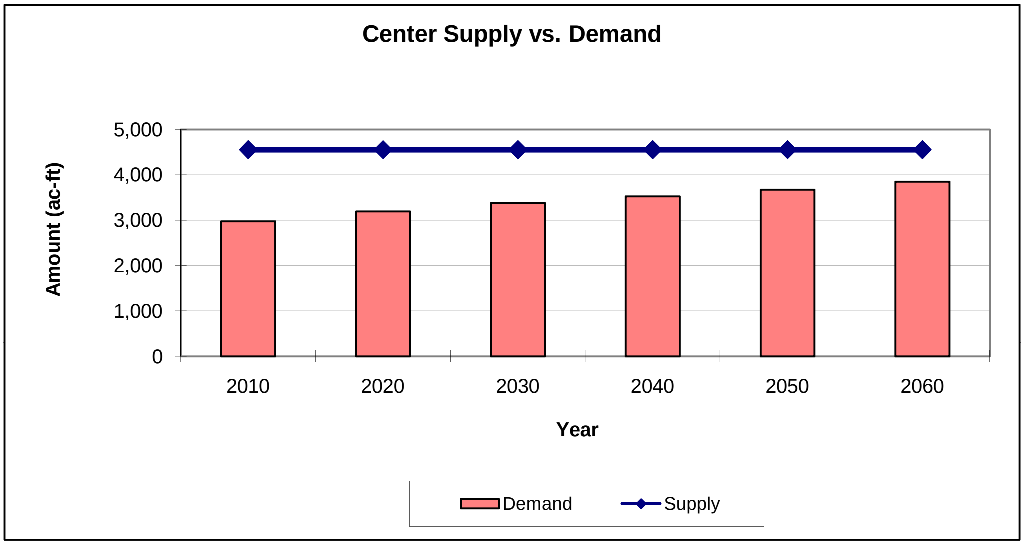


Center
(Units: Acre-Feet per Year)

Customers	Recipient	2010	2020	2030	2040	2050	2060
Shelby County-Other	Sand Hills WSC	167	174	179	180	184	190
Shelby County-Other	Shelbyville WSC	21	22	22	23	23	24
Manufacturing	Manufacturing	1,156	1,282	1,391	1,501	1,598	1,716
City of Center	Center	1,633	1,718	1,785	1,823	1,867	1,923
Total Demand		**2,977**	**3,195**	**3,378**	**3,527**	**3,672**	**3,853**

Current Supplies	Notes	2010	2020	2030	2040	2050	2060
Pinkston Reservoir	*wr to use 3,800 ac-ft/yr (COA #4404)	3,800	3,800	3,800	3,800	3,800	3,800
Lake Center		754	754	754	754	754	754
Total Supplies		**4,554**	**4,554**	**4,554**	**4,554**	**4,554**	**4,554**

Supplies Less Current Customer Demand		**1,577**	**1,359**	**1,176**	**1,027**	**882**	**701**

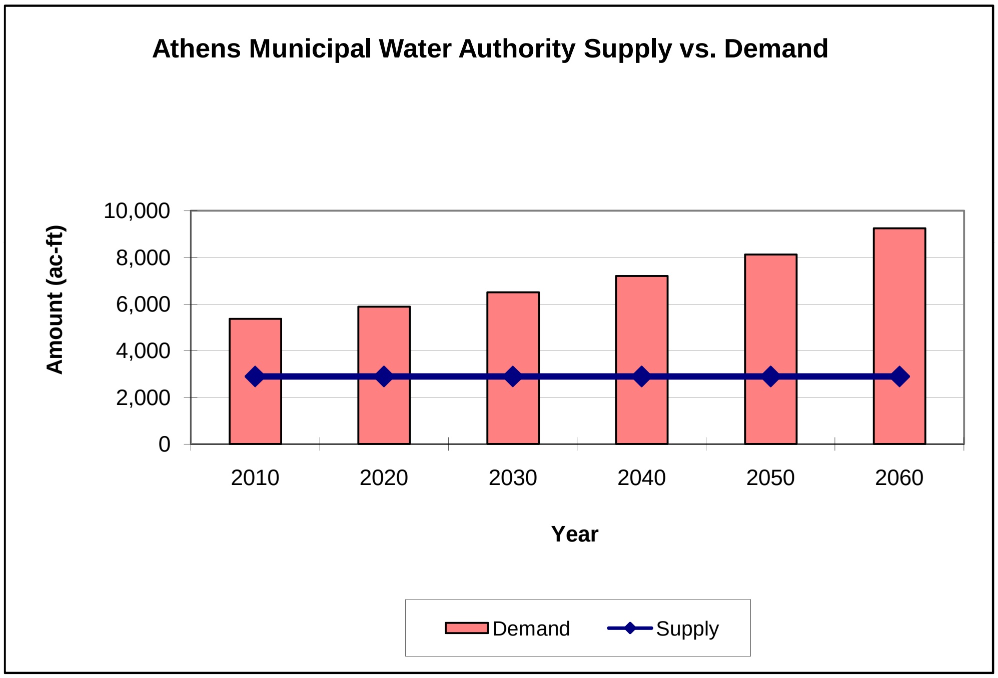


Athens Municipal Water Authority
(Units: Acre-Feet per Year)

WUGs	Recipient	2010	2020	2030	2040	2050	2060
City of Athens (less groundwater supplies)	City of Athens	2,085	2,591	3,190	3,870	4,762	5,867
Henderson Co. Irrigation	Lakeside irrigation	159	164	169	174	179	185
Henderson County Livestock	TPWD Fish Hatchery	3,023	3,023	3,023	3,023	3,023	3,023
Henderson County Manufacturing (90% - Reg C)	City of Athens	100	106	120	136	155	176
Total Demand		**5,367**	**5,884**	**6,502**	**7,203**	**8,119**	**9,251**

Current Supplies		2010	2020	2030	2040	2050	2060
Lake Athens (firm yield)		6,064	5,983	5,903	5,822	5,741	5,660
Lake Athens (safe yield)		5,172	5,084	4,996	4,908	4,820	4,730
Lake Athens (operational yield)		2,900	2,900	2,900	2,900	2,900	2,900
Reuse (limit- 2,677)		2,872	0	0	0	0	0
Total Supplies		**2,900**	**2,900**	**2,900**	**2,900**	**2,900**	**2,900**

Supplies Less Current Customer Demand		**-2,467**	**-2,984**	**-3,602**	**-4,303**	**-5,219**	**-6,351**



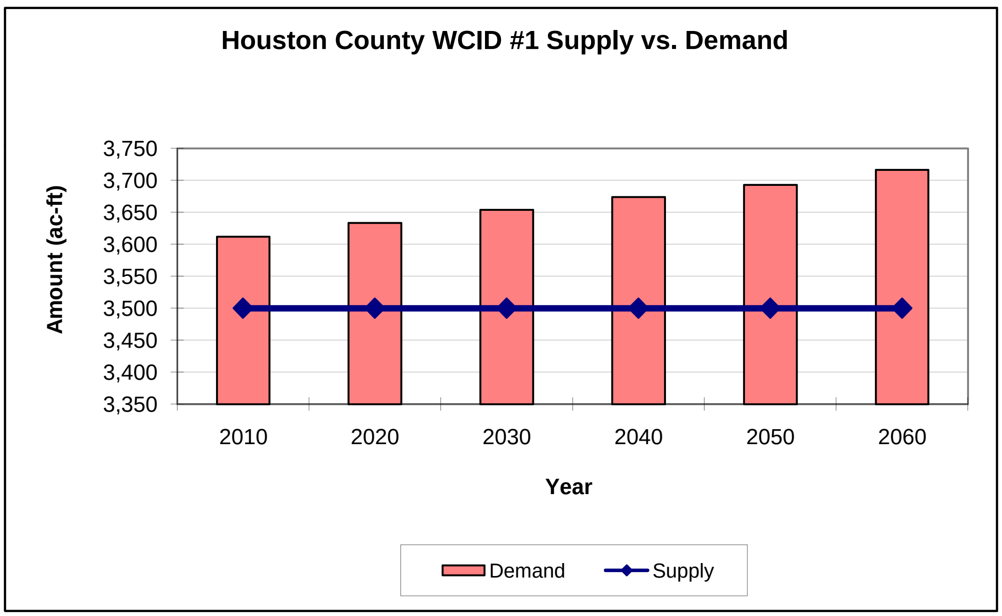
Houston County WCID #1
(Units: Acre-Feet per Year)

WUGs	Recipient	2010	2020	2030	2040	2050	2060
Grapeland	Grapeland	405	405	405	405	405	405
Houston County-Other	County-Other	89	90	91	93	96	100
Houston County Manufacturing	Manufacturing	169	190	209	227	243	263
Crockett	Crockett	1,841	1,841	1,841	1,841	1,841	1,841
Lovelady	Lovelady	77	77	77	77	77	77
Consolidated WSC	Consolidated WSC	1,031	1,031	1,031	1,031	1,031	1,031
Total Demand		**3,612**	**3,634**	**3,654**	**3,674**	**3,693**	**3,717**

Potential Future Customers							
Consolidated WSC	Consolidated WSC	1,031	1,031	1,031	1,031	1,031	1,031
Steam Electric Power	Nacogdoches Power	0	340	340	340	340	340
Total Potential Future Customers		**1,031**	**1371**	**1371**	**1371**	**1371**	**1371**

Current Supplies	Notes	2010	2020	2030	2040	2050	2060
Houston County Lake	*wr to use 3,500 ac-ft/yr	3,500	3,500	3,500	3,500	3,500	3,500
Total Supplies		**3,500**	**3,500**	**3,500**	**3,500**	**3,500**	**3,500**

Supplies Less Current Customer Demand		**-112**	**-134**	**-154**	**-174**	**-193**	**-217**
Supplies Less Potential Customer Demand		**-1,143**	**-1,505**	**-1,525**	**-1,545**	**-1,564**	**-1,588**

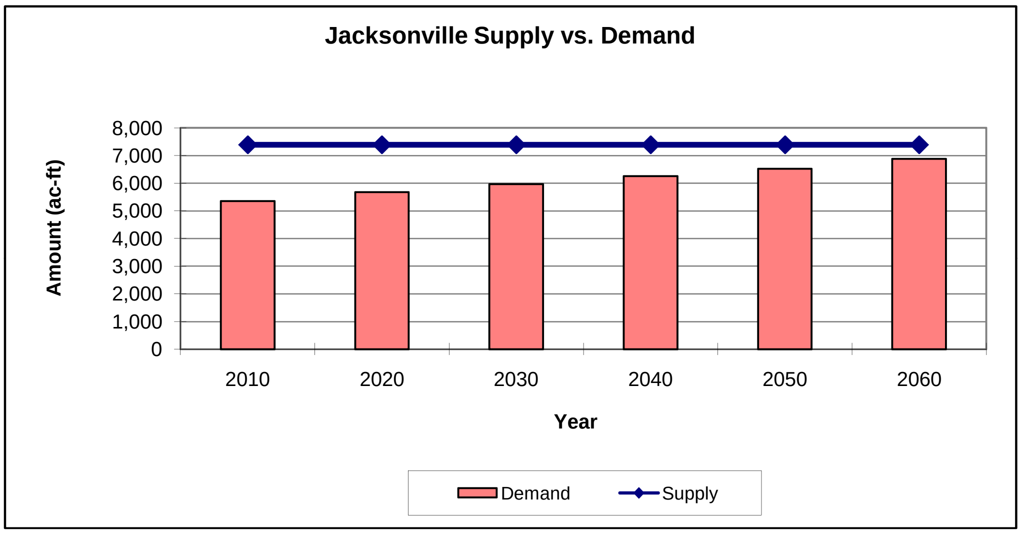


Jacksonville
(Units: Acre-Feet per Year)

WUGs	Recipient	2010	2020	2030	2040	2050	2060
City of Jacksonville	Jacksonville	3,502	3,637	3,741	3,827	3,948	4,111
Cherokee County Manufacturing	Manufacturing	718	784	839	891	934	1,007
Cherokee County-Other	County-Other	226	198	154	95	68	55
North Cherokee WSC	N. Cherokee WSC	387	439	482	519	560	616
Bullard		10	10	10	10	10	10
Craft-Turney WSC	Craft-Turney WSC	515	614	742	908	995	1,078
Total Demand		**5,358**	**5,682**	**5,968**	**6,250**	**6,515**	**6,877**

Current Supplies	Notes	2010	2020	2030	2040	2050	2060
Lake Jacksonville	*CA3274 allows cosumptive use of 6,200 ac-ft, WTP capacity - 5173	5,173	5,173	5,173	5,173	5,173	5,173
Carrizo-Wilcox		2,218	2,218	2,218	2,218	2,218	2,218
Total Supplies		**7,391**	**7,391**	**7,391**	**7,391**	**7,391**	**7,391**

Supplies Less Current Customer Demand		**2,034**	**1,710**	**1,423**	**1,142**	**876**	**515**



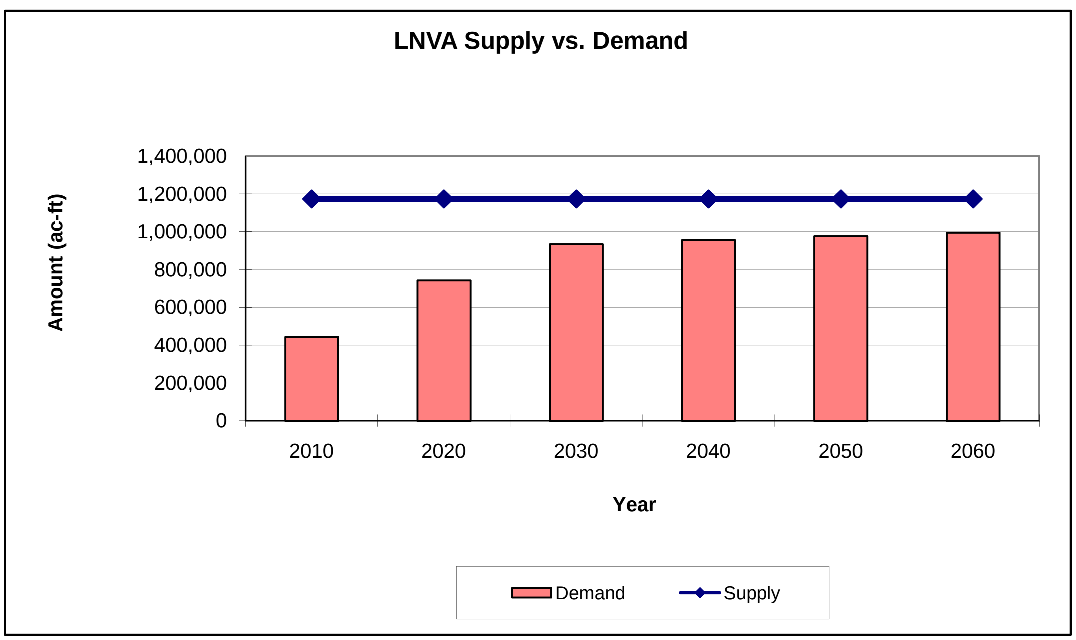
LNVA
(Units: Acre-Feet per Year)

WUGs	Recipient	2010	2020	2030	2040	2050	2060
Jasper County Manufacturing	Manufacturing	20,189	23,571	26,084	28,281	29,928	29,991
Mining - Hardin County	Mining	0	0	0	0	0	0
Groves	Groves	3,190	3,137	3,085	3,031	2,996	2,996
Nederland	Nederland	4,125	4,268	4,387	4,456	4,573	4,834
Port Arthur	Port Arthur	15,849	16,377	16,904	17,433	18,026	18,750
Port Neches	Port Neches	1,782	1,782	1,789	1,780	1,804	1,882
Jefferson County-Other	County-Other	188	244	291	327	368	445
Jefferson County Manufacturing	Manufacturing	144,032	235,566	235,566	260,566	285,566	310,566
Irrigation - Jefferson County	Irrigation	140,000	140,000	140,000	140,000	140,000	140,000
West Jefferson County MWD	West Jefferson County MWD	1,029	1,148	1,264	1,345	1,436	1,631
Jefferson County WCID #10	Jefferson County WCID #10	640	700	750	787	832	929
Nome	Nome	127	136	144	150	157	172
Trinity Bay Conservation District	Winnie & Stowell	2,688	2,688	2,688	2,688	2,688	2,688
Bolivar Pennisula SUD		6,000	6,000	6,000	6,000	6,000	6,000
Irrigation - Chambers County		37,000	37,000	37,000	37,000	37,000	37,000
Irrigation- Liberty County		23,000	23,000	23,000	23,000	23,000	23,000
Jefferson County LNG	Industry	0	179,225	358,450	358,450	358,450	358,450
Delivery Losses		43,982	67,484	77,166	70,824	63,898	56,360
Total Demand		**443,822**	**742,326**	**934,568**	**956,117**	**976,721**	**995,694**

Other Obligations		2010	2020	2030	2040	2050	2060
City of Beaumont - Reserve		31,360	31,360	31,360	31,360	31,360	31,360
West Vaco - Contract		50,000	50,000	50,000	50,000	50,000	50,000
City of Woodville - Contract		5,600	5,600	5,600	5,600	5,600	5,600
Obligation sub-total		**86,960**	**86,960**	**86,960**	**86,960**	**86,960**	**86,960**

Current Supplies		2010	2020	2030	2040	2050	2060
B. A. Steinhagen Lake/Sam Rayburn	*water right is for 792,000 ac-ft (transfer of 28,000 to Lufkin)	792,000	792,000	792,000	792,000	792,000	792,000
Pine Island Run-of-river Rights	Neches	381,876	381,876	381,876	381,876	381,876	381,876
Total Supplies		**1,173,876**	**1,173,876**	**1,173,876**	**1,173,876**	**1,173,876**	**1,173,876**

Supplies Less Current Customer Demand		**730,054**	**431,550**	**239,308**	**217,759**	**197,155**	**178,182**
Supplies Less Current Customer Demand & Other Obligations		**643,094**	**344,590**	**152,348**	**130,799**	**110,195**	**91,222**

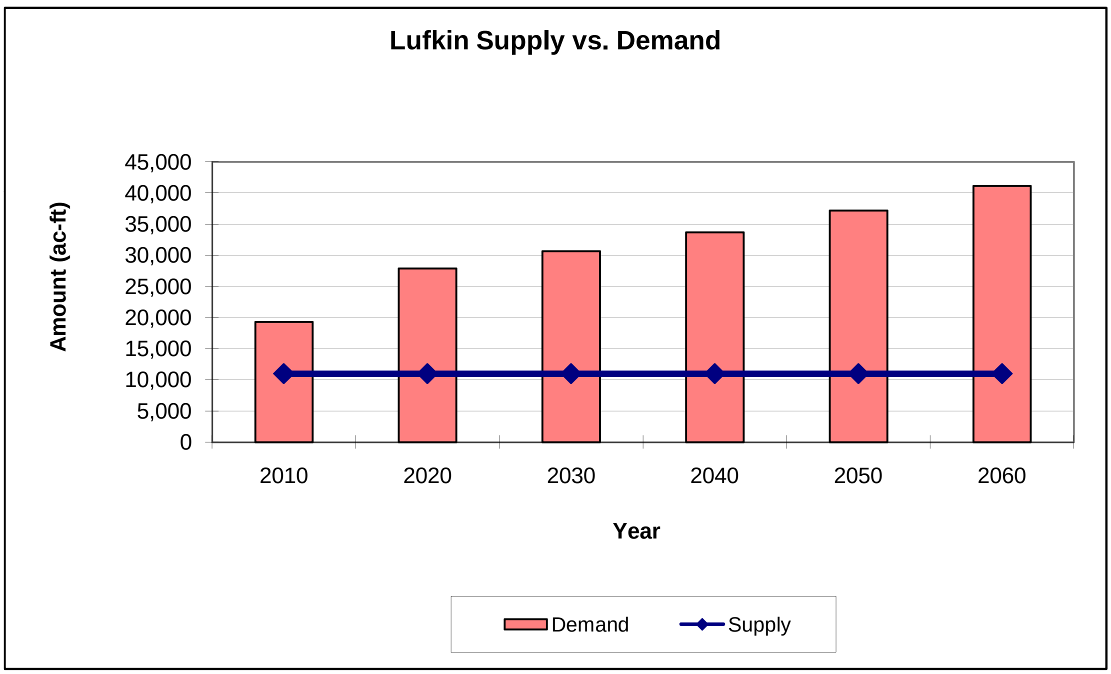


Lufkin
(Units: Acre-Feet per Year)

WUGs	Recipient	2010	2020	2030	2040	2050	2060
City of Lufkin	Lufkin	7,546	8,444	9,446	10,565	11,951	13,599
Angelina County-Other	County-Other	91	94	99	104	115	131
Angelina County Manufacturing	Manufacturing	9,550	17,255	18,981	20,879	22,966	25,263
Angelina County-Other	Redland WSC	107	104	101	98	97	97
Angelina County-Other	Angelina Fresh Water	40	54	66	72	80	88
Huntington	Huntington	20	27	33	36	40	44
City of Diboll	Diboll	1,940	1,940	1,940	1,940	1,940	1,940
Total Demand		**19,294**	**27,918**	**30,664**	**33,694**	**37,189**	**41,162**

Current Supplies		2010	2020	2030	2040	2050	2060
Carrizo-Wilcox		11,000	11,000	11,000	11,000	11,000	11,000
Lake Kurth		0	0	0	0	0	0
Sam Rayburn		0	0	0	0	0	0
Total Supplies		**11,000**	**11,000**	**11,000**	**11,000**	**11,000**	**11,000**

Supplies Less Current Customer Demand		**-8,294**	**-16,918**	**-19,664**	**-22,694**	**-26,189**	**-30,162**

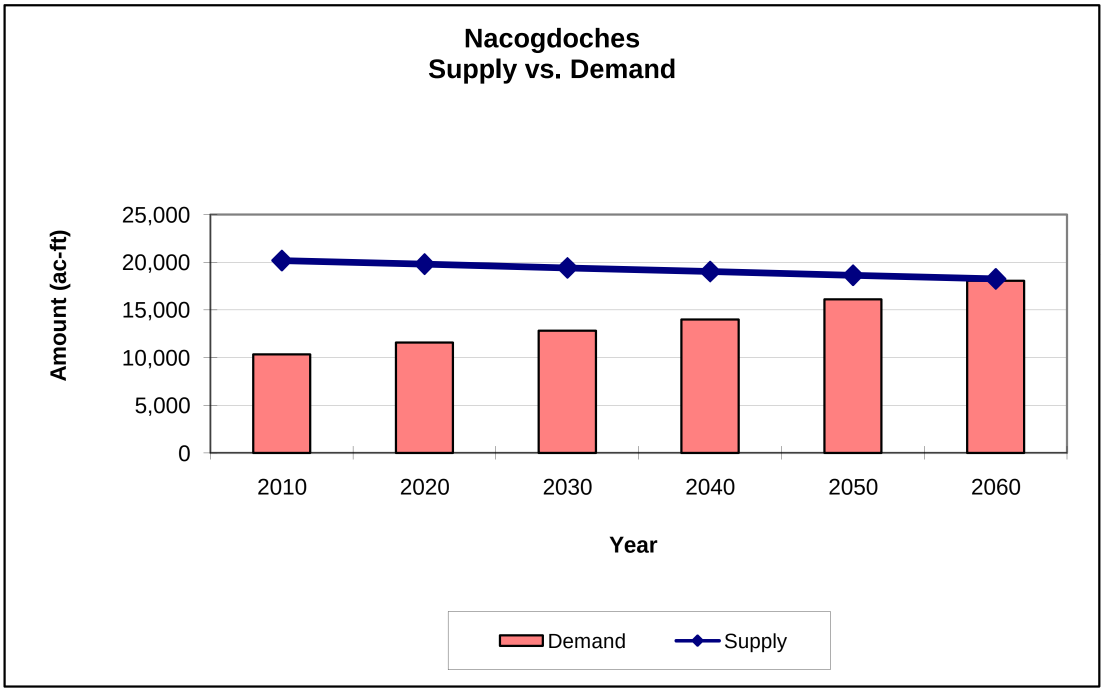


Nacogdoches
(Units: Acre-Feet per Year)

WUGs	Recipient	2010	2020	2030	2040	2050	2060
City of Nacogdoches	City of Nacogdoches	7,625	8,423	9,218	9,939	11,352	12,540
Nacogdoches County Manufacturing	Manufacturing	2,288	2,553	2,786	3,016	3,214	3,468
Nacogdoches County-Other	D&M WSC	406	452	491	540	652	780
Appleby WSC	Appleby WSC	25	145	317	511	878	1,274
Total Demand		**10,344**	**11,573**	**12,812**	**14,006**	**16,096**	**18,062**

Current Supplies	Notes	2010	2020	2030	2040	2050	2060
Lake Nacogdoches	*wr for 22,000 ac-ft	17,067	16,683	16,300	15,917	15,533	15,150
Carrizo-Wilcox		3,100	3,100	3,100	3,100	3,100	3,100
Total Supplies		**20,167**	**19,783**	**19,400**	**19,017**	**18,633**	**18,250**

Supplies Less Current Customer Demand		**9,823**	**8,210**	**6,588**	**5,010**	**2,537**	**188**



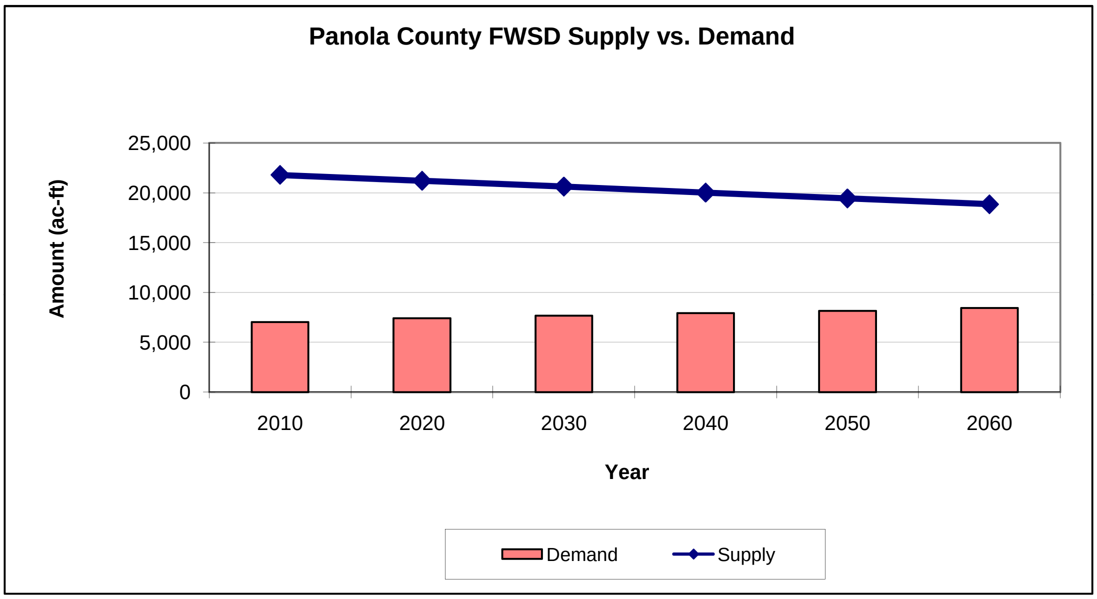
Panola County FWSD
(Units: Acre-Feet per Year)

WUGs	Recipient	2010	2020	2030	2040	2050	2060
City of Carthage*	Carthage	2,274	2,297	2,311	2,317	2,326	2,343
Panola County-Other	County-Other	1,487	1,487	1,487	1,487	1,487	1,487
Panola County Manufacturing	Manufacturing	1,018	1,078	1,125	1,171	1,211	1,290
Panola County Mining	Mining	2,254	2,563	2,752	2,943	3,137	3,322
Total Demand		**7,032**	**7,424**	**7,675**	**7,918**	**8,160**	**8,442**

* City of Carthage has a contract for 13,443 acre-feet per year.

Current Supplies	Notes	2010	2020	2030	2040	2050	2060
Lake Murvaul	*owned by PCFWSD and has right for 22,400 ac-ft (COA #4654)	21,792	21,203	20,615	20,027	19,438	18,850
Total Supplies		**21,792**	**21,203**	**20,615**	**20,027**	**19,438**	**18,850**

Supplies Less Current Customer Demand		**14,759**	**13,779**	**12,940**	**12,109**	**11,278**	**10,408**

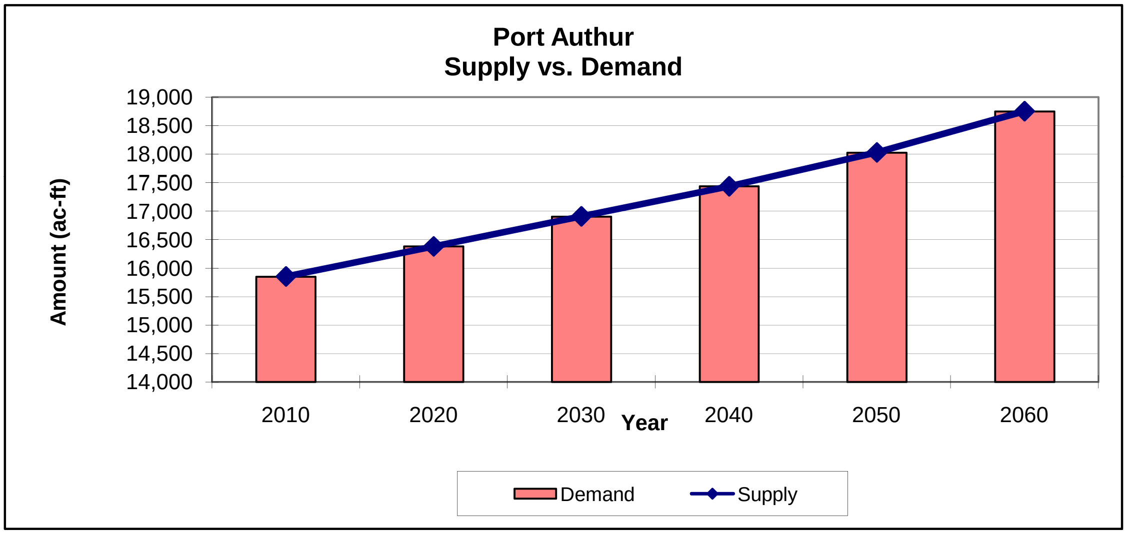


Port Arthur
(Units: Acre-Feet per Year)

WUGs	Recipient	2010	2020	2030	2040	2050	2060
City of Port Arthur	Port Arthur	9,704	9,510	9,315	9,122	8,993	8,993
Jefferson County Other	Texas Parks and Wildlife	5	5	5	5	5	5
Manufacturing	Motiva	129	144	159	174	189	205
Manufacturing	Std Alloys & Mfg	3	3	3	3	3	5
Manufacturing	Transit Mix Concrete	1	1	1	1	1	2
Manufacturing	Signal International TX	24	27	30	33	36	38
Manufacturing	Great Lakes Carbon	578	646	714	782	850	918
Manufacturing	Huntsman Corp	5,327	5,954	6,581	7,208	7,835	8,460
Manufacturing	KMTEX Inc.	78	87	96	105	114	124
Total Demand		**15,849**	**16,377**	**16,904**	**17,433**	**18,026**	**18,750**

Current Supplies		2010	2020	2030	2040	2050	2060
LNVA (Sam Rayburn)		15,849	16,377	16,904	17,433	18,026	18,750
Treated effluent	Std Alloys & Mfg	3	3	3	3	3	3
Total Supplies		**15,852**	**16,380**	**16,907**	**17,436**	**18,029**	**18,753**

Supplies Less Current Customer Demand		**3**	**3**	**3**	**3**	**3**	**3**

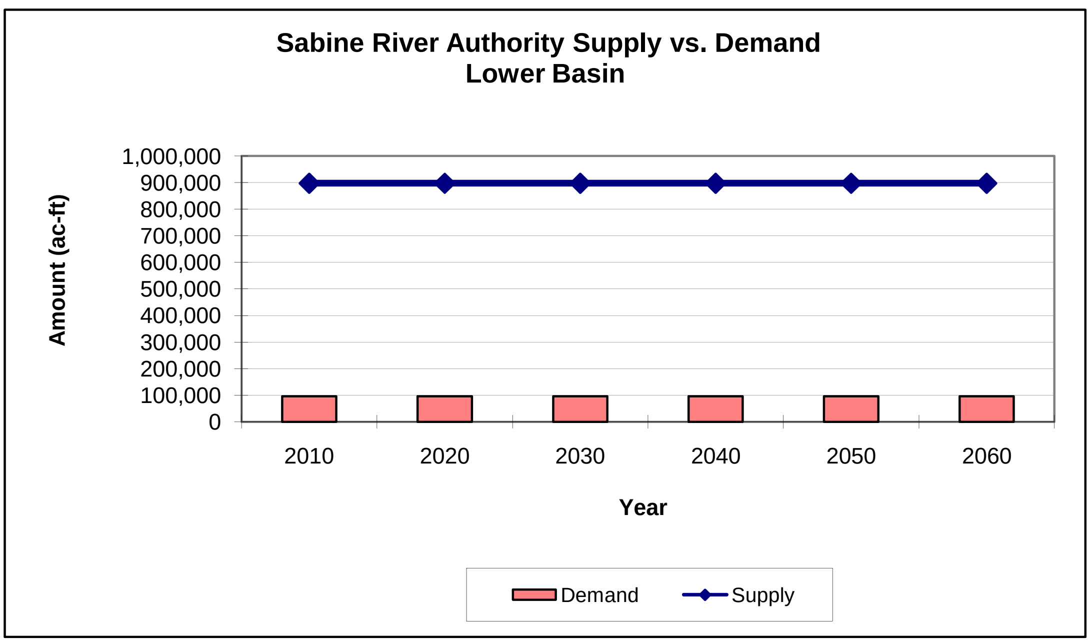


Sabine River Authority
(Units: Acre-Feet per Year)

Lower Basin Customers	Contract Amount	2010	2020	2030	2040	2050	2060
Toledo Bend:							
Hemphill	1,841	1,841	1,841	1,841	1,841	1,841	1,841
Huxley	280	280	280	280	280	280	280
Tenaska	17,922	17,922	17,922	17,922	17,922	17,922	17,922
Beechwood WSC	190	190	190	190	190	190	190
El Camino WS	18	18	18	18	18	18	18
Pendleton Utility Corp	28	28	28	28	28	28	28
Canal (Gulf Coast Division)							
Honeywell	1,120	1,120	1,120	1,120	1,120	1,120	1,120
Bayer	1,120	1,120	1,120	1,120	1,120	1,120	1,120
Chevron Phillips	2,240	2,240	2,240	2,240	2,240	2,240	2,240
E.I. DuPont	24,643	24,643	24,643	24,643	24,643	24,643	24,643
Entergy	4,481	4,481	4,481	4,481	4,481	4,481	4,481
Firestone	737	737	737	737	737	737	737
Temple Inland	22,403	22,403	22,403	22,403	22,403	22,403	22,403
Gerdau Ameristeel US Inc. (Neches)	1,120	1,120	1,120	1,120	1,120	1,120	1,120
Lanxess	1,120	1,120	1,120	1,120	1,120	1,120	1,120
A. Schulman, Inc.	224	224	224	224	224	224	224
Cottonwood Energy	13,442	13,442	13,442	13,442	13,442	13,442	13,442
Rose City (Neches)	478	478	478	478	478	478	478
Irrigation (Orange Co. demands)	2,500	2,500	2,500	2,500	2,500	2,500	2,500
Total demands - Lower basin		**95,907**	**95,907**	**95,907**	**95,907**	**95,907**	**95,907**

Current Supplies - Lower basin		2010	2020	2030	2040	2050	2060
Toledo Bend		750,000	750,000	750,000	750,000	750,000	750,000
Sabine River, Run-of-the-River supplies		147,100	147,100	147,100	147,100	147,100	147,100
Total Supplies		**897,100**	**897,100**	**897,100**	**897,100**	**897,100**	**897,100**

Supplies Less Current Customer Demand		**801,193**	**801,193**	**801,193**	**801,193**	**801,193**	**801,193**



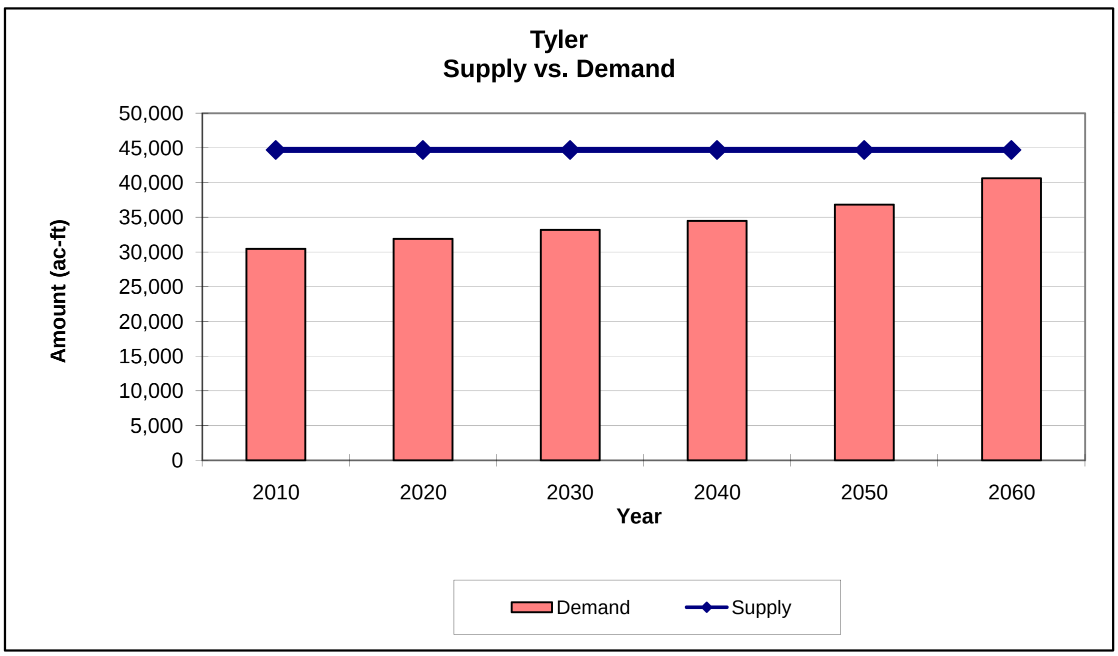
Tyler
(Units: Acre-Feet per Year)

WUGs	Recipient	2010	2020	2030	2040	2050	2060
Tyler	Tyler (Region I)	25,528	26,385	27,211	28,007	29,771	32,253
Tyler	Tyler (Region D)	358	464	567	668	844	1,081
Smith County Manufacturing	Manufacturing	2,885	3,223	3,523	3,811	4,055	4,391
Whitehouse	Whitehouse	687	749	807	868	984	1,145
Southern Utilities Company	Southern Utilities Company	303	315	325	338	370	918
Smith County Other	Walnut Grove	445	467	491	515	541	568
Smith County Irrigation	Irrigation/Golf courses	300	300	300	300	300	300
Total Demand		**30,506**	**31,903**	**33,224**	**34,506**	**36,865**	**40,656**

Current Supplies	Notes	2010	2020	2030	2040	2050	2060
Lake Tyler/Tyler East		23,541	23,541	23,541	23,541	23,541	23,541
Lake Bellwood	*Tyler has wr to use 2,100 ac-ft (CA 3237)	0	0	0	0	0	0
Lake Palestine	limited to infrastructure (30 mgd)	16,815	16,815	16,815	16,815	16,815	16,815
Carrizo-Wilcox	reduced supplies due to aquifer limits	4,340	4,340	4,340	4,340	4,340	4,340
Total Supplies		**44,696**	**44,696**	**44,696**	**44,696**	**44,696**	**44,696**

* Lake Bellwood is used only for manufacturing directly from the lake.

Supplies Less Current Customer Demand		**14,190**	**12,793**	**11,472**	**10,190**	**7,831**	**4,040**

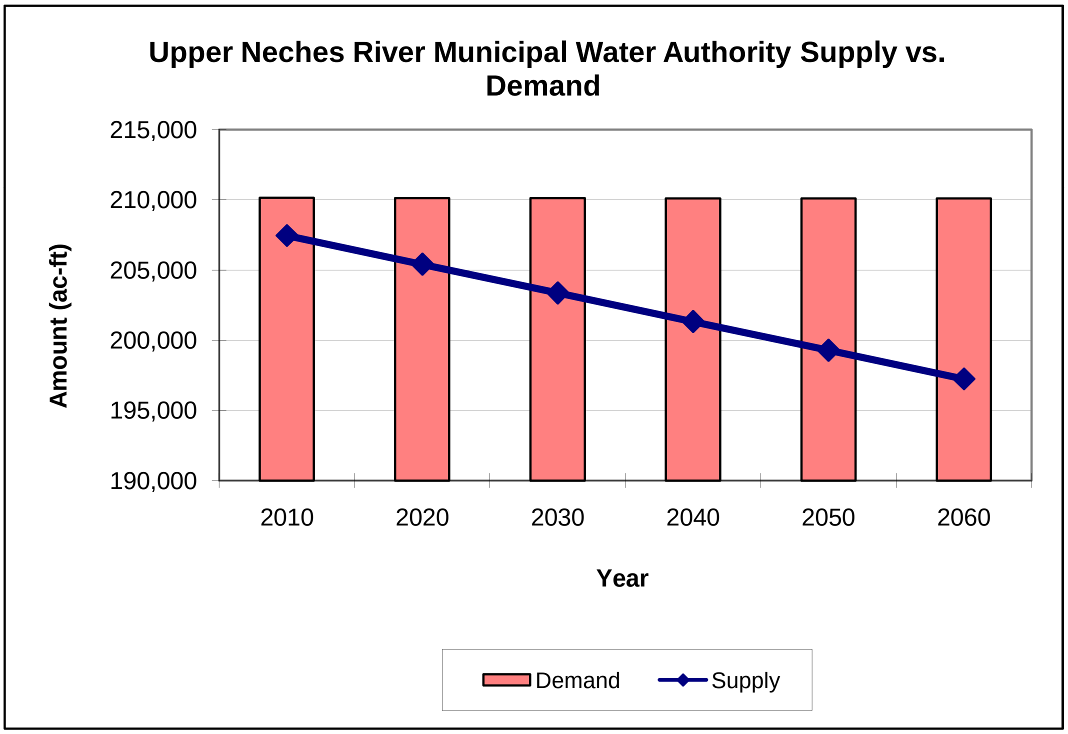


Upper Neches River Municipal Water Authority
(Units: Acre-Feet per Year)

WUGs	Recipient	2010	2020	2030	2040	2050	2060
City of Dallas (not connected)		114,337	114,337	114,337	114,337	114,337	114,337
City of Tyler		67,200	67,200	67,200	67,200	67,200	67,200
City of Palestine		28,000	28,000	28,000	28,000	28,000	28,000
Smith County-Other (1%)		93	82	73	64	57	51
Super Tree Farm for International Paper (Cherokee County irrigation)		300	300	300	300	300	300
TECON (Henderson County-Other)		100	100	100	100	100	100
Emerald Bay Golf Course (Smith County irrigation)		105	105	105	105	105	105
Total Demand		**210,135**	**210,124**	**210,115**	**210,106**	**210,099**	**210,093**

Current Supplies		2010	2020	2030	2040	2050	2060
Lake Palestine System		207,458	205,417	203,375	201,333	199,292	197,250
Total Supplies		**207,458**	**205,417**	**203,375**	**201,333**	**199,292**	**197,250**

Supplies Less Current Customer Demand		**-2,677**	**-4,708**	**-6,740**	**-8,773**	**-10,808**	**-12,843**



Appendix 4A-B

Socioeconomic Impact Analysis

A socioeconomic impact analysis of not meeting water needs was conducted by the TWDB. The full report entitled, *Socioeconomic Impacts of Projected Water Shortages for the East Texas Regional Water Planning Area (Region I)*, is included in this appendix.

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Socioeconomic Impacts of Projected Water Shortages for the East Texas Regional Water Planning Area (Region I)

Prepared in Support of the 2011 East Texas Regional Water Plan

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May 2010

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Introduction

Water shortages during drought would likely curtail or eliminate economic activity in business and industries reliant on water. For example, without water farmers cannot irrigate; refineries cannot produce gasoline, and paper mills cannot make paper. Unreliable water supplies would not only have an immediate and real impact on existing businesses and industry, but they could also adversely affect economic development in Texas. From a social perspective, water supply reliability is critical as well. Shortages would disrupt activity in homes, schools and government and could adversely affect public health and safety. For all of the above reasons, it is important to analyze and understand how restricted water supplies during drought could affect communities throughout the state.

Administrative rules require that regional water planning groups evaluate the impacts of not meeting water needs as part of the regional water planning process, and rules direct TWDB staff to provide technical assistance: "*The executive administrator shall provide available technical assistance to the regional water planning groups, upon request, on water supply and demand analysis, including methods to evaluate the social and economic impacts of not meeting needs*" [(§357.7 (4)(A)]. Staff of the TWDB's Water Resources Planning Division designed and conducted this report in support of the Northeast Texas Regional Water Planning Group (Region I).

This document summarizes the results of our analysis and discusses the methodology used to generate the results. Section 1 outlines the overall methodology and discusses approaches and assumptions specific to each water use category (i.e., irrigation, livestock, mining, steam-electric, municipal and manufacturing). Section 2 presents the results for each category where shortages are reported at the regional planning area level and river basin level. Results for individual water user groups are not presented, but are available upon request.

1. Methodology

Section 1 provides a general overview of how economic and social impacts were measured. In addition, it summarizes important clarifications, assumptions and limitations of the study.

1.1 Economic Impacts of Water Shortages

1.1.1 General Approach

Economic analysis as it relates to water resources planning generally falls into two broad areas. Supply side analysis focuses on costs and alternatives of developing new water supplies or implementing programs that provide additional water from current supplies. Demand side analysis concentrates on impacts or benefits of providing water to people, businesses and the environment. Analysis in this report focuses strictly on demand side impacts. When analyzing the economic impacts of water shortages as defined in Texas water planning, three potential scenarios are possible:

1) Scenario 1 involves situations where there are physical shortages of raw surface or groundwater due to drought of record conditions. For example, City A relies on a reservoir with average conservation storage of 500 acre-feet per year and a firm yield of 100 acre feet. In 2010, the city uses about 50 acre-feet per year, but by 2030 their demands are expected to increase to 200 acre-feet. Thus, in 2030 the reservoir would not have enough water to meet the city's demands,

and people would experience a shortage of 100 acre-feet assuming drought of record conditions. Under normal or average climatic conditions, the reservoir would likely be able to provide reliable water supplies well beyond 2030.

2) Scenario 2 is a situation where despite drought of record conditions, water supply sources can meet existing use requirements; however, limitations in water infrastructure would preclude future water user groups from accessing these water supplies. For example, City B relies on a river that can provide 500 acre-feet per year during drought of record conditions and other constraints as dictated by planning assumptions. In 2010, the city is expected to use an estimated 100 acre-feet per year and by 2060 it would require no more than 400 acre-feet. But the intake and pipeline that currently transfers water from the river to the city's treatment plant has a capacity of only 200 acre-feet of water per year. Thus, the city's water supplies are adequate even under the most restrictive planning assumptions, but their conveyance system is too small. This implies that at some point – perhaps around 2030 - infrastructure limitations would constrain future population growth and any associated economic activity or impacts.

3) Scenario 3 involves water user groups that rely primarily on aquifers that are being depleted. In this scenario, projected and in some cases existing demands may be unsustainable as groundwater levels decline. Areas that rely on the Ogallala aquifer are a good example. In some communities in the region, irrigated agriculture forms a major base of the regional economy. With less irrigation water from the Ogallala, population and economic activity in the region could decline significantly assuming there are no offsetting developments.

Assessing the social and economic effects of each of the above scenarios requires various levels and methods of analysis and would generate substantially different results for a number of reasons; the most important of which has to do with the time frame of each scenario. Scenario 1 falls into the general category of static analysis. This means that models would measure impacts for a small interval of time such as a drought. Scenarios 2 and 3, on the other hand imply a dynamic analysis meaning that models are concerned with changes over a much longer time period.

Since administrative rules specify that planning analysis be evaluated under drought of record conditions (a static and random event), socioeconomic impact analysis developed by the TWDB for the state water plan is based on assumptions of Scenario 1. Estimated impacts under scenario 1 are point estimates for years in which needs are reported (2010, 2020, 2030, 2040, 2050 and 2060). They are independent and distinct "what if" scenarios for a particular year and shortages are assumed to be temporary events resulting from drought of record conditions. Estimated impacts measure what would happen if water user groups experience water shortages for a period of one year.

The TWDB recognize that dynamic models may be more appropriate for some water user groups; however, combining approaches on a statewide basis poses several problems. For one, it would require a complex array of analyses and models, and might require developing supply and demand forecasts under "normal" climatic conditions as opposed to drought of record conditions. Equally important is the notion that combining the approaches would produce inconsistent results across regions resulting in a so-called "apples to oranges" comparison.

A variety tools are available to estimate economic impacts, but by far, the most widely used today are input-output models (IO models) combined with social accounting matrices (SAMs). Referred to as IO/SAM models, these tools formed the basis for estimating economic impacts for agriculture (irrigation and livestock water uses) and industry (manufacturing, mining, steam-electric and commercial business activity for municipal water uses).

Since the planning horizon extends through 2060, economic variables in the baseline are adjusted in accordance with projected changes in demographic and economic activity. Growth rates for municipal water use sectors (i.e., commercial, residential and institutional) are based on TWDB population forecasts. Future values for manufacturing, agriculture, and mining and steam-electric activity are based on the same underlying economic forecasts used to estimate future water use for each category.

The following steps outline the overall process.

Step 1*: Generate IO/SAM Models and Develop Economic Baseline*

IO/SAM models were estimated using propriety software known as IMPLAN PRO™ (Impact for Planning Analysis). IMPLAN is a modeling system originally developed by the U.S. Forestry Service in the late 1970s. Today, the Minnesota IMPLAN Group (MIG Inc.) owns the copyright and distributes data and software. It is probably the most widely used economic impact model in existence. IMPLAN comes with databases containing the most recently available economic data from a variety of sources.[1] Using IMPLAN software and data, transaction tables conceptually similar to the one discussed previously were estimated for each county in the region and for the region as a whole. Each transaction table contains 528 economic sectors and allows one to estimate a variety of economic statistics including:

- **total sales -** total production measured by sales revenues;
- **intermediate sales -** sales to other businesses and industries within a given region;
- **final sales –** sales to end users in a region and exports out of a region**;**
- **employment -** number of full and part-time jobs (annual average) required by a given industry including self-employment;
- **regional income -** total payroll costs (wages and salaries plus benefits) paid by industries, corporate income, rental income and interest payments; and
- **business taxes -** sales, excise, fees, licenses and other taxes paid during normal operation of an industry (does not include income taxes).

TWDB analysts developed an economic baseline containing each of the above variables using year 2000 data. Since the planning horizon extends through 2060, economic variables in the baseline were allowed to change in accordance with projected changes in demographic and economic activity. Growth rates for municipal water use sectors (i.e., commercial, residential and institutional) are based on TWDB population forecasts. Projections for manufacturing, agriculture, and mining and steam-electric activity are based on the same underlying economic forecasts used to estimate future water use for each category. Monetary impacts in future years are reported in constant year 2006 dollars.

It is important to stress that employment, income and business taxes are the most useful variables when comparing the relative contribution of an economic sector to a regional economy. Total sales as reported in IO/SAM models are less desirable and can be misleading because they include sales to other industries in the region for use in the production of other goods. For example, if a mill buys grain from local farmers and uses it to produce feed, sales of both the processed feed and raw corn are counted as "output" in an IO model. Thus, total sales double-count or overstate the true economic value of goods

[1]The IMPLAN database consists of national level technology matrices based on benchmark input-output accounts generated by the U.S. Bureau of Economic Analysis and estimates of final demand, final payments, industry output and employment for various economic sectors. IMPLAN regional data (i.e. states, a counties or groups of counties within a state) are divided into two basic categories: 1) data on an industry basis including value-added, output and employment, and 2) data on a commodity basis including final demands and institutional sales. State-level data are balanced to national totals using a matrix ratio allocation system and county data are balanced to state totals.

and services produced in an economy. They are not consistent with commonly used measures of output such as Gross National Product (GNP), which counts only final sales.

Another important distinction relates to terminology. Throughout this report, the term *sector* refers to economic subdivisions used in the IMPLAN database and resultant input-output models (528 individual sectors based on Standard Industrial Classification Codes). In contrast, the phrase *water use category* refers to water user groups employed in state and regional water planning including irrigation, livestock, mining, municipal, manufacturing and steam electric. Each IMPLAN sector was assigned to a specific water use category.

Step 2: *Estimate Direct and Indirect Economic Impacts of Water Needs*

Direct impacts are reductions in output by sectors experiencing water shortages. For example, without adequate cooling and process water a refinery would have to curtail or cease operation, car washes may close, or farmers may not be able to irrigate and sales revenues fall. Indirect impacts involve changes in inter-industry transactions as supplying industries respond to decreased demands for their services, and how seemingly non-related businesses are affected by decreased incomes and spending due to direct impacts. For example, if a farmer ceases operations due to a lack of irrigation water, they would likely reduce expenditures on supplies such as fertilizer, labor and equipment, and businesses that provide these goods would suffer as well.

Direct impacts accrue to immediate businesses and industries that rely on water and without water industrial processes could suffer. However, output responses may vary depending upon the severity of shortages. A small shortage relative to total water use would likely have a minimal impact, but large shortages could be critical. For example, farmers facing small shortages might fallow marginally productive acreage to save water for more valuable crops. Livestock producers might employ emergency culling strategies, or they may consider hauling water by truck to fill stock tanks. In the case of manufacturing, a good example occurred in the summer of 1999 when Toyota Motor Manufacturing experienced water shortages at a facility near Georgetown, Kentucky.[2] As water levels in the Kentucky River fell to historic lows due to drought, plant managers sought ways to curtail water use such as reducing rinse operations to a bare minimum and recycling water by funneling it from paint shops to boilers. They even considered trucking in water at a cost of 10 times what they were paying. Fortunately, rains at the end of the summer restored river levels, and Toyota managed to implement cutbacks without affecting production, but it was a close call. If rains had not replenished the river, shortages could have severely reduced output.[3]

To account for uncertainty regarding the relative magnitude of impacts to farm and business operations, the following analysis employs the concept of elasticity. Elasticity is a number that shows how a change in one variable will affect another. In this case, it measures the relationship between a percentage reduction in water availability and a percentage reduction in output. For example, an elasticity of 1.0 indicates that a 1.0 percent reduction in water availability would result in a 1.0 percent reduction in economic output. An elasticity of 0.50 would indicate that for every 1.0 percent of unavailable water, output is reduced by 0.50 percent and so on. Output elasticities used in this study are:[4]

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[2] Royal, W. "*High And Dry - Industrial Centers Face Water Shortages*." in Industry Week, Sept, 2000.

[3] The efforts described above are not planned programmatic or long-term operational changes. They are emergency measures that individuals might pursue to alleviate what they consider a temporary condition. Thus, they are not characteristic of long-term management strategies designed to ensure more dependable water supplies such as capital investments in conservation technology or development of new water supplies.

[4] Elasticities are based on one of the few empirical studies that analyze potential relationships between economic output and water shortages in the United States. The study, conducted in California, showed that a significant number of industries would suffer reduced output during water shortages. Using a survey based approach researchers posed two scenarios to different industries. In

- if water needs are 0 to 5 percent of total water demand, no corresponding reduction in output is assumed;

- if water needs are 5 to 30 percent of total water demand, for each additional one percent of water need that is not met, there is a corresponding 0.50 percent reduction in output;

- if water needs are 30 to 50 percent of total water demand, for each additional one percent of water need that is not met, there is a corresponding 0.75 percent reduction in output; and

- if water needs are greater than 50 percent of total water demand, for each additional one percent of water need that is not met, there is a corresponding 1.0 percent (i.e., a proportional reduction).

In some cases, elasticities are adjusted depending upon conditions specific to a given water user group.

Once output responses to water shortages were estimated, direct impacts to total sales, employment, regional income and business taxes were derived using regional level economic multipliers estimating using IO/SAM models. The formula for a given IMPLAN sector is:

$D_{i,t} = Q_{i,t} *_{,} S_{i,t} * E_Q * RFD_i * DM_{i(Q, L, I, T)}$

where:

$D_{i,t}$ = direct economic impact to sector *i* in period *t*

$Q_{i,t}$ = total sales for sector *i* in period *t* in an affected county

$RFD_{i,}$ = ratio of final demand to total sales for sector *i* for a given region

$S_{i,t}$ = water shortage as percentage of total water use in period *t*

E_Q = elasticity of output and water use

$DM_{i(L, I, T)}$ = direct output multiplier coefficients for labor (L), income (I) and taxes (T) for sector *i*.

Secondary impacts were derived using the same formula used to estimate direct impacts; however, indirect multiplier coefficients are used. Methods and assumptions specific to each water use sector are discussed in Sections 1.1.2 through 1.1.4.

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the first scenario, they asked how a 15 percent cutback in water supply lasting one year would affect operations. In the second scenario, they asked how a 30 percent reduction lasting one year would affect plant operations. In the case of a 15 percent shortage, reported output elasticities ranged from 0.00 to 0.76 with an average value of 0.25. For a 30 percent shortage, elasticities ranged from 0.00 to 1.39 with average of 0.47. For further information, see, California Urban Water Agencies, "*Cost of Industrial Water Shortages,*" Spectrum Economics, Inc. November, 1991.

General Assumptions and Clarification of the Methodology

As with any attempt to measure and quantify human activities at a societal level, assumptions are necessary and every model has limitations. Assumptions are needed to maintain a level of generality and simplicity such that models can be applied on several geographic levels and across different economic sectors. In terms of the general approach used here several clarifications and cautions are warranted:

1. Shortages as reported by regional planning groups are the starting point for socioeconomic analyses.

2. Estimated impacts are point estimates for years in which needs are reported (i.e., 2010, 2020, 2030, 2040, 2050 and 2060).They are independent and distinct "what if" scenarios for each particular year and water shortages are assumed to be temporary events resulting from severe drought conditions combined with infrastructure limitations. In other words, growth occurs and future shocks are imposed on an economy at 10-year intervals and resultant impacts are measured. Given, that reported figures are not cumulative in nature, it is inappropriate to sum impacts over the entire planning horizon. Doing so, would imply that the analysis predicts that drought of record conditions will occur every ten years in the future, which is not the case. Similarly, authors of this report recognize that in many communities needs are driven by population growth, and in the future total population will exceed the amount of water available due to infrastructure limitations, regardless of whether or not there is a drought. This implies that infrastructure limitations would constrain economic growth. However, since needs as defined by planning rules are based upon water supply and demand under the assumption of drought of record conditions, it improper to conduct economic analysis that focuses on growth related impacts over the planning horizon. Figures generated from such an analysis would presume a 50-year drought of record, which is unrealistic. Estimating lost economic activity related to constraints on population and commercial growth due to lack of water would require developing water supply and demand forecasts under "normal" or "most likely" future climatic conditions.

3. While useful for planning purposes, this study is not a benefit-cost analysis. Benefit cost analysis is a tool widely used to evaluate the economic feasibility of specific policies or projects as opposed to estimating economic impacts of unmet water needs. Nevertheless, one could include some impacts measured in this study as part of a benefit cost study if done so properly. Since this is not a benefit cost analysis, future impacts are not weighted differently. In other words, estimates are not discounted. If used as a measure of economic benefits, one should incorporate a measure of uncertainty into the analysis. In this type of analysis, a typical method of discounting future values is to assign probabilities of the drought of record recurring again in a given year, and weight monetary impacts accordingly. This analysis assumes a probability of one.

4. IO multipliers measure the strength of backward linkages to supporting industries (i.e., those who sell inputs to an affected sector). However, multipliers say nothing about forward linkages consisting of businesses that purchase goods from an affected sector for further processing. For example, ranchers in many areas sell most of their animals to local meat packers who process animals into a form that consumers ultimately see in grocery stores and restaurants. Multipliers do not capture forward linkages to meat packers, and since meat packers sell livestock purchased from ranchers as "final sales," multipliers for the ranching sector do fully account for all losses to a region's economy. Thus, as mentioned previously, in some cases closely linked sectors were moved from one water use category to another.

5. Cautions regarding interpretations of direct and secondary impacts are warranted. IO/SAM multipliers are based on "fixed-proportion production functions," which basically means that input use - including labor - moves in lockstep fashion with changes in levels of output. In a

scenario where output (i.e., sales) declines, losses in the immediate sector or supporting sectors could be much less than predicted by an IO/SAM model for several reasons. For one, businesses will likely expect to continue operating so they might maintain spending on inputs for future use; or they may be under contractual obligations to purchase inputs for an extended period regardless of external conditions. Also, employers may not lay-off workers given that experienced labor is sometimes scarce and skilled personnel may not be readily available when water shortages subside. Lastly people who lose jobs might find other employment in the region. As a result, direct losses for employment and secondary losses in sales and employment should be considered an upper bound. Similarly, since projected population losses are based on reduced employment in the region, they should be considered an upper bound as well.

6. IO models are static. Models and resultant multipliers are based upon the structure of the U.S. and regional economies in 2006. In contrast, water shortages are projected to occur well into the future. Thus, the analysis assumes that the general structure of the economy remains the same over the planning horizon, and the farther out into the future we go, this assumption becomes less reliable.

7. Impacts are annual estimates. If one were to assume that conditions persisted for more than one year, figures should be adjusted to reflect the extended duration. The drought of record in most regions of Texas lasted several years.

8. Monetary figures are reported in constant year 2006 dollars.

1.1.2 Impacts to Agriculture

Irrigated Crop Production

The first step in estimating impacts to irrigation required calculating gross sales for IMPLAN crop sectors. Default IMPLAN data do not distinguish irrigated production from dry-land production. Once gross sales were known other statistics such as employment and income were derived using IMPLAN direct multiplier coefficients. Gross sales for a given crop are based on two data sources:

1) county-level statistics collected and maintained by the TWDB and the USDA Farm Services Agency (FSA) including the number of irrigated acres by crop type and water application per acre, and

2) regional-level data published by the Texas Agricultural Statistics Service (TASS) including prices received for crops (marketing year averages), crop yields and crop acreages.

Crop categories used by the TWDB differ from those used in IMPLAN datasets. To maintain consistency, sales and other statistics are reported using IMPLAN crop classifications. Table 1 shows the TWDB crops included in corresponding IMPLAN sectors, and Table 2 summarizes acreage and estimated annual water use for each crop classification (five-year average from 2003-2007). Table 3 displays average (2003-2007) gross revenues per acre for IMPLAN crop categories.

Table 1: Crop Classifications Used in TWDB Water Use Survey and Corresponding IMPLAN Crop Sectors	
IMPLAN Category	**TWDB Category**
Oilseeds	Soybeans and "other oil crops"
Grains	Grain sorghum, corn, wheat and "other grain crops"
Vegetable and melons	"Vegetables" and potatoes
Tree nuts	Pecans
Fruits	Citrus, vineyard and other orchard
Cotton	Cotton
Sugarcane and sugar beets	Sugarcane and sugar beets
All "other" crops	"Forage crops", peanuts, alfalfa, hay and pasture, rice and "all other crops"

Table 2: Summary of Irrigated Crop Acreage and Water Demand for the East Texas Regional Water Planning Area (average 2003-2007)

Sector	Acres (1000s)	Distribution of acres	Water use (1000s of AF)	Distribution of water use
Grains	<1	<1%	<1	<1%
Vegetable and melons	<1	3%	<1	<1%
Fruits	<1	<1%	<1%	<1%
Cotton	<1	2%	0.58	1%
Rice	22	93%	108	99%
Total	23	100%	109	100%

Source: Water demand figures are a 5- year average (2003-2007) of the TWDB's annual Irrigation Water Use Estimates. Statistics for irrigated crop acreage are based upon annual survey data collected by the TWDB and the Farm Service Agency. Values do not include acreage or water use for the TWDB categories classified by the Farm Services Agency as "failed acres," "golf course" or "waste water."

Table 3: Average Gross Sales Revenues per Acre for Irrigated Crops for the East Texas Regional Water Planning Area (2003-2007)		
IMPLAN Sector	**Gross revenues per acre**	**Crops included in estimates**
Grains	$442	Based on five-year (2003-2007) average weighted by acreage for "irrigated grain sorghum," "irrigated corn", "irrigated wheat" and "irrigated 'other' grain crops."
Vegetable and melons	$6,184	Based on five-year (2003-2007) average weighted by acreage for "irrigated shallow and deep root vegetables", "irrigated Irish potatoes" and "irrigated melons."
Fruits	$3,502	Based on five-year (2003-2007) average weighted by acreage for "irrigated citrus", "irrigated vineyards" and "irrigated 'other' orchard."
Cotton	$400	Based on five-year (2003-2007) average weighted by acreage for "irrigated cotton."
All Other Crops	$500	Irrigated figure is based on five-year (2003-2007) average weighted by acreage for "irrigated 'forage' crops", "irrigated peanuts", "irrigated alfalfa", "irrigated 'hay' and pasture" and "irrigated 'all other' crops."

*Figures are rounded. Source: Based on data from the Texas Agricultural Statistics Service, Texas Water Development Board, and Texas A&M University.

An important consideration when estimating impacts to irrigation was determining which crops are affected by water shortages. One approach is the so-called rationing model, which assumes that farmers respond to water supply cutbacks by fallowing the lowest value crops in the region first and the highest valued crops last until the amount of water saved equals the shortage.[5] For example, if farmer A grows vegetables (higher value) and farmer B grows wheat (lower value) and they both face a proportionate cutback in irrigation water, then farmer B will sell water to farmer A. Farmer B will fallow her irrigated acreage before farmer A fallows anything. Of course, this assumes that farmers can and do transfer enough water to allow this to happen. A different approach involves constructing farm-level profit maximization models that conform to widely-accepted economic theory that farmers make decisions based on marginal net returns. Such models have good predictive capability, but data requirements and complexity are high. Given that a detailed analysis for each region would require a substantial amount of farm-level data and analysis, the following investigation assumes that projected shortages are distributed equally across predominant crops in the region. Predominant in this case are crops that comprise at least one percent of total acreage in the region.

The following steps outline the overall process used to estimate direct impacts to irrigated agriculture:

1. *Distribute shortages across predominant crop types in the region*. Again, unmet water needs were distributed equally across crop sectors that constitute one percent or more of irrigated acreage.

2. *Estimate associated reductions in output for affected crop sectors*. Output reductions are based on elasticities discussed previously and on estimated values per acre for different crops. Values per acre stem from the same data used to estimate output for the year 2006 baseline. Using multipliers, we then generate estimates of forgone income, jobs, and tax revenues based on reductions in gross sales and final demand.

Livestock

The approach used for the livestock sector is basically the same as that used for crop production. As is the case with crops, livestock categorizations used by the TWDB differ from those used in IMPLAN datasets, and TWDB groupings were assigned to a given IMPLAN sector (Table 4). Then we:

1) *Distribute projected water needs equally among predominant livestock sectors and estimate lost output*: As is the case with irrigation, shortages are assumed to affect all livestock sectors equally; however, the category of "other" is not included given its small size. If water needs were small relative to total demands, we assume that producers would haul in water by truck to fill stock tanks. The cost per acre-foot ($24,000) is based on 2008 rates charged by various water haulers in Texas, and assumes that the average truck load is 6,500 gallons at a hauling distance of 60 miles.

3) *Estimate reduced output in forward processors for livestock sectors*. Reductions in output for livestock sectors are assumed to have a proportional impact on forward processors in the region such as meat packers. In other words, if the cows were gone, meat-packing plants or fluid milk manufacturers) would likely have little to process. This is not an unreasonable premise. Since the

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[5] The rationing model was initially proposed by researchers at the University of California at Berkeley, and was then modified for use in a study conducted by the U.S. Environmental Protection Agency that evaluated how proposed water supply cutbacks recommended to protect water quality in the Bay/Delta complex in California would affect farmers in the Central Valley. See, Zilberman, D., Howitt, R. and Sunding, D. "*Economic Impacts of Water Quality Regulations in the San Francisco Bay and Delt*a." Western Consortium for Public Health. May 1993.

1950s, there has been a major trend towards specialized cattle feedlots, which in turn has decentralized cattle purchasing from livestock terminal markets to direct sales between producers and slaughterhouses. Today, the meat packing industry often operates large processing facilities near high concentrations of feedlots to increase capacity utilization.[6] As a result, packers are heavily dependent upon nearby feedlots. For example, a recent study by the USDA shows that on average meat packers obtain 64 percent of cattle from within 75 miles of their plant, 82 percent from within 150 miles and 92 percent from within 250 miles.[7]

Table 4: Description of Livestock Sectors

IMPLAN Category	TWDB Category
Cattle ranching and farming	Cattle, cow calf, feedlots and dairies
Poultry and egg production	Poultry production.
Other livestock	Livestock other than cattle and poultry (i.e., horses, goats, sheep, hogs)
Milk manufacturing	Fluid milk manufacturing, cheese manufacturing, ice cream manufacturing etc.
Meat packing	Meat processing present in the region from slaughter to final processing

1.1.3 Impacts to Municipal Water User Groups

Disaggregation of Municipal Water Demands

Estimating the economic impacts for the municipal water user groups is complicated for a number of reasons. For one, municipal use comprises a range of consumers including commercial businesses, institutions such as schools and government and households. However, reported water needs are not distributed among different municipal water users. In other words, how much of a municipal need is commercial and how much is residential (domestic)?

The amount of commercial water use as a percentage of total municipal demand was estimated based on "GED" coefficients (gallons per employee per day) published in secondary sources.[8] For example, if year 2006 baseline data for a given economic sector (e.g., amusement and recreation services) shows employment at 30 jobs and the GED coefficient is 200, then average daily water use by that sector is (30 x

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[6] Ferreira, W.N. "*Analysis of the Meat Processing Industry in the United States*." Clemson University Extension Economics Report ER211, January 2003.

[7] Ward, C.E. "*Summary of Results from USDA's Meatpacking Concentration Study*." Oklahoma Cooperative Extension Service, OSU Extension Facts WF-562.

[8] Sources for GED coefficients include: Gleick, P.H., Haasz, D., Henges-Jeck, C., Srinivasan, V., Wolff, G. Cushing, K.K., and Mann, A. "*Waste Not, Want Not*: *The Potential for Urban Water Conservation in California*." Pacific Institute. November 2003. U.S. Bureau of the Census. 1982 Census of Manufacturers: Water Use in Manufacturing. USGPO, Washington D.C. See also: "*U.S. Army Engineer Institute for Water Resources, IWR Report 88-R-6.*," Fort Belvoir, VA. See also, Joseph, E. S., 1982, "*Municipal and Industrial Water Demands of the Western United States*." Journal of the Water Resources Planning and Management Division, Proceedings of the American Society of Civil Engineers, v. 108, no. WR2, p. 204-216. See also, Baumann, D. D., Boland, J. J., and Sims, J. H., 1981, "*Evaluation of Water Conservation for Municipal and Industrial Water Supply*." U.S. Army Corps of Engineers, Institute for Water Resources, Contract no. 82-C1.

200 = 6,000 gallons) or 6.7 acre-feet per year. Water not attributed to commercial use is considered domestic, which includes single and multi-family residential consumption, institutional uses and all use designated as "county-other." Based on our analysis, commercial water use is about 5 to 35 percent of municipal demand. Less populated rural counties occupy the lower end of the spectrum, while larger metropolitan counties are at the higher end.

After determining the distribution of domestic versus commercial water use, we developed methods for estimating impacts to the two groups.

Domestic Water Uses

Input output models are not well suited for measuring impacts of shortages for domestic water uses, which make up the majority of the municipal water use category. To estimate impacts associated with domestic water uses, municipal water demand and needs are subdivided into residential, and commercial and institutional use. Shortages associated with residential water uses are valued by estimating proxy demand functions for different water user groups allowing us to estimate the marginal value of water, which would vary depending upon the level of water shortages. The more severe the water shortage, the more costly it becomes. For instance, a 2 acre-foot shortage for a group of households that use 10 acre-feet per year would not be as severe as a shortage that amounted to 8 acre-feet. In the case of a 2 acre-foot shortage, households would probably have to eliminate some or all outdoor water use, which could have implicit and explicit economic costs including losses to the horticultural and landscaping industry. In the case of an 8 acre-foot shortage, people would have to forgo all outdoor water use and most indoor water consumption. Economic impacts would be much higher in the latter case because people, and would be forced to find emergency alternatives assuming alternatives were available.

To estimate the value of domestic water uses, TWDB staff developed marginal loss functions based on constant elasticity demand curves. This is a standard and well-established method used by economists to value resources such as water that have an explicit monetary cost.

A constant price elasticity of demand is estimated using a standard equation:

$$w = kc^{(-\varepsilon)}$$

where:

- w is equal to average monthly residential water use for a given water user group measured in thousands of gallons;
- k is a constant intercept;
- c is the average cost of water per 1,000 gallons; and
- ε is the price elasticity of demand.

Price elasticities (-0.30 for indoor water use and -0.50 for outdoor use) are based on a study by Bell et al.[9] that surveyed 1,400 water utilities in Texas that serve at least 1,000 people to estimate demand elasticity for several variables including price, income, weather etc. Costs of water and average use per month per household are based on data from the Texas Municipal League's annual water and

[9] Bell, D.R. and Griffin, R.C. "*Community Water Demand in Texas as a Century is Turned*." Research contract report prepared for the Texas Water Development Board. May 2006.

wastewater rate surveys - specifically average monthly household expenditures on water and wastewater in different communities across the state. After examining variance in costs and usage, three different categories of water user groups based on population (population less than 5,000, cities with populations ranging from 5,000 to 99,999 and cities with populations exceeding 100,000) were selected to serve as proxy values for municipal water groups that meet the criteria (Table 5).[10]

Table 5: Water Use and Costs Parameters Used to Estimated Water Demand Functions (average monthly costs per acre-foot for delivered water and average monthly use per household)

Community Population	Water	Wastewater	Total monthly cost	Avg. monthly use (gallons)
Less than or equal to 5,000	$1,335	$1,228	$2,563	6,204
5,000 to 100,000	$1,047	$1,162	$2,209	7,950
Great than or equal to 100,000	$718	$457	$1,190	8,409

Source: Based on annual water and wastewater rate surveys published by the Texas Municipal League.

As an example, Table 6 shows the economic impact per acre-foot of domestic water needs for municipal water user groups with population exceeding 100,000 people. There are several important assumptions incorporated in the calculations:

1) Reported values are net of the variable costs of treatment and distribution such as expenses for chemicals and electricity since using less water involves some savings to consumers and utilities alike; and for outdoor uses we do not include any value for wastewater.

2) Outdoor and “non-essential” water uses would be eliminated before indoor water consumption was affected, which is logical because most water utilities in Texas have drought contingency plans that generally specify curtailment or elimination of outdoor water use during droughts.[11] Determining how much water is used for outdoor purposes is based on several secondary sources. The first is a major study sponsored by the American Water Works Association, which surveyed cities in states including Colorado, Oregon, Washington, California, Florida and Arizona. On average across all cities surveyed 58 percent of single family residential water use was for outdoor activities. In cities with climates comparable to large metropolitan areas of Texas, the average was 40 percent.[12] Earlier findings of the U.S. Water Resources Council showed a national

[10] Ideally, one would want to estimate demand functions for each individual utility in the state. However, this would require an enormous amount of time and resources. For planning purposes, we believe the values generated from aggregate data are more than sufficient.

[11] In Texas, state law requires retail and wholesale water providers to prepare and submit plans to the Texas Commission on Environmental Quality (TCEQ). Plans must specify demand management measures for use during drought including curtailment of “non-essential water uses.” Non-essential uses include, but are not limited to, landscape irrigation and water for swimming pools or fountains. For further information see the Texas Environmental Quality Code §288.20.

[12] See, Mayer, P.W., DeOreo, W.B., Opitz, E.M., Kiefer, J.C., Davis, W., Dziegielewski, D., Nelson, J.O. “*Residential End Uses of Water*.” Research sponsored by the American Water Works Association and completed by Aquacraft, Inc. and Planning and Management Consultants, Ltd. (PMCL@CDM).

average of 33 percent. Similarly, the United States Environmental Protection Agency (USEPA) estimated that landscape watering accounts for 32 percent of total residential and commercial water use on annual basis.[13] A study conducted for the California Urban Water Agencies (CUWA) calculated average annual values ranging from 25 to 35 percent.[14] Unfortunately, there does not appear to be any comprehensive research that has estimated non-agricultural outdoor water use in Texas. As an approximation, an average annual value of 30 percent based on the above references was selected to serve as a rough estimate in this study.

3) As shortages approach 100 percent values become immense and theoretically infinite at 100 percent because at that point death would result, and willingness to pay for water is immeasurable. Thus, as shortages approach 80 percent of monthly consumption, we assume that households and non-water intensive commercial businesses (those that use water only for drinking and sanitation would have water delivered by tanker truck or commercial water delivery companies. Based on reports from water companies throughout the state, we estimate that the cost of trucking in water is around $21,000 to $27,000 per acre-feet assuming a hauling distance of between 20 to 60 miles. This is not an unreasonable assumption. The practice was widespread during the 1950s drought and recently during droughts in this decade. For example, in 2000 at the heels of three consecutive drought years Electra - a small town in North Texas - was down to its last 45 days worth of reservoir water when rain replenished the lake, and the city was able to refurbish old wells to provide supplemental groundwater. At the time, residents were forced to limit water use to 1,000 gallons per person per month - less than half of what most people use - and many were having water delivered to their homes by private contractors.[15] In 2003 citizens of Ballinger, Texas, were also faced with a dwindling water supply due to prolonged drought. After three years of drought, Lake Ballinger, which supplies water to more than 4,300 residents in Ballinger and to 600 residents in nearby Rowena, was almost dry. Each day, people lined up to get water from a well in nearby City Park. Trucks hauling trailers outfitted with large plastic and metal tanks hauled water to and from City Park to Ballinger.[16]

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[13] U.S. Environmental Protection Agency. *"Cleaner Water through Conservation*." USEPA Report no. 841-B-95-002. April, 1995.

[14] Planning and Management Consultants, Ltd. "*Evaluating Urban Water Conservation Programs: A Procedures Manual*." Prepared for the California Urban Water Agencies. February 1992.

[15] Zewe, C. "*Tap Threatens to Run Dry in Texas Town*." July 11, 2000. CNN Cable News Network.

[16] Associated Press, "*Ballinger Scrambles to Finish Pipeline before Lake Dries Up*." May 19, 2003.

Table 6: Economic Losses Associated with Domestic Water Shortages in Communities with Populations Exceeding 100,000 people				
Water shortages as a percentage of total monthly household demands	**No. of gallons remaining per household per day**	**No of gallons remaining per person per day**	**Economic loss (per acre-foot)**	**Economic loss (per gallon)**
1%	278	93	$748	$0.00005
5%	266	89	$812	$0.0002
10%	252	84	$900	$0.0005
15%	238	79	$999	$0.0008
20%	224	75	$1,110	$0.0012
25%	210	70	$1,235	$0.0015
30%[a]	196	65	$1,699	$0.0020
35%	182	61	$3,825	$0.0085
40%	168	56	$4,181	$0.0096
45%	154	51	$4,603	$0.011
50%	140	47	$5,109	$0.012
55%	126	42	$5,727	$0.014
60%	112	37	$6,500	$0.017
65%	98	33	$7,493	$0.02
70%	84	28	$8,818	$0.02
75%	70	23	$10,672	$0.03
80%	56	19	$13,454	$0.04
85%	42	14	$18,091 ($24,000)[b]	$0.05 ($0.07)[b]
90%	28	9	$27,363 ($24,000)	$0.08 ($0.07)
95%	14	5	$55,182 ($24,000)	$0.17 ($0.07)
99%	3	0.9	$277,728 ($24,000)	$0.85 ($0.07)
99.9%	1	0.5	$2,781,377 ($24,000)	$8.53 ($0.07)
100%	0	0	Infinite ($24,000)	Infinite ($0.07)

[a] The first 30 percent of needs are assumed to be restrictions of outdoor water use; when needs reach 30 percent of total demands all outdoor water uses would be restricted. Needs greater than 30 percent include indoor use

[b] As shortages approach 100 percent the value approaches infinity assuming there are not alternatives available; however, we assume that communities would begin to have water delivered by tanker truck at an estimated cost of $24,000 per acre-foot when shortages breached 85 percent.

Commercial Businesses

Effects of water shortages on commercial sectors were estimated in a fashion similar to other business sectors meaning that water shortages would affect the ability of these businesses to operate. This is particularly true for “water intensive” commercial sectors that are need large amounts of water (in addition to potable and sanitary water) to provide their services. These include:

- car-washes,
- laundry and cleaning facilities,
- sports and recreation clubs and facilities including race tracks,
- amusement and recreation services,
- hospitals and medical facilities,
- hotels and lodging places, and
- eating and drinking establishments.

A key assumption is that commercial operations would not be affected until water shortages were at least 50 percent of total municipal demand. In other words, we assume that residential water consumers would reduce water use including all non-essential uses before businesses were affected.

An example will illustrate the breakdown of municipal water needs and the overall approach to estimating impacts of municipal needs. Assume City A experiences an unexpected shortage of 50 acre-feet per year when their demands are 200 acre-feet per year. Thus, shortages are only 25 percent of total municipal use and residents of City A could eliminate needs by restricting landscape irrigation. City B, on the other hand, has a deficit of 150 acre-feet in 2020 and a projected demand of 200 acre-feet. Thus, total shortages are 75 percent of total demand. Emergency outdoor and some indoor conservation measures could eliminate 50 acre-feet of projected needs, yet 50 acre-feet would still remain. To eliminate” the remaining 50 acre-feet water intensive commercial businesses would have to curtail operations or shut down completely.

Three other areas were considered when analyzing municipal water shortages: 1) lost revenues to water utilities, 2) losses to the horticultural and landscaping industries stemming for reduction in water available for landscape irrigation, and 3) lost revenues and related economic impacts associated with reduced water related recreation.

Water Utility Revenues

Estimating lost water utility revenues was straightforward. We relied on annual data from the “*Water and Wastewater Rate Survey*” published annually by the Texas Municipal League to calculate an average value per acre-foot for water and sewer. For water revenues, average retail water and sewer rates multiplied by total water needs served as a proxy. For lost wastewater, total unmet needs were adjusted for return flow factor of 0.60 and multiplied by average sewer rates for the region. Needs reported as “county-other” were excluded under the presumption that these consist primarily of self-supplied water uses. In addition, 15 percent of water demand and needs are considered non-billed or “unaccountable” water that comprises things such as leakages and water for municipal government functions (e.g., fire departments). Lost tax receipts are based on current rates for the “miscellaneous gross receipts tax, “which the state collects from utilities located in most incorporated cities or towns in Texas. We do not include lost water utility revenues when aggregating impacts of municipal water shortages to regional and state levels to prevent double counting.

Horticultural and Landscaping Industry

The horticultural and landscaping industry, also referred to as the “green Industry,” consists of businesses that produce, distribute and provide services associated with ornamental plants, landscape and garden supplies and equipment. Horticultural industries often face big losses during drought. For example, the recent drought in the Southeast affecting the Carolinas and Georgia horticultural and landscaping businesses had a harsh year. Plant sales were down, plant mortality increased, and watering costs increased. Many businesses were forced to close locations, lay off employees, and even file for bankruptcy. University of Georgia economists put statewide losses for the industry at around $3.2 billion during the 3-year drought that ended in 2008.[17] Municipal restrictions on outdoor watering play a significant role. During drought, water restrictions coupled with persistent heat has a psychological effect on homeowners that reduces demands for landscaping products and services. Simply put, people were afraid to spend any money on new plants and landscaping.

In Texas, there do not appear to be readily available studies that analyze the economic effects of water shortages on the industry. However, authors of this report believe negative impacts do and would result in restricting landscape irrigation to municipal water consumers. The difficulty in measuring them is two-fold. First, as noted above, data and research for these types of impacts that focus on Texas are limited; and second, economic data provided by IMPLAN do not disaggregate different sectors of the green industry to a level that would allow for meaningful and defensible analysis.[18]

Recreational Impacts

Recreational businesses often suffer when water levels and flows in rivers, springs and reservoirs fall significantly during drought. During droughts, many boat docks and lake beaches are forced to close, leading to big losses for lakeside business owners and local communities. Communities adjacent to popular river and stream destinations such as Comal Springs and the Guadalupe River also see their business plummet when springs and rivers dry up. Although there are many examples of businesses that have suffered due to drought, dollar figures for drought-related losses to the recreation and tourism industry are not readily available, and very difficult to measure without extensive local surveys. Thus, while they are important, economic impacts are not measured in this study.

Table 7 summarizes impacts of municipal water shortages at differing levels of magnitude, and shows the ranges of economic costs or losses per acre-foot of shortage for each level.

[17] Williams, D. *“Georgia landscapers eye rebound from Southeast drought.”* Atlanta Business Chronicle, Friday, June 19, 2009

[18] Economic impact analyses prepared by the TWDB for 2006 regional water plans did include estimates for the horticultural industry. However, year 2000 and prior IMPLAN data were disaggregated to a finer level. In the current dataset (2006), the sector previously listed as “Landscaping and Horticultural Services” (IMPLAN Sector 27) is aggregated into “Services to Buildings and Dwellings” (IMPLAN Sector 458).

Table 7: Impacts of Municipal Water Shortages at Different Magnitudes of Shortages		
Water shortages as percent of total municipal demands	Impacts	Economic costs per acre-foot*
0-30%	✓ Lost water utility revenues ✓ Restricted landscape irrigation and non-essential water uses	$730 - $2,040
30-50%	✓ Lost water utility revenues ✓ Elimination of landscape irrigation and non-essential water uses ✓ Rationing of indoor use	$2,040 - $10,970
>50%	✓ Lost water utility revenues ✓ Elimination of landscape irrigation and non-essential water uses ✓ Rationing of indoor use ✓ Restriction or elimination of commercial water use ✓ Importing water by tanker truck	$10,970 - varies
*Figures are rounded		

1.1.4 Industrial Water User Groups

Manufacturing

Impacts to manufacturing were estimated by distributing water shortages among industrial sectors at the county level. For example, if a planning group estimates that during a drought of record water supplies in County A would only meet 50 percent of total annual demands for manufactures in the county, we reduced output for each sector by 50 percent. Since projected manufacturing demands are based on TWDB Water Uses Survey data for each county, we only include IMPLAN sectors represented in the TWBD survey database. Some sectors in IMPLAN databases are not part of the TWDB database given that they use relatively small amounts of water - primarily for on-site sanitation and potable purposes. To maintain consistency between IMPLAN and TWDB databases, Standard Industrial Classification (SIC) codes both databases were cross referenced in county with shortages. Non-matches were excluded when calculating direct impacts.

Mining

The process of mining is very similar to that of manufacturing. We assume that within a given county, shortages would apply equally to relevant mining sectors, and IMPLAN sectors are cross referenced with TWDB data to ensure consistency.

In Texas, oil and gas extraction and sand and gravel (aggregates) operations are the primary mining industries that rely on large volumes of water. For sand and gravel, estimated output reductions are straightforward; however, oil and gas is more complicated for a number of reasons. IMPLAN does not necessarily report the physical extraction of minerals by geographic local, but rather the sales revenues reported by a particular corporation.

For example, at the state level revenues for IMPLAN sector 19 (oil and gas extraction) and sector 27 (drilling oil and gas wells) totals $257 billion. Of this, nearly $85 billion is attributed to Harris County. However, only a very small fraction (less than one percent) of actual production takes place in the county. To measure actual potential losses in well head capacity due to water shortages, we relied on county level production data from the Texas Railroad Commission (TRC) and average well-head market prices for crude and gas to estimate lost revenues in a given county. After which, we used to IMPLAN ratios to estimate resultant losses in income and employment.

Other considerations with respect to mining include:

1) Petroleum and gas extraction industry only uses water in significant amounts for secondary recovery. Known in the industry as enhanced or water flood extraction, secondary recovery involves pumping water down injection wells to increase underground pressure thereby pushing oil or gas into other wells. IMPLAN output numbers do not distinguish between secondary and non-secondary recovery. To account for the discrepancy, county-level TRC data that show the proportion of barrels produced using secondary methods were used to adjust IMPLAN data to reflect only the portion of sales attributed to secondary recovery.

2) A substantial portion of output from mining operations goes directly to businesses that are classified as manufacturing in our schema. Thus, multipliers measuring backward linkages for a given manufacturer might include impacts to a supplying mining operation. Care was taken not to double count in such situations if both a mining operation and a manufacturer were reported as having water shortages.

Steam-electric

At minimum without adequate cooling water, power plants cannot safely operate. As water availability falls below projected demands, water levels in lakes and rivers that provide cooling water would also decline. Low water levels could affect raw water intakes and outfalls at electrical generating units in several ways. For one, power plants are regulated by thermal emission guidelines that specify the maximum amount of heat that can go back into a river or lake via discharged cooling water. Low water levels could result in permit compliance issues due to reduced dilution and dispersion of heat and subsequent impacts on aquatic biota near outfalls.[19] However, the primary concern would be a loss of head (i.e., pressure) over intake structures that would decrease flows through intake tunnels. This would affect safety related pumps, increase operating costs and/or result in sustained shut-downs. Assuming plants did shutdown, they would not be able to generate electricity.

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[19] Section 316 (b) of the Clean Water Act requires that thermal wastewater discharges do not harm fish and other wildlife.

Among all water use categories steam-electric is unique and cautions are needed when applying methods used in this study. Measured changes to an economy using input-output models stem directly from changes in sales revenues. In the case of water shortages, one assumes that businesses will suffer lost output if process water is in short supply. For power generation facilities this is true as well. However, the electric services sector in IMPLAN represents a corporate entity that may own and operate several electrical generating units in a given region. If one unit became inoperable due to water shortages, plants in other areas or generation facilities that do not rely heavily on water such as gas powered turbines might be able to compensate for lost generating capacity. Utilities could also offset lost production via purchases on the spot market.[20] Thus, depending upon the severity of the shortages and conditions at a given electrical generating unit, energy supplies for local and regional communities could be maintained. But in general, without enough cooling water, utilities would have to throttle back plant operations, forcing them to buy or generate more costly power to meet customer demands.

Measuring impacts end users of electricity is not part of this study as it would require extensive local and regional level analysis of energy production and demand. To maintain consistency with other water user groups, impacts of steam-electric water shortages are measured in terms of lost revenues (and hence income) and jobs associated with shutting down electrical generating units.

1.2 Social Impacts of Water Shortages

As the name implies, the effects of water shortages can be social or economic. Distinctions between the two are both semantic and analytical in nature – more so analytic in the sense that social impacts are harder to quantify. Nevertheless, social effects associated with drought and water shortages are closely tied to economic impacts. For example, they might include:

- demographic effects such as changes in population,
- disruptions in institutional settings including activity in schools and government,
- conflicts between water users such as farmers and urban consumers,
- health-related low-flow problems (e.g., cross-connection contamination, diminished sewage flows, increased pollutant concentrations),
- mental and physical stress (e.g., anxiety, depression, domestic violence),
- public safety issues from forest and range fires and reduced fire fighting capability,
- increased disease caused by wildlife concentrations,
- loss of aesthetic and property values, and
- reduced recreational opportunities.[21]

[20] Today, most utilities participate in large interstate "power pools" and can buy or sell electricity "on the grid" from other utilities or power marketers. Thus, assuming power was available to buy, and assuming that no contractual or physical limitations were in place such as transmission constraints; utilities could offset lost power that resulted from waters shortages with purchases via the power grid.

[21] Based on information from the website of the National Drought Mitigation Center at the University of Nebraska Lincoln. Available online at: http://www.drought.unl.edu/risk/impacts.htm. See also, Vanclay, F. "*Social Impact Assessment*." in Petts, J. (ed) International Handbook of Environmental Impact Assessment. 1999.

Social impacts measured in this study focus strictly on demographic effects including changes in population and school enrollment. Methods are based on demographic projection models developed by the Texas State Data Center and used by the TWDB for state and regional water planning. Basically, the social impact model uses results from the economic component of the study and assesses how changes in labor demand would affect migration patterns in a region. Declines in labor demand as measured using adjusted IMPLAN data are assumed to affect net economic migration in a given regional water planning area. Employment losses are adjusted to reflect the notion that some people would not relocate but would seek employment in the region and/or public assistance and wait for conditions to improve. Changes in school enrollment are simply the proportion of lost population between the ages of 5 and 17.

2. Results

Section 2 presents the results of the analysis at the regional level. Included are baseline economic data for each water use category, and estimated economics impacts of water shortages for water user groups with reported deficits. According to the 2011 *Rio Grande Regional Water Plan*, during severe drought irrigation, livestock, municipal, manufacturing, mining and steam-electric water user groups would experience water shortages in the absence of new water management strategies.

2.1 Overview of Regional Economy

On an annual basis, the East Texas regional economy generates $34 billion in gross state product for Texas ($32 billion in income and $2 billion worth of business taxes) and supports 481,393 jobs (Table 8). Generating about $12 billion worth of income per year, agriculture, manufacturing, and mining are the primary base economic sectors in the region.[22] Municipal sectors also generate substantial amounts of income and are major employers. However, while municipal sectors are the largest employer and source of wealth, many businesses that make up the municipal category such as restaurants and retail stores are non-basic industries meaning they exist to provide services to people who work would in base industries such as manufacturing, agriculture and mining. In other words, without base industries such agriculture, many municipal jobs in the region would not exist.

[22] Base industries are those that supply markets outside of the region. These industries are crucial to the local economy and are called the economic base of a region. Appendix A shows how IMPLAN's 529 sectors were allocated to water use category, and shows economic data for each sector.

Table 8: The East Texas Regional Economy by Water User Group ($millions)*						
Water Use Category	Total sales	Intermediate sales	Final sales	Jobs	Income	Business taxes
Irrigation	$78.03	$8.73	$69.30	618	$20.24	$0.85
Livestock	$2,637.85	$1,339.95	$1,297.90	16,521	$499.23	$21.09
Manufacturing	$62,475.81	$19,826.73	$42,649.08	80,609	$9,096.38	$255.38
Mining	$3,693.95	$1,475.81	$2,218.13	7,862	$1,831.54	$200.96
Steam-electric	$990.40	$278.62	$711.78	1,893	$687.65	$117.45
Municipal	$33,562.37	$9,053.48	$24,508.89	373,890	$19,618.82	$1,723.75
Regional total	$103,438.41	$31,983.32	$71,455.08	481,393	$31,753.86	$2,319.48

[a] Appendix 1 displays data for individual IMPLAN sectors that make up each water use category. Based on data from the Texas Water Development Board, and year 2006 data from the Minnesota IMPLAN Group, Inc.

2.2 Impacts of Agricultural Water Shortages

According to the 2011 *East Texas Regional Water Plan*, during severe drought the counties of Hardin, Houston, San Augustine and Smith would experiences shortages of irrigation water. In 2010, shortages range from about 1 to 48 percent of annual irrigation demands, and farmers would be short nearly 1,675 acre-feet in 2010 and nearly 3,420 acre-feet in 2060. Shortages of these magnitudes would reduce gross state product (income plus state and local business taxes) by less than $1 million per year in each decade.

Table 9: Economic Impacts of Water Shortages for Irrigation Water User Groups ($millions)			
Decade	Lost income from reduced crop production [a]	Lost state and local tax revenues from reduced crop production	Lost jobs from reduced crop production
2010	$0.18	$0.03	2
2020	$0.19	$0.03	2
2030	$0.23	$0.03	2
2040	$0.40	$0.04	2
2050	$0.48	$0.05	2
2060	$0.57	$0.05	3

*Changes to income and business taxes are collectively equivalent to a decrease in gross state product, which is analogous to gross domestic product measured at the state rather than national level. Appendix 2 shows results by water user group.

Shortages for livestock producers are reported for Angelina, Henderson, Houston, Nacogdoches, Sabine, San Augustine, and Shelby counties. Shortages of these magnitudes would reduce gross state product (income plus state and local business taxes) by $14 million per year in 2010, and $551 million in 2060 (Table 10).

Table 10: Economic Impacts of Water Shortages for Livestock Water User Groups ($millions)[a]

Decade	Lost income from reduced livestock production[b]	Lost state and local tax revenues from reduced livestock production	Lost jobs from reduced livestock crop production
2010	$13.22	$0.60	124
2020	$53.29	$2.43	500
2030	$92.78	$4.23	873
2040	$266.31	$12.12	2,495
2050	$390.77	$17.79	3,660
2060	$527.74	$24.02	4,942

[a] Includes impacts to forward processors (meat packing and poultry processing).

[b] Changes to income and business taxes are collectively equivalent to a decrease in gross state product, which is analogous to gross domestic product measured at the state rather than national level. Appendix 2 shows results by water user group.

2.3 Impacts of Municipal Water Shortages

Water shortages are projected to occur in a significant number of communities in the region. Deficits range from approximately 1 to roughly 75 percent of total annual water use. At the regional level, the estimated economic value of domestic water shortages totals $19 million in 2010 and $157 million in 2060 (Table 11). Due to curtailment of commercial business activity operation, municipal shortages would reduce gross state product (income plus taxes) by an estimated $34 million in 2020 and $162 million in 2060.

Table 11: Economic Impacts of Water Shortages for Municipal Water User Groups ($millions)					
Decade	**Monetary value of domestic water shortages**	**Lost income from reduced commercial business activity***	**Lost state and local taxes from reduced commercial business activity**	**Lost jobs from reduced commercial business activity**	**Lost water utility revenues**
2010	$19.03	$0.00	$0.00	0	$6.16
2020	$65.60	$33.91	$3.61	754	$10.21
2030	$84.52	$42.30	$4.50	941	$12.92
2040	$102.76	$51.89	$5.53	1,156	$16.54
2050	$193.14	$129.22	$13.84	2,898	$22.23
2060	$162.16	$162.23	$17.55	3,683	$29.75

*Changes to Income and business taxes are collectively equivalent to a decrease in gross state product, which is analogous to gross domestic product measured at the state rather than national level. Appendix 2 shows results by water user group.

2.4 Impacts of Manufacturing Water Shortages

Manufacturing water shortages in the region are projected to occur in Angelina, Henderson, Houston, Nacogdoches, Sabine, San Augustine, and Shelby counties. In 2010, the East Texas planning group estimates that these manufacturers would be short about 3,400 acre-feet; and by 2060, this figure increases to nearly 50,000 acre-feet. Shortages of these magnitudes would reduce gross state product (income plus taxes) by an estimated $41 million in 2010 and $1.2 billion in 2060 (Table 12).

Table 12: Economic Impacts of Water Shortages for Manufacturing Water User Groups ($millions)			
Decade	**Lost income due to reduced manufacturing output**	**Lost state and local business tax revenues due to reduced manufacturing output**	**Lost jobs due to reduced manufacturing output**
2010	$40.43	$1.28	79
2020	$292.52	$9.01	651
2030	$397.41	$12.09	1,114
2040	$878.32	$26.94	2,038
2050	$1,026.90	$31.44	2,516
2060	$1,188.24	$36.33	3,046

*Changes to Income and business taxes are collectively equivalent to a decrease in gross state product, which is analogous to gross domestic product measured at the state rather than national level. Appendix 2 shows results by water user group.

2.5 Impacts of Mining Water Shortages

Ming water shortages in Region I are projected to occur in San Augustine, Angelina, Jefferson, Nacogdoches, Newton and Rusk counties, and would primarily affect extraction of gas in the Haynesville shale formation. Combined shortages for each county would result in estimated losses in gross state product totaling $1.2 billion dollars in 2010, and about $900 million 2060 (Table 13).

Table 13: Economic Impacts of Water Shortages for Mining Water User Groups ($millions)

Decade	Lost income due to reduced mining output	Lost state and local business tax revenues due to reduced mining output	Lost jobs due to reduced mining output
2010	$1,105.82	$99.40	8,178
2020	$2,226.70	$222.67	16,468
2030	$701.19	$70.12	5,186
2040	$749.60	$74.96	5,544
2050	$797.20	$79.72	5,896
2060	$834.13	$83.41	6,169

*Changes to Income and business taxes are collectively equivalent to a decrease in gross state product, which is analogous to gross domestic product measured at the state rather than national level. Appendix 2 shows results by water user group.

2.6 Impacts of Steam-electric Water Shortages

Water shortages for electrical generating units are projected to occur in Anderson, Angelina, Jefferson, Nacogdoches, Newton, and Rusk counties, and would result in estimated losses of gross state product totaling $119 million dollars in 2020, and $3.7 billion 2060 (Table 14).

Table 14: Economic Impacts of Water Shortages for Steam-electric Water User Groups ($millions)			
Decade	**Lost income due to reduced electrical generation**	**Lost state and local business tax revenues due to reduced electrical generation**	**Lost jobs due to reduced electrical generation**
2010	$104.61	$15.01	356
2020	$640.67	$91.96	2,178
2030	$853.57	$122.52	2,902
2040	$1,662.28	$238.59	5,651
2050	$2,682.62	$385.05	9,119
2060	$3,244.45	$465.69	11,029

*Changes to Income and business taxes are collectively equivalent to a decrease in gross state product, which is analogous to gross domestic product measured at the state rather than national level. Appendix 2 shows results by water user group.

2.7 Social Impacts of Water Shortages

As discussed previously, estimated social impacts focus on changes in population and school enrollment in the region. In 2010, estimated population losses total 10,511 with corresponding reductions in school enrollment of 2,965 students (Table 15). In 2060, population in the region would decline by 34,773 and school enrollment would fall by 9,865.

Table 15: Social Impacts of Water Shortages (2010-2060)		
Year	**Population Losses**	**Declines in School Enrollment**
2010	10,511	2,965
2020	24,754	7,023
2030	13,269	3,764
2040	20,337	5,770
2050	29,015	8,232
2060	34,773	9,865

2.8 Distribution of Impacts by Major River Basin

Administrative rules require that impacts are presented by both planning region and major river basin. To meet rule requirements, impacts were allocated among basins based on the distribution of water shortages in relevant basins. For example, if 50 percent of water shortages in River Basin A and 50 percent occur in River Basin B, then impacts were split equally among the two basins. Table 16 displays the results.

Table 16: Distribution of Impacts by Major River Basin (2010-2060)						
Water Use	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Irrigation						
Neches	100%	100%	90%	82%	76%	70%
Trinity	0%	0%	10%	18%	24%	30%
Livestock						
Neches	48%	36%	38%	38%	39%	38%
Sabine	52%	61%	57%	56%	56%	56%
Trinity	<1%	4%	5%	5%	6%	5%
Manufacturing						
Neches	93%	66%	54%	48%	45%	42%
Sabine	6%	33%	45%	51%	54%	57%
Trinity	<1%	<1%	<1%	<1%	<1%	<1%
Mining						
Neches	>99%	>99%	>99%	>99%	99%	99%
Neches-Trinity	0%	0%	0%	0%	<1%	<1%
Sabine	0%	0%	0%	<1%	1%	1%
Trinity	<1%	<1%	<1%	<1%	<1%	<1%
Municipal						
Neches	96%	96%	96%	96%	97%	97%
Sabine	4%	4%	4%	4%	3%	3%
Trinity	<1%	<1%	<1%	<1%	<1%	<1%
Steam-electric						
Neches	100%	100%	93%	88%	84%	73%
Sabine	0%	0%	7%	12%	16%	27%

Appendix 1: Economic Data for Individual IMPLAN Sectors for the East Texas Regional Water Planning Area

Economic Data for Agricultural Water User Groups ($millions)									
Water Use Category	**IMPLAN Sector**	**IMPLAN Code**	**Total Sales**	**Intermediate Sales**	**Final Sales**	**Jobs**	**Income**	**Business Taxes**
Irrigation	Rice milling	49	$52.89	$0.40	$52.48	88	$6.26	$0.38
Irrigation	Rice	10	$11.49	$7.41	$4.08	164	$5.62	$0.22
Irrigation	Fruit Farming	5	$9.66	$0.81	$8.86	269	$5.53	$0.21
Irrigation	Vegetable and Melon Farming	3	$3.72	$0.10	$3.62	92	$2.73	$0.04
Irrigation	Cotton Farming	8	$0.22	$0	$0.22	3	$0.08	$0.00
Irrigation	Grain Farming	2	$0.05	$0.01	$0.04	2	$0.02	$0.00
	Total irrigation		**$78.03**	**$8.73**	**$69.30**	**618**	**$20.24**	**$0.85**
Livestock	Poultry processing	70	$1,085.13	$345.26	$739.86	4,772	$171.09	$7.77
Livestock	Poultry and egg production	12	$746.27	$584.87	$161.39	2,459	$251.12	$2.53
Livestock	Meat processed from carcasses	68	$380.67	$112.30	$268.36	867	$42.62	$2.18
Livestock	Cattle ranching and farming	11	$378.89	$262.72	$116.17	6,997	$29.93	$7.96
Livestock	Animal production- except cattle and poultry	13	$38.71	$32.82	$5.89	1,412	$3.76	$0.60
Livestock	Fluid milk manufacturing	62	$8.19	$1.97	$6.22	14	$0.71	$0.04
	Total livestock		**$2,637.85**	**$1,339.95**	**$1,297.90**	**16,521**	**$499.23**	**$21.09**
	Total agriculture		**$2,715.88**	**$1,348.69**	**$1,367.20**	**17,139**	**$519.46**	**$21.93**
Based on year 2006 data from the Minnesota IMPLAN Group, Inc.								

Economic Data for Mining and Steam-electric Water User Groups ($millions)									
Water Use Category	**IMPLAN Sector**	**IMPLAN Code**	**Total Sales**	**Intermediate Sales**	**Final Sales**	**Jobs**	**Income**	**Business Taxes**
Mining	Drilling oil and gas wells	27	$1,443.30	$7.20	$1,436.09	2,304	$419.03	$55.25
Mining	Oil and gas extraction	19	$1,377.01	$1,278.81	$98.20	1,902	$791.16	$84.41
Mining	Support activities for oil and gas operations	28	$532.90	$74.02	$458.88	2,706	$482.88	$22.17
Mining	Coal mining	20	$298.50	$111.86	$186.64	734	$115.80	$37.78
Mining	Sand- gravel- clay- and refractory mining	25	$20.75	$2.19	$18.56	138	$12.09	$0.62
Mining	Other nonmetallic mineral mining	26	$11.66	$1.17	$10.50	36	$6.17	$0.44
Mining	Stone mining and quarrying	24	$5.57	$0.57	$5.00	29	$3.07	$0.07
Mining	Iron ore mining	21	$4.26	-$0.01	$4.27	13	$1.34	$0.23
	Total mining		**$3,693.95**	**$1,475.81**	**$2,218.13**	**7,862**	**$1,831.54**	**$200.96**
Steam-electric	**Power generation and supply**	**30**	**$990.40**	**$278.62**	**$711.78**	**1,893**	**$687.65**	**$117.45**
Based on year 2006 data from the Minnesota IMPLAN Group, Inc.								

Economic Data for Manufacturing Water User Groups ($millions)									
Water Use Category	**IMPLAN Sector**	**IMPLAN Code**	**Total Sales**	**Intermediate Sales**	**Final Sales**	**Jobs**	**Income**	**Business Taxes**
Manufacturing	Petroleum refineries	142	$35,420.78	$13,165.92	$22,254.85	4,227	$1,693.35	$71.73
Manufacturing	Petrochemical manufacturing	147	$7,340.32	$3,363.10	$3,977.22	903	$823.05	$46.91
Manufacturing	New residential 1-unit structures- all	33	$1,488.13	$0.00	$1,488.13	9,677	$519.58	$8.18
Manufacturing	Plastics material and resin manufacturing	152	$1,297.60	$51.39	$1,246.21	902	$248.53	$8.15
Manufacturing	Paper and paperboard mills	125	$1,199.74	$0.28	$1,199.46	1,922	$394.51	$10.43
Manufacturing	AC- refrigeration- and forced air heating	278	$947.25	$0.00	$947.24	2,853	$234.89	$5.77
Manufacturing	Synthetic rubber manufacturing	153	$899.08	$22.05	$877.03	1,061	$263.14	$6.33
Manufacturing	Commercial and institutional buildings	38	$855.47	$0.00	$855.47	8,436	$445.87	$5.48
Manufacturing	Pesticide and other agricultural chemical man	159	$724.82	$121.45	$603.37	460	$218.41	$3.81
Manufacturing	Other basic organic chemical manufacturing	151	$706.58	$131.74	$574.84	621	$103.32	$4.05
Manufacturing	Other basic inorganic chemical manufacturing	150	$662.12	$145.88	$516.24	1,201	$213.52	$2.43
Manufacturing	Reconstituted wood product manufacturing	114	$578.60	$242.21	$336.39	1,216	$312.29	$2.90
Manufacturing	Sawmills	112	$524.45	$465.15	$59.30	1,810	$173.11	$3.00
Manufacturing	Industrial gas manufacturing	148	$489.53	$257.41	$232.12	490	$193.08	$2.93
Manufacturing	Sheet metal work manufacturing	236	$460.57	$25.10	$435.47	1,924	$225.10	$2.97
Manufacturing	Logging	14	$448.42	$335.08	$113.34	1,805	$117.91	$3.97
Manufacturing	Iron and steel mills	203	$443.31	$31.93	$411.38	519	$92.33	$3.50
Manufacturing	Ferrous metal foundries	221	$384.48	$0.38	$384.10	1,900	$148.93	$2.96
Manufacturing	Other new construction	41	$374.53	$0.00	$374.53	3,869	$206.68	$1.62
Manufacturing	Fabricated structural metal manufacturing	233	$335.65	$17.38	$318.27	1,183	$132.54	$2.13
Manufacturing	Tire manufacturing	179	$325.28	$0.07	$325.21	1,148	$104.18	$10.68
Manufacturing	Ship building and repairing	357	$320.54	$1.86	$318.69	1,673	$129.83	$1.45
Manufacturing	New residential additions and alterations-all	35	$213.35	$0.00	$213.35	1,151	$82.45	$1.16
Manufacturing	Forest nurseries- forest products- and timber	15	$209.23	$3.23	$206.01	260	$62.29	$9.46
Manufacturing	Metal valve manufacturing	248	$199.73	$21.63	$178.10	698	$91.21	$1.18
Manufacturing	Plastics plumbing fixtures and all other plastics	177	$194.82	$141.13	$53.68	1,068	$66.44	$1.14
Manufacturing	**All other manufacturing**		**$4,280.97**	**$1,186.11**	**$3,094.87**	**22,438**	**$1,451.56**	**$26.15**
Manufacturing	**Total manufacturing**		**$62,475.81**	**$19,826.73**	**$42,649.08**	**80,609**	**$9,096.38**	**$255.38**
Based on year 2006 data from the Minnesota IMPLAN Group, Inc.								

Economic Data for Municipal Water User Groups ($millions)								
Water Use Category	**IMPLAN Sector**	**IMPLAN Code**	**Total Sales**	**Intermediate Sales**	**Final Sales**	**Jobs**	**Income**	**Business Taxes**
Manufacturing	Owner-occupied dwellings	509	$2,769.76	$0.00	$2,769.76	0	$2,145.64	$327.51
Manufacturing	Wholesale trade	390	$1,979.48	$947.70	$1,031.78	12,668	$1,042.46	$292.48
Manufacturing	State & Local Education	503	$1,884.71	$0.00	$1,884.70	46,257	$1,884.71	$0.00
Manufacturing	Hospitals	467	$1,727.97	$0.00	$1,727.96	15,876	$892.06	$11.37
Manufacturing	Offices of physicians- dentists- and other he	465	$1,682.35	$0.00	$1,682.35	12,751	$1,205.26	$10.56
Manufacturing	Food services and drinking places	481	$1,324.54	$169.14	$1,155.40	27,969	$537.72	$62.79
Manufacturing	Monetary authorities and depository credit in	430	$1,099.85	$362.24	$737.61	5,913	$772.33	$14.07
Manufacturing	Architectural and engineering services	439	$1,009.63	$636.44	$373.19	8,507	$531.11	$4.42
Manufacturing	State & Local Non-Education	504	$958.83	$0.00	$958.83	17,038	$958.83	$0.00
Manufacturing	Telecommunications	422	$942.90	$323.87	$619.03	2,611	$390.63	$65.05
Manufacturing	Motor vehicle and parts dealers	401	$866.67	$94.24	$772.43	7,972	$447.32	$126.86
Manufacturing	Legal services	437	$771.37	$489.56	$281.81	5,986	$486.47	$15.24
Manufacturing	Real estate	431	$737.30	$291.86	$445.44	4,444	$426.85	$90.59
Manufacturing	General merchandise stores	410	$729.87	$76.93	$652.94	12,607	$335.61	$106.88
Manufacturing	Lessors of nonfinancial intangible assets	436	$688.93	$375.69	$313.23	39	$323.18	$31.68
Manufacturing	Truck transportation	394	$676.79	$366.46	$310.33	5,415	$299.17	$6.80
Manufacturing	Pipeline transportation	396	$582.34	$254.68	$327.66	925	$168.62	$35.48
Manufacturing	Other State and local government enterprises	499	$490.03	$159.57	$330.46	2,341	$179.70	$0.06
Manufacturing	Food and beverage stores	405	$478.57	$63.98	$414.58	8,897	$240.01	$52.64
Manufacturing	Nursing and residential care facilities	468	$448.72	$0.00	$448.72	10,615	$265.53	$6.25
Manufacturing	Building material and garden supply stores	404	$435.38	$67.52	$367.86	5,102	$205.30	$62.45
Manufacturing	Home health care services	464	$390.02	$0.00	$390.02	11,031	$236.27	$1.39
Manufacturing	Management of companies and enterprises	451	$388.18	$365.05	$23.13	1,671	$243.23	$3.88
Manufacturing	Securities- commodity contracts- investments	426	$373.14	$247.80	$125.34	3,209	$128.28	$3.80
Manufacturing	Automotive repair and maintenance- except car	483	$344.16	$81.75	$262.41	4,607	$127.97	$25.40
Manufacturing	Waste management and remediation services	460	$320.28	$180.02	$140.26	1,915	$152.72	$12.34
Manufacturing	All other municipal		$9,460.62	$3,498.97	$5,961.65	137,524	$4,991.87	$353.80
Manufacturing	**Total**		**$33,562.37**	**$9,053.48**	**$24,508.89**	**373,890**	**$19,618.82**	**$1,723.75**

Based on year 2006 data from the Minnesota IMPLAN Group, Inc.

Appendix 2: Impacts by Water User Group

Irrigation ($millions)						
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Hardin County						
Reduced income from lost crop production	$0.10	$0.10	$0.10	$0.10	$0.10	$0.10
Reduced business taxes from lost crop production	$0.03	$0.03	$0.03	$0.03	$0.03	$0.03
Reduced jobs from lost crop production	2	2	2	2	2	2
Houston County						
Reduced income from lost crop production	$0.058	$0.068	$0.100	$0.271	$0.349	$0.436
Reduced business taxes from lost crop production	$0.004	$0.004	$0.006	$0.017	$0.022	$0.027
Reduced jobs from lost crop production	0	0	0	0	0	0
San Augustine County						
Reduced income from lost crop production	$0.020	$0.020	$0.020	$0.020	$0.020	$0.020
Reduced business taxes from lost crop production	$0.001	$0.001	$0.001	$0.001	$0.001	$0.001
Reduced jobs from lost crop production	0	0	0	0	0	0
Smith						
Reduced income from lost crop production	$0.001	$0.004	$0.007	$0.010	$0.013	$0.017
Reduced business taxes from lost crop production	$0.000	$0.000	$0.000	$0.001	$0.001	$0.001
Reduced jobs from lost crop production	0	0	0	0	0	0

Livestock ($millions)						
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Angelina County						
Reduced income from lost livestock production	$0.00	$0.00	$0.00	$0.08	$0.23	$0.40
Reduced business taxes from lost livestock production	$0.00	$0.00	$0.00	$0.00	$0.01	$0.02
Reduced jobs from lost crop livestock production	0	0	0	1	3	5
Henderson County						
Reduced income from lost livestock production	$0.00	$0.13	$0.98	$1.75	$2.53	$3.27
Reduced business taxes from lost livestock production	$0.00	$0.01	$0.05	$0.09	$0.13	$0.17
Reduced jobs from lost crop livestock production	0	2	12	22	31	40
Houston County						
Reduced income from lost livestock production	$0.33	$0.95	$1.82	$2.76	$3.77	$4.87
Reduced business taxes from lost livestock production	$0.02	$0.05	$0.09	$0.14	$0.19	$0.25
Reduced jobs from lost crop livestock production	4	12	22	34	46	60
Nacogdoches County						
Reduced income from lost livestock production	$0.00	$0.00	$3.45	$7.97	$26.40	$38.40
Reduced business taxes from lost livestock production	$0.00	$0.00	$0.16	$0.36	$1.20	$1.74
Reduced jobs from lost crop livestock production	0	0	32	74	246	358
Sabine County						
Reduced income from lost livestock production	$0.53	$1.14	$1.84	$2.65	$7.18	$9.24
Reduced business taxes from lost livestock production	$0.02	$0.05	$0.08	$0.12	$0.33	$0.42
Reduced jobs from lost crop livestock production	5	11	17	25	67	86
San Augustine County						
Reduced income from lost livestock production	$1.30	$2.41	$3.71	$10.40	$13.88	$17.70
Reduced business taxes from lost livestock production	$0.06	$0.11	$0.17	$0.47	$0.63	$0.80
Reduced jobs from lost crop livestock production	12	22	35	97	129	165
Shelby County						
Reduced income from lost livestock production	$11.07	$48.66	$80.98	$240.70	$336.76	$453.86
Reduced business taxes from lost livestock production	$0.50	$2.21	$3.68	$10.93	$15.30	$20.62
Reduced jobs from lost crop livestock production	103	453	754	2,243	3,137	4,228

Manufacturing ($millions)						
	2010	2020	2030	2040	2050	2060
Angelina County						
Reduced income from lost manufacturing	$37.70	$254.28	$314.02	$749.13	$858.12	$975.28
Reduced business taxes from lost manufacturing	$1.18	$7.93	$9.79	$23.36	$26.75	$30.41
Reduced jobs from lost crop livestock manufacturing	45	305	376	898	1,028	1,169
Hardin County						
Reduced income from lost manufacturing	$0.38	$0.65	$1.78	$2.29	$2.74	$3.22
Reduced business taxes from lost manufacturing	$0.02	$0.03	$0.08	$0.10	$0.12	$0.14
Reduced jobs from lost crop livestock manufacturing	4	6	17	22	26	31
Houston County						
Reduced income from lost manufacturing	$0.10	$0.16	$0.23	$0.29	$0.39	$0.49
Reduced business taxes from lost manufacturing	$0.00	$0.01	$0.01	$0.01	$0.02	$0.02
Reduced jobs from lost crop livestock manufacturing	1	2	2	3	4	5
Newton County						
Reduced income from lost manufacturing	$1.16	$2.06	$5.76	$7.43	$8.94	$10.39
Reduced business taxes from lost manufacturing	$0.01	$0.02	$0.06	$0.08	$0.09	$0.11
Reduced jobs from lost crop livestock manufacturing	7	13	36	47	56	65
Orange County						
Reduced income from lost manufacturing	$0.00	$33.43	$72.49	$111.43	$146.00	$184.89
Reduced business taxes from lost manufacturing	$0.00	$0.92	$1.99	$3.06	$4.01	$5.07
Reduced jobs from lost crop livestock manufacturing	0	294	637	979	1,282	1,624
Panola County						
Reduced income from lost manufacturing	$1.10	$1.33	$1.51	$1.68	$1.84	$2.14
Reduced business taxes from lost manufacturing	$0.07	$0.09	$0.10	$0.11	$0.12	$0.14
Reduced jobs from lost crop livestock manufacturing	22	27	30	34	37	43
Polk County						
Reduced income from lost manufacturing	$0.00	$0.61	$1.56	$5.11	$6.93	$8.53
Reduced business taxes from lost manufacturing	$0.00	$0.02	$0.06	$0.19	$0.26	$0.32
Reduced jobs from lost crop livestock manufacturing	0	6	14	47	64	79
San Augustine County						
Reduced income from lost manufacturing	$0.00	$0.00	$0.00	$0.00	$0.01	$0.04
Reduced business taxes from lost manufacturing	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Reduced jobs from lost crop livestock manufacturing	0	0	0	0	0	0

Manufacturing cont. ($millions)						
	2010	2020	2030	2040	2050	2060
Shelby County						
Reduced income from lost manufacturing	$0.00	$0.00	$0.00	$0.00	$0.19	$0.46
Reduced business taxes from lost manufacturing	$0.00	$0.00	$0.00	$0.00	$0.01	$0.02
Reduced jobs from lost crop livestock manufacturing	0	0	0	0	2	4
Smith County						
Reduced income from lost manufacturing	$0.00	$0.00	$0.06	$0.96	$1.73	$2.80
Reduced business taxes from lost manufacturing	$0.00	$0.00	$0.00	$0.04	$0.06	$0.10
Reduced jobs from lost crop livestock manufacturing	0	0	1	9	16	26

Mining ($millions)	2010	2020	2030	2040	2050	2060
Anderson County						
Reduced income from lost mining output	$0.34	$0.41	$0.84	$1.31	$1.78	$2.23
Reduced business taxes from lost mining output	$0.03	$0.04	$0.08	$0.13	$0.18	$0.22
Reduced jobs from lost mining output	2	3	6	10	13	16
Angelina County						
Reduced income from lost mining output	$149.06	$298.79	$0.00	$0.56	$1.12	$1.65
Reduced business taxes from lost mining output	$3.73	$29.88	$0.00	$0.06	$0.11	$0.16
Reduced jobs from lost mining output	1,102	2,210	0	4	8	12
Cherokee County						
Reduced income from lost mining output	$36.70	$111.91	$0.00	$0.00	$0.00	$0.15
Reduced business taxes from lost mining output	$3.67	$11.19	$0.00	$0.00	$0.00	$0.01
Reduced jobs from lost mining output	271	828	0	0	0	1
Hardin County						
Reduced income from lost mining output	$582.15	$645.67	$688.44	$731.06	$773.98	$806.71
Reduced business taxes from lost mining output	$58.22	$64.57	$68.84	$73.11	$77.40	$80.67
Reduced jobs from lost mining output	4,305	4,775	5,091	5,407	5,724	5,966
Jefferson County						
Reduced income from lost mining output	$0.00	$0.00	$0.00	$0.00	$0.09	$0.17
Reduced business taxes from lost mining output	$0.00	$0.00	$0.00	$0.00	$0.01	$0.02
Reduced jobs from lost mining output	0	0	0	0	1	1
Nacogdoches County						
Reduced income from lost mining output	$186.88	$523.80	$0.00	$0.00	$0.00	$0.00
Reduced business taxes from lost mining output	$18.69	$52.38	$0.00	$0.00	$0.00	$0.00
Reduced jobs from lost mining output	1,382	3,874	0	0	0	0
Rusk County						
Reduced income from lost mining output	$0.00	$0.00	$0.00	$0.56	$1.12	$1.65
Reduced business taxes from lost mining output	$0.00	$0.00	$0.00	$0.06	$0.11	$0.16
Reduced jobs from lost mining output	0	0	0	4	8	12
Shelby County						
Reduced income from lost mining output	$112.36	$524.33	$0.00	$0.00	$0.00	$0.00
Reduced business taxes from lost mining output	$11.24	$52.43	$0.00	$0.00	$0.00	$0.00
Reduced jobs from lost mining output	831	3,878	0	0	0	0

Mining cont. ($millions)						
	2010	**2020**	**2030**	**2040**	**2050**	**2060**
Smith County						
Reduced income from lost manufacturing	$0.88	$9.44	$11.91	$16.10	$19.10	$21.57
Reduced business taxes from lost manufacturing	$0.09	$0.94	$1.19	$1.61	$1.91	$2.16
Reduced jobs from lost crop livestock manufacturing	7	70	88	119	141	160

Steam-electric ($millions)						
	2010	2020	2030	2040	2050	2060
Anderson County						
Reduced income from lost electrical generation	$0.00	$179.52	$209.88	$246.90	$292.01	$347.00
Reduced business taxes from lost electrical generation	$0.00	$25.77	$30.13	$35.44	$41.91	$49.81
Reduced jobs from lost electrical generation	0	610	713	839	993	1,180
Angelina County						
Reduced income from lost electrical generation	$63.51	$31.76	$63.51	$63.51	$63.51	$63.51
Reduced business taxes from lost electrical generation	$9.12	$4.56	$9.12	$9.12	$9.12	$9.12
Reduced jobs from lost electrical generation	216	108	216	216	216	216
Jefferson County						
Reduced income from lost electrical generation	$0.00	$426.37	$498.46	$1,172.73	$1,387.03	$1,648.27
Reduced business taxes from lost electrical generation	$0.00	$61.20	$71.55	$168.33	$199.09	$236.58
Reduced jobs from lost electrical generation	0	1,449	1,694	3,987	4,715	5,603
Nacogdoches County						
Reduced income from lost electrical generation	$41.09	$3.02	$21.56	$44.19	$713.97	$848.43
Reduced business taxes from lost electrical generation	$5.90	$0.43	$3.10	$6.34	$102.48	$121.78
Reduced jobs from lost electrical generation	140	10	73	150	2,427	2,884
Newton County						
Reduced income from lost electrical generation	$0.00	$0.00	$60.14	$134.94	$226.10	$337.25
Reduced business taxes from lost electrical generation	$0.00	$0.00	$8.63	$19.37	$32.45	$48.41
Reduced jobs from lost electrical generation	0	0	204	459	769	1,146

Municipal ($millions)						
	2010	2020	2030	2040	2050	2060
Athens						
Monetary value of domestic water shortages	$0.00	$1.25	$1.68	$1.34	$1.76	$2.32
Lost income from reduced commercial business activity	$0.00	$0.00	$0.00	$0.09	$0.13	$0.18
Lost jobs due to reduced commercial business activity	0	0	0	3	5	7
Lost state and local taxes from reduced commercial business activity	$0.00	$0.00	$0.00	$0.01	$0.02	$0.03
Lost utility revenues	$0.00	$0.09	$0.12	$0.15	$0.21	$0.27
Brownsboro						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.00	$0.00	$0.06
Lost utility revenues	$0.00	$0.00	$0.00	$0.00	$0.00	$0.01
Bullard						
Monetary value of domestic water shortages	$0.00	$0.01	$0.05	$0.11	$0.25	$0.40
Lost utility revenues	$0.00	$0.02	$0.07	$0.13	$0.22	$0.34
Community Water Company						
Monetary value of domestic water shortages	$0.08	$0.97	$1.22	$1.84	$2.74	$4.27
Lost utility revenues	$0.07	$0.15	$0.20	$0.23	$0.30	$0.40
County-other (Anderson)						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.00	$0.00	$0.07
County-other (Angelina)						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.00	$0.00	$0.11
County-other (Hardin)						
Monetary value of domestic water shortages	$0.16	$0.30	$0.33	$0.35	$0.41	$0.55
County-other (Henderson)						
Monetary value of domestic water shortages	$0.11	$0.26	$0.44	$0.59	$0.93	$1.62
County-other (Jasper)						
Monetary value of domestic water shortages	$0.10	$0.19	$0.23	$0.15	$0.13	$0.13
County-other (Orange)						
Monetary value of domestic water shortages	$0.12	$0.08	$0.04	$0.01	$0.00	$0.00

Municipal (cont.)						
	2010	2020	2030	2040	2050	2060
County-other (Polk)						
Monetary value of domestic water shortages	$0.27	$0.68	$5.21	$3.93	$4.73	$5.83
County-other (Sabine)						
Monetary value of domestic water shortages	$1.26	$1.34	$1.39	$1.44	$1.49	$1.74
County-other (San Augustine)						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.00	$0.00	$0.01
County-other (Shelby)						
Monetary value of domestic water shortages	$0.31	$0.40	$0.53	$0.55	$0.61	$0.69
County-other (Trinity)						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.01	$0.03	$0.07
County-other (Tyler)						
Monetary value of domestic water shortages	$0.00	$0.15	$0.27	$0.29	$0.27	$0.27
D&M WSC						
Monetary value of domestic water shortages	$0.00	$0.02	$0.07	$0.14	$0.29	$1.89
Lost utility revenues	$0.00	$0.00	$0.04	$0.12	$0.32	$0.55
Diboll						
Monetary value of domestic water shortages	$0.03	$0.24	$0.61	$3.57	$5.99	$10.75
Lost income from reduced commercial business activity	$0.00	$0.00	$0.00	$0.00	$2.28	$4.21
Lost jobs due to reduced commercial business activity	0	0	0	0	72	133
Lost state and local taxes from reduced commercial business activity	$0.00	$0.00	$0.00	$0.00	$0.33	$0.60
Lost utility revenues	$0.06	$0.33	$0.66	$1.09	$1.70	$2.54
Four Way WSC						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.00	$0.00	$0.31
Lost utility revenues	$0.00	$0.00	$0.00	$0.00	$0.00	$0.40
Frankston						
Monetary value of domestic water shortages	$0.00	$0.00	$0.01	$0.03	$0.05	$0.07
Lost utility revenues	$0.00	$0.00	$0.01	$0.04	$0.07	$0.10

Municipal (cont.)						
	2010	2020	2030	2040	2050	2060
Hudson						
Monetary value of domestic water shortages	$0.00	$0.00	$0.14	$0.58	$5.00	$9.31
Lost income from reduced commercial business activity	$0.00	$0.00	$0.00	$0.00	$0.00	$3.35
Lost jobs due to reduced commercial business activity	0	0	0	0	0	106
Lost state and local taxes from reduced commercial business activity	$0.00	$0.00	$0.00	$0.00	$0.00	$0.48
Lost utility revenues	$0.00	$0.00	$0.22	$0.63	$1.25	$2.07
Hudson WSC						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.11	$0.60	$4.67
Lost utility revenues	$0.00	$0.00	$0.00	$0.18	$0.65	$1.29
Jackson WSC						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.00	$0.03	$0.09
Lost utility revenues	$0.00	$0.00	$0.07	$0.15	$0.21	$0.28
Lilly Grove SUD						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.00	$0.24	$0.64
Lost utility revenues	$0.00	$0.00	$0.00	$0.00	$0.39	$0.82
Lindale Rural WSC						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.00	$0.00	$0.09
Lost utility revenues	$0.00	$0.00	$0.00	$0.00	$0.00	$0.13
Lufkin						
Monetary value of domestic water shortages	$16.57	$59.57	$71.97	$86.30	$165.27	$112.62
Lost income from reduced commercial business activity	$0.00	$33.91	$42.30	$51.80	$126.81	$154.49
Lost jobs due to reduced commercial business activity	0	754	941	1,152	2,821	3,437
Lost state and local taxes from reduced commercial business activity	$0.00	$3.61	$4.50	$5.51	$13.49	$16.44
Lost utility revenues	$5.99	$9.45	$11.18	$13.14	$15.54	$18.40
Mauriceville SUD						
Monetary value of domestic water shortages	$0.00	$0.03	$0.08	$0.10	$0.18	$0.26
Lost utility revenues	$0.00	$0.07	$0.14	$0.17	$0.28	$0.36

Municipal (cont.)						
	2010	2020	2030	2040	2050	2060
New Summerfield WSC						
Monetary value of domestic water shortages	$0.00	$0.07	$0.18	$1.12	$1.63	$2.34
Lost utility revenues	$0.00	$0.00	$0.07	$0.13	$0.21	$0.29
Rusk WSC						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.04	$0.12	$0.24
Lost utility revenues	$0.00	$0.00	$0.00	$0.07	$0.20	$0.37
Swift WSC						
Monetary value of domestic water shortages	$0.00	$0.00	$0.00	$0.06	$0.24	$0.49
Lost utility revenues	$0.00	$0.00	$0.00	$0.11	$0.42	$0.75
Whitehorse						
Monetary value of domestic water shortages	$0.02	$0.05	$0.07	$0.11	$0.16	$0.26
Lost utility revenues	$0.05	$0.10	$0.14	$0.18	$0.27	$0.39

Appendix 4B-A

Screening Criteria for Strategies

The screening criteria used to assess the feasibility of potential strategies in the ETRWPA is provided as follows. These criteria were adopted as guidelines, and strategies could be retained or dismissed at the discretion of the ETRWPG.

4B-A.1 General

- Feasible strategy must have an identified sponsor or authority.
- Feasible strategy must consider the end use. This includes water quality, distance to end use, etc. For example, long transmission systems with pumping are not likely to be economically feasible for irrigation use.
- Strategy should provide a reasonable percentage of the projected need (except conservation, which will be evaluated for all needs).
- Strategy must meet existing federal and state regulations.
- Strategies must be based on proven technology.
- Strategy must be able to be implemented.
- Strategy must be appropriate for regional water planning.

4B-A.2 Evaluation by Water Strategy Type

In accordance with 31 TAC Chapter 357.7, the ETRWPG must evaluate all WMSs the regional water planning group determines to be potentially feasible. The types of WMSs to be evaluated are described below.

4B-A.2.1 Water Conservation. The guidelines for water planning require that water conservation be considered as a strategy for every identified need. If water conservation is not adopted, the reason must be documented. Water conservation in the ETRWPA is driven more by economics than lack of readily available supply and therefore not every user will have the need to implement conservation. Additional screening criteria for conservation strategies was adopted to comply with this general policy. The criteria are outlined below.

- Municipal conservation strategies will be evaluated for municipal WUGs that have a need identified during the planning period and a current per capita water use greater than 140 gpcd. This is the TWDB recommended goal for municipal users based on the Conservation Task Force recommendations. Municipal conservation will not be evaluated for WUGs with less than 140 gpcd.

- Industrial, commercial and institutional (ICI) conservation strategies will be considered for cities with ICI use that exceeds 20 percent of the city's total water use.

- Industrial conservation will be evaluated for counties with manufacturing demands greater than 1,000 ac-ft per year and/or have identifiable industries with water use greater than 500 ac-ft per year.

- Steam-electric power water demands consider a high level of conservation in the development of the projections. No additional conservation measures will be considered for steam-electric power.

- Irrigation conservation measures will be considered by crop type and water source.
- Conservation will not be considered for livestock water demands.
- Conservation will not be considered for mining demands.

4B-A.2.2 Drought Management Measures. Drought management WMSs are implemented in response to drought conditions. These strategies provide a safety factor for water users during drought. Drought management measures will not be adopted as strategies to meet long-range needs.

4B-A.2.3 Wastewater Reuse. Reuse projects will be considered on a case-by-case basis. Both direct and indirect reuse will be considered, as appropriate.

4B-A.2.4 Expanded Use of Existing Supplies. Use of existing supplies should be optimized, where possible, to meet new demands. Following is a discussion of how various types of existing supplies might be expanded.

Connection of Existing Supplies. The connection of existing supplies will be considered on a case-by-case basis. In general, supplies should be owned by the water group with a need for additional supply or available to that group for purchase or permitting.

System Operation. New or additional system operations may be considered if they are feasible and the owner wishes to adopt such strategies. Existing operating policies will be considered during evaluation of available supplies.

Conjunctive Use of Groundwater and Surface Water. The conjunctive use of groundwater and surface water supplies may be considered when groundwater supplies are available. Applicable groundwater conservation district rules will be considered for such conjunctive systems.

Reallocation of Reservoir Storage. Reallocation of reservoir storage will be considered if the owner is amenable to reallocation and, where reallocation in federal reservoirs is being considered (such as from flood to conservation storage), an appropriate and willing local sponsor can be found to sponsor a federal study.

Voluntary Redistribution of Water Resources. Voluntary redistribution with the involved parties will be considered and the ETRWPG will come to a consensus on an approach. If the involved parties are not interested, this option will not be pursued.

Voluntary Subordination of Existing Water Rights. Voluntary subordination of existing water rights will be considered if the involved parties are amenable to the strategy. Alternatively, the ETRWPG may recommend that the water right holder consider selling water under their water right to the willing buyer.

Yield Enhancement. ETRWPG will consider yield enhancement projects, as appropriate, for the water source and identified need.

Water Quality Improvement. Water quality improvement projects will be considered for municipal supplies that bring the existing water supply into compliance with state and federal regulations. General water quality projects may be considered if they improve the usability of the water source to help meet demands.

4B-A.2.5 New Supply Development. The development of new water supplies may be necessary to meet new water demands. A discussion of the development of new water supplies follows.

Surface Water Resources. New surface water resources that can be permitted will be considered, provided a reasonable amount of supply to meet the identified need is located within a reasonable distance of the end users, and recommended new sources would be expected to provide water supplies at a reasonable cost.

Groundwater Resources. The ETRWPG will consider groundwater supplies in areas where additional groundwater is available.

Brush Control. Brush control is not considered a cost effective water supply strategy in the ETRWPA due to the large amount of rainfall and lack of invasive brush species, and will not be considered as a WMS.

Precipitation Enhancement. The ETRWPA has an abundance of precipitation. Precipitation enhancement will not be considered as a WMS.

Desalination. The ETRWPG will consider desalination on a case-by-case basis.

Water Right Cancellation. The ETRWPG will generally not pursue water right cancellation as a means of obtaining additional water supplies. Instead, the ETRWPG will recommend that the water right holder consider selling water under their water right to the willing buyer.

Aquifer Storage and Recovery. Aquifer storage and recovery (ASR) will be considered where the structure of the aquifer is such that this method is applicable. An ASR study must have already been performed to consider an area feasible for an ASR project.

4B-A.2.6 Interbasin Transfers. The ETRWPG will recommend interbasin transfers when necessary to transport water from the source to its destination. Interbasin transfers will be evaluated in accordance with current regulations**.** The process for selection of the WMSs is described as follows:

1. Define groupings or common areas with supply deficiencies
2. Develop comprehensive list of potentially feasible strategies, per screening process
3. Contact potential suppliers/WUGs to determine current strategies under consideration
4. Prepare qualitative rating based on cost, reliability, environmental impact, impacts on other water resources, impacts on agricultural and natural resources, and political acceptability for the various strategies.

5. Select one or more strategies as appropriate for each need or group.

6. Contact each WUG with a need and confirm the selected strategies are acceptable.

7. Present proposed WMSs to the ETRWPG in a public meeting for discussion, modification, and approval.

Appendix 4C-A

Cost Estimates

As part of the 2006 East Texas Region Water Plan, cost estimates were developed for each of the recommended water management strategies in the East Texas Region. As appropriate, these cost estimates have been updated for the 2011 regional water plan. In accordance with the Texas Water Development Board guidance the costs for water management strategies are to be updated from second quarter 2002 dollars to September 2008 dollars. The methodology used to develop the 2011 costs is described in the following sections. Where updated unit costs were not available, the Engineering News Record (ENR) Index for construction was used to increase the costs from second quarter 2002 (March) costs to September 2008 costs. An increase of 134% from March 2002 to September 2008 was determined using the ENR Index method. For strategies that do not rely heavily on construction, such as conservation, costs were updated based on an annual inflation rate of 3 percent.

4C-A.1 Introduction

1. The evaluation of water management strategies requires developing cost estimates. Guidance for cost estimates may be found in the TWDB's "General Guidelines for Regional Water Plan Development (2007-2012)", Section 4.1.2. Costs are to be reported in September 2008 dollars.
2. Standard unit costs for installed pipe, pump stations and standard treatment facilities were developed from actual bid data from similar projects throughout the State of Texas. These estimates were used for all SB1 projects, unless more detailed costing is available. All unit costs include the contractors' mobilization, overhead and profit. The unit costs **do not** include engineering, contingency, financial and legal services, costs for land and rights-of-way, permits, environmental and archeological studies, or mitigation. The costs for these items are determined separately in the cost tables.

3. The information presented in this section is intended to be 'rule-of-thumb' guidance. Specific situations may call for alteration of the procedures and costs. Note that the costs in this memorandum provide a planning level estimate for comparison purposes.
4. It is important that when comparing alternatives that the cost estimates be similar and include similar items. If an existing reliable cost estimate is available for a project it should be used where appropriate. All cost estimates must meet the requirements set forth in the TWDB's "General Guidelines for Regional Water Plan Development (2007-2012)".
5. The cost estimates have two components:
    - Initial capital costs, including engineering and construction costs, and
    - Average annual costs, including annual operation and maintenance costs and debt service.

TWDB does not require the consultant to determine life cycle or present value analysis. For most situations annual costs are sufficient for comparison purposes and a life-cycle analysis is not required.

4C-A.2 Assumptions For Capital Costs

4C-A.2.1 Conveyance Systems. Standard pipeline costs used for these cost estimates are shown in Table 4C-A.1. Pump station costs are based on required Horsepower capacity and are listed in Table 4C-A.2. The power capacity is to be determined from the hydraulic analyses conducted from a planning level hydraulic grade line evaluation (or detailed analysis if available). Pipelines and pump stations are to be sized for peak pumping capacity.

- Pump efficiency is assumed to be 75 percent.
- Peaking factor of 2 times the average demand is to be used for strategies when the water is pumped directly to a water treatment plant. (or historical peaking factor, if available)

Table 4C-A.1

Pipeline Costs (does not include ROW)

Diameter (Inches)	Base Installed Cost ($/Foot)	Rural Cost with Appurtenances ($/Foot)	Urban Cost with Appurtenances ($/Foot)	Assumed ROW Width (Feet)	Assumed Temporary Easement Width (Feet)
6	24	26	39	15	50
8	31	34	52	15	50
10	39	43	65	20	60
12	47	52	77	20	60
14	55	60	90	20	60
16	62	69	103	20	60
18	70	77	116	20	60
20	82	90	135	20	60
24	105	116	174	20	60
30	132	145	215	20	60
36	167	184	276	20	60
42	196	215	323	30	70
48	244	269	374	30	70
54	288	317	435	30	70
60	332	366	495	30	70
66	401	441	591	30	70
72	469	516	697	30	70
78	538	591	799	40	80
84	616	677	914	40	80
90	704	774	1,045	40	80
96	782	860	1,161	40	80
102	870	957	1,290	40	80
108	977	1,075	1,451	40	80
114	1,075	1,183	1,596	50	100
120	1,212	1,333	1,801	50	100
132	1,466	1,613	2,177	50	100
144	1,730	1,903	2,569	50	100

Notes:
- a Costs are based on PVC class 150 pipe for the smaller long, rural pipelines.
- b Appurtenances assumed to be 10% of installed pipe costs.
- c For urban pipelines, costs were increased by 35% for cost with appurtenances. For pipes 42"and smaller, additional costs were added.
- d Adjust costs for obstacles (rock, forested areas) and easy conditions (soft soil in flat country).

Table 4C-A.2
Pump Station Costs for Transmission Systems

Horsepower	Booster PS Costs	Lake PS with Intake Costs
5	$516,000	
10	$538,000	
20	$564,000	
25	$591,000	
50	$645,000	
100	$742,000	
200	$1,118,000	$1,484,000
300	$1,441,000	$1,914,000
400	$1,795,000	$2,387,000
500	$2,032,000	$2,698,000
600	$2,150,000	$2,860,000
700	$2,268,000	$3,021,000
800	$2,516,000	$3,343,000
900	$2,634,000	$3,505,000
1,000	$2,870,000	$3,817,000
2,000	$4,182,000	$5,562,000
3,000	$5,020,000	$6,677,000
4,000	$6,095,000	$8,107,000
5,000	$6,988,000	$9,293,000
6,000	$8,063,000	$10,723,000
7,000	$8,923,000	$11,867,000
8,000	$9,890,000	$13,154,000
9,000	$10,965,000	$14,583,000
10,000	$12,255,000	$16,299,000
20,000	$20,425,000	$27,165,000
30,000	$26,875,000	$35,744,000
40,000	$33,325,000	$44,322,000
50,000	$38,700,000	$51,471,000
60,000	$44,075,000	$58,620,000
70,000	$49,450,000	$65,769,000

Note:
1. Lake PS with intake costs include intake and pump station.
2. Adjust pump station costs upward if the pump station is designed to move large quantities of water at a low head (i.e. low horsepower).
3. Assumed multiple pump setup for all pump stations.

- Peaking factor of 1.2 to 1.5 is to be used if there are additional water sources and/or the water is transported to a terminal storage facility.

- Ground storage is to be provided at each booster pump station along the transmission line unless there is a more detailed design.

- Ground storage tanks should provide sufficient storage for 2.5 to 4 hours of pumping at peak capacity. Costs for ground storage are shown in Table 4C-A.3. Covered storage tanks are used for all strategies transporting treated water.

4C-A.2.2 Water Treatment Plants. Water treatment plants are to be sized for peak day capacity (assume peaking factor of 2 if no specific data is available). Costs estimated for new conventional surface water treatment facilities and expansions of existing facilities are listed in Table 4C-A.4. Conventional treatment does not include advanced technologies, such as ozone or UV treatment. All treatment plants are to be sized for finished water capacity.

- For reverse osmosis plants for surface water, increase construction costs shown on Table 4C-A.4 by the amount shown on Table 4C-A.5 for the appropriate size plant that will be used for RO. If groundwater is the raw water source, use only the costs in Table 4C-A.5. These costs were based on actual cost estimates of similar facilities.

- The amount of reject water generated by reverse osmosis treatment is dependent upon the incoming quality of the raw water. Final treatment goals should be between 600 and 800 mg/l of TDS. (This provides a safety margin in meeting secondary treatment standards.) For reverse osmosis treatment of brackish water (1,000 – 3,000 mg/l of TDS), assume that 20 percent of the raw water treated with membranes is discharged as reject water, unless project-specific data is available. For brackish water with TDS concentrations between 3,000 and 10,000 mg/l, assume 30% reject water. Desalination of seawater or very high TDS water will have a higher percent of reject water (50 to 60%). Minimal losses are assumed for conventional treatment facilities.

Table 4C-A.3
Ground Storage Tanks

Size (MG)	With Roof	Without Roof
0.05	$125,000	$106,000
0.1	$183,000	$156,000
0.5	$438,000	$333,000
1	$634,000	$469,000
1.5	$796,000	$591,000
2	$957,000	$714,000
2.5	$1,086,000	$821,000
3	$1,215,000	$928,000
3.5	$1,355,000	$1,023,000
4	$1,505,000	$1,118,000
5	$1,720,000	$1,303,000
6	$2,075,000	$1,505,000
7	$2,446,000	$1,740,000
8	$2,822,000	$2,069,000
10	$3,746,000	$2,752,000
12	$4,671,000	$3,419,000
14	$5,595,000	$4,085,000

Note: Costs assume steel tanks smaller than 1 MG, concrete tanks 1 MG and larger.

Table 4C-A.4
Conventional Water Treatment Plant Costs

Plant Capacity (MGD)	New Conventional Plants	Conventional Plant Expansions
1	$5,800,000	$2,900,000
3	$10,600,000	$7,400,000
7	$17,500,000	$12,900,000
10	$22,400,000	$16,000,000
15	$29,100,000	$20,900,000
20	$35,400,000	$26,100,000
30	$47,600,000	$35,700,000
40	$60,000,000	$45,500,000
50	$72,600,000	$54,400,000
60	$84,900,000	$63,500,000
70	$96,600,000	$72,200,000
80	$107,900,000	$81,400,000
90	$118,500,000	$90,500,000
100	$130,200,000	$100,200,000

Note: Plant is sized for finished peak day capacity.

Table 4C-A. 5
Additional Cost for Reverse Osmosis Treatment

Plant Capacity (MGD)	Reverse Osmosis Facilities Cost
0.5	$1,300,000
1	$1,600,000
3	$3,200,000
7	$7,200,000
10	$9,800,000
15	$14,200,000
20	$18,300,000
30	$25,500,000
40	$31,400,000
50	$36,600,000
60	$40,700,000

Note: Plant is sized for finished water capacity.

- Costs for ion exchange facilities are shown on Table 4C-A.6. For these facilities it is assumed that 2 to 3 percent of the raw water would be discharged as reject water.

4C-A.2.3 New Groundwater Wells. Cost estimates required for water management strategies that include additional wells or well fields can be roughly estimated from the relationships in Table 4C-A.7. These cost relationships are "rule-of-thumb" in nature and are only appropriate in the broad context of the cost evaluations for the RWP process.

Table 4C-A. 6
Groundwater Nitrate Treatment

Treatment Capacity (MGD)	Ion Exchange Plant Cost
0.25	$800,000
1.0	$1,700,000
3.0	$3,900,000

Note: Plant is sized for finished water capacity.

Table 4C-A.7
Cost Elements for Water Wells

Well Diameter (inches)	Typical Production Range (gpm)	Estimated Cost a=production rate (gpm), b= well depth (feet)
6	25-150	9500 + 93a + 82b
8	150-300	13600 + 89a + 191b
10	300-500	20400 + 86a + 245b
12	500-800	27300 + 82a + 307b
16	800-2000	30000 + 82a + 436b

For well uses other than municipal, the total well cost estimated from Table 7 should be multiplied by 0.70.

The cost relationships assume construction methods required for public water supply wells, including carbon steel surface casing and pipe-based, stainless steel, and wire-wrap screen. The cost estimates assume that wells would be gravel-packed in the screen sections and the surface casing cemented to their total depth. Estimates include the cost of drilling, completion, well development, well testing, pump, motor, motor controls, column pipe, installation and mobilization. The cost relationships do not include engineering, contingency, financial and legal services, land costs, or permits. A more detailed cost analysis should be completed prior to developing a project.

The generic cost relationships were developed for wells of different well casing diameter. A cost relationship was developed for wells ranging from 6 to 16 inches in diameter and each relationship includes the variables for discharge and well depth. The pump costs assume that the pump is set at 300 feet below ground surface. Pump depth and lift requirements will vary in each situation and may need to be adjusted for individual projects.

Using the cost relationships in Table 4C-A.7, a 700-gpm well with a total depth of 1,000 feet would cost approximately $391,000. For well uses other than municipal, the total well cost estimated from Table 4C-A.1 should be multiplied by 0.70.

The costs associated with conveyance systems for multi-well systems can vary widely based on the distance between wells, terrain characteristics, well production, and distance to the treatment facility. These costs should be estimated using standard engineering approaches and site-specific information.

4C-A.2.4 New Reservoirs. Site-specific cost estimates will be made for reservoir sites. The elements required for reservoir sites are included in Table 4C-A.8. Lake intake structures for new reservoirs will be determined on a case-by-case basis. Generally, costs for construction of such facilities prior to filling of the reservoir will be less than shown on Table 4C-A.2.

4C-A.2.5 Other Costs. Engineering, contingency, construction management, financial and legal costs are to be estimated at 30 percent of construction cost for pipelines and 35 percent of construction costs for pump stations, treatment facilities and reservoir projects. (This is in accordance with TWDB guidance.)

- Permitting and mitigation for transmission and treatment projects are to be estimated at 1 percent of the total construction costs. For reservoirs, mitigation and permitting costs are assumed equal to twice the land purchase cost, unless site specific data is available.
- Right-of-way (ROW) costs for transmission lines are estimated at $2,000 per acre of rural ROW. Urban ROW will be higher. If no data is available, assume $20,000 per acre. If a small pipeline follows existing right-of-ways (such as highways), no additional right-of-way cost may be assumed. Large pipelines will require ROW costs regardless of routing.

Interest during construction is the total of interest accrued at the end of the construction period using a 6 percent annual interest rate on total borrowed funds, less a 4 percent rate of return on investment of unspent funds. This is calculated assuming that the total estimated project cost (excluding interest during construction) would be drawn down at a constant rate per month during the construction period. Factors were determined for different lengths of time for project construction. These factors were used in cost estimating and are presented in Table 4C-A. 9.

Table 4C-A.8
Cost Elements for Reservoir Sites

Capital Costs	Studies and Permitting
Embankment	Environmental and archeological studies
Spillway	Permitting
Outlet works	Terrestrial mitigation tracts
Site work	Engineering and contingencies
Land	Construction management
Administrative facilities	
Supplemental pumping facilities	
Flood protection	

Table 4C-A. 9
Factors for Interest During Construction

Construction Period	Factor
6 months	0.02167
12 months	0.04167
18 months	0.06167
24 months	0.08167
36 month construction	0.12167

4C-A.3 Assumptions for Annual Costs

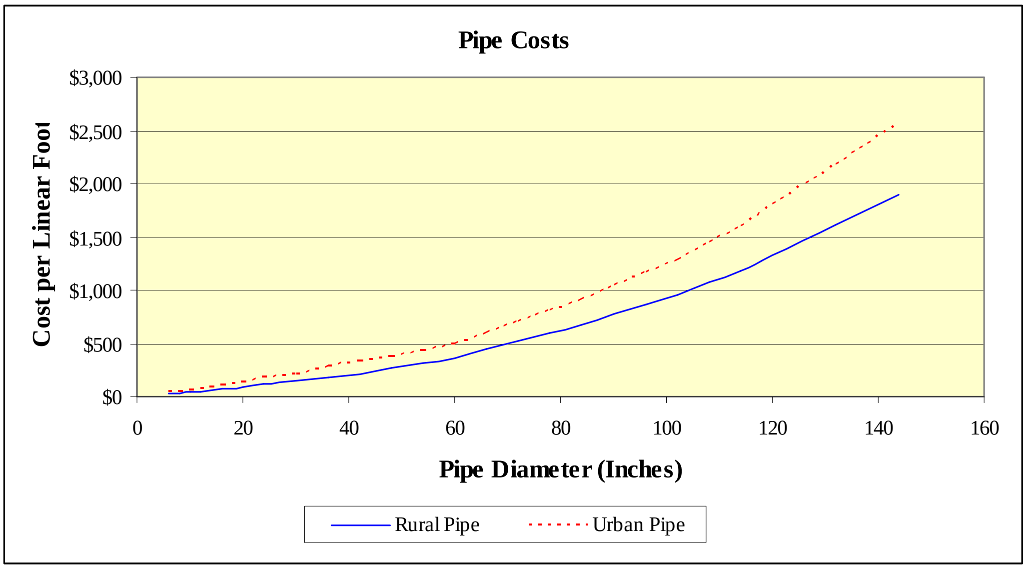
Annual costs are to be estimated using the following assumptions:

- Debt service for all transmission and treatment facilities is to be annualized over 20 years, but not longer than the life of the project. [Note: uniform amortization periods should be used when evaluating similar projects for an entity.]
- Annual interest rate for debt service is 6 percent.
- Water purchase costs are to be based on wholesale rates reported by the selling entity when possible. In lieu of known rates, a typical regional cost for treated water and raw water will be developed. For planning purposes, treated water costs are $3 per 1,000 gallons and raw water is $0.50 per 1,000 gallons. Actual costs are negotiated between the buyer and seller.
- Operation and Maintenance costs are to be calculated based on the construction cost of the capital improvement. Engineering, permitting, etc. should not be included as a basis for this calculation. However, a 20% allowance for construction contingencies should be included for all O&M calculations. Per the "General Guidelines for Regional Water Plan Development (2007-2012)", O&M should be calculated at:
    - 1 percent of the construction costs for pipelines
    - 1.5 percent for dams
    - 2.5 percent of the construction costs for pump stations, storage tanks, meters and SCADA systems
    - Assume O&M costs for treatment facilities are included in the treatment cost
- Surface water treatment costs are estimated at $0.70 per 1,000 gallons for conventional plants and $1.24 per 1,000 gallons of finished water for surface water plants with reverse osmosis. Assume cost for treatment of groundwater by reverse osmosis is $0.75 per 1,000 gallons. If only a portion of the water will be treated with RO, apply costs proportionately. Treatment for nitrates is estimated at $0.40 per 1,000 gallons. Treatment for groundwater (assuming disinfection and labor only) is estimated at $0.30 per 1,000 gallons. These costs include chemicals, labor and electricity for treatment and should be applied to amount of finished water receiving the treatment. Electricity

associated with moving raw water to the treatment facility is calculated separately (this includes electricity associated with groundwater well fields).

- Reject water disposal for treatment of brackish water is to be estimated on a case-by-case basis depending on disposal method. If no method is defined, assume a cost of $0.35 per 1,000 gallons of reject water. [This value represents a moderate cost estimate. If the water were returned to a brackish surface water source, the costs would be negligible. If evaporation beds or deep well injection were used, the costs could be much higher.]
- Pumping costs are to be estimated using an electricity rate of $0.09 per Kilowatt Hour. If local data is available, this can be used.

Figure 1



WUGNAME: **Anderson_County-Other**
STRATEGY: **New Wells in Queen City Aquifer**
AMOUNT (ac-ft/yr): **100**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Water Well Construction		2	ea	$ 29,473	$ 58,947
Connection to Water System		2	ea	$ 50,000	$ 100,000
Subtotal					**$ 158,947**
Engineering and Contingencies (30%)					$ 47,684
Mitigation and Permitting (1%)					$ 1,589
Subtotal					**$ 208,220**
Interest During Construction					$ 4,512
TOTAL CAPITAL COST					***$ 212,732***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Debt Service					$ 18,547
Pipeline O&M (1%)					$ 1,000
Pump O&M (2.5%)					$ 1,474
Chemicals			1000 gal	$ 0.30	$ 9,776
Electricity					$ 1,314
TOTAL ANNUAL COST w/ AMORTIZATION					***$ 32,110***
TOTAL ANNUAL COST AFTER AMORTIZATION					$ 13,563

UNIT COSTS (Until Amortized)	
Cost per acre-ft	$ 321
Cost per 1000 gallons	$ 0.99

UNIT COSTS (After Amortization)	
Cost per acre-ft	$ 136
Cost per 1000 gallons	$ 0.42

WUGNAME: **Anderson_County-Other**
STRATEGY: **New Wells in Carizzo-Wilcox Aquifer**
AMOUNT (ac-ft/yr): **100**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Water Well Construction		1	ea	$ 95,900	$ 95,900
Connection to Water System		1	ea	$ 100,000	$ 100,000
Subtotal					**$ 195,900**
Engineering and Contingencies (30%)					$ 58,770
Mitigation and Permitting (1%)					$ 1,959
Subtotal					**$ 256,629**
Interest During Construction					$ 5,560
TOTAL CAPITAL COST					***$ 262,189***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Debt Service					$ 22,859
Pipeline O&M (1%)					$ 1,000
Pump O&M (2.5%)					$ 2,398
Chemicals			1000 gal	$ 0.30	$ 9,776
Electricity					$ 4,599
TOTAL ANNUAL COST w/ AMORTIZATION					***$ 40,631***
TOTAL ANNUAL COST AFTER AMORTIZATION					$ 17,772

UNIT COSTS (Until Amortized)	
Cost per acre-ft	$ 406
Cost per 1000 gallons	$ 1.25
UNIT COSTS (After Amortization)	
Cost per acre-ft	$ 178
Cost per 1000 gallons	$ 0.55

WUGNAME: **Frankston**
STRATEGY: **New Wells in Carizzo-Wilcox Aquifer**
AMOUNT (ac-ft/yr): **120**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**		**Cost**	
Water Well Construction		1	ea	$	91,239	$	91,239
Connection to Water System		1	ea	$	100,000	$	100,000
Subtotal						**$**	**191,239**
Engineering and Contingencies (30%)						$	57,372
Mitigation and Permitting (1%)						$	1,912
Subtotal						**$**	**250,523**
Interest During Construction						$	5,428
TOTAL CAPITAL COST						***$***	***255,951***
ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**		**Cost**	
Debt Service						$	22,315
Pipeline O&M (1%)						$	1,000
Pump O&M (2.5%)						$	2,281
Chemicals			1000 gal	$	0.30	$	11,731
Electricity						$	5,519
TOTAL ANNUAL COST w/ AMORTIZATION						***$***	***42,846***
TOTAL ANNUAL COST AFTER AMORTIZATION						***$***	***20,531***
UNIT COSTS (Until Amortized)							
Cost per acre-ft						$	357
Cost per 1000 gallons						$	1.10
UNIT COSTS (After Amortization)							
Cost per acre-ft						$	171
Cost per 1000 gallons						$	0.53

WUGNAME: **Anderson_Mining**
STRATEGY: **New Wells in Carizzo-Wilcox Aquifer**
AMOUNT (ac-ft/yr): **120**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Water Well Construction		1	ea	$ 70,900	$ 70,900
Connection to Water System		1	ea	$ 100,000	$ 100,000
Subtotal					**$ 170,900**
Engineering and Contingencies (30%)					$ 51,270
Mitigation and Permitting (1%)					$ 1,709
Subtotal					**$ 223,879**
Interest During Construction					$ 4,851
TOTAL CAPITAL COST					***$ 228,730***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Debt Service					$ 19,942
Pipeline O&M (1%)					$ 1,000
Pump O&M (2.5%)					$ 1,773
Chemicals			1000 gal	NA	$ -
Electricity					$ 5,519
TOTAL ANNUAL COST w/ AMORTIZATION					***$ 28,233***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$ 8,292***

UNIT COSTS (Until Amortized)	
Cost per acre-ft	$ 233
Cost per 1000 gallons	$ 0.72

UNIT COSTS (After Amortization)	
Cost per acre-ft	$ 68
Cost per 1000 gallons	$ 0.21

WUGNAME: **Anderson_Steam Electric Power_1**
STRATEGY: **Lake Palestine**
AMOUNT (ac-ft/yr): **21,853** 19.50 MGD

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Transmission Facilities					
Pipeline	42 in.	58080	ft	$ 215	$ 12,487,200
Right of Way Easements		40	AC	$ 2,000	$ 80,000
Terminal Storage	5.00 MG	1	LS	$ 1,303,000	$ 1,303,000
Contingencies (10%, engineering done)					$ 1,256,720
		11	miles		
Pipeline Subtotal					**$ 15,126,920**
Pump Station					$ 4,345,875
Contingencies (10%, engineering done)					$ 434,587
Pump Station Subtotal					**$ 4,780,462**
Environmental and Permitting		0	ft	$ 0.57	$ 199,074
Additional Engineering (20%)					$ 3,981,476
Interest During Construction					$ 829,481
TOTAL CAPITAL COST					***$ 24,917,413***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Debt Service					$ 2,172,414
Raw Water Cost		7,120,822	1000 gal	$ 0.65	$ 4,628,534
Pipeline O&M (1%)					$ 124,872
Pump O&M (2.5%)					$ 152,087
Chemicals			1000 gal	$ -	$ -
Electricity					$ 422,708
TOTAL ANNUAL COST					***$ 7,500,615***
UNIT COSTS (Until Amortized)					
Cost per acre-ft					$ 343
Cost per 1000 gallons					$ 1.05
UNIT COSTS (After Amortization)					
Cost per acre-ft					$ 244
Cost per 1000 gallons					$ 0.75

WUGNAME: **Angelina_County-Other_Phase1**
STRATEGY: **New Wells in Yegua-Jackson Aquifer**
AMOUNT (ac-ft/yr): **150**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Water Well Construction			1 ea	$ 56,800	$ 56,800
Connection to Water System			1 ea	$ 100,000	$ 100,000
Subtotal					**$ 156,800**
Engineering and Contingencies (30%)					$ 47,040
Mitigation and Permitting (1%)					$ 1,568
Subtotal					**$ 205,408**
Interest During Construction					$ 4,451
TOTAL CAPITAL COST					***$ 209,859***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Debt Service					$ 18,296
Pipeline O&M (1%)					$ 1,000
Pump O&M (2.5%)					$ 1,420
Chemicals			1000 gal	$ 0.30	$ 14,661
Electricity					$ 5,913
TOTAL ANNUAL COST w/ AMORTIZATION					***$ 41,291***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$ 22,994***

UNIT COSTS (Until Amortized)	
Cost per acre-ft	$ 275
Cost per 1000 gallons	$ 0.84

UNIT COSTS (After Amortization)	
Cost per acre-ft	$ 153
Cost per 1000 gallons	$ 0.47

WUGNAME: **Angelina_County-Other_Phase2**
STRATEGY: **New Wells in Yegua-Jackson Aquifer**
AMOUNT (ac-ft/yr): **150**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Water Well Construction			1 ea	$ 56,800	$ 56,800
Connection to Water System			1 ea	$ 100,000	$ 100,000
Subtotal					**$ 156,800**
Engineering and Contingencies (30%)					$ 47,040
Mitigation and Permitting (1%)					$ 1,568
Subtotal					**$ 205,408**
Interest During Construction					$ 4,451
TOTAL CAPITAL COST					***$ 209,859***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Debt Service					$ 18,296
Pipeline O&M (1%)					$ 1,000
Pump O&M (2.5%)					$ 1,420
Chemicals			1000 gal	$ 0.30	$ 14,661
Electricity					$ 5,913
TOTAL ANNUAL COST w/ AMORTIZATION					***$ 41,291***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$ 22,994***

UNIT COSTS (Until Amortized)	
Cost per acre-ft	$ 275
Cost per 1000 gallons	$ 0.84

UNIT COSTS (After Amortization)	
Cost per acre-ft	$ 153
Cost per 1000 gallons	$ 0.47

WUGNAME: **Angelina County-Other**
STRATEGY: **Purchase Water from Lufkin**
AMOUNT (ac-ft/yr): **1,100** 2.0 MGD

Expand Treated Water Supply	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline					
Pipeline to Angelina County customers	12 in.	66,000	LF	$52	$3,432,000
Pipeline to Angelina County customers	8 in.	66,000	LF	$34	$2,244,000
Right of Way Easements Rural (ROW)		45.5	ACRE	$2,000	$91,000
Engineering and Contingencies (30%)					$1,703,000
Subtotal of Pipeline					**$7,470,000**
Pump Station(s)					
Pump Station	470 HP	1	LS	$1,961,000	$1,961,000
Engineering and Contingencies (35%)					$686,000
Subtotal of Pump Station(s)					**$2,647,000**
CONSTRUCTION TOTAL					**$10,117,000**
Permitting and Mitigation					**$65,000**
Interest During Construction			**(12 months)**		**$422,000**
TOTAL COST					**$10,604,000**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$925,000
Electricity ($0.09 kWh)					$48,000
Operation & Maintenance					$100,000
Treated Water Purchase			Kgal	$2.00	$717,000
Total Annual Costs					**$1,790,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$1,627
Per 1,000 Gallons					$4.99
UNIT COSTS (After Amortization)					
Per Acre-Foot					$786
Per 1,000 Gallons					$2.41

WWPNAME:	**Diboll**				
STRATEGY:	**Purchase from Lufkin**				
Quantity:	**800** AF/Y		1.25 MGD		

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline to Lake Nacogdoches	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	14 in.	61,250	LF	$60	$3,675,000
Right of Way Easements Rural (ROW)		28.1	ACRE	$2,000	$56,000
Engineering and Contingencies (30%)					$1,103,000
Subtotal of Pipeline					**$4,834,000**
Pump Station(s)					
Pump with intake & building	50 HP	1	LS	$871,000	$871,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$305,000
Subtotal of Pump Station(s)					**$1,176,000**
CONSTRUCTION TOTAL					**$6,010,000**
Permitting and Mitigation					**$55,000**
Interest During Construction			**(6 months)**		**$130,000**
TOTAL COST					**$6,195,000**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$540,100
Electricity ($0.09 kWh)					$13,600
Operation & Maintenance					$70,200
Treated Water Purchase			Kgal	$2.00	$521,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$1,144,900**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$1,431
Per 1,000 Gallons					$4.39
UNIT COSTS (After Amortization)					
Per Acre-Foot					$756
Per 1,000 Gallons					$2.32

WUGNAME: **Diboll_Phase1**
STRATEGY: **New Wells in Yegua-Jackson Aquifer**
AMOUNT (ac-ft/yr): **600**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**	
Water Well Construction		2	ea	$ 115,400	$	230,800
Connection to Water System		2	ea	$ 100,000	$	200,000
Subtotal					**$**	**430,800**
Engineering and Contingencies (30%)					$	129,240
Mitigation and Permitting (1%)					$	4,308
Subtotal					**$**	**564,348**
Interest During Construction					$	12,228
TOTAL CAPITAL COST					***$***	***576,576***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**	
Debt Service					$	50,268
Pipeline O&M (1%)					$	2,000
Pump O&M (2.5%)					$	5,770
Chemicals			1000 gal	$ 0.30	$	58,653
Electricity					$	23,652
TOTAL ANNUAL COST w/ AMORTIZATION					***$***	***140,344***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$***	***90,075***

UNIT COSTS (Until Amortized)		
Cost per acre-ft	$	234
Cost per 1000 gallons	$	0.72

UNIT COSTS (After Amortization)		
Cost per acre-ft	$	150
Cost per 1000 gallons	$	0.46

WUGNAME: **Four Way WSC**
STRATEGY: **Purchase water from Lufkin**
AMOUNT (ac-ft/yr): **225**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Connection to Water System		1	ea	$ 500,000	$ 500,000
Subtotal					**$ 500,000**
Engineering and Contingencies (30%)					$ 150,000
Mitigation and Permitting (1%)					$ 5,000
Subtotal					**$ 655,000**
Interest During Construction					$ 14,192
TOTAL CAPITAL COST					***$ 669,192***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Debt Service					$ 58,343
Pipeline O&M (1%)					$ 5,000
Purchase cost		73,300	Kgal	$ 2	$ 146,600
Electricity					$ 1,478
TOTAL ANNUAL COST w/ AMORTIZATION					***$ 211,421***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$ 153,078***

UNIT COSTS (Until Amortized)	
Cost per acre-ft	$ 940
Cost per 1000 gallons	$ 2.88

UNIT COSTS (After Amortization)	
Cost per acre-ft	$ 680
Cost per 1000 gallons	$ 2.09

WUGNAME: **Hudson WSC_Phase1**
STRATEGY: **New Wells in Carrizo-Wilcox Aquifer**
AMOUNT (ac-ft/yr): **600**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Water Well Construction		2	ea	$ 264,052	$ 528,103
Connection to Water System		2	ea	$ 100,000	$ 200,000
Subtotal					**$ 728,103**
Engineering and Contingencies (30%)					$ 218,431
Mitigation and Permitting (1%)					$ 7,281
Subtotal					**$ 953,815**
Interest During Construction					$ 20,666
TOTAL CAPITAL COST					***$ 974,482***
ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Debt Service					$ 84,960
Pipeline O&M (1%)					$ 2,000
Pump O&M (2.5%)					$ 13,203
Chemicals			1000 gal	$ 0.30	$ 58,653
Electricity					$ 31,536
TOTAL ANNUAL COST w/ AMORTIZATION					***$ 190,352***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$ 105,392***
UNIT COSTS (Until Amortized)					
Cost per acre-ft					$ 317
Cost per 1000 gallons					$ 0.97
UNIT COSTS (After Amortization)					
Cost per acre-ft					$ 176
Cost per 1000 gallons					$ 0.54

WUGNAME: **Hudson WSC_Phase2**
STRATEGY: **New Wells in Carrizo-Wilcox Aquifer**
AMOUNT (ac-ft/yr): **1400**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Water Well Construction		4	ea	$ 329,568	$ 1,318,274
Connection to Water System		4	ea	$ 100,000	$ 400,000
Subtotal					**$ 1,718,274**
Engineering and Contingencies (30%)					$ 515,482
Mitigation and Permitting (1%)					$ 17,183
Subtotal					**$ 2,250,939**
Interest During Construction					$ 48,771
TOTAL CAPITAL COST					***$ 2,299,710***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Debt Service					$ 200,499
Pipeline O&M (1%)					$ 4,000
Pump O&M (2.5%)					$ 32,957
Chemicals			1000 gal	$ 0.30	$ 136,857
Electricity					$ 73,584
TOTAL ANNUAL COST w/ AMORTIZATION					***$ 447,897***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$ 247,398***

UNIT COSTS (Until Amortized)	
Cost per acre-ft	$ 320
Cost per 1000 gallons	$ 0.98

UNIT COSTS (After Amortization)	
Cost per acre-ft	$ 177
Cost per 1000 gallons	$ 0.54

SBLIV-1
Angelina County Livestock
Increase Supply from Local Sources

Owner:	Angelina County Livestock	
Quantity:	90	AF/Y

Item	Size	Quantity	Unit	Unit Price	Cost
Capital Costs					
Stock Ponds					
Stock Ponds	25 AF/Y	4	Ea.	$34,000	$122,400
Engineering and Contingencies					$42,800
Subtotal for Local Supply					**$165,200**
TOTAL CONSTRUCTION COST					**$165,200**
Interest During Construction			**(6 months)**		**$3,600**
Permitting and Mitigation					**$0**
TOTAL CAPITAL COST					**$168,800**
Annual Costs					
Debt Service (6 percent for 20 years)					$14,700
Total Annual Cost					**$14,700**
UNIT COSTS (Until Amortized)					
Water Cost ($ per ac-ft)					**$163**
Water Cost ($ per 1,000 gallons)					**$0.50**
UNIT COSTS (After Amortization)					
Water Cost ($ per ac-ft)					**$0**
Water Cost ($ per 1,000 gallons)					**$0.00**

WUGNAME: **Angelina Manufacturing**
STRATEGY: **Lake Columbia**
Quantity: **8,551** AF/Y 11.44 MGD

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	30 in.	15,840	LF	$145	$2,297,000
Pipeline Urban	30 in.	0	LF	$215	$0
Right of Way Easements Rural (ROW)		7.3	ACRE	$2,000	$15,000
Right of Way Easements Urban (ROW)		0.0	ACRE	$20,000	$0
Engineering and Contingencies (30%)					$689,000
Subtotal of Pipeline					**$3,001,000**
Pump Station(s)					
Pump with intake & building	400 HP	1	LS	$2,423,000	$2,423,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$848,050
Subtotal of Pump Station(s)					**$3,271,050**
Terminal Storage					
Storage	2 MG	1	LS	$714,000	**$714,000**
Engineering and Contingencies (35%)					$249,900
Subtotal of WTP					**$963,900**
CONSTRUCTION TOTAL					**$7,235,950**
Permitting and Mitigation					**$65,000**
Interest During Construction			**(12 months)**		**$302,000**
TOTAL COST					**$7,602,950**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$663,000
Electricity ($0.09 kWh)					$133,000
Operation & Maintenance					$101,000
Raw Water Purchase			Kgal	$0.66	$1,839,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$2,736,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of water					$320
Per 1,000 Gallons					$0.98
UNIT COSTS (After Amortization)					
Per Acre-Foot					$242
Per 1,000 Gallons					$0.74

WUGNAME:	**Angelina Manufacturing**				
STRATEGY:	**Purchase from Lufkin**				
Raw Water Quantity:	**11,800** AF/Y		15.79 MGD		
Treated Water Quantity:	**7,000** AF/Y		9.37 MGD		

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	36 in.	52,800	LF	$184	$9,715,000
Pipeline Urban	36 in.	0	LF	$276	$0
Right of Way Easements Rural (ROW)		24.2	ACRE	$2,000	$48,000
Right of Way Easements Urban (ROW)		0.0	ACRE	$20,000	$0
Engineering and Contingencies (30%)					$2,915,000
Subtotal of Pipeline					**$12,678,000**
Pump Station(s)					
Pump with building	315 HP	2	LS	$1,494,000	$2,988,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$1,045,800
Subtotal of Pump Station(s)					**$4,033,800**
Terminal Storage					
Storage	2 MG	1	LS	$714,000	**$714,000**
Engineering and Contingencies (35%)					$250,000
Subtotal of Storage					**$964,000**
CONSTRUCTION TOTAL					**$17,675,800**
Permitting and Mitigation					**$161,000**
Interest During Construction			**(12 months)**		**$737,000**
TOTAL COST					**$18,573,800**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$1,619,000
Electricity ($0.09 kWh)					$225,000
Operation & Maintenance					$207,000
Raw Water Purchase			Kgal	$0.50	$1,923,000
Treated Water Purchase			Kgal	$2.00	$4,562,000
Total Annual Costs					**$8,536,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of water					$454
Per 1,000 Gallons					$1.39
UNIT COSTS (After Amortization)					
Per Acre-Foot					$368
Per 1,000 Gallons					$1.13

WUGNAME:	**Angelina Mining**				
STRATEGY:	**Angelina River/ Lake Columbia**				
Quantity:	**4,000** AF/Y		5.35 MGD		

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	20 in.	26,400	LF	$90	$2,376,000
Right of Way Easements Rural (ROW)		12.1	ACRE	$2,000	$24,000
Engineering and Contingencies (30%)					$713,000
Subtotal of Pipeline					**$3,113,000**
Pump Station(s)					
Pump with intake	200 HP	1	LS	$1,509,000	$1,509,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$528,150
Subtotal of Pump Station(s)					**$2,037,150**
Terminal Storage	**1.0 MG**	**1**	**LS**	**$469,000**	**$469,000**
CONSTRUCTION TOTAL					**$5,619,150**
Permitting and Mitigation					**$52,000**
Interest During Construction			**(6 months)**		**$122,000**
TOTAL COST					**$5,793,150**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$505,000
Electricity ($0.09 kWh)					$74,000
Operation & Maintenance					$88,000
Raw Water Purchase			Kgal	$0.66	$860,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$1,527,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$382
Per 1,000 Gallons					$1.17
UNIT COSTS (After Amortization)					
Per Acre-Foot					$256
Per 1,000 Gallons					$0.78

WUGNAME: **Angelina_Steam Electric Power**
STRATEGY: **New Wells in Carizzo-Wilcox**
AMOUNT (ac-ft/yr): **1000**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Water Well Construction		3	ea	$ 329,600	$ 988,800
Connection to Water System		3	ea	$ 100,000	$ 300,000
Subtotal					**$ 1,288,800**
Engineering and Contingencies (30%)					$ 386,640
Mitigation and Permitting (1%)					$ 12,888
Subtotal					**$ 1,688,328**
Interest During Construction					$ 36,581
TOTAL CAPITAL COST					***$ 1,724,909***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Debt Service					$ 150,385
Pipeline O&M (1%)					$ 3,000
Pump O&M (2.5%)					$ 24,720
Chemicals			1000 gal	$ -	$ -
Electricity					$ 52,560
TOTAL ANNUAL COST w/ AMORTIZATION					***$ 230,665***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$ 80,280***

UNIT COSTS (Until Amortized)	
Cost per acre-ft	$ 1,538
Cost per 1000 gallons	$ 4.72

UNIT COSTS (After Amortization)	
Cost per acre-ft	$ 535
Cost per 1000 gallons	$ 1.64

WUGNAME: **New Summerfield**
STRATEGY: **New Wells - Carrizo Wilcox Aquifer**
AMOUNT (ac-ft/yr): **242**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**		**Cost**	
Water Well Construction		1	ea	$	123,742	$	123,742
Connection to Water System		1	ea	$	100,000	$	100,000
Subtotal						**$**	**223,742**
Engineering and Contingencies (30%)						$	67,122
Mitigation and Permitting (1%)						$	2,237
Subtotal						**$**	**293,101**
Interest During Construction						$	6,351
TOTAL CAPITAL COST						***$***	***299,452***
ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**		**Cost**	
Debt Service						$	26,108
Pipeline O&M (1%)						$	1,000
Pump O&M (2.5%)						$	3,094
Chemicals			1000 gal	$	0.30	$	23,667
Electricity						$	9,461
TOTAL ANNUAL COST w/ AMORTIZATION						***$***	***63,329***
TOTAL ANNUAL COST AFTER AMORTIZATION						***$***	***37,221***
UNIT COSTS (Until Amortized)							
Cost per acre-ft						$	262
Cost per 1000 gallons						$	0.80
UNIT COSTS (After Amortization)							
Cost per acre-ft						$	154
Cost per 1000 gallons						$	0.47

WUGNAME: **Rusk**
STRATEGY: **New Wells - Carrizo Wilcox Aquifer**
AMOUNT (ac-ft/yr): **212**

CAPITAL COSTS	Size	Quantity	Units	Unit Price	Cost
Water Well Construction		1	ea	$ 123,742	$ 123,742
Connection to Water System		1	ea	$ 100,000	$ 100,000
Subtotal					**$ 223,742**
Engineering and Contingencies (30%)					$ 67,122
Mitigation and Permitting (1%)					$ 2,237
Subtotal					**$ 293,101**
Interest During Construction					$ 6,351
TOTAL CAPITAL COST					***$ 299,452***

ANNUAL COSTS	Size	Quantity	Units	Unit Price	Cost
Debt Service					$ 26,108
Pipeline O&M (1%)					$ 1,000
Pump O&M (2.5%)					$ 3,094
Chemicals			1000 gal	$ 0.30	$ 20,724
Electricity					$ 9,461
TOTAL ANNUAL COST w/ AMORTIZATION					***$ 60,386***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$ 34,279***

UNIT COSTS (Until Amortized)	
Cost per acre-ft	$ 285
Cost per 1000 gallons	$ 0.87

UNIT COSTS (After Amortization)	
Cost per acre-ft	$ 162
Cost per 1000 gallons	$ 0.50

WUGNAME: **City of Rusk**
STRATEGY: **Lake Columbia**
Quantity: **3,000** AF/Y 5.00 MGD

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	20 in.	50,160	LF	$90	$4,514,000
Pipeline Urban	20 in.	0	LF	$135	$0
Right of Way Easements Rural (ROW)		23.0	ACRE	$2,000	$46,000
Right of Way Easements Urban (ROW)		0.0	ACRE	$20,000	$0
Engineering and Contingencies (30%)					$1,354,000
Subtotal of Pipeline					**$5,914,000**
Pump Station(s)					
Pump with intake & building	225 HP	1	LS	$1,618,000	$1,618,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$566,300
Subtotal of Pump Station(s)					**$2,184,300**
Water Treatment Facility					
New Water Treatment Plant	5 MGD	1	LS	$14,050,000	**$14,050,000**
Engineering and Contingencies (35%)					$4,917,500
Subtotal of WTP					**$18,967,500**
CONSTRUCTION TOTAL					**$27,065,800**
Permitting and Mitigation					**$242,000**
Interest During Construction			**(12 months)**		**$1,128,000**
TOTAL COST					**$28,435,800**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$2,479,000
Electricity ($0.09 kWh)					$57,000
Operation & Maintenance					$103,000
Raw Water Purchase			Kgal	$0.66	$645,000
Treatment			Kgal	$0.70	$684,000
Total Annual Costs					**$3,968,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$1,323
Per 1,000 Gallons					$4.06
UNIT COSTS (After Amortization)					
Per Acre-Foot					$496
Per 1,000 Gallons					$1.52

WUGNAME: **Cherokee Mining**
STRATEGY: **Angelina River/ Lake Columbia**
Quantity: **1,500** AF/Y 2.01 MGD

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	12 in.	26,400	LF	$52	$1,373,000
Right of Way Easements Rural (ROW)		12.1	ACRE	$2,000	$24,000
Engineering and Contingencies (30%)					$412,000
Subtotal of Pipeline					**$1,809,000**
Pump Station(s)					
Pump with intake	115 HP	1	LS	$1,078,000	$1,078,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$377,300
Subtotal of Pump Station(s)					**$1,455,300**
Terminal Storage	**0.2 MG**	**1**	**LS**	$247,000	**$247,000**
CONSTRUCTION TOTAL					**$3,511,300**
Permitting and Mitigation					**$32,000**
Interest During Construction			**(6 months)**		**$76,000**
TOTAL COST					**$3,619,300**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$316,000
Electricity ($0.09 kWh)					$34,000
Operation & Maintenance					$55,000
Raw Water Purchase			Kgal	$0.66	$323,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$728,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$485
Per 1,000 Gallons					$1.49
UNIT COSTS (After Amortization)					
Per Acre-Foot					$275
Per 1,000 Gallons					$0.84

Hardin County
County - Other

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		153	306	306	306	459	459
Well Design, gpm (2*Reqd)		190	379	379	379	569	569
Supplied groundwater, MGD		0.1366	0.2732	0.2732	0.2732	0.4098	0.4098
County GW Parameters							
All. GPM/well	200						
Well Depth	800						
Cost /Well	**184200**						
No. of Wells		0.9485	1.8969	1.8969	1.8969	2.8454	2.8454
Phasing of Wells		1	1	0	0	1	0
Well Cost		$ 184,200.00	$ 184,200.00	$ -	$ -	$ 184,200.00	$ -
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	10						
Head Loss/100 feet	0.213						
Depth to Water Surface	400						
Total Head Required	491						
Total Horsepower	35						
Cost of Pipeline	**43**	$ 227,040.00	$ 227,040.00	$ -	$ -	$ 227,040.00	$ -
1 MG ground storage and elev	0	0	0		0	0	0
Total Capital Cost		$ 411,240.00	$ 411,240.00	$ -	$ -	$ 411,240.00	$ -
Engineering & Cont. (30%)		$123,372	$123,372	$0	$0	$123,372	$0
Interest During Construction		$22,276	$22,276	$0	$0	$22,276	$0
Total Cost		$556,888	$556,888	$0	$0	$556,888	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$48,552	$48,552	$0	$0	$48,552	$0
New Plus Existing		$48,552	$97,104	$48,552	$0	$48,552	$48,552
O&M Cost							
Electricity		10,430	20,859	20,859	20,859	31,289	31,289
O&M		$4,605	$9,210	$9,210	$9,210	$13,815	$13,815
Transmission Line		$2,270	$4,541	$4,541	$4,541	$6,811	$6,811
Total Annual Cost		$65,857	$131,714	$83,162	$34,610	$100,467	$100,467
Unit Cost, $/1000 gallons		$1.32	$1.32	$0.83	$0.35	$0.67	$0.67
Unit Cost, $/acft		$430.44	$430.44	$271.77	$113.11	$218.88	$218.88
							$286.96
							$0.88

Hardin County Manufacturing

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		114	114	114	114	114	114
Well Design, gpm (2*Reqd)		141	141	141	141	141	141
Supplied groundwater, MGD		0.1018	0.1018	0.1018	0.1018	0.1018	0.1018
County GW Parameters							
All. GPM/well (200)	140						
Well Depth	700						
Cost /Well	**79920**						
No. of Wells		1.0096	1.0096	1.0096	1.0096	1.0096	1.0096
Phasing of Wells		1	0	0	0	0	0
Well Cost		$ 79,920.00	$ -	$ -	$ -	$ -	$ -
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	**6**						
Head Loss/100 feet	0.176						
Depth to Water Surface	20						
Total Head Required	109						
Total Horsepower	6						
Cost of Pipeline	**26**	$ 137,280.00	0	0	0	0	0
Booster Station and Ground							
Storage per 3 wells	$ 100,000.00	$ 100,000.00	0	0	0	0	0
Total Capital Cost		$ 317,200.00	0	0	0	0	0
Engineering & Cont. (30%)		$95,160	$0	$0	$0	$0	$0
Interest During Construction		$17,182	$0	$0	$0	$0	$0
Total Cost		$429,542	$0	$0	$0	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$37,449	$0	$0	$0	$0	$0
New Plus Existing		$37,449	$37,449	$0	$0	$0	$0
O&M Cost							
Electricity		1,624	1,624	1,624	1,624	1,624	1,624
O&M		$1,998	$1,998	$1,998	$1,998	$1,998	$1,998
Transmission Line		$2,373	$2,373	$2,373	$2,373	$2,373	$2,373
Total Annual Cost		$43,444	$43,444	$5,995	$5,995	$5,995	$5,995
Unit Cost, $/1000 gallons		$1.17	$1.17	$0.16	$0.16	$0.16	$0.16

Hardin County
Irrigation

		2010	2020	2030	2040	2050	2060
Required water, af/y		1002	1002	1002	1002	1002	1002
Distribution Design, gpm (1.5*Reqd)		932	932	932	932	932	932
Supplied water, MGD		0.89	0.89	0.89	0.89	0.89	0.89
Distribution Cost							
Length Dist. Pipe	12500						
Pumping Rate, gpm	3451						
Pipe Diameter, in	20						
Head Loss/100 feet	0.18						
Depth to Water Surface	20						
Total Head Required	42.5						
Total Horsepower	53						
Cost of Pipeline per foot	$90						
Pump Station	$651,000		0				
Total Capital Cost		$1,776,000	0	0	0	0	0
Engineering & Cont. (30%)		$532,800	$0	$0	$0	$0	$0
Interest During Construction		$96,201	$0	$0	$0	$0	$0
Total Cost		$2,405,001	$0	$0	$0	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		($209,679)	$0	$0	$0	$0	$0
New Plus Existing		($209,679)	($209,679)		$0	$0	$0
O&M Cost							
Electricity		(5,605)	(5,605)	(5,605)	(5,605)	(5,605)	(5,605)
O&M		$0	$0	$0	$0	$0	$0
Transmission Line		$0	$0	$0	$0	$0	$0
Raw Water Cost $0.25/1000 gallons		($81,636)	($81,636)	($81,636)	($81,636)	($81,636)	($81,636)
Total Annual Cost		($296,920)	($296,920)	($87,241)	($87,241)	($87,241)	($87,241)
Unit Cost, $/1000 gallons		($0.91)	($0.91)	($0.27)	($0.27)	($0.27)	($0.27)

Table
Henderson County-Other
Purchase Water from UNRMWA

Probable Owner:	County-Other					
Quantity:	500 AF/Y		0.78 MGD			

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	10 in.	26,400	LF	$43	$1,135,000
Pipeline Urban	10 in.	0	LF	$65	$0
Right of Way Easements Rural (ROW)		12.1	ACRE	$2,000	$24,000
Right of Way Easements Urban (ROW)		0.0	ACRE	$20,000	$0
Engineering and Contingencies (30%)					$341,000
Subtotal of Pipeline					**$1,500,000**
Pump Station(s)					
Pump with intake & building	30 HP	1	LS	$602,000	$602,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$210,700
Subtotal of Pump Station(s)					**$812,700**
Ground Storage					
Ground Storage Tanks at Booster	0.25 MG	1	LS	$279,000	$279,000
Engineering and Contingencies (35%)					$97,650
Subtotal of Ground Storage					**$376,650**
Surface Water Treatment					
Water treatment plant	1 MGD	1	LS	$5,800,000	$5,800,000
CONSTRUCTION TOTAL					**$8,489,350**
Permitting and Mitigation					**$94,000**
Interest During Construction			**(12 months)**		**$354,000**
TOTAL COST					**$8,937,350**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$779,000
Electricity ($0.09 kWh)					$8,000
Operation & Maintenance					$40,000
Raw Water Purchase			Kgal	$0.25	$41,000
Treatment			Kgal	$0.70	$114,000
Total Annual Costs					**$982,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$1,964
Per 1,000 Gallons					$6.02
UNIT COSTS (After Amortization)					
Per Acre-Foot					$406

Per 1,000 Gallons	$1.25

Table
Henderson County-Other
Install New Wells in Queen City

Owner:	County-Other	
Quantity:	500	AF/Y

Item	Size		Quantity	Unit	Unit Price	Cost
Capital Costs						
Wellfield and Treatment						
Wells	50	gpm	12	Ea.	$19,070	$228,800
Connection to Existing Distribution System			12	Ea.	$10,000	$120,000
Storage Tank (Closed)	10,000	Gal	12	Ea.	$10,050	$120,600
Engineering and Contingencies (35% for well field)						$164,300
Subtotal for Wellfield						**$633,700**
Transmission System						
Pipeline - Rural	6	inch	31,680	LF	$26	$823,700
Pipeline - Urban	6	inch	0	LF	$39	$0
Pump Station	30	HP	3	LS	$602,000	$1,806,000
Easement - Rural	15	Feet	11	AC	$2,000	$21,800
Easement - Urban	15	Feet	0	AC	$20,000	$0
Engineering and Contingencies (30% for pipleines, 35% for other items)						$879,200
Subtotal for Transmission						**$3,530,700**
TOTAL CONSTRUCTION COST						**$4,164,400**
Interest During Construction				**(6 months)**		**$90,200**
Permitting and Mitigation						**$15,500**
Groundwater Rights/ Purchase						**$150,000**
TOTAL CAPITAL COST						**$4,420,100**
Annual Costs						
Debt Service (6 percent for 20 years)						$385,400
Electricity (Transmission)						$6,000
Well operation and treatment						$48,900
Operation and Maintenance of transmission						$64,100
Total Annual Cost						**$504,400**
UNIT COSTS (Until Amortized)						
Water Cost ($ per ac-ft)						**$1,009**
Water Cost ($ per 1,000 gallons)						**$3.10**
UNIT COSTS (After Amortization)						
Water Cost ($ per ac-ft)						**$238**
Water Cost ($ per 1,000 gallons)						**$0.73**

Table
Henderson County-Other
Install New Wells in Carrizo-Wilcox

Owner: County-Other
Quantity: 50 AF/Y

Item	Size	Quantity	Unit	Unit Price	Cost
Capital Costs					
Wellfield and Treatment					
Wells	50 gpm	1	Ea.	$48,590	$48,600
Connection to Existing Distribution System		1	Ea.	$10,000	$10,000
Storage Tank (Closed)	10,000 Gal	0	Ea.	$10,050	$0
Engineering and Contingencies (35% for well field)					$20,500
Subtotal for Wellfield					**$79,100**
Transmission System					
Pipeline - Rural	6 inch	10,560	LF	$26	$274,600
Pipeline - Urban	6 inch	0	LF	$39	$0
Pump Station	2 HP	1	LS	$100,000	$100,000
Easement - Rural	15 Feet	4	AC	$2,000	$7,300
Easement - Urban	15 Feet	0	AC	$20,000	$0
Engineering and Contingencies (30% for pipleines, 35% for other items)					$117,400
Subtotal for Transmission					**$499,300**
TOTAL CONSTRUCTION COST					**$578,400**
Interest During Construction			**(6 months)**		**$12,500**
Permitting and Mitigation					**$4,000**
Groundwater Rights/ Purchase					**$15,000**
TOTAL CAPITAL COST					**$609,900**
Annual Costs					
Debt Service (6 percent for 20 years)					$53,200
Electricity (Transmission)					$500
Well operation and treatment					$4,900
Operation and Maintenance of transmission					$6,300
Total Annual Cost					**$64,900**
UNIT COSTS (Until Amortized)					
Water Cost ($ per ac-ft)					**$1,298**
Water Cost ($ per 1,000 gallons)					**$3.98**
UNIT COSTS (After Amortization)					
Water Cost ($ per ac-ft)					**$234**
Water Cost ($ per 1,000 gallons)					**$0.72**

Houston County
Irrigation

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		766	766	766	873	1149	1149
Well Design, gpm (2*Reqd)		950	950	950	1082	1425	1425
Supplied groundwater, MGD		0.6839	0.6839	0.6839	0.7795	1.0259	1.0259
County GW Parameters							
All. GPM/well	475						
Well Depth	800						
Cost /Well	**257250**						
No. of Wells		1.9994	1.9994	1.9994	2.2787	2.9991	2.9991
Phasing of Wells		2	0	0	0	1	0
Well Cost		$ 514,500.00	$ -	$ -	$ -	$ 257,250.00	$ -
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	6						
Head Loss/100 feet	0.213						
Depth to Water Surface	400						
Total Head Required	491						
Total Horsepower	84						
Cost of Pipeline	**26**	$ 274,560.00	$ -	$ -	$ -	$ 137,280.00	$ -
1 MG ground storage and elev	0	0	0		0	0	0
Total Capital Cost		$ 789,060.00	$ -	$ -	$ -	$ 394,530.00	$ -
Engineering & Cont. (30%)		$236,718	$0	$0	$0	$118,359	$0
Interest During Construction		$42,741	$0	$0	$0	$21,371	$0
Total Cost		$1,068,519	$0	$0	$0	$534,260	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$93,158	$0	$0	$0	$46,579	$0
New Plus Existing		$93,158	$93,158	$0	$0	$46,579	$46,579
O&M Cost							
Electricity		49,541	49,541	49,541	49,541	74,311	74,311
O&M		$12,863	$12,863	$12,863	$12,863	$19,294	$19,294
Transmission Line		$2,746	$2,746	$2,746	$2,746	$4,118	$4,118
Total Annual Cost		$158,307	$158,307	$65,149	$65,149	$144,303	$144,303
Unit Cost, $/1000 gallons		$0.63	$0.63	$0.26	$0.23	$0.39	$0.39
Unit Cost, $/acft		$206.67	$206.67	$85.05	$74.63	$125.59	$125.59
							$125.59
							$0.39

Houston County
Livestock

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		211	231	462	693	924	1180
Well Design, gpm (2*Reqd)		262	286	573	859	1146	1463
Supplied groundwater, MGD		0.1884	0.2063	0.4125	0.6188	0.8250	1.0536
County GW Parameters							
All. GPM/well	275						
Well Depth	800						
Cost /Well	**190875**						
No. of Wells		0.9513	1.0415	2.0829	3.1244	4.1658	5.3200
Phasing of Wells		1	0	1	1	1	1
Well Cost		$ 257,250.00	$ -	$ 257,250.00	$ 257,250.00	$ 257,250.00	$ 257,250.00
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	6						
Head Loss/100 feet	0.213						
Depth to Water Surface	400						
Total Head Required	491						
Total Horsepower	49						
Cost of Pipeline	**26**	$ 137,280.00	$ -	$ 137,280.00	$ 137,280.00	$ 137,280.00	$ 137,280.00
1 MG ground storage and elev	0	0	0		0	0	0
Total Capital Cost		$ 394,530.00	$ -	$ 394,530.00	$ 394,530.00	$ 394,530.00	$ 394,530.00
Engineering & Cont. (30%)		$118,359	$0	$118,359	$118,359	$118,359	$118,359
Interest During Construction		$21,371	$0	$21,371	$21,371	$21,371	$21,371
Total Cost		$534,260	$0	$534,260	$534,260	$534,260	$534,260
Annual Cost							
New Debt Service,6%, 20yrs.		$46,579	$0	$46,579	$46,579	$46,579	$46,579
New Plus Existing		$46,579	$46,579	$46,579	$93,158	$93,158	$93,158
O&M Cost							
Electricity		24,770	24,770	49,541	74,311	99,082	123,852
O&M		$6,431	$6,431	$12,863	$19,294	$25,725	$32,156
Transmission Line		$1,373	$1,373	$2,746	$4,118	$5,491	$6,864
Total Annual Cost		$79,154	$79,154	$111,728	$190,882	$223,456	$256,031
Unit Cost, $/1000 gallons		$1.15	$1.05	$0.74	$0.85	$0.74	$0.67
Unit Cost, $/acft		$375.14	$342.66	$241.84	$275.44	$241.84	$216.98

Jasper County
County - Other

Neches	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		550	550	550	550	550	550
Well Design, gpm (2*Reqd)		682	682	682	682	682	682
Supplied groundwater, MGD		0.4911	0.4911	0.4911	0.4911	0.4911	0.4911
County GW Parameters							
All. GPM/well (125)	800						
Well Depth	1600						
Cost /Well	**584100**						
No. of Wells		0.8524	0.8524	0.8524	0.8524	0.8524	0.8524
Phasing of Wells		1	0	0	0	0	0
Well Cost		584100	0	0	0	0	0
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	6						
Head Loss/100 feet	0.176						
Depth to Water Surface	1500						
Total Head Required	1589						
Total Horsepower	459						
Cost of Pipeline	**26**	$ 137,280.00	$ -	$ -	$ -	$ -	$ -
Booster Station and Ground Storage per 3 wells			0		0	0	0
Total Capital Cost		$ 721,380.00	$ -	$ -	$ -	$ -	$ -
Engineering & Cont. (30%)		$216,414	$0	$0	$0	$0	$0
Interest During Construction		$39,075	$0	$0	$0	$0	$0
Total Cost		$976,869	$0	$0	$0	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$85,168	$0	$0	$0	$0	$0
New Plus Existing		$85,168	$85,168	$0	$0	$0	$0
O&M Cost							
Electricity		134,969	134,969	134,969	134,969	134,969	134,969
O&M		$14,603	$14,603	$14,603	$14,603	$14,603	$14,603
Transmission Line		$1,373	$1,373	$1,373	$1,373	$1,373	$1,373
Total Annual Cost		$236,113	$236,113	$150,945	$150,945	$150,945	$150,945
Unit Cost, $/1000 gallons		$1.32	$1.32	$0.84	$0.84	$0.84	$0.84
Unit Cost, $/acft		$429.30	$429.30	$274.44	$274.44	$274.44	$274.44
							$429.30
							$1.32

Sabine	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		82	82	82	82	82	82
Well Design, gpm (2*Reqd)		102	102	102	102	102	102
Supplied groundwater, MGD		0.0732	0.0732	0.0732	0.0732	0.0732	0.0732
County GW Parameters							
All. GPM/well (125)	125						
Well Depth	1600						
Cost /Well	152622						
No. of Wells		0.1271	0.1271	0.1271	0.1271	0.1271	0.1271
Phasing of Wells		1		0	0	0	0
Well Cost		153000	0	0	0	0	0
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	6						
Head Loss/100 feet	0.176						
Depth to Water Surface	1500						
Total Head Required	1589						
Total Horsepower	72						
Cost of Pipeline	26	$ 137,280.00	$ -	$ -	$ -	$ -	$ -
Booster Station and Ground							
Storage per 3 wells			0		0	0	0
Total Capital Cost		$ 290,280.00	$ -	$ -	$ -	$ -	$ -
Engineering & Cont. (30%)		$87,084	$0	$0	$0	$0	$0
Interest During Construction		$15,724	$0	$0	$0	$0	$0
Total Cost		$393,088	$0	$0	$0	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$34,271	$0	$0	$0	$0	$0
New Plus Existing		$34,271	$34,271	$0	$0	$0	$0
O&M Cost							
Electricity		134,969	134,969	134,969	134,969	134,969	134,969
O&M		$3,825	$3,825	$3,825	$3,825	$3,825	$3,825
Transmission Line		$1,373	$1,373	$1,373	$1,373	$1,373	$1,373
Total Annual Cost		$174,438	$174,438	$140,167	$140,167	$140,167	$140,167
Unit Cost, $/1000 gallons		$6.53	$6.53	$5.25	$5.25	$5.25	$5.25
Unit Cost, $/acft		$2,127.30	$2,127.30	$1,709.36	$1,709.36	$1,709.36	$1,709.36
							$2,127.30
							$6.53

Jefferson County
Steam Electric

	2000	2010	2020	2030	2040	2050	2060
Required water, af/y			25951	25951	25951	25951	25951
Distribution Design, gpm (1.5*Reqd)		0	24131	24131	24131	24131	24131
Supplied water, MGD		0	23.17	23.17	23.17	23.17	23.17
Distribution Cost							
Length Dist. Pipe	25000						
Pumping Rate	18000						
Pipe Diameter, in	42						
Head Loss/100 feet	0.104						
Depth to Water Surface	20						
Total Head Required	126						
Total Horsepower	818						
Cost of Pipeline	215						
Booster Station and Ground Storage (5 MG)	$4,703,000		$10,078,000				
Total Capital Cost	$10,078,000		$10,078,000	0	0	0	0
Engineering & Cont. (30%)		$0	$3,023,400	$0	$0	$0	$0
Interest During Construction		$0	$545,896	$0	$0	$0	$0
Total Cost		$0	$13,647,296	$0	$0	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$0	$1,189,833	$0	$0	$0	$0
New Plus Existing		$0	$1,189,833	$1,189,833		$0	$0
O&M Cost							
Electricity		0	430,358	430,358	430,358	430,358	430,358
O&M		$0	$117,575	$117,575	$117,575	$117,575	$117,575
Transmission Line		$0	$53,750	$53,750	$53,750	$53,750	$53,750
Raw Water Cost $0.15/1000 gallons			$1,268,587	$1,268,587	$1,268,587	$1,268,587	$1,268,587
Total Annual Cost		$0	$3,060,104	$3,060,104	$1,870,270	$1,870,270	$1,870,270
Unit Cost, $/1000 gallons			$0.36	$0.36	$0.22	$0.22	$0.22
Unit Cost, $/acft			$117.92	$117.92	$72.07	$72.07	$72.07
							$117.92
							$0.36

Mining-Jefferson

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y						4	9
Well Design, gpm (2*Reqd)		0	0	0	0	5.0	11
Supplied groundwater, MGD		0	0	0	0	0.0	0.0080
County GW Parameters							
All. GPM/well	11						
Well Depth	800						
Cost /Well	**76123**						
No. of Wells		0.0000	0.0000	0.0000	0.0000	0.5	1.0144
Phasing of Wells		0	0	0	0	1.0	0
Well Cost		$ -	$ -	$ -	$ -	76123.0	$ -
Distribution Cost							
Length Dist. Pipe/Well	0						
Total Length							
Pipe Diameter, in	0						
Head Loss/100 feet	0.176						
Depth to Water Surface	1500						
Total Head Required	1580						
Total Horsepower	6						
Cost of Pipeline	0	$ -	$ -	$ -	$ -	$ -	$ -
Booster Station and Ground Storage per 3 wells			0		0	0	0
Total Capital Cost		$ -	$ -	$ -	$ -	$ 76,123.00	$ -
Engineering & Cont. (30%)		$0	$0	$0	$0	$22,837	$0
Interest During Construction		$0	$0	$0	$0	$4,123	$0
Total Cost		$0	$0	$0	$0	$103,083	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$0	$0	$0	$0	$8,987	$0
New Plus Existing		$0	$0	$0	$0	$8,987	$8,987
O&M Cost							
Electricity		0	0	0	0	0	0
O&M		$0	$0	$0	$0	$1,903	$1,903
Transmission Line		$0	$0	$0	$0	$0	$0
Total Annual Cost		$0	$0	$0	$0	$10,890	$10,890
Unit Cost, $/1000 gallons							$3.71

WUGNAME:	**Nacgodoches County-Other**		
STRATEGY:	**Lake Naconiche Regional Water System - Phase 1**		
AMOUNT (ac-ft/yr):	**1,700**	3.0 MGD	

Expand Treated Water Supply	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline					
Pipeline Segment A	16 in.	13,200	LF	$69	$911,000
Pipeline Segment B	16 in.	26,400	LF	$69	$1,822,000
Pipeline Segment C	12 in.	15,840	LF	$52	$824,000
Pipeline Segment D	10 in.	21,120	LF	$43	$908,000
Pipeline Segment E	12 in.	5,280	LF	$52	$275,000
Pipeline Segment F	10 in.	36,960	LF	$43	$1,589,000
Pipeline Segment G	6 in.	29,040	LF	$26	$755,000
Subtotal of Pipeline		147,840			7,084,000
Right of Way Easements Rural (ROW)		50.9	ACRE	$2,000	$102,000
Engineering and Contingencies (30%)					$2,125,000
Subtotal of Pipeline					**$9,311,000**
Pump Station(s)					
Pump Station	375 HP	1	LS	$1,707,000	$1,707,000
Lake Intake	3.0 MGD	1	LS		$500,000
Engineering and Contingencies (35%)					$772,000
Subtotal of Pump Station(s)					**$2,979,000**
Water Treatment Plant					
Water Treatment Plant	3.0 MGD	1	LS	$10,600,000	**$10,600,000**
CONSTRUCTION TOTAL					**$22,890,000**
Permitting and Mitigation - infrastructure					**$233,000**
Water rights Permitting					**$500,000**
Interest During Construction			**(12 months)**		**$954,000**
TOTAL COST					**$24,577,000**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$2,143,000
Electricity ($0.09 kWh)					$46,000
Operation & Maintenance					$151,000
Raw Water Purchase			Kgal	$0.25	$138,000
Treatment Cost			Kgal	$0.70	$388,000
Total Annual Costs					**$2,866,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$1,686
Per 1,000 Gallons					$5.17
UNIT COSTS (After Amortization)					
Per Acre-Foot					$425
Per 1,000 Gallons					$1.30

WUGNAME:	**Nacogdoches Mining**				
STRATEGY:	**Angelina River/ Lake Columbia**				
Quantity:	**7,000** AF/Y		9.37 MGD		

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	36 in.	26,400	LF	$184	$4,858,000
Right of Way Easements Rural (ROW)		12.1	ACRE	$2,000	$24,000
Engineering and Contingencies (30%)					$1,457,000
Subtotal of Pipeline					**$6,339,000**
Pump Station(s)					
Pump with intake	250 HP	1	LS	$1,727,000	$1,727,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$604,450
Subtotal of Pump Station(s)					**$2,331,450**
Terminal Storage	**1.0 MG**	**1**	**LS**	$634,000	**$634,000**
CONSTRUCTION TOTAL					**$9,304,450**
Permitting and Mitigation					**$87,000**
Interest During Construction			**(6 months)**		**$202,000**
TOTAL COST					**$9,593,450**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$836,000
Electricity ($0.09 kWh)					$104,000
Operation & Maintenance					$129,000
Raw Water Purchase			Kgal	$0.66	$1,505,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$2,574,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$368
Per 1,000 Gallons					$1.13
UNIT COSTS (After Amortization)					
Per Acre-Foot					$248
Per 1,000 Gallons					$0.76

Table
Nacogdoches County Steam Electric
Purchase Water from ANRA

Probable Owner: Nacogdoches County Steam Electric Power
Quantity: 13,400 AF/Y 17.93 MGD

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	36 in.	26,400	LF	$184	$4,858,000
Right of Way Easements Rural (ROW)		12.1	ACRE	$2,000	$24,000
Engineering and Contingencies (30%)					$1,457,000
Subtotal of Pipeline					**$6,339,000**
Pump Station(s)					
Pump with intake & building	600 HP	1	LS	$2,860,000	$2,860,000
Engineering and Contingencies (35%)					$1,001,000
Subtotal of Pump Station(s)					**$3,861,000**
CONSTRUCTION TOTAL					**$10,200,000**
Permitting and Mitigation					**$93,000**
Interest During Construction			**(12 months)**		**$425,000**
TOTAL COST					**$10,718,000**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$934,000
Electricity ($0.09 kWh)					$265,000
Operation & Maintenance					$144,000
Raw Water Purchase			Kgal	$0.66	$2,882,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$4,225,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$315
Per 1,000 Gallons					$0.97
UNIT COSTS (After Amortization)					
Per Acre-Foot					$246
Per 1,000 Gallons					$0.75

Table
Nacogdoches County Steam Electric
Purchase Water from Houston County WCID

Probable Owner: Nacogdoches County Steam Electric Power
Quantity: 340 AF/Y 0.45 MGD

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	8 in.	26,400	LF	$34	$898,000
Right of Way Easements Rural (ROW)		12.1	ACRE	$2,000	$24,000
Engineering and Contingencies (30%)					$269,000
Subtotal of Pipeline					**$1,191,000**
Pump Station(s)					
Pump	20 HP	1	LS	$564,000	$564,000
Engineering and Contingencies (35%)					$197,400
Subtotal of Pump Station(s)					**$761,400**
CONSTRUCTION TOTAL					**$1,952,400**
Permitting and Mitigation					**$18,000**
Interest During Construction			**(6 months)**		**$42,000**
TOTAL COST					**$2,012,400**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$175,000
Electricity ($0.09 kWh)					$5,000
Operation & Maintenance					$28,000
Raw Water Purchase			Kgal	$0.50	$55,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$263,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$774
Per 1,000 Gallons					$2.37
UNIT COSTS (After Amortization)					
Per Acre-Foot					$259
Per 1,000 Gallons					$0.79

Nacogdoches County
D&M WSC

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		0	0	310	310	310	310
Well Design, gpm (2*Reqd)		0	0	384	384	384	384
Supplied groundwater, MGD		0.0000	0.0000	0.2768	0.2768	0.2768	0.2768
County GW Parameters							
All. GPM/well	400						
Well Depth	700						
Cost /Well	**226300**						
No. of Wells		0.0000	0.0000	0.9609	0.9609	0.9609	0.9609
Phasing of Wells			0	1	0	0	0
Well Cost		$0	$0	$226,300	$0	$0	$0
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	6						
Head Loss/100 feet	0.134						
Depth to Water Surface	1100						
Total Head Required	1187						
Total Horsepower	171						
Cost of Pipeline	**26**	$0	$0	$137,280	$0	$0	0
Ground Storage and Pressure		$0	$0	$0	$0	$0	$0
Total Capital Cost		$0	$0	$363,580	$0	$0	$0
Engineering & Cont. (30%)		$0	$0	$109,074	$0	$0	$0
Interest During Construction		$0	$0	$19,694	$0	$0	$0
Total Cost		$0	$0	$492,348	$0	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$0	$0	$42,925	$0	$0	$0
New Plus Existing		$0	$0	$42,925	$42,925	$0	$0
O&M Cost							
Electricity		0	0	50,406	50,406	50,406	50,406
O&M		$0	$0	$5,658	$5,658	$5,658	$5,658
Transmission Line		$0	$0	$1,373	$1,373	$1,373	$1,373
Total Annual Cost		$0	$0	$100,361	$100,361	$57,436	$57,436
Unit Cost, $/1000 gallons			#DIV/0!	$0.99	$0.99	$0.57	$0.57
Unit Cost, $/acft				$323.75	$323.75	$185.28	$185.28
							$323.75
							0.994

Nacogdoches County
Lily Grove WSC

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y			0	0	0	250	500
Well Design, gpm (2*Reqd)		0	0	0	0	310	620
Supplied groundwater, MGD		0.0000	0.0000	0.0000	0.0000	0.2232	0.4464
County GW Parameters							
All. GPM/well	600						
Well Depth	700						
Cost /Well	**291400**						
No. of Wells		0.0000	0.0000	0.0000	0.0000	0.5166	1.0332
Phasing of Wells			0			1	0
Well Cost		$0	$0	$0	$0	$291,400	$0
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	6						
Head Loss/100 feet	0.134						
Depth to Water Surface	1100						
Total Head Required	1187						
Total Horsepower	257						
Cost of Pipeline	**26**	$0	$0	$0	$0	$137,280	0
Ground Storage and Pressure		$0	$0	$0	$0	$0	$0
Total Capital Cost		$0	$0	$0	$0	$428,680	0
Engineering & Cont. (30%)		$0	$0	$0	$0	$128,604	$0
Interest During Construction		$0	$0	$0	$0	$23,220	$0
Total Cost		$0	$0	$0	$0	$580,504	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$0	$0	$0	$0	$50,611	$0
New Plus Existing		$0	$0	$0	$0	$50,611	$50,611
O&M Cost							
Electricity		0	0	0	0	75,609	75,609
O&M		$0	$0	$0	$0	$7,285	$7,285
Transmission Line		$0	$0	$0	$0	$1,373	$1,373
Total Annual Cost		$0	$0	$0	$0	$134,877	$134,877
Unit Cost, $/1000 gallons						$1.66	$0.83
Unit Cost, $/acft						540	270
							270
							0.83

Nacogdoches County
Swift WSC

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		350	350	350	350	350	350
Well Design, gpm (2*Reqd)		434	434	434	434	434	434
Supplied groundwater, MGD		0.3125	0.3125	0.3125	0.3125	0.3125	0.3125
County GW Parameters							
All. GPM/well	450						
Well Depth	700						
Cost /Well	**230600**						
No. of Wells		0.9643	0.9643	0.9643	0.9643	0.9643	0.9643
Phasing of Wells		1	0	0	0	0	0
Well Cost		$230,600	$0	$0	$0	$0	$0
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	6						
Head Loss/100 feet	0.134						
Depth to Water Surface	1100						
Total Head Required	1187						
Total Horsepower	193						
Cost of Pipeline	**26**	$137,280	$0	$0	$0	$0	0
Ground Storage and Pressure		$0	$0	$0	$0	$0	$0
Total Capital Cost		$367,880	$0	$0	$0	$0	0
Engineering & Cont. (30%)		$110,364	$0	$0	$0	$0	$0
Interest During Construction		$19,927	$0	$0	$0	$0	$0
Total Cost		$498,171	$0	$0	$0	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$43,433	$0	$0	$0	$0	$0
New Plus Existing		$43,433	$43,433	$0	$0	$0	$0
O&M Cost							
Electricity		56,706	56,706	56,706	56,706	56,706	56,706
O&M		$5,765	$5,765	$5,765	$5,765	$5,765	$5,765
Transmission Line		$1,373	$1,373	$1,373	$1,373	$1,373	$1,373
Total Annual Cost		$107,277	$107,277	$63,844	$63,844	$63,844	$63,844
Unit Cost, $/1000 gallons		$0.94	$0.94	$0.56	$0.56	$0.56	$0.56
Unit Cost, $/acft		$306.51	$306.51	$182.41	$182.41	$182.41	$182.41
							182
							0.560

Nacogdoches County
Livestock

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		0	0	322	644	966	1350
Well Design, gpm (2*Reqd)		0	0	399	798	1198	1674
Supplied groundwater, MGD		0.0000	0.0000	0.2875	0.5750	0.8625	1.2054
County GW Parameters							
All. GPM/well	400						
Well Depth	700						
Cost /Well	**226300**						
No. of Wells		0.0000	0.0000	0.9981	1.9961	2.9942	4.1844
Phasing of Wells		0	0	1	1	1	1
Well Cost		$0	$0	$226,300	$226,300	$226,300	$226,300
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	6						
Head Loss/100 feet	0.134						
Depth to Water Surface	1100						
Total Head Required	1187						
Total Horsepower	171						
Cost of Pipeline	**26**	$0	$0	$137,280	$137,280	$137,280	137280
Ground Storage and Pressure		$0	$0	$0	$0	$0	$0
Total Capital Cost		$0	$0	$363,580	$363,580	$363,580	363580
Engineering & Cont. (30%)		$0	$0	$109,074	$109,074	$109,074	$109,074
Interest During Construction		$0	$0	$19,694	$19,694	$19,694	$19,694
Total Cost		$0	$0	$492,348	$492,348	$492,348	$492,348
Annual Cost							
New Debt Service,6%, 20yrs.		$0	$0	$42,925	$42,925	$42,925	$42,925
New Plus Existing		$0	$0	$42,925	$85,850	$85,850	$85,850
O&M Cost							
Electricity		0	0	50,406	100,811	151,217	201,623
O&M		$0	$0	$5,658	$11,315	$16,973	$22,630
Transmission Line		$0	$0	$1,373	$2,746	$4,118	$5,491
Total Annual Cost		$0	$0	$100,361	$200,722	$258,158	$315,594
Unit Cost, $/1000 gallons				$0.96	$0.96	$0.82	$0.72
Unit Cost, $/acft				312	312	267	234
							$233.77
							$0.72

Newton County
Manufacturing

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		400	400	400	800	800	800
Well Design, gpm (2*Reqd)		496	496	496	992	992	992
Supplied groundwater, MGD		0.3571	0.3571	0.3571	0.7143	0.7143	0.7143
County GW Parameters							
All. GPM/well (125)	450						
Well Depth	700						
Cost /Well	**191900**						
No. of Wells		1.1021	1.1021	1.1021	2.2042	2.2042	2.2042
Phasing of Wells		1	0	0	1	0	0
Well Cost		$ 191,900.00	$ -	$ -	$ 191,900.00	$ -	$ -
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	6						
Head Loss/100 feet	0.176						
Depth to Water Surface	1500						
Total Head Required	1589						
Total Horsepower	258						
Cost of Pipeline	**26**	$ 137,280.00	$ -	$ -	$ 137,280.00	$ -	$ -
Booster Station and Ground							
Storage per 3 wells			0		0	0	0
Total Capital Cost		$ 329,180.00	$ -	$ -	$ 329,180.00	$ -	$ -
Engineering & Cont. (30%)		$98,754	$0	$0	$98,754	$0	$0
Interest During Construction		$17,831	$0	$0	$17,831	$0	$0
Total Cost		$445,765	$0	$0	$445,765	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$38,864	$0	$0	$38,864	$0	$0
New Plus Existing		$38,864	$38,864	$0	$38,864	$38,864	$0
O&M Cost							
Electricity		75,920	75,920	75,920	151,841	151,841	151,841
O&M		$4,798	$4,798	$4,798	$9,595	$9,595	$9,595
Transmission Line		$1,373	$1,373	$1,373	$2,746	$2,746	$2,746
Total Annual Cost		$120,954	$120,954	$82,091	$203,045	$203,045	$164,181
Unit Cost, $/1000 gallons		$0.93	$0.93	$0.63	$0.78	$0.78	$0.63

WUGNAME:	**Newton Steam Electric Power**				
STRATEGY:	**Purchase from SRA**				
Quantity:	**15,000** AF/Y		20.07 MGD		

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	36 in.	26,400	LF	$184	$4,858,000
Right of Way Easements Rural (ROW)		12.1	ACRE	$2,000	$24,000
Engineering and Contingencies (30%)					$1,457,000
Subtotal of Pipeline					**$6,339,000**
Pump Station(s)					
Pump with intake	700 HP	1	LS	$3,021,000	$3,021,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$1,057,350
Subtotal of Pump Station(s)					**$4,078,350**
Terminal Storage	**5.0 MG**	**1**	**LS**	$1,720,000	**$1,720,000**
CONSTRUCTION TOTAL					**$12,137,350**
Permitting and Mitigation					**$115,000**
Interest During Construction			**(6 months)**		**$263,000**
TOTAL COST					**$12,515,350**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$1,091,000
Electricity ($0.09 kWh)					$255,000
Operation & Maintenance					$201,000
Raw Water Purchase			Kgal	$0.50	$2,444,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$3,991,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$266
Per 1,000 Gallons					$0.82
UNIT COSTS (After Amortization)					
Per Acre-Foot					$193
Per 1,000 Gallons					$0.59

WUGNAME: **Orange_County-Other**
STRATEGY: **New Wells in Gulf Coast Aquifer**
AMOUNT (ac-ft/yr): **140**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**		**Cost**	
Water Well Construction		2	ea	$	61,472	$	122,943
Connection to Water System		2	ea	$	100,000	$	200,000
Subtotal						**$**	**322,943**
Engineering and Contingencies (30%)						$	96,883
Mitigation and Permitting (1%)						$	3,229
Subtotal						**$**	**423,055**
Interest During Construction						$	9,166
TOTAL CAPITAL COST						***$***	***432,222***
ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**		**Cost**	
Debt Service						$	37,683
Pipeline O&M (1%)						$	2,000
Pump O&M (2.5%)						$	3,074
Chemicals			1000 gal	$	0.30	$	13,686
Electricity						$	1,314
TOTAL ANNUAL COST w/ AMORTIZATION						***$***	***57,756***
TOTAL ANNUAL COST AFTER AMORTIZATION						$	20,073
UNIT COSTS (Until Amortized)							
Cost per acre-ft						$	413
Cost per 1000 gallons						$	1.27
UNIT COSTS (After Amortization)							
Cost per acre-ft						$	143
Cost per 1000 gallons						$	0.44

Orange County
Mauriceville

Neches	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		0	203	203	203	203	203
Well Design, gpm (2*Reqd)		0	252	252	252	252	252
Supplied groundwater, MGD		0.0000	0.1813	0.1813	0.1813	0.1813	0.1813
County GW Parameters							
All. GPM/well (125)	300						
Well Depth	1200						
Cost /Well	**269500**						
No. of Wells		0.0000	0.8390	0.8390	0.8390	0.8390	0.8390
Phasing of Wells		0	1	0	0	0	0
Well Cost		0	269500	0	0	0	0
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	6						
Head Loss/100 feet	0.176						
Depth to Water Surface	1500						
Total Head Required	1589						
Total Horsepower	172						
Cost of Pipeline	**26**	$ -	$ 137,280.00	$ -	$ -	$ -	$ -
Booster Station and Ground Storage per 3 wells			0		0	0	0
Total Capital Cost		$ -	$ 406,780.00	$ -	$ -	$ -	$ -
Engineering & Cont. (30%)		$0	$122,034	$0	$0	$0	$0
Interest During Construction		$0	$22,034	$0	$0	$0	$0
Total Cost		$0	$550,848	$0	$0	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$0	$48,025	$0	$0	$0	$0
New Plus Existing		$0	$48,025	$48,025	$0	$0	$0
O&M Cost							
Electricity		0	50,614	50,614	50,614	50,614	50,614
O&M		$0	$6,738	$6,738	$6,738	$6,738	$6,738
Transmission Line		$0	$1,373	$1,373	$1,373	$1,373	$1,373
Total Annual Cost		$0	$106,749	$106,749	$58,724	$58,724	$58,724
Unit Cost, $/1000 gallons			$1.61	$1.61	$0.89	$0.89	$0.89
Unit Cost, $/acft			$525.86	$525.86	$289.28	$289.28	$289.28

Polk County
County Other

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		208	417	624	832	832	832
Well Design, gpm (2*Reqd)		258	517	774	1032	1032	1032
Supplied groundwater, MGD		0.1857	0.3723	0.5571	0.7429	0.7429	0.7429
County GW Parameters							
All. GPM/well	260						
Well Depth	450						
Cost /Well	122690						
No. of Wells		0.9919	1.9885	2.9756	3.9675	3.9675	3.9675
Phasing of Wells		1	1	1	1		0
Well Cost		$122,690	$122,690	$122,690	$122,690	$0	$0.00
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	8						
Head Loss/100 feet	0.134						
Depth to Water Surface	20						
Total Head Required	107						
Total Horsepower	10						
Cost of Pipeline	**34**	$179,520	$179,520	$179,520	$179,520	$0	0
Ground Storage and Pressure	250000	$250,000	$250,000	$250,000	$250,000	$0	$0
Total Capital Cost		$552,210	$552,210	$552,210	$552,210	$0	0
Engineering & Cont. (30%)		$165,663	$165,663	$165,663	$165,663	$0	$0
Interest During Construction		$29,912	$29,912	$29,912	$29,912	$0	$0
Total Cost		$747,785	$747,785	$747,785	$747,785	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$65,195	$65,195	$65,195	$65,195	$0	$0
New Plus Existing		$65,195	$130,391	$130,391	$130,391	$65,195	$0
O&M Cost							
Electricity		2,955	5,911	8,866	11,821	11,821	11,821
O&M		$3,067	$6,135	$9,202	$12,269	$12,269	$12,269
Transmission Line		$4,295	$8,590	$12,886	$17,181	$17,181	$17,181
Total Annual Cost		$75,513	$151,026	$161,344	$171,662	$106,466	$41,271
Unit Cost, $/1000 gallons		$1.11	$1.11	$0.79	$0.63	$0.39	$0.15
Amount Provided	63			63	126	126	126
				$2,561	$1,362	$845	$328
Unit Cost, $/acft		$363.04	$362.17	$258.56	$206.32	$127.96	$49.60
							$194
							$0.60

Polk County Manufacturing

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y			225	225	450	450	450
Well Design, gpm (2*Reqd)		0	279	279	558	558	558
Supplied groundwater, MGD		0.0000	0.2009	0.2009	0.4018	0.4018	0.4018
County GW Parameters							
All. GPM/well (250)	300						
Well Depth	450						
Cost /Well	**126250**						
No. of Wells		0.0000	0.9299	0.9299	1.8598	1.8598	1.8598
Phasing of Wells		0	1	0	1	0	0
Well Cost		$0	$126,250	$0	$126,250	$0	$0.00
Distribution Cost							
Length Dist. Pipe/Well	2600						
Total Length							
Pipe Diameter, in	8						
Head Loss/100 feet	0.134						
Depth to Water Surface	20						
Total Head Required	103						
Total Horsepower	11						
Cost of Pipeline	**34**	$0	$88,400	$0	$88,400	$0	0
Booster Station and Ground							
Storage per 3 wells		$0	$0	$0	$0	$0	0
Total Capital Cost		$0	$214,650	$0	$214,650	$0	0
Engineering & Cont. (30%)		$0	$64,395	$0	$64,395	$0	$0
Interest During Construction		$0	$11,627	$0	$11,627	$0	$0
Total Cost		$0	$290,672	$0	$290,672	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$0	$25,342	$0	$25,342	$0	$0
New Plus Existing		$0	$25,342	$25,342	$25,342	$25,342	$0
O&M Cost							
Electricity		0	3,296	3,296	6,591	6,591	6,591
O&M		$0	$3,156	$3,156	$6,313	$6,313	$6,313
Transmission Line		$0	$884	$884	$1,768	$1,768	$1,768
Total Annual Cost		$0	$32,678	$32,678	$40,014	$40,014	$14,672
Unit Cost, $/1000 gallons			$0.45	$0.45	$0.27	$0.27	$0.10

WUGNAME: **Rusk_Mining**
STRATEGY: **New Wells Queen City Aquifer**
AMOUNT (ac-ft/yr): **158**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**	
Water Well Construction		1	ea	$ 104,850	$	104,850
Pipeline Connection to Water System	6 in.	200	LF	$ 26	$	5,200
Ground Storage Tank					$	67,000
Subtotal					**$**	**177,050**
Engineering and Contingencies (30%)					$	53,115
Mitigation and Permitting (1%)					$	1,771
Subtotal					**$**	**231,936**
Interest During Construction					$	9,664
TOTAL CAPITAL COST					***$***	***241,600***
ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**	
Debt Service					$	21,064
Pipeline O&M (1%)					$	52
Pump O&M (2.5%)					$	4,296
Chemicals			1000 gal		$	-
Electricity					$	2,138
TOTAL ANNUAL COST w/ AMORTIZATION					***$***	***27,550***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$***	***6,486***
UNIT COSTS (Until Amortized)						
Cost per acre-ft					$	174
Cost per 1000 gallons					$	0.54
UNIT COSTS (After Amortization)						
Cost per acre-ft					$	41
Cost per 1000 gallons					$	0.13

Table
Rusk County Steam Electric
Purchase Water from ANRA

Probable Owner:	Rusk County Steam Electric					
Quantity:	8,500 AF/Y		11.37 MGD			

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	30 in.	26,400	LF	$145	$3,828,000
Right of Way Easements Rural (ROW)		12.1	ACRE	$2,000	$24,000
Engineering and Contingencies (30%)					$1,148,000
Subtotal of Pipeline					**$5,000,000**
Pump Station(s)					
Pump with intake & building	400 HP	1	LS	$2,387,000	$2,387,000
Engineering and Contingencies (35%)					$835,450
Subtotal of Pump Station(s)					**$3,222,450**
CONSTRUCTION TOTAL					**$8,222,450**
Permitting and Mitigation					**$75,000**
Interest During Construction			**(12 months)**		**$343,000**
TOTAL COST					**$8,640,450**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$753,000
Electricity ($0.09 kWh)					$140,000
Operation & Maintenance					$118,000
Raw Water Purchase			Kgal	$0.50	$1,385,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$2,396,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$282
Per 1,000 Gallons					$0.86
UNIT COSTS (After Amortization)					
Per Acre-Foot					$193
Per 1,000 Gallons					$0.59

Table
Rusk County Steam Electric
Purchase Water from SRA

Probable Owner:	Rusk County Steam Electric				
Quantity:	1,500 AF/Y		2.01 MGD		
CONSTRUCTION COSTS					
TRANSMISSION FACILITIES					
Pump Station(s)					
Infrastructure improvements	150 HP	1	LS	$930,000	$930,000
Engineering and Contingencies (35%)					$325,500
Subtotal of Pump Station(s)					**$1,255,500**
CONSTRUCTION TOTAL					**$1,255,500**
Permitting and Mitigation					**$11,000**
Interest During Construction			**(12 months)**		**$52,000**
TOTAL COST					**$1,318,500**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$115,000
Electricity ($0.09 kWh)					$40,000
Operation & Maintenance					$28,000
Raw Water Purchase			Kgal	$0.25	$122,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$305,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$203
Per 1,000 Gallons					$0.62
UNIT COSTS (After Amortization)					
Per Acre-Foot					$127
Per 1,000 Gallons					$0.39

Sabine County
County - Other

Neches	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		32	32	32	64	64	64
Well Design, gpm (2*Reqd)		40	40	40	79	79	79
Supplied groundwater, MGD		0.0286	0.0286	0.0286	0.0571	0.0571	0.0571
County GW Parameters							
All. GPM/well (125)	40						
Well Depth	1200						
Cost /Well	**111620**						
No. of Wells		0.9919	0.9919	0.9919	1.9837	1.9837	1.9837
Phasing of Wells		1	0	0	1	0	0
Well Cost		$ 111,620.00	$ -	$ -	$ 111,620.00	$ -	$ -
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	2						
Head Loss/100 feet	0.176						
Depth to Water Surface	1000						
Total Head Required	1089						
Total Horsepower	16						
Cost of Pipeline	**10**	$ 52,800.00	$ -	$ -	$ 52,800.00	$ -	$ -
Booster Station and Ground							
Storage per 3 wells			0		0	0	0
Total Capital Cost		$ 164,420.00	$ -	$ -	$ 164,420.00	$ -	$ -
Engineering & Cont. (30%)		$49,326	$0	$0	$49,326	$0	$0
Interest During Construction		$8,906	$0	$0	$8,906	$0	$0
Total Cost		$222,652	$0	$0	$222,652	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$19,412	$0	$0	$19,412	$0	$0
New Plus Existing		$19,412	$19,412	$0	$19,412	$19,412	$0
O&M Cost							
Electricity		4,625	4,625	4,625	9,251	9,251	9,251
O&M		$2,791	$2,791	$2,791	$5,581	$5,581	$5,581
Transmission Line		$528	$528	$528	$1,056	$1,056	$1,056
Total Annual Cost		$27,356	$27,356	$7,944	$35,300	$35,300	$15,888
Unit Cost, $/1000 gallons		$2.62	$2.62	$0.76	$1.69	$1.69	$0.76
							$124.12
							$0.38

Sabine County
Livestock

Neches	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		50	50	50	100	100	100
Well Design, gpm (2*Reqd)		62	62	62	124	124	124
Supplied groundwater, MGD		0.0446	0.0446	0.0446	0.0893	0.0893	0.0893
County GW Parameters							
All. GPM/well (125)	70						
Well Depth	1200						
Cost /Well	**114410**						
No. of Wells		0.8856	0.8856	0.8856	1.7712	1.7712	1.7712
Phasing of Wells		1		0	1		
Well Cost		$ 114,410.00	$ -	$ -	$ 114,410.00	$ -	$ -
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	2						
Head Loss/100 feet	0.176						
Depth to Water Surface	1000						
Total Head Required	1089						
Total Horsepower	28						
Cost of Pipeline	**10**	$ 52,800.00	$ -	$ -	$ 52,800.00	$ -	$ -
Booster Station and Ground Storage per 3 wells			0		0	0	0
Total Capital Cost		$ 167,210.00	$ -	$ -	$ 167,210.00	$ -	$ -
Engineering & Cont. (30%)		$50,163	$0	$0	$50,163	$0	$0
Interest During Construction		$9,057	$0	$0	$9,057	$0	$0
Total Cost		$226,430	$0	$0	$226,430	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$19,741	$0	$0	$19,741	$0	$0
New Plus Existing		$19,741	$19,741	$0	$19,741	$19,741	$0
O&M Cost							
Electricity		8,094	8,094	8,094	16,189	16,189	16,189
O&M		$2,860	$2,860	$2,860	$5,721	$5,721	$5,721
Transmission Line		$528	$528	$528	$1,056	$1,056	$1,056
Total Annual Cost		$31,224	$31,224	$11,483	$42,707	$42,707	$22,965
Unit Cost, $/1000 gallons		$1.92	$1.92	$0.70	$1.31	$1.31	$0.70

SBCTY-3
Sabine County - Other
Purchase Water from City of Hemphill

Probable Owner: Sabine County Other
Quantity: 100 AF/Y

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	6 in.	26,400	LF	$ 26	$686,000
Pipeline Urban	6 in.	0	LF		$0
Right of Way Easements Rural (ROW)		9.1	ACRE	$2,000	$18,000
Right of Way Easements Urban (ROW)		0.0	ACRE	$20,000	$0
Engineering and Contingencies (30%)					$206,000
Subtotal of Pipeline					**$910,000**
Pump Station(s)					
Pump	3 HP	1	LS	$60,000	$60,000
Booster Pump Station	0 HP	0	LS	$0	$0
Engineering and Contingencies (35%)					$21,000
Subtotal of Pump Station(s)					**$81,000**
CONSTRUCTION TOTAL					**$991,000**
Permitting and Mitigation					**$9,000**
Interest During Construction			**(6 months)**		**$21,000**
TOTAL COST					**$1,021,000**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$89,000
Electricity ($0.09 kWh)					$300
Operation & Maintenance					$10,000
Water Purchase Agreement with City			Kgal	$1.50	$48,900
Total Annual Costs					**$148,200**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$1,482
Per 1,000 Gallons					$4.55
UNIT COSTS (After Amortization)					
Per Acre-Foot					$592
Per 1,000 Gallons					$1.82

Notes: Cost for buying treated water is assumed to be $1.50 per 1,000 gallons

SBLIV-1
Sabine County Livestock
Increase Supply from Local Sources

Owner:	Sabine County Livestock	
Quantity:	300	AF/Y

Item	Size	Quantity	Unit	Unit Price	Cost
Capital Costs					
Stock Ponds					
Stock Ponds	25 AF/Y	12	Ea.	$34,000	$408,000
Engineering and Contingencies					$142,800
Subtotal for Local Supply					**$550,800**
TOTAL CONSTRUCTION COST					**$550,800**
Interest During Construction			**(6 months)**		**$11,900**
Permitting and Mitigation					**$0**
TOTAL CAPITAL COST					**$562,700**
Annual Costs					
Debt Service (6 percent for 20 years)					$49,100
Total Annual Cost					**$49,100**
UNIT COSTS (Until Amortized)					
Water Cost ($ per ac-ft)					**$164**
Water Cost ($ per 1,000 gallons)					**$0.50**
UNIT COSTS (After Amortization)					
Water Cost ($ per ac-ft)					**$0**
Water Cost ($ per 1,000 gallons)					**$0.00**

SBLIV-1
San Augustine County Livestock
Increase Supply from Local Sources

Owner:	San Augustine County Livestock
Quantity:	300 AF/Y

Item	Size	Quantity	Unit	Unit Price	Cost
Capital Costs					
Stock Ponds					
Stock Ponds	25 AF/Y	12	Ea.	$34,000	$408,000
Engineering and Contingencies					$142,800
Subtotal for Local Supply					**$550,800**
TOTAL CONSTRUCTION COST					**$550,800**
Interest During Construction			**(6 months)**		**$11,900**
Permitting and Mitigation					**$0**
TOTAL CAPITAL COST					**$562,700**
Annual Costs					
Debt Service (6 percent for 20 years)					$49,100
Total Annual Cost					**$49,100**
UNIT COSTS (Until Amortized)					
Water Cost ($ per ac-ft)					**$164**
Water Cost ($ per 1,000 gallons)					**$0.50**
UNIT COSTS (After Amortization)					
Water Cost ($ per ac-ft)					**$0**
Water Cost ($ per 1,000 gallons)					**$0.00**

WUGNAME: **San Augustine Mining**
STRATEGY: **Angelina River**
Quantity: **500** AF/Y 0.67 MGD

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	8 in.	26,400	LF	$34	$898,000
Right of Way Easements Rural (ROW)		12.1	ACRE	$2,000	$24,000
Engineering and Contingencies (30%)					$269,000
Subtotal of Pipeline					**$1,191,000**
Pump Station(s)					
Pump with intake	50 HP	1	LS	$871,000	$871,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$304,850
Subtotal of Pump Station(s)					**$1,175,850**
Terminal Storage	**0.1 MG**	**1**	**LS**	$183,000	**$183,000**
CONSTRUCTION TOTAL					**$2,549,850**
Permitting and Mitigation					**$23,000**
Interest During Construction			**(6 months)**		**$55,000**
TOTAL COST					**$2,627,850**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$229,000
Electricity ($0.09 kWh)					$11,000
Operation & Maintenance					$42,000
Raw Water Purchase			Kgal	$0.50	$81,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$363,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$726
Per 1,000 Gallons					$2.23
UNIT COSTS (After Amortization)					
Per Acre-Foot					$268
Per 1,000 Gallons					$0.82

WUGNAME: **San Augustine Mining**
STRATEGY: **Purchase from LNVA**
Quantity: **6,500** AF/Y 8.70 MGD

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	30 in.	26,400	LF	$145	$3,828,000
Right of Way Easements Rural (ROW)		12.1	ACRE	$2,000	$24,000
Engineering and Contingencies (30%)					$1,148,000
Subtotal of Pipeline					**$5,000,000**
Pump Station(s)					
Pump with intake	250 HP	1	LS	$1,727,000	$1,727,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$604,450
Subtotal of Pump Station(s)					**$2,331,450**
Terminal Storage	**1.0 MG**	**1**	**LS**	$634,000	**$634,000**
CONSTRUCTION TOTAL					**$7,965,450**
Permitting and Mitigation					**$74,000**
Interest During Construction			**(6 months)**		**$173,000**
TOTAL COST					**$8,212,450**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$716,000
Electricity ($0.09 kWh)					$101,000
Operation & Maintenance					$117,000
Raw Water Purchase			Kgal	$0.50	$1,059,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$1,993,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$307
Per 1,000 Gallons					$0.94
UNIT COSTS (After Amortization)					
Per Acre-Foot					$196
Per 1,000 Gallons					$0.60

San Augustine
Irrigation

		2010	2020	2030	2040	2050	2060
Neches							
Required groundwater, af/y		100	100	100	100	100	100
Well Design, gpm (2*Reqd)		124	124	124	124	124	124
Supplied groundwater, MGD		0.0893	0.0893	0.0893	0.0893	0.0893	0.0893
County GW Parameters							
All. GPM/well (125)	125						
Well Depth	800						
Cost /Well	**86725**						
No. of Wells		0.9919	0.9919	0.9919	0.9919	0.9919	0.9919
Phasing of Wells		1	0	0	0	0	0
Well Cost		86725	0	0	0	0	0
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	4						
Head Loss/100 feet	0.176						
Depth to Water Surface	1500						
Total Head Required	1589						
Total Horsepower	72						
Cost of Pipeline	**15**	$ 79,200.00	$ -	$ -	$ -	$ -	$ -
Booster Station and Ground							
Storage per 3 wells			0		0	0	0
Total Capital Cost		$ 165,925.00	$ -	$ -	$ -	$ -	$ -
Engineering & Cont. (30%)		$49,778	$0	$0	$0	$0	$0
Interest During Construction		$8,988	$0	$0	$0	$0	$0
Total Cost		$224,690	$0	$0	$0	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$19,590	$0	$0	$0	$0	$0
New Plus Existing		$19,590	$19,590	$0	$0	$0	$0
O&M Cost							
Electricity		21,089	21,089	21,089	21,089	21,089	21,089
O&M		$2,168	$2,168	$2,168	$2,168	$2,168	$2,168
Transmission Line		$792	$792	$792	$792	$792	$792
Total Annual Cost		$43,639	$43,639	$24,049	$24,049	$24,049	$24,049
Unit Cost, $/1000 gallons		$1.34	$1.34	$0.74	$0.74	$0.74	$0.74
							$436.39

$1.34

San Augustine
Manufacturing

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		2	3	4	5	6	7.25
Well Design, gpm (2*Reqd)		2	4	5	6	7	9
Supplied groundwater, MGD		0.0018	0.0027	0.0036	0.0045	0.0054	0.0065
County GW Parameters							
All. GPM/well (125)	10						
Well Depth	800						
Cost /Well	**76030**						
No. of Wells		0.2480	0.3720	0.4959	0.6199	0.7439	0.8989
Phasing of Wells		1	0	0	0	0	0
Well Cost		$ 76,030.00	$ -	$ -	$ -	$ -	$ -
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	2						
Head Loss/100 feet	0.176						
Depth to Water Surface	1500						
Total Head Required	1589						
Total Horsepower	6						
Cost of Pipeline	**10**	$ 52,800.00	$ -	$ -	$ -	$ -	$ -
Booster Station and Ground							
Storage per 3 wells			0		0	0	0
Total Capital Cost		$ 128,830.00	$ -	$ -	$ -	$ -	$ -
Engineering & Cont. (30%)		$38,649	$0	$0	$0	$0	$0
Interest During Construction		$6,978	$0	$0	$0	$0	$0
Total Cost		$174,457	$0	$0	$0	$0	$0
Annual Cost							
New Debt Service,6%, 30yrs.		($12,674)	$0	$0	$0	$0	$0
New Plus Existing		($12,674)	($12,674)	($12,674)	$0	$0	$0
O&M Cost							
Electricity		(1,687)	(1,687)	(1,687)	(1,687)	(1,687)	(1,687)
O&M		($1,901)	($1,901)	($1,901)	($1,901)	($1,901)	($1,901)
Transmission Line		($528)	($528)	($528)	($528)	($528)	($528)
Total Annual Cost		($16,790)	($16,790)	($16,790)	($4,116)	($4,116)	($4,116)
Unit Cost, $/1000 gallons		($25.76)	($17.17)	($12.88)	($2.53)	($2.10)	($1.74)

San Augustine
County Other

Neches	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		1	0	0	0	0	13
Well Design, gpm (2*Reqd)		1	0	0	0	0	16
Supplied groundwater, MGD		0.0009	0.0000	0.0000	0.0000	0.0000	0.0116
County GW Parameters							
All. GPM/well (125)	20						
Well Depth	800						
Cost /Well	**76960**						
No. of Wells		0.0620	0.0000	0.0000	0.0000	0.0000	0.8059
Phasing of Wells		0	0	0	0	0	1
Well Cost		$ -	$ -	$ -	$ -	$ -	$ 76,960.00
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	2						
Head Loss/100 feet	0.176						
Depth to Water Surface	1500						
Total Head Required	1589						
Total Horsepower	11						
Cost of Pipeline	**10**	$ -	$ -	$ -	$ -	$ -	$ 52,800.00
Booster Station and Ground Storage per 3 wells			0		0	0	0
Total Capital Cost		$ -	$ -	$ -	$ -	$ -	$129,760.00
Engineering & Cont. (30%)		$0	$0	$0	$0	$0	$38,928
Interest During Construction		$0	$0	$0	$0	$0	$7,029
Total Cost		$0	$0	$0	$0	$0	$175,717
Annual Cost							
New Debt Service,6%, 30yrs.		$0	$0	$0	$0	$0	($12,766)
New Plus Existing		$0	$0	$0	$0	$0	($12,766)
O&M Cost							
Electricity		0	0	0	0	0	(3,374)
O&M		$0	$0	$0	$0	$0	($1,924)
Transmission Line		$0	$0	$0	$0	$0	($528)
Total Annual Cost		$0	$0	$0	$0	$0	($18,592)
Unit Cost, $/1000 gallons							($4.39)

San Augustine
Livestock

Neches	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		150	150	250	300	400	400
Well Design, gpm (2*Reqd)		186	186	310	372	496	496
Supplied groundwater, MGD		0.1339	0.1339	0.2232	0.2679	0.3571	0.3571
County GW Parameters							
All. GPM/well (125)	130						
Well Depth	800						
Cost /Well	**87190**						
No. of Wells		1.4306	1.4306	2.3843	2.8612	3.8149	3.8149
Phasing of Wells		1		1		1	
Well Cost		$ 87,190.00	$ -	$ 87,190.00	$ -	$ 87,190.00	$ -
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	2						
Head Loss/100 feet	0.176						
Depth to Water Surface	1500						
Total Head Required	1589						
Total Horsepower	75						
Cost of Pipeline	**10**	$ 52,800.00	$ -	$ 52,800.00	$ -	$ 52,800.00	$ -
Booster Station and Ground							
Storage per 3 wells			0		0	0	0
Total Capital Cost		$ 139,990.00	$ -	$ 139,990.00	$ -	$ 139,990.00	$ -
Engineering & Cont. (30%)		$41,997	$0	$41,997	$0	$41,997	$0
Interest During Construction		$7,583	$0	$7,583	$0	$7,583	$0
Total Cost		$189,570	$0	$189,570	$0	$189,570	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$16,528	$0	$16,528	$0	$16,528	$0
New Plus Existing		$16,528	$16,528	$16,528	$16,528	$16,528	$16,528
O&M Cost							
Electricity		21,933	21,933	43,865	43,865	65,798	65,798
O&M		$2,180	$2,180	$4,360	$4,360	$6,539	$6,539
Transmission Line		$528	$528	$1,056	$1,056	$1,584	$1,584
Total Annual Cost		$41,168	$41,168	$65,808	$65,808	$90,448	$90,448
Unit Cost, $/1000 gallons		$0.84	$0.84	$0.81	$0.67	$0.69	$0.69

SHCTY-2
Shelby County Other
Increase Supply from Carrizo-Wilcox Aquifer

Owner: Shelby County Other
Quantity: 350 AF/Y

Item	Size		Quantity	Unit	Unit Price	Cost
Capital Costs						
Wellfield and Treatment						
Wells	150	gpm	3	Ea.	$80,964	$242,900
Connection to Pump Station			3	Ea.	$20,000	$60,000
Storage Tank (Closed)	25,000	Gal	3	Ea.	$20,000	$60,000
Engineering and Contingencies (35% for well field)						$127,000
Subtotal for Wellfield and Treatment						**$489,900**
Transmission System						
Pipeline - Rural	6	inch	26,400	LF	$26	$686,400
Pipeline - Urban	6	inch	0	LF	$39	$0
Pump Station	22.0	HP	1	LS	$575,000	$575,000
Easement - Rural	15	Feet	9	AC	$2,000	$18,200
Easement - Urban	15	Feet	0	AC	$20,000	$0
Engineering and Contingencies (30% for pipleines, 35% for other items)						$407,200
Subtotal for Transmission						**$1,686,800**
TOTAL CONSTRUCTION COST						**$2,176,700**
Interest During Construction				**(6 months)**		**$36,600**
Permitting and Mitigation						**$12,600**
Groundwater Rights/ Purchase						**$52,500**
TOTAL CAPITAL COST						**$2,278,400**
Annual Costs						
Debt Service (6 percent for 20 years)						$198,600
Electricity (Transmission)						$16,797
Well operation and treatment				Kgal	$0.30	$34,200
Operation and Maintenance of transmission						$25,500
Total Annual Cost						**$275,097**
UNIT COSTS (Until Amortized)						
Water Cost ($ per ac-ft)						**$786**
Water Cost ($ per 1,000 gallons)						**$2.41**
UNIT COSTS (After Amortization)						
Water Cost ($ per ac-ft)						**$219**
Water Cost ($ per 1,000 gallons)						**$0.67**

SHCTY-3
Shelby County - Other
Purchase Water from Sabine River Authority

Probable Owner: Shelby County Other
Quantity: 150 AF/Y

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	6 in.	26,400	LF	$26	$686,000
Pipeline Urban	6 in.	0	LF	$39	$0
Right of Way Easements Rural (ROW)		9.1	ACRE	$2,000	$18,000
Right of Way Easements Urban (ROW)		0.0	ACRE	$20,000	$0
Engineering and Contingencies (30%)					$206,000
Subtotal of Pipeline					**$910,000**
Pump Station(s)					
Pump Station and Intake	8 HP	1	LS	$529,000	$529,000
Booster Pump Station	0 HP	0	LS	$0	$0
Engineering and Contingencies (35%)					$185,150
Subtotal of Pump Station(s)					**$714,150**
Surface Water Treatment					
Water treatment plant	0.25 MGD	1	LS	$1,250,000	$1,250,000
CONSTRUCTION TOTAL					**$2,874,150**
Permitting and Mitigation					**$30,000**
Interest During Construction			**(12 months)**		**$120,000**
TOTAL COST					**$3,024,150**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$263,700
Electricity ($0.09 kWh)					$1,100
Operation & Maintenance					$24,000
Water Purchase Agreement with SRA			Kgal	$0.50	$24,400
Treatment Costs			Kgal	$0.70	$34,200
Total Annual Costs					**$347,400**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$2,316
Per 1,000 Gallons					$7.10
UNIT COSTS (After Amortization)					
Per Acre-Foot					$558
Per 1,000 Gallons					$1.01

Notes: Cost for buying treated water is assumed to be $1.50 per 1,000 gallons

SHLIV-1
Shelby County Livestock
Increase Supply from Carrizo-Wilcox Aquifer (Sabine Basin)

Owner:	Shelby County Livestock				
Quantity:	2,000 AF/Y				

Item	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Capital Costs					
Wellfield and Treatment					
Wells	300 gpm	8	Ea.	$72,331	$578,600
Engineering and Contingencies (35% for well field)					$202,500
Subtotal for Wellfield and Treatment					**$781,100**
Transmission System	**ASSUME NO NEW TRANSMISSION**				
TOTAL CONSTRUCTION COST					**$781,100**
Interest During Construction			**(2 months)**		**$6,500**
Permitting and Mitigation					**$0**
Groundwater Rights/ Purchase					**$600,000**
TOTAL CAPITAL COST					**$1,387,600**
Annual Costs					
Debt Service (6 percent for 20 years)					$121,000
Electricity				$0.09	$92,000
Total Annual Cost					**$213,000**
UNIT COSTS (Until Amortized)					
Water Cost ($ per ac-ft)					**$107**
Water Cost ($ per 1,000 gallons)					**$0.33**
UNIT COSTS (After Amortization)					
Water Cost ($ per ac-ft)					**$46**
Water Cost ($ per 1,000 gallons)					**$0.14**

SHLIV-1
Shelby County Livestock
Increase Supply from Carrizo-Wilcox Aquifer (Neches Basin)

Owner: Shelby County Livestock
Quantity: 1,500 AF/Y

Item	Size	Quantity	Unit	Unit Price	Cost
Capital Costs					
Wellfield and Treatment					
Wells	300 gpm	6	Ea.	$72,331	$434,000
Engineering and Contingencies (35% for well field)					$151,900
Subtotal for Wellfield and Treatment					**$585,900**
Transmission System	**ASSUME NO NEW TRANSMISSION**				
TOTAL CONSTRUCTION COST					**$585,900**
Interest During Construction			**(2 months)**		**$4,900**
Permitting and Mitigation					**$0**
Groundwater Rights/ Purchase					**$450,000**
TOTAL CAPITAL COST					**$1,040,800**
Annual Costs					
Debt Service (6 percent for 20 years)					$90,700
Electricity				$0.09	$69,000
Total Annual Cost					**$159,700**
UNIT COSTS (Until Amortized)					
Water Cost ($ per ac-ft)					**$106**
Water Cost ($ per 1,000 gallons)					**$0.33**
UNIT COSTS (After Amortization)					
Water Cost ($ per ac-ft)					**$46**
Water Cost ($ per 1,000 gallons)					**$0.14**

SHLIV-2
Shelby County - Livestock
Purchase Water from Toledo Bend Reservoir

Probable Owner: Shelby County Livestock
Quantity: 4,000 AF/Y

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	20 in.	26,400	LF	$90	$2,376,000
Pipeline Urban	20 in.	0	LF	$135	$0
Right of Way Easements Rural (ROW)		12.1	ACRE	$2,000	$24,000
Right of Way Easements Urban (ROW)		0.0	ACRE	$20,000	$0
Engineering and Contingencies (30%)					$713,000
Subtotal of Pipeline					**$3,113,000**
Pump Station(s)					
Pump with intake & building	110 HP	1	LS	$1,052,000	$1,052,000
Booster Pump Station	0 HP	0	LS	$0	$0
Engineering and Contingencies (35%)					$368,200
Subtotal of Pump Station(s)					**$1,420,200**
CONSTRUCTION TOTAL					**$4,533,200**
Permitting and Mitigation					**$41,000**
Interest During Construction			**(12 months)**		**$189,000**
TOTAL COST					**$4,763,200**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$415,000
Electricity ($0.09 kWh)				$0.09	$49,000
Operation & Maintenance					$61,000
Raw Water Purchase			Kgal	$0.50	$652,000
Total Annual Costs					**$1,177,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of raw water					$294
Per 1,000 Gallons					$0.90
UNIT COSTS (After Amortization)					
Per Acre-Foot					$191
Per 1,000 Gallons					$0.58

SALIV-1
Shelby County Livestock
Increase Supply from Local Sources

Owner: Shelby County Livestock
Quantity: 500 AF/Y

Item	Size	Quantity	Unit	Unit Price	Cost
Capital Costs					
Stock Ponds					
Stock Ponds	50 AF/Y	10	Ea.	$50,000	$500,000
Engineering and Contingencies					$175,000
Subtotal for Local Supply					**$675,000**
TOTAL CONSTRUCTION COST					**$675,000**
Interest During Construction			**(6 months)**		**$14,600**
Permitting and Mitigation					**$0**
TOTAL CAPITAL COST					**$689,600**
Annual Costs					
Debt Service (6 percent for 20 years)					$60,100
Total Annual Cost					**$60,100**
UNIT COSTS (Until Amortized)					
Water Cost ($ per ac-ft)					**$120**
Water Cost ($ per 1,000 gallons)					**$0.37**
UNIT COSTS (After Amortization)					
Water Cost ($ per ac-ft)					**$0**
Water Cost ($ per 1,000 gallons)					**$0.00**

WUGNAME:	**Shelby Mining**				
STRATEGY:	**Angelina River**				
Quantity:	**250** AF/Y		0.33 MGD		

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	6 in.	10,560	LF	$26	$275,000
Right of Way Easements Rural (ROW)		4.8	ACRE	$2,000	$10,000
Engineering and Contingencies (30%)					$83,000
Subtotal of Pipeline					**$368,000**
Pump Station(s)					
Pump with intake	15 HP	1	LS	$744,000	$744,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$260,400
Subtotal of Pump Station(s)					**$1,004,400**
Terminal Storage	**0.05 MG**	**1**	**LS**	$125,000	**$125,000**
CONSTRUCTION TOTAL					**$1,497,400**
Permitting and Mitigation					**$14,000**
Interest During Construction			**(6 months)**		**$32,000**
TOTAL COST					**$1,543,400**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$135,000
Electricity ($0.09 kWh)					$4,000
Operation & Maintenance					$29,000
Raw Water Purchase			Kgal	$0.50	$41,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$209,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$836
Per 1,000 Gallons					$2.56
UNIT COSTS (After Amortization)					
Per Acre-Foot					$296
Per 1,000 Gallons					$0.91

WUGNAME:	**Shelby Mining**				
STRATEGY:	**Purchase from SRA**				
Quantity:	**1,250** AF/Y		1.67 MGD		

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	14 in.	26,400	LF	$60	$1,584,000
Right of Way Easements Rural (ROW)		12.1	ACRE	$2,000	$24,000
Engineering and Contingencies (30%)					$475,000
Subtotal of Pipeline					**$2,083,000**
Pump Station(s)					
Pump with intake	60 HP	1	LS	$897,000	$897,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$313,950
Subtotal of Pump Station(s)					**$1,210,950**
Terminal Storage	**0.5 MG**	**1**	**LS**	$438,000	**$438,000**
CONSTRUCTION TOTAL					**$3,731,950**
Permitting and Mitigation					**$35,000**
Interest During Construction			**(6 months)**		**$81,000**
TOTAL COST					**$3,847,950**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$335,000
Electricity ($0.09 kWh)					$21,000
Operation & Maintenance					$59,000
Raw Water Purchase			Kgal	$0.50	$204,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$619,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$495
Per 1,000 Gallons					$1.52
UNIT COSTS (After Amortization)					
Per Acre-Foot					$227
Per 1,000 Gallons					$0.70

SMITH COUNTY

Bullard

	2000	2010	2020	2030	2040	2050	2060	
Required groundwater, af/y			13	42	71	124	195	
Well Design, gpm (2*Reqd)		0	16	52	88	154	242	
Supplied groundwater, MGD		0.0000	0.0116	0.0375	0.0634	0.1107	0.1741	
County GW Parameters								
All. GPM/well	125							
Well Depth	800							
Cost /Well	86725							
No. of Wells		0	0.1289429	0.4165848	0.7042266	1.2299169	1.9341436	
Phasing of Wells			1			1		
Well Cost		$0	$86,725	$0	$0	$86,725	$0.00	$173,450
Distribution Cost								
Length Dist. Pipe/Well	5280							
Total Length								
Pipe Diameter, in	6							
Head Loss/100 feet	0.132							
Depth to Water Surface	800							
Total Head Required	887							
Total Horsepower	40							
Cost of Pipeline	26	$0	$137,280	$0	$0	$137,280	0	$274,560
Ground Storage and Pressure	0	$0	$0	$0	$0	$0	$0	
Total Capital Cost		$0	$224,005	$0	$0	$224,005	0	448010
Engineering & Cont. (30%)		$0	$67,202	$0	$0	$67,202	$0	$134,403
Interest During Construction		$0	$12,134	$0	$0	$12,134	$0	$24,267
Total Cost		$0	$303,340	$0	$0	$303,340	$0	$606,680
Annual Cost								
New Debt Service,6%, 30yrs.		$0	($22,037)	$0	$0	($22,037)	$0	($44,075)
New Plus Existing		$0	($22,037)	($22,037)	($22,037)	($22,037)	($22,037)	
O&M Cost								
Electricity		0	(7,846)	(7,846)	(7,846)	(15,693)	(15,693)	
O&M		$0	($2,168)	($2,168)	($2,168)	($4,336)	($4,336)	
Transmission Line		$0	($1,373)	($1,373)	($1,373)	($2,746)	($2,746)	
Total Annual Cost		$0	($33,425)	($33,425)	($33,425)	($44,812)	($44,812)	
Unit Cost, $/1000 gallons			($7.89)	($2.44)	($1.44)	($1.11)	($0.71)	

Community Water Co.

	2000	2010	2020	2030	2040	2050	2060	
Required groundwater, af/y		37	88	111	132	171	227	
Well Design, gpm (2*Reqd)		46	109	138	164	212	281	
Supplied groundwater, MGD		0.0330	0.0786	0.0991	0.1179	0.1527	0.2027	
County GW Parameters								
All. GPM/well	150							
Well Depth	1000							
Cost /Well	105450							
No. of Wells		0.3058261	0.7273702	0.9174784	1.0910553	1.4134126	1.8762846	
Phasing of Wells		1					1	
Well Cost		$105,450	$0	$0	$0	$0	$105,450	$210,900
Distribution Cost								
Length Dist. Pipe/Well	5280							
Total Length								
Pipe Diameter, in	6							
Head Loss/100 feet	0.226							
Depth to Water Surface	20							
Total Head Required	112							
Total Horsepower	6							
Cost of Pipeline	26	$137,280	$0	$0	$0	$0	137280	$274,560
Ground Storage and Pressure	200000	$200,000	$0	$0	$0	$0	$200,000	
Total Capital Cost		$442,730	$0	$0	$0	$0	442730	485460
Engineering & Cont. (30%)		$132,819	$0	$0	$0	$0	$132,819	$145,638
Interest During Construction		$23,981	$0	$0	$0	$0	$23,981	$26,296
Total Cost		$599,530	$0	$0	$0	$0	$599,530	$657,394
Annual Cost								
New Debt Service,6%, 30yrs.		($43,555)	$0	$0	$0	$0	($43,555)	($47,759)
New Plus Existing		($43,555)	($43,555)	($43,555)	$0	$0	($43,555)	
O&M Cost								
Electricity		(1,188)	(1,188)	(1,188)	(1,188)	(1,188)	(2,376)	-7793.28221
O&M		($2,636)	($2,636)	($2,636)	($2,636)	($2,636)	($5,273)	-3060.4
Transmission Line		($3,373)	($3,373)	($3,373)	($3,373)	($3,373)	($6,746)	-3168
Total Annual Cost		($50,753)	($50,753)	($50,753)	($7,197)	($7,197)	($57,950)	($61,781)
Unit Cost, $/1000 gallons		($4.21)	($1.77)	($1.40)	($0.17)	($0.13)	($0.78)	
Amount Provided								

Jackson WSC

	2000	2010	2020	2030	2040	2050	2060	
Required groundwater, af/y						28	68	
Well Design, gpm (2*Reqd)		0	0	0	0	35	84	
Supplied groundwater, MGD		0.0000	0.0000	0.0000	0.0000	0.0250	0.0607	
County GW Parameters								
All. GPM/well	85							
Well Depth	900							
Cost /Well	91205							
No. of Wells		0	0	0	0	0.4084164	0.9918685	
Phasing of Wells						1		
Well Cost		$0	$0	$0	$0	$91,205	$0.00	$91,205
Distribution Cost								
Length Dist. Pipe/Well	5280							
Total Length								
Pipe Diameter, in	6							
Head Loss/100 feet	0.062							
Depth to Water Surface	20							
Total Head Required	103							
Total Horsepower	3							
Cost of Pipeline	26	$0	$0	$0	$0	$137,280	0	$137,280
Ground Storage and Pressure	250000	$0	$0	$0	$0	$250,000	$0	
Total Capital Cost		$0	$0	$0	$0	$478,485	0	228485
Engineering & Cont. (30%)		$0	$0	$0	$0	$143,546	$0	$68,546
Interest During Construction		$0	$0	$0	$0	$25,918	$0	$12,376
Total Cost		$0	$0	$0	$0	$647,949	$0	$309,407
Annual Cost								
New Debt Service,6%, 30yrs.		$0	$0	$0	$0	($47,073)	$0	($22,478)
New Plus Existing		$0	$0	$0	$0	($47,073)	($47,073)	
O&M Cost								
Electricity		0	0	0	0	(621)	(621)	-7793.28221
O&M		$0	$0	$0	$0	($2,280)	($2,280)	-3060.4
Transmission Line		$0	$0	$0	$0	($3,873)	($3,873)	-3168
Total Annual Cost		$0	$0	$0	$0	($53,847)	($53,847)	($36,500)
Unit Cost, $/1000 gallons						($5.90)	($2.43)	
Amount Provided								

Lindale

	2000	2010	2020	2030	2040	2050	2060	
Required groundwater, af/y					8	33	59	
Well Design, gpm (2*Reqd)		0	0	0	10	41	73	
Supplied groundwater, MGD		0.0000	0.0000	0.0000	0.0071	0.0295	0.0527	
County GW Parameters								
All. GPM/well	60							
Well Depth	1200							
Cost /Well	113480							
No. of Wells		0	0	0	0.1653114	0.6819096	1.2191717	
Phasing of Wells							1	
Well Cost		$0	$0	$0	$0	$0	$113,480	$113,480
Distribution Cost								
Length Dist. Pipe/Well	5280							
Total Length								
Pipe Diameter, in	6							
Head Loss/100 feet	0.062							
Depth to Water Surface	1100							
Total Head Required	1183							
Total Horsepower	26							
Cost of Pipeline	26	$0	$0	$0	$0	$0	137280	$137,280
Ground Storage and Pressure		$0	$0	$0	$0	$0	$0	
Total Capital Cost		$0	$0	$0	$0	$0	250760	250760
Engineering & Cont. (30%)		$0	$0	$0	$0	$0	$75,228	$75,228
Interest During Construction		$0	$0	$0	$0	$0	$13,583	$13,583
Total Cost		$0	$0	$0	$0	$0	$339,571	$339,571
Annual Cost								
New Debt Service,6%, 30yrs.		$0	$0	$0	$0	$0	($24,669)	($24,669)
New Plus Existing		$0	$0	$0	$0	$0	($24,669)	
O&M Cost								
Electricity		0	0	0	0	0	(5,024)	-7793.28221
O&M		$0	$0	$0	$0	$0	($2,837)	-3060.4
Transmission Line		$0	$0	$0	$0	$0	($1,373)	-3168
Total Annual Cost		$0	$0	$0	$0	$0	($33,904)	($38,691)
Unit Cost, $/1000 gallons					$0.00	$0.00	($1.76)	
Amount Provided								

Lindale Rural WSC

	2000	2010	2020	2030	2040	2050	2060	
Required groundwater, af/y							74	
Well Design, gpm (2*Reqd)		0	0	0	0	0	92	
Supplied groundwater, MGD		0.0000	0.0000	0.0000	0.0000	0.0000	0.0661	
County GW Parameters								
All. GPM/well	100							
Well Depth	1200							
Cost /Well	117200							
No. of Wells		0	0	0	0	0	0.9174784	
Phasing of Wells							1	
Well Cost		$0	$0	$0	$0	$0	$117,200	$117,200
Distribution Cost								
Length Dist. Pipe/Well	5280							
Total Length								
Pipe Diameter, in	6							
Head Loss/100 feet	0.094							
Depth to Water Surface	1100							
Total Head Required	1185							
Total Horsepower	43							
Cost of Pipeline	26	$0	$0	$0	$0	$0	137280	$137,280
Ground Storage and Pressure		$0	$0	$0	$0	$0	$0	
Total Capital Cost		$0	$0	$0	$0	$0	254480	254480
Engineering & Cont. (30%)		$0	$0	$0	$0	$0	$76,344	$76,344
Interest During Construction		$0	$0	$0	$0	$0	$13,784	$13,784
Total Cost		$0	$0	$0	$0	$0	$344,608	$344,608
Annual Cost								
New Debt Service,6%, 30yrs.		$0	$0	$0	$0	$0	($25,035)	($25,035)
New Plus Existing		$0	$0	$0	$0	$0	($25,035)	
O&M Cost								
Electricity		0	0	0	0	0	(8,386)	-7793.28221
O&M		$0	$0	$0	$0	$0	($2,930)	-3060.4
Transmission Line		$0	$0	$0	$0	$0	($1,373)	-3168
Total Annual Cost		$0	$0	$0	$0	$0	($37,724)	($39,057)
Unit Cost, $/1000 gallons							($1.56)	
Amount Provided								

Smith County Irrigation

	2000	2010	2020	2030	2040	2050	2060	
Required groundwater, af/y		5	34	65	96	128	162	
Well Design, gpm (2*Reqd)		6	42	81	119	159	201	
Supplied groundwater, MGD		0.0045	0.0304	0.0580	0.0857	0.1143	0.1446	
County GW Parameters								
All. GPM/well	50							
Well Depth	500							
Cost /Well	55150							
No. of Wells		0.1239836	0.8430882	1.6117863	2.3804844	3.1739792	4.0170674	
Phasing of Wells		1		1	1	1		
Well Cost		$55,150	$0	$55,150	$55,150	$55,150	$0.00	$220,600
Distribution Cost								
Length Dist. Pipe/Well	400							
Total Length								
Pipe Diameter, in	6							
Head Loss/100 feet	0.027							
Depth to Water Surface	500							
Total Head Required	580							
Total Horsepower	10							
Cost of Pipeline	26	$10,400	$0	$10,400	$10,400	$10,400	0	$41,600
Ground Storage and Pressure		$0	$0	$0	$0	$0	$0	
Total Capital Cost		$65,550	$0	$65,550	$65,550	$65,550	0	262200
Engineering & Cont. (30%)		$19,665	$0	$19,665	$19,665	$19,665	$0	$78,660
Interest During Construction		$3,551	$0	$3,551	$3,551	$3,551	$0	$14,203
Total Cost		$88,766	$0	$88,766	$88,766	$88,766	$0	$355,063
Annual Cost								
New Debt Service,6%, 30yrs.		($6,449)	$0	($6,449)	($6,449)	($6,449)	$0	($25,795)
New Plus Existing		($6,449)	($6,449)	($12,897)	($12,897)	($19,346)	($12,897)	
O&M Cost								
Electricity		(2,053)	(2,053)	(4,105)	(6,158)	(8,211)	(8,211)	-7793.28221
O&M		($1,379)	($1,379)	($2,758)	($4,136)	($5,515)	($5,515)	-3060.4
Transmission Line		($104)	($104)	($208)	($312)	($416)	($416)	-3168
Total Annual Cost		($9,984)	($9,984)	($19,968)	($23,504)	($33,488)	($27,039)	($39,817)
Unit Cost, $/1000 gallons		($6.13)	($0.90)	($0.94)	($0.75)	($0.80)	($0.51)	
Amount Provided								

WUGNAME: **Smith_Bullard Phase 1**
STRATEGY: **New Wells Carrizo-Wilcox Aquifer**
AMOUNT (ac-ft/yr): **100**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**	
Water Well Construction		1	ea	$ 86,725	$	86,725
Pipeline Connection to Water System	6 in.	5280	ea	$ 26	$	137,280
Subtotal					**$**	**224,005**
Engineering and Contingencies (30%)					$	67,202
Mitigation and Permitting (1%)					$	2,240
Subtotal					**$**	**293,447**
Interest During Construction					$	12,227
TOTAL CAPITAL COST					***$***	***305,674***
ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**	
Debt Service					$	26,650
Pipeline O&M (1%)					$	1,373
Pump O&M (2.5%)					$	2,168
Chemicals			1000 gal	$ 0.30	$	9,776
Electricity					$	11,770
TOTAL ANNUAL COST w/ AMORTIZATION					***$***	***51,736***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$***	***25,086***
UNIT COSTS (Until Amortized)						
Cost per acre-ft					$	517
Cost per 1000 gallons					$	1.59
UNIT COSTS (After Amortization)						
Cost per acre-ft					$	251
Cost per 1000 gallons					$	0.77

WUGNAME: **Smith_Community Water Company**
STRATEGY: **Purchase Water From the City of Tyler**
AMOUNT (ac-ft/yr): **227**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Pipeline Connection to Water System	6 in.	26400	ea	$ 26	$ 686,400
Booster Pump Station	5 HP	1	ea	$ 516,000	$ 516,000
Subtotal					**$ 1,202,400**
Engineering and Contingencies (30%)					$ 360,720
Mitigation and Permitting (1%)					$ 12,024
Subtotal					**$ 1,575,144**
Interest During Construction					$ 65,632
TOTAL CAPITAL COST					***$ 1,640,776***
ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Debt Service					$ 143,050
Pipeline O&M (1%)					$ 6,864
Pump O&M (2.5%)					$ 17,160
Chemicals			1000 gal		$ -
Electricity					$ 6,582
Treated Water Purchase		73,968	1000 gal	$ 3.00	$ 221,905
TOTAL ANNUAL COST w/ AMORTIZATION					***$ 395,561***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$ 252,511***
UNIT COSTS (Until Amortized)					
Cost per acre-ft					$ 1,743
Cost per 1000 gallons					$ 5.35
UNIT COSTS (After Amortization)					
Cost per acre-ft					$ 1,112
Cost per 1000 gallons					$ 3.41

WUGNAME: **Smith_Lindale WSC**
STRATEGY: **New Wells Carrizo-Wilcox Aquifer**
AMOUNT (ac-ft/yr): **80**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**	
Water Well Construction		1	ea	$ 117,200	$	117,200
Pipeline Connection to Water System	6 in.	5280	ea	$ 26	$	137,280
Subtotal					**$**	**254,480**
Engineering and Contingencies (30%)					$	76,344
Mitigation and Permitting (1%)					$	2,545
Subtotal					**$**	**333,369**
Interest During Construction					$	13,890
TOTAL CAPITAL COST					***$***	***347,259***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**	
Debt Service					$	30,276
Pipeline O&M (1%)					$	1,373
Pump O&M (2.5%)					$	2,930
Chemicals			1000 gal	$ 0.30	$	7,820
Electricity					$	23,539
TOTAL ANNUAL COST w/ AMORTIZATION					***$***	***65,938***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$***	***35,662***

UNIT COSTS (Until Amortized)		
Cost per acre-ft	$	824
Cost per 1000 gallons	$	2.53

UNIT COSTS (After Amortization)		
Cost per acre-ft	$	446
Cost per 1000 gallons	$	1.37

WUGNAME: **Smith_Irrigation**
STRATEGY: **New Wells Queen City Aquifer**
AMOUNT (ac-ft/yr): **168**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**	
Water Well Construction		4	ea	$ 55,150	$	220,600
Pipeline Connection to Water System	6 in.	1600	ea	$ 26	$	41,600
Subtotal					**$**	**262,200**
Engineering and Contingencies (30%)					$	78,660
Mitigation and Permitting (1%)					$	2,622
Subtotal					**$**	**343,482**
Interest During Construction					$	14,312
TOTAL CAPITAL COST					***$***	***357,794***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**	
Debt Service					$	31,194
Pipeline O&M (1%)					$	416
Pump O&M (2.5%)					$	5,515
Chemicals			1000 gal		$	-
Electricity					$	2,208
TOTAL ANNUAL COST w/ AMORTIZATION					***$***	***39,333***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$***	***8,139***

UNIT COSTS (Until Amortized)		
Cost per acre-ft	$	234
Cost per 1000 gallons	$	0.72

UNIT COSTS (After Amortization)		
Cost per acre-ft	$	48
Cost per 1000 gallons	$	0.15

WUGNAME: **Smith_Manufacturing**
STRATEGY: **Purchase Water From the City of Tyler**
AMOUNT (ac-ft/yr): **294**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**		**Cost**	
Pipeline Connection to Water System	8 in.	15840	ea	$	34	$	538,560
Booster Pump Station	12 HP	1	ea	$	543,200	$	543,200
Subtotal						**$**	**1,081,760**
Engineering and Contingencies (30%)						$	324,528
Mitigation and Permitting (1%)						$	10,818
Subtotal						**$**	**1,417,106**
Interest During Construction						$	59,047
TOTAL CAPITAL COST						***$***	***1,476,152***
ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**		**Cost**	
Debt Service						$	128,698
Pipeline O&M (1%)						$	5,386
Pump O&M (2.5%)						$	13,464
Chemicals			1000 gal			$	-
Electricity						$	3,863
Treated Water Purchase		95,800	1000 gal	$	3.00	$	287,401
TOTAL ANNUAL COST w/ AMORTIZATION						***$***	***438,811***
TOTAL ANNUAL COST AFTER AMORTIZATION						***$***	***310,113***
UNIT COSTS (Until Amortized)							
Cost per acre-ft						$	1,493
Cost per 1000 gallons						$	4.58
UNIT COSTS (After Amortization)							
Cost per acre-ft						$	1,055
Cost per 1000 gallons						$	3.24

WUGNAME: **Smith_Mining**
STRATEGY: **New Wells Queen City Aquifer**
AMOUNT (ac-ft/yr): **329**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**	
Water Well Construction		7	ea	$ -	$	-
Pipeline Connection to Water System	6 in.	3500	ea	$ 26	$	91,000
Subtotal					**$**	**91,000**
Engineering and Contingencies (30%)					$	27,300
Mitigation and Permitting (1%)					$	910
Subtotal					**$**	**119,210**
Interest During Construction					$	4,967
TOTAL CAPITAL COST					***$***	***124,177***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**	
Debt Service					$	10,826
Pipeline O&M (1%)					$	910
Pump O&M (2.5%)					$	-
Chemicals			1000 gal		$	-
Electricity					$	4,323
TOTAL ANNUAL COST w/ AMORTIZATION					***$***	***16,059***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$***	***5,233***

UNIT COSTS (Until Amortized)		
Cost per acre-ft	$	49
Cost per 1000 gallons	$	0.15
UNIT COSTS (After Amortization)		
Cost per acre-ft	$	16
Cost per 1000 gallons	$	0.05

Trinity County
County - Other

Neches	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y		0	0	0	60	60	60
Well Design, af/y (2*Reqd)		0	0	0	120	120	120
Well Design, gpm (2*Reqd)		0	0	0	74	74	74
Supplied groundwater, MGD		0.0000	0.0000	0.0000	0.0536	0.0536	0.0536
County GW Parameters							
All. GPM/well (125)	75						
Well Depth	375						
Cost /Well	**47225**						
No. of Wells		0.0000	0.0000	0.0000	0.9919	0.9919	0.9919
Phasing of Wells		0	0	0	1	0	0
Well Cost		$ -	$ -	$ -	$ 47,225.00	$ -	$ -
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	6						
Head Loss/100 feet	0.176						
Depth to Water Surface	1500						
Total Head Required	1589						
Total Horsepower	43						
Cost of Pipeline	**26**	$ -	$ -	$ -	$ 137,280.00	$ -	$ -
Booster Station and Ground Storage per 3 wells			0		0	0	0
Total Capital Cost		$ -	$ -	$ -	$ 184,505.00	$ -	$ -
Engineering & Cont. (30%)		$0	$0	$0	$55,352	$0	$0
Interest During Construction		$0	$0	$0	$9,994	$0	$0
Total Cost		$0	$0	$0	$249,851	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$0	$0	$0	$21,783	$0	$0
New Plus Existing		$0	$0	$0	$21,783	$21,783	$21,783
O&M Cost							
Electricity		0	0	0	12,653	12,653	12,653
O&M			$0	$0	$1,181	$1,181	$1,181
Transmission Line		$0	$0	$0	$1,373	$1,373	$1,373
Total Annual Cost		$0	$0	$0	$36,990	$36,990	$36,990
Unit Cost, $/1000 gallons					$1.89	$1.89	$1.89
Unit Cost, $/ac-ft							$616.50

TYLER COUNTY

County Other

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y			251	251	251	251	251
Well Design, gpm (2*Reqd)		0	311	311	311	311	311
Supplied groundwater, MGD		0.0000	0.2241	0.2241	0.2241	0.2241	0.2241
County GW Parameters							
All. GPM/well (100)	300						
Well Depth	355						
Cost /Well	**133175**						
No. of Wells		0.0000	1.0373	1.0373	1.0373	1.0373	1.0373
Phasing of Wells		0	1	0	0	0	0
Well Cost		$0	$133,175	$0	$0	$0	$0.00
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	6						
Head Loss/100 feet	0.42						
Depth to Water Surface	300						
Total Head Required	402						
Total Horsepower	44						
Cost of Pipeline	**26**	$0	$137,280	$0	$0	$0	0
Booster Station and Ground Storage per 3 wells		$0	$0	$0	$0	$0	0
Total Capital Cost		$0	$270,455	$0	$0	$0	$0
Engineering & Cont. (30%)		$0	$81,137	$0	$0	$0	$0
Interest During Construction		$0	$14,650	$0	$0	$0	$0
Total Cost		$0	$366,241	$0	$0	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$0	$31,931	$0	$0	$0	$0
New Plus Existing		$0	$31,931	$31,931	$0	$0	$0
O&M Cost							
Electricity		0	12,808	12,808	12,808	12,808	12,808
O&M		$0	$3,329	$3,329	$3,329	$3,329	$3,329
Transmission Line		$0	$1,373	$1,373	$1,373	$1,373	$1,373
Total Annual Cost		$0	$49,441	$49,441	$17,510	$17,510	$17,510
Unit Cost, $/1000 gallons			$0.60	$0.60	$0.21	$0.21	$0.21

TYLER COUNTY

City of Woodville

	2000	2010	2020	2030	2040	2050	2060
Required groundwater, af/y			300	300	300	300	300
Well Design, gpm (2*Reqd)		0	372	372	372	372	372
Supplied groundwater, MGD		0.0000	0.2679	0.2679	0.2679	0.2679	0.2679
County GW Parameters							
All. GPM/well (100)	500						
Well Depth	550						
Cost /Well	**198150**						
No. of Wells		0.0000	0.7439	0.7439	0.7439	0.7439	0.7439
Phasing of Wells		0	1	0	0	0	0
Well Cost		$0	$198,150	$0	$0	$0	$0.00
Distribution Cost							
Length Dist. Pipe/Well	5280						
Total Length							
Pipe Diameter, in	8						
Head Loss/100 feet	0.42						
Depth to Water Surface	300						
Total Head Required	402						
Total Horsepower	73						
Cost of Pipeline	**34**	$0	$179,520	$0	$0	$0	0
Booster Station and Ground							
Storage per 3 wells		$0	$0	$0	$0	$0	0
Total Capital Cost		$0	$377,670	$0	$0	$0	$0
Engineering & Cont. (30%)		$0	$113,301	$0	$0	$0	$0
Interest During Construction		$0	$20,457	$0	$0	$0	$0
Total Cost		$0	$511,428	$0	$0	$0	$0
Annual Cost							
New Debt Service,6%, 20yrs.		$0	$44,589	$0	$0	$0	$0
New Plus Existing		$0	$44,589	$44,589	$0	$0	$0
O&M Cost							
Electricity		0	21,347	21,347	21,347	21,347	21,347
O&M		$0	$4,954	$4,954	$4,954	$4,954	$4,954
Transmission Line		$0	$1,795	$1,795	$1,795	$1,795	$1,795
Total Annual Cost		$0	$72,684	$72,684	$28,095	$28,095	$28,095
Unit Cost, $/1000 gallons			$0.74	$0.74	$0.29	$0.29	$0.29

WWPNAME:	**ANRA**
STRATEGY:	**Lake Columbia**
AMOUNT (ac-ft/yr):	**75,700**

Dam	**Cost**
Embankment	$27,097,000
Internal Drainage	$575,000
Soil Cement Slope Protection	$3,092,000
Service Spillway	$5,657,000
Outlet Works	$1,166,000
Miscellaneous Items	$4,970,000
Engineering and Contingencies	$14,895,000
Geotechnical Investigations	$585,000
Subtotal for Dam	$58,036,000
Conflict Resolution	
Communications	$2,361,000
Electric Utilities	$14,485,000
Oil and Gas	$3,671,000
Water Utilities	$155,000
State and County Roads1	$35,144,000
Railroad	$27,609,000
Road and Railroad Erosion Protection	$4,019,000
Engineering and Contingencies	$27,505,000
Subtotal for Conflicts	$114,949,000
Land	
Land and Easement Purchase	$23,496,000
Survey, Appraisal, Legal costs	$2,603,000
Contingencies	$5,220,000
Subtotal for Land	$31,319,000
Mitigation	
Archeological/Historical Resources	$11,026,000
Aquatic/Terrestrial Resources	$16,535,000
Subtotal for Mitigation	$27,561,000
TOTAL COST	**$231,865,000**

ANNUAL COSTS	
Debt Service (6% for 40 years)	$15,410,000
Operation & Maintenance	$870,500
Total Annual Costs	**$16,280,500**
UNIT COSTS (Until Amortized)	
Per Acre-Foot of treated water	$215
Per 1,000 Gallons	$0.66
UNIT COSTS (After Amortization)	
Per Acre-Foot	$11.50
Per 1,000 Gallons	$0.04

WWPNAME:	**ANRA**		
STRATEGY:	**Regional Water Treatment Facililties**		
Quantity:	**5,100 AF/Y**		10.00 MGD

CONSTRUCTION COSTS

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Segment A: WTP to Troup	24 in.	63,360	LF	$116	$7,350,000
Segment B: Troup to Arp	12 in.	34,320	LF	$52	$1,785,000
Segment C: Troup to Whitehouse	16 in.	39,600	LF	$69	$2,732,000
Segment D: Arp to New London	8 in.	36,960	LF	$34	$1,257,000
Segment E: WTP to New Summerfield	12 in.	13,200	LF	$52	$686,000
Right of Way Easements Rural (ROW)		86.1	ACRE	$2,000	$172,000
Engineering and Contingencies (30%)					$4,143,000
Subtotal of Pipeline					**$4,315,000**
Pump Station(s)					
Pump with intake & building	1400 HP	1	LS	$4,515,000	$4,515,000
Engineering and Contingencies (35%)					$1,580,250
Subtotal of Pump Station(s)					**$6,095,250**
Water Treatment Plant	10 MGD	1	LS	$22,400,000	**$22,400,000**
Storage Tanks	0.5 MG	1	LS	$438,000	**$438,000**
CONSTRUCTION TOTAL					**$33,248,250**
Permitting and Mitigation					**$494,000**
Interest During Construction			**(12 months)**		**$1,385,000**
TOTAL COST					**$35,127,250**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$3,063,000
Electricity ($0.09 kWh)					$234,000
Operation & Maintenance					$311,950
Raw Water Purchase			Kgal	$0.66	$1,097,000
Treatment			Kgal	$0.70	$1,163,000
Total Annual Costs					**$5,868,950**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$1,151
Per 1,000 Gallons					$3.53
UNIT COSTS (After Amortization)					
Per Acre-Foot					$550
Per 1,000 Gallons					$1.69

Notes: Cost for buying raw water is assumed to be the unit costs for developing Lake Columbia.

Athens - New Wells in Carrizo-Wilcox Aquifer

Henderson County, Carrizo-Wilcox Aquifer

Supply	1400	Ac-ft/yr	868	gpm
Depth to Water	106			
Well Depth	490			
Well Yield	434	gpm		
Well Size	12	in		
Wells Needed	4			

Construction Costs

	Number	Unit Cost	Total Cost
Water Wells	4	$250,000	$1,000,000
Connection to Transmission System	4	$50,000	$200,000
Engineering and Contingencies (30%)			$360,000
Subtotal of Well(s)			**$1,560,000**

Transmission System	Size	Quantity	Unit	Unit Cost	Total Cost
Pipeline - Rural	14 in.	15,840	LF	$60	$950,000
Pump Station	66 HP	1	EA	$500,000	$500,000
Ground Storage Tank	0.25MG	1	EA	$219,000	$219,000
Easement - Rural		7.3	ACRE	$2,000	$15,000
Engineering and Contingencies (30% for pipelines, 35% for other items)					$460,000
Subtotal for Transmission					**2,144,000**

Permitting and Mitigation				$14,000
Construction Total				$3,718,000
Interest During Construction	6	months		$81,000
Total Capital Cost				**$3,799,000**
Debt Service - Total Capital				$276,000
O&M				
Transmission	1%			$14,000
Well(s) and Pump Station	2.5%			$45,000
Add Chemicals etc.	456,191	$0.30	per 1000 gal	$136,900
Pumping Costs				$42,000
		Total Annual Cost		**$513,900**

UNIT COSTS (First 30 Years)

Cost per ac-ft	$367
Cost per 1000 gallons	$1.13

UNIT COSTS (After 30 Years)

Cost per ac-ft	$170
Cost per 1000 gallons	$0.52

Table

Obtain Water from Forest Grove Reservoir and Transport to New 4 MGD WTP Near Athens

WWPNAME: Athens MWA
STRATEGY: Forest Grove Reservoir/ TRWD
Quantity: 2240 ac-ft/yr

CONSTRUCTION COSTS

TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	24 in.	21,120	LF	$116	$2,450,000
Pipeline Urban	24 in.	5,280	LF	$174	$919,000
Right of Way Easements		See Region C costs estimate			$254,000
Engineering and Contingencies (30%)					$1,011,000
Subtotal of Pipeline					**$4,634,000**
Intake and Pump Station	450 HP	1	EA	$2,540,000	$2,540,000
Engineering and Contingencies (35%)					$889,000
Subtotal of Pump Station(s)					**$3,429,000**
Water Treatment plant					
Water Treatment plant	4.0 MGD	1	EA		$12,325,000
Engineering and Contingencies (35%)					$4,314,000
Subtotal					**$16,639,000**
Permitting and Mitigation		1	LS		$182,000
CONSTRUCTION TOTAL					**$24,884,000**
Interest During Construction			**(18 months)**		**$1,535,000**
Permitting associated with water rights transfer					$200,000
TOTAL CAPITAL COST					**$26,619,000**
ANNUAL COSTS TREATED WATER					
Debt Service (6% for 30 years)					$1,934,000
Treatment			Kgal	$0.70	$510,900
Electricity ($0.09 kWh)					$59,000
Facility Operation & Maintenance					$124,700
Total Annual Costs					**$2,628,600**
Per Acre-Foot of raw water					$1,173
Per 1,000 Gallons of raw water					$3.60
UNIT COSTS - (After Amortization)					
Per Acre-Foot of raw water					$310
Per 1,000 Gallons of raw water					$0.95

Table

Water Treatment Plant Expansion at City of Athens - Forest Grove

Probable Owner: Athens MWA
Amount: 2,240 Acre-Feet/Year

CONSTRUCTION COSTS

WATER TREATMENT FACILITIES

New Treatment Plant at City	4.0 MGD	1	LS	$12,325,000	$12,325,000
Engineering and Contingencies (35%)					$4,314,000
Subtotal of Treatment					**$16,639,000**
Permitting of treatment plant					$147,900
CONSTRUCTION TOTAL					**$16,786,900**
Interest During Construction			**(18 months)**		**$1,035,000**
TOTAL CAPITAL COST					**$17,821,900**
ANNUAL COSTS TREATED WATER					
Debt Service (6% for 30 years)					$1,294,700
Electricity ($0.09 kWh)					$59,000
Facility Operation & Maintenance					$0
Water Treatment ($.70/1,000 gal finished water)		2,240	af/y		$510,900
Total Annual Costs					**$1,864,600**
UNIT COSTS (During Amortization)					
Per Acre-Foot of treated water					$951
Per 1,000 Gallons of treated water					$2.92
UNIT COSTS (After Amortization)					
Per Acre-Foot of treated water					$291
Per 1,000 Gallons of treated water					$0.89

WWPNAME:	**Jacksonville**				
STRATEGY:	**Lake Columbia**				
Quantity:	**1,700** AF/Y		2.65 MGD		

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	16 in.	23,400	LF	$69	$1,615,000
Pipeline Urban	16 in.	3,000	LF	$103	$309,000
Right of Way Easements Rural (ROW)		10.7	ACRE	$2,000	$21,000
Right of Way Easements Urban (ROW)		1.4	ACRE	$20,000	$28,000
Engineering and Contingencies (30%)					$577,000
Subtotal of Pipeline					**$2,550,000**
Pump Station(s)					
Pump with intake & building	100 HP	1	LS	$1,002,000	$1,002,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$350,700
Subtotal of Pump Station(s)					**$1,352,700**
Water Treatment Facility					
New Water Treatment Plant	3 MGD	1	LS	$10,600,000	**$10,600,000**
Engineering and Contingencies (35%)					$3,710,000
Subtotal of WTP					**$14,310,000**
CONSTRUCTION TOTAL					**$18,212,700**
Permitting and Mitigation					**$162,000**
Interest During Construction			**(12 months)**		**$759,000**
TOTAL COST					**$19,133,700**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$1,668,000
Electricity ($0.09 kWh)					$28,000
Operation & Maintenance					$53,000
Raw Water Purchase			Kgal	$0.66	$366,000
Treatment			Kgal	$0.70	$388,000
Total Annual Costs					**$2,503,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$1,472
Per 1,000 Gallons					$4.52
UNIT COSTS (After Amortization)					
Per Acre-Foot					$491
Per 1,000 Gallons					$1.51

WWPNAME:	**LNVA**		
STRATEGY:	**Purchase from SRA**		
Quantity:	**36,000**	AF/Y	41.75 MGD

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	54 in.	77,000	LF	$317	$24,409,000
Right of Way Easements Rural (ROW)		35.4	ACRE	$2,000	$71,000
Engineering and Contingencies (30%)					$7,323,000
Subtotal of Pipeline					**$31,803,000**
Pump Station(s)					
Pump with intake	1100 HP	1	LS	$4,052,000	$4,052,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$1,418,200
Subtotal of Pump Station(s)					**$5,470,200**
CONSTRUCTION TOTAL					**$37,273,200**
Permitting and Mitigation					**$342,000**
Interest During Construction			**(12 months)**		**$1,553,000**
TOTAL COST					**$39,168,200**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$3,415,000
Electricity ($0.09 kWh)					$377,000
Operation & Maintenance					$415,000
Raw Water Purchase			Kgal	$0.15	$1,760,000
Treatment			Kgal	$0.00	$0
Total Annual Costs					**$5,967,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$166
Per 1,000 Gallons					$0.51
UNIT COSTS (After Amortization)					
Per Acre-Foot					$71
Per 1,000 Gallons					$0.22

WWPNAME:		**Lufkin**				
STRATEGY:		**Increase Groundwater - Carrizo-Wilcox**				
Quantity:		**4,650**	AF/Y			8.30 MGD
CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**	
Groundwater Water Treatment Plant Improvments						
Remove Existing Plant Piping		1	LS	$ 54,000		$54,000
Replace Plant Piping		1	LS	$ 433,000		$433,000
Rehabilitate Ground Storage Tanks	2.1 MGD	2	EA	$ 633,500		$1,267,000
Decommision Clarifier		1	LS	$ 65,000		$65,000
Construct Chlorine Building		1	LS	$ 542,000		$542,000
Construct Booster Pump Building		1	LS	$ 1,354,000		$1,354,000
Water Main to Existing City Main on Loop 287	16 -inch	7,000	LF	$ 43		$303,000
Construct All-weather access road to FM 842		2,500	LF	$ 136		$341,000
Site Fencing		1	LS	$ 76,000		$76,000
SCADA Station		1	LS	$ 54,000		$54,000
Electrical (Including flow meters)		4	EA	$ 74,500		$298,000
Aerators		2	EA	$ 189,500		$379,000
Subtotal Ground Water Treatment Plant Improvments						***$5,166,000***
Auxillary Booster Station Improvments						
Upgrade Station Bypass	24 -inch	200	LF	$ 270		$54,000
Renovate Pump Station Building		1	LS	$ 32,000		$32,000
SCADA Station		1	LS	$ 54,000		$54,000
Electrical (Including flow meter)		1	EA	$233,000		$233,000
Subtotal Auxillary Booster Station Improvments						***$373,000***
Water Well Improvments						
Plug Wells # 1 and #3		2	EA	$81,000		$162,000
SCADA Stations		6	EA	$54,000		$325,000
Electrical (Including flow meters)		6	EA	$39,667		$238,000
Subtotal Water Well Improvments						***$725,000***
Pipeline						
Pipeline	24 -inch	48000	LF	$ 82		$3,936,000
Values		15	EA	$ 8,840		$133,000
Subtotal Pipeline						***$4,069,000***
Project Subtotal						**$10,333,000**
Engineering & Contingency (30%)						**$3,100,000**
Total Project without Easements						**$13,433,000**
Easements						$100,000
Total Project with Easements						**$13,533,000**
Interest during construction				(12 months)		$564,000
Total Capital Costs						**$14,097,000**
ANNUAL COSTS						
Debt Service (6% for 20 years)						$1,229,000
Electricity						$244,000
Treatment ($0.30/ kgal)						$455,000
Operation & Maintenance						$58,800
Total Annual Costs						**$1,986,800**
UNIT COSTS (Until Amortized)						
Per Acre-Foot of treated water						$427
Per 1,000 Gallons						$1.31
UNIT COSTS (After Amortization)						
Per Acre-Foot						$163
Per 1,000 Gallons						$0.50

WWPNAME:	**Lufkin**				
STRATEGY:	**Develop Lake Kurth**				
Raw Water Quantity:	**6,800** AF/Y				
Treated Water Quantity	**11,600**	15.0 MGD			

Phase 1: Raw Water Improvements:

Angelina River Intake and Pump Station	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
New Stop Logs		3	EA	$5,333	$16,000
Replace Slide Gate		1	EA	$43,000	$43,000
SCADA Station		1	EA	$54,000	$54,000
Electrical (Including flow meter)		1	EA	$76,000	$76,000
Subtotal Angelina River Intake and Pump Station					***$189,000***
Kurth Lake Intake and Pump Station					
Rebuild Linkbelt Screen		1	LS	$162,000	$162,000
Rebuild Trash Bar Screens		2	EA	$11,000	$22,000
SCADA Station		1	EA	$54,000	$54,000
Electrical (Including flow meter)		1	EA	$119,000	$119,000
Subtotal Kurth Lake Intake					***$357,000***
Engineering and Contingencies (35%)					***$191,100***
CONSTRUCTION TOTAL					**$737,100**
Permitting and Mitigation					**$7,000**
Interest During Construction			**(6 months)**		**$16,000**
TOTAL COST					**$760,100**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$66,000
Operation & Maintenance					$361,700
Total Annual Costs					**$427,700**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$63
Per 1,000 Gallons					$0.19
UNIT COSTS (After Amortization)					
Per Acre-Foot					$53
Per 1,000 Gallons					$0.16

Phase 2: Treated Water Supply Pipeline from WTP to Lufkin	Size	Quantity	Unit	Unit Price	Cost
Pipeline Rural	36 in.	31,680	LF	$184	$5,829,000
Pipeline Urban	36 in.	5,280	LF	$276	$1,457,000
Right of Way Easements Rural (ROW)		14.5	ACRE	$2,000	$29,000
Right of Way Easements Urban (ROW)		2.4	ACRE	$20,000	$48,000
Engineering and Contingencies (30%)					$2,186,000
Subtotal of Pipeline					**$9,549,000**
Storage Facilities					
Ground Storage	3	1	EA	$1,215,000	$1,215,000
Engineering and Contingencies (35%)					$425,000
Subtotal of Storage					**$1,640,000**
Pump Station(s)					
Pump Station	600 HP	1	LS	$2,150,000	$2,150,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$752,500
Subtotal of Pump Station(s)					**$2,902,500**
Water Treatment Facility					
New Water Treatment Plant	15 MGD	1	LS	$29,100,000	**$29,100,000**
Engineering and Contingencies (35%)					$10,185,000
Subtotal of WTP					**$39,285,000**
CONSTRUCTION TOTAL					**$53,376,500**
Permitting and Mitigation					**$128,000**
Interest During Construction			**(12 months)**		**$2,224,000**
TOTAL COST					**$55,728,500**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$4,859,000
Electricity ($0.09 kWh)					$193,000
Operation & Maintenance					$188,000
Raw Water Purchase			Kgal	$0.50	$0
Treatment			Kgal	$0.70	$2,646,000
Total Annual Costs					**$7,886,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$680
Per 1,000 Gallons					$2.09
UNIT COSTS (After Amortization)					
Per Acre-Foot					$261
Per 1,000 Gallons					$0.80

WWPNAME:	**Lufkin**				
STRATEGY:	**Develop Water from Sam Rayburn**				
Quantity to Customers	**0**	2.0 MGD			
Treated Water Quantity	**11,210**	15.0 MGD			

Expand Treated Water Supply	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline					
Pipeline to Angelina County customers	12 in.	0	LF	$52	$0
Pipeline to Angelina County customers	6 in.	0	LF	$26	$0
Pipeline from Sam Rayburn	36 in.	65,500	LF	$276	$18,078,000
Right of Way Easements Rural (ROW)		30.1	ACRE	$2,000	$60,000
Engineering and Contingencies (30%)					$5,423,000
Subtotal of Pipeline					**$23,561,000**
Storage Facilities					
Additional Storage at WTP	5.00 MG	1	EA	$1,303,000	$1,303,000
Engineering and Contingencies (35%)					$456,000
Subtotal of Storage					**$1,759,000**
Pump Station(s)					
Lake Intake and Pump Station	600 HP	1	LS	$2,860,000	$2,860,000
Booster Pump Station	500 HP	0	LS	$2,032,000	$0
Engineering and Contingencies (35%)					$1,001,000
Subtotal of Pump Station(s)					**$3,861,000**
Water Treatment Facility					
Expand Water Treatment Plant	10 MGD	1	LS	$16,000,000	**$16,000,000**
Engineering and Contingencies (35%)					$5,600,000
Subtotal of WTP					**$21,600,000**
CONSTRUCTION TOTAL					**$50,781,000**
Permitting and Mitigation					**$267,000**
Interest During Construction			**(12 months)**		**$2,116,000**
TOTAL COST					**$53,164,000**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$4,635,000
Electricity ($0.09 kWh)					$10,145,000
Operation & Maintenance					$342,000
Raw Water Purchase			Kgal	$0.00	$0
Treatment			Kgal	$0.70	$2,557,000
Total Annual Costs					**$17,679,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$1,577
Per 1,000 Gallons					$4.84
UNIT COSTS (After Amortization)					
Per Acre-Foot					$1,164
Per 1,000 Gallons					$3.57

WWPNAME:	**Nacogdoches**				
STRATEGY:	**Lake Columbia**				
Quantity:	**8,551** AF/Y		11.44 MGD		

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline to Lake Nacogdoches	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	30 in.	21,120	LF	$145	$3,062,000
Right of Way Easements Rural (ROW)		9.7	ACRE	$2,000	$19,000
Engineering and Contingencies (30%)					$919,000
Subtotal of Pipeline					**$4,000,000**
Pump Station(s)					
Pump with intake & building	400 HP	1	LS	$2,423,000	$2,423,000
Booster Pump Station	0 HP	1	LS	$0	$0
Engineering and Contingencies (35%)					$848,050
Subtotal of Pump Station(s)					**$3,271,050**
Water Treatment Facility					
Expand Existing Water Treatment Plant	15 MGD	1	LS	$20,900,000	**$20,900,000**
Engineering and Contingencies (35%)					$7,315,000
Subtotal of WTP					**$28,215,000**
CONSTRUCTION TOTAL					**$35,486,050**
Permitting and Mitigation					**$317,000**
Interest During Construction			**(12 months)**		**$1,479,000**
TOTAL COST					**$37,282,050**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$3,250,000
Electricity ($0.09 kWh)					$138,000
Operation & Maintenance					$110,000
Raw Water Purchase			Kgal	$0.66	$1,839,000
Treatment			Kgal	$0.70	$1,950,000
Total Annual Costs					**$7,287,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$852
Per 1,000 Gallons					$2.61
UNIT COSTS (After Amortization)					
Per Acre-Foot					$472
Per 1,000 Gallons					$1.45

Nacogdoches - Toledo Bend via Center

TRANSMISSION	Combined Cost
New Water Plant-10 mgd	$22,400,000
Pump Station	
Intake at Logansport (600 HP)	$2,860,000
Center (800 HP)	$2,516,000
Storage at Swift	
Transmission	
30" line, 359,600 ft.	$52,142,000
ROW Costs	$495,000
Total Capital Cost	$80,413,000
Engineering & Cont.	$25,364,000
Interest During Construction	$8,641,981
Total Cost	**$114,418,981**
Annual Cost	
Debt Service,6%, 30yrs.	$8,312,414
O&M Cost	
Treatment Plant	$1,180,395
Pump Station	
Electricity	453,176
O&M	$134,400
Transmission Line	$521,420
Total Annual Cost	**$10,601,806**
Capacity (af/y)	5,175
Unit Cost/AF	$2,049
Unit Cost/1000 gallons	$6.29

WWPNAME: **City of Nacogdoches**
STRATEGY: **New Wells in Carizzo-Wilcox Aquifer**
AMOUNT (ac-ft/yr): **2800**

CAPITAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Water Well Construction	12 in.	5	ea	$ 307,500	$ 1,537,500
Connection to Water System		5	ea	$ 100,000	$ 500,000
Subtotal					**$ 2,037,500**
Engineering and Contingencies (30%)					$ 611,250
Mitigation and Permitting (1%)					$ 20,375
Subtotal					**$ 2,669,125**
Interest During Construction					$ 57,832
TOTAL CAPITAL COST					***$ 2,726,957***

ANNUAL COSTS	**Size**	**Quantity**	**Units**	**Unit Price**	**Cost**
Debt Service					$ 237,749
Pipeline O&M (1%)					$ 5,000
Pump O&M (2.5%)					$ 38,438
Chemicals			1000 gal	$ 0.30	$ 273,680
Electricity					$ 169,769
TOTAL ANNUAL COST w/ AMORTIZATION					***$ 724,635***
TOTAL ANNUAL COST AFTER AMORTIZATION					***$ 486,887***

UNIT COSTS (Until Amortized)	
Cost per acre-ft	$ 259
Cost per 1000 gallons	$ 0.79
UNIT COSTS (After Amortization)	
Cost per acre-ft	$ 174
Cost per 1000 gallons	$ 0.53

WWPNAME:	**City of Tyler**				
STRATEGY:	**Lake Palestine Expansion**				
Quantity:	**16,815** AF/Y		30.00 MGD		

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Pipeline Rural	36 in.	23,400	LF	$184	$4,306,000
Pipeline Urban	36 in.	3,000	LF	$276	$828,000
Right of Way Easements Rural (ROW)		10.7	ACRE	$2,000	$21,000
Right of Way Easements Urban (ROW)		1.4	ACRE	$20,000	$28,000
Engineering and Contingencies (30%)					$1,540,000
Subtotal of Pipeline					**$6,723,000**
Pump Station(s)					
Booster Pump Station	1400 HP	1	LS	$3,395,000	$3,395,000
Engineering and Contingencies (35%)					$1,188,250
Subtotal of Pump Station(s)					**$4,583,250**
Water Treatment Facility					
Expand Water Treatment Plant	30 MGD	1	LS	$47,600,000	**$47,600,000**
Engineering and Contingencies (35%)					$16,660,000
Subtotal of WTP					**$64,260,000**
CONSTRUCTION TOTAL					**$75,566,250**
Permitting and Mitigation					**$674,000**
Interest During Construction			**(12 months)**		**$3,149,000**
TOTAL COST					**$79,389,250**
ANNUAL COSTS					
Debt Service (6% for 20 years)					$6,922,000
Electricity ($0.09 kWh)					$296,000
Operation & Maintenance					$164,000
Raw Water Purchase			Kgal	$0.50	$2,740,000
Treatment			Kgal	$0.70	$3,835,000
Total Annual Costs					**$13,957,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot of treated water					$830
Per 1,000 Gallons					$2.55
UNIT COSTS (After Amortization)					
Per Acre-Foot					$418
Per 1,000 Gallons					$1.28

WWPNAME:	**Sabine River Authority**				
STRATEGY:	**Toledo Bend Pipeline Project**				
Quantity:	**500,000 Ac-ft per year**				

CONSTRUCTION COSTS
TRANSMISSION FACILITIES

Pipeline	**No.**	**Size**	**Quantity**	**Unit**	**Cost**
Segment A	2x	102 in.	1,129,920	LF	$1,081,333,000
Segment B	2x	96 in.	168,425	LF	$144,845,000
Segment C	1x	90 in.	502,495	LF	$431,858,000
Segment D	1x	90 in.	172,995	LF	$180,780,000
Segment E	1x	102 in.	224,077	LF	$214,441,000
Segment F	1x	96 in.	63,231	LF	$54,378,000
Engineering and Contingencies (30%)					$632,291,000
Subtotal of Pipeline					**$2,739,926,000**
Right of Way					
Rural ROW			1773	AC	$17,730,000
Urban ROW			304	AC	$18,240,000
Pump Station(s)					
Lake Intake - Toledo Bend			1		$19,866,000
Booster Pump Station 1		35000 HP	2	EA	$60,200,000
Booster Pump Station 2		30000 HP	2	EA	$53,750,000
Booster Pump Station 3		32500 HP	2	EA	$56,975,000
Booster Pump Station 4		13000 HP	1	EA	$14,706,000
Booster Pump Station 5		19000 HP	1	EA	$19,608,000
Booster Pump Station 6		26000 HP	1	EA	$24,295,000
Booster Pump Station 7		22000 HP	1	EA	$21,715,000
Booster Pump Station 8		15000 HP	1	EA	$16,340,000
Booster Pump Station 9		12000 HP	1	EA	$13,889,000
Engineering and Contingencies (35%)					$105,470,000
Subtotal of Pump Station(s)					**$406,814,000**
Storage					
Ground Storage Tank 1		70.0 MG	2	EA	$12,954,000
Ground Storage Tank 2		63.0 MG	1	EA	$6,158,000
Ground Storage Tank 3		28.0 MG	5	EA	$17,235,000
Engineering and Contingencies (35%)					$12,721,000
Subtotal of Storage					**$49,068,000**
CONSTRUCTION TOTAL					**$3,231,778,000**
Permitting and Mitigation					**$24,813,000**
Interest During Construction					**$396,231,000**
TOTAL COST					**$3,652,822,000**

Capital Cost by User:		
SRA	100,000 AF/Y	**$475,648,000**
NTMWD	200,000 AF/Y	**$1,239,758,000**
TRWD	200,000 AF/Y	**$1,937,416,000**
ANNUAL COSTS for SRA		
Debt Service (6% for 30 years)		$34,555,000
Electricity ($0.09 kWh)		$15,718,800
Operation & Maintenance		$4,403,511
Raw Water Purchase		$0
Total Annual Costs		**$54,677,311**
UNIT COSTS (Until Amortized)		
Per Acre-Foot of treated water		$547
Per 1,000 Gallons		$1.68
UNIT COSTS (After Amortization)		
Per Acre-Foot		$201
Per 1,000 Gallons		$0.62

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Appendix 4C-B

Needs and Costs Data from the Data Web Interface

The following appendix includes a copy of the data from the TWDB Data Web Interface. This appendix provides a summary of needs analyses and cost estimates for implementing WMSs for WUGs and WWPs in the ETRWPA.

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Region I Water User Group Needs
(Ac-ft per year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
BRUSHY CREEK WSC	ANDERSON	NECHES	55	53	51	52	50	46
BRUSHY CREEK WSC	ANDERSON	TRINITY	47	45	43	44	42	39
CONSOLIDATED WSC	ANDERSON	NECHES	9	9	9	9	9	8
CONSOLIDATED WSC	ANDERSON	TRINITY	32	30	30	32	29	27
COUNTY-OTHER	ANDERSON	NECHES	59	28	9	-10	-31	-53
COUNTY-OTHER	ANDERSON	TRINITY	577	395	285	173	51	-79
ELKHART	ANDERSON	TRINITY	251	245	243	240	236	232
FOUR PINE WSC	ANDERSON	TRINITY	266	257	253	248	243	235
FRANKSTON	ANDERSON	NECHES	34	11	-6	-24	-40	-54
IRRIGATION	ANDERSON	NECHES	216	216	216	216	216	216
IRRIGATION	ANDERSON	TRINITY	1,218	1,218	1,218	1,218	1,218	1,218
LIVESTOCK	ANDERSON	NECHES	71	71	71	71	71	71
LIVESTOCK	ANDERSON	TRINITY	350	350	350	350	350	350
MINING	ANDERSON	NECHES	43	3	-20	-43	-65	-87
MINING	ANDERSON	TRINITY	-18	-22	-25	-27	-30	-32
PALESTINE	ANDERSON	NECHES	323	260	216	172	122	68
PALESTINE	ANDERSON	TRINITY	291	234	195	155	110	61
STEAM ELECTRIC POWER	ANDERSON	NECHES	0	-11,306	-13,218	-15,549	-18,390	-21,853
WALSTON SPRINGS WSC	ANDERSON	NECHES	406	395	392	389	381	369
ANGELINA WSC	ANGELINA	NECHES	250	234	214	187	137	65
CENTRAL WCID OF ANGELINA COUNTY	ANGELINA	NECHES	198	188	172	150	96	12
COUNTY-OTHER	ANGELINA	NECHES	153	71	-20	-135	-349	-661
DIBOLL	ANGELINA	NECHES	-32	-187	-374	-618	-965	-1,441
FOUR WAY WSC	ANGELINA	NECHES	1,004	871	699	486	180	-225
HUDSON	ANGELINA	NECHES	229	76	-123	-360	-710	-1,174
HUDSON WSC	ANGELINA	NECHES	337	223	89	-104	-367	-735
HUNTINGTON	ANGELINA	NECHES	393	374	349	312	257	180
IRRIGATION	ANGELINA	NECHES	8	8	8	8	8	8
LIVESTOCK	ANGELINA	NECHES	62	40	13	-17	-52	-89
LUFKIN	ANGELINA	NECHES	-3,244	-5,117	-6,057	-7,116	-8,416	-9,965
MANUFACTURING	ANGELINA	NECHES	-3,117	-10,513	-12,983	-15,486	-17,739	-20,161
MINING	ANGELINA	NECHES	-1,990	-3,989	11	11	11	11
REDLAND WSC	ANGELINA	NECHES	553	542	529	511	477	428
STEAM ELECTRIC POWER	ANGELINA	NECHES	-1,000	-1,000	-1,000	-1,000	-1,000	-1,000
ZAVALLA	ANGELINA	NECHES	107	109	111	113	115	115
ALTO	CHEROKEE	NECHES	316	301	288	276	263	245
ALTO RURAL WSC	CHEROKEE	NECHES	363	352	347	345	332	309
BULLARD	CHEROKEE	NECHES	0	0	0	0	0	0

Region I Water User Group Needs
(Ac-ft per year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
COUNTY-OTHER	CHEROKEE	NECHES	972	1,046	1,173	1,356	1,438	1,479
CRAFT-TURNEY WSC	CHEROKEE	NECHES	195	185	177	166	134	81
IRRIGATION	CHEROKEE	NECHES	262	259	256	253	251	248
JACKSONVILLE	CHEROKEE	NECHES	1,329	1,094	892	699	531	308
LIVESTOCK	CHEROKEE	NECHES	612	612	612	612	612	612
MANUFACTURING	CHEROKEE	NECHES	272	236	200	163	126	76
MINING	CHEROKEE	NECHES	-490	-1,494	4	2	0	-2
NEW SUMMERFIELD	CHEROKEE	NECHES	54	4	-40	-76	-117	-165
NORTH CHEROKEE WSC	CHEROKEE	NECHES	147	132	115	95	76	46
RUSK	CHEROKEE	NECHES	185	96	27	-42	-116	-212
RUSK RURAL WSC	CHEROKEE	NECHES	179	165	156	149	136	114
SOUTHERN UTILITIES COMPANY	CHEROKEE	NECHES	153	145	147	152	155	150
STEAM ELECTRIC POWER	CHEROKEE	NECHES	0	0	0	0	0	0
TROUP	CHEROKEE	NECHES	2	2	1	1	0	0
WELLS	CHEROKEE	NECHES	237	238	240	242	244	243
COUNTY-OTHER	HARDIN	NECHES	-154	-263	-284	-304	-357	-429
COUNTY-OTHER	HARDIN	TRINITY	1	0	0	-1	-1	-2
IRRIGATION	HARDIN	NECHES	-1,002	-1,002	-1,002	-1,002	-1,002	-1,002
KOUNTZE	HARDIN	NECHES	423	406	403	401	393	381
LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY	HARDIN	TRINITY	2	1	1	1	1	1
LIVESTOCK	HARDIN	NECHES	3	3	3	3	3	3
LIVESTOCK	HARDIN	TRINITY	0	0	0	0	0	0
LUMBERTON	HARDIN	NECHES	270	185	156	127	85	2
LUMBERTON MUD	HARDIN	NECHES	1,052	908	856	802	736	656
MANUFACTURING	HARDIN	NECHES	-27	-46	-63	-81	-97	-114
MINING	HARDIN	NECHES	-7,772	-8,620	-9,191	-9,760	-10,333	-10,770
NORTH HARDIN WSC	HARDIN	NECHES	714	683	685	679	663	637
SILSBEE	HARDIN	NECHES	536	472	459	447	415	373
SOUR LAKE	HARDIN	NECHES	590	582	583	584	580	573
WEST HARDIN WSC	HARDIN	NECHES	284	274	274	274	269	257
ATHENS	HENDERSON	NECHES	4	-52	-70	-88	-117	-155
BERRYVILLE	HENDERSON	NECHES	53	45	37	30	17	0
BETHEL-ASH WSC	HENDERSON	NECHES	400	347	299	246	182	94
BROWNSBORO	HENDERSON	NECHES	142	118	94	68	37	-4
BRUSHY CREEK WSC	HENDERSON	NECHES	137	130	123	118	109	95
CHANDLER	HENDERSON	NECHES	330	286	245	201	143	65
COUNTY-OTHER	HENDERSON	NECHES	-75	-216	-348	-479	-683	-964

Region I Water User Group Needs
(Ac-ft per year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
IRRIGATION	HENDERSON	NECHES	161	84	76	69	61	54
LIVESTOCK	HENDERSON	NECHES	1,488	-29	-218	-388	-561	-724
MANUFACTURING	HENDERSON	NECHES	0	0	0	0	0	0
MINING	HENDERSON	NECHES	13	13	13	13	13	13
MURCHISON	HENDERSON	NECHES	112	103	94	85	72	55
R P M WSC	HENDERSON	NECHES	53	47	42	36	27	16
CONSOLIDATED WSC	HOUSTON	NECHES	114	119	121	123	116	103
CONSOLIDATED WSC	HOUSTON	TRINITY	294	307	310	316	297	266
COUNTY-OTHER	HOUSTON	NECHES	572	572	571	570	569	568
COUNTY-OTHER	HOUSTON	TRINITY	291	289	288	286	283	280
CROCKETT	HOUSTON	TRINITY	293	267	222	177	123	46
GRAPELAND	HOUSTON	NECHES	155	155	153	151	148	144
GRAPELAND	HOUSTON	TRINITY	472	467	461	456	448	437
IRRIGATION	HOUSTON	NECHES	-567	-659	-761	-873	-997	-1,134
IRRIGATION	HOUSTON	TRINITY	185	-8	-225	-461	-723	-1,012
LIVESTOCK	HOUSTON	NECHES	-72	-130	-194	-262	-336	-416
LIVESTOCK	HOUSTON	TRINITY	37	-81	-209	-348	-499	-662
LOVELADY	HOUSTON	TRINITY	173	173	172	172	170	167
MANUFACTURING	HOUSTON	NECHES	4	3	2	1	1	0
MANUFACTURING	HOUSTON	TRINITY	-3	-5	-7	-9	-12	-15
MINING	HOUSTON	NECHES	32	33	34	35	36	36
MINING	HOUSTON	TRINITY	32	34	35	36	37	38
COUNTY-OTHER	JASPER	NECHES	-334	-395	-406	-368	-350	-350
COUNTY-OTHER	JASPER	SABINE	-40	-75	-82	-62	-53	-53
JASPER	JASPER	NECHES	2,932	2,852	2,820	2,835	2,846	2,846
JASPER COUNTY WCID #1	JASPER	SABINE	231	226	230	243	249	249
KIRBYVILLE	JASPER	SABINE	126	106	94	99	101	101
LIVESTOCK	JASPER	NECHES	2	2	2	2	2	2
LIVESTOCK	JASPER	SABINE	7	7	7	7	7	7
MANUFACTURING	JASPER	NECHES	0	1	1	1	1	1
MANUFACTURING	JASPER	SABINE	0	0	0	0	0	0
MAURICEVILLE SUD	JASPER	SABINE	8	4	4	5	5	5
MINING	JASPER	NECHES	0	0	0	0	0	0
MINING	JASPER	SABINE	0	0	0	0	0	0
BEAUMONT	JEFFERSON	NECHES	584	503	446	419	327	17
BEAUMONT	JEFFERSON	NECHES-TRINITY	1,100	957	858	811	651	109
BEVIL OAKS	JEFFERSON	NECHES	267	271	276	280	283	283

Region I Water User Group Needs
(Ac-ft per year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
CHINA	JEFFERSON	NECHES-TRINITY	192	200	206	212	217	221
COUNTY-OTHER	JEFFERSON	NECHES	0	0	0	0	0	0
COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
GROVES	JEFFERSON	NECHES	0	0	0	0	0	0
GROVES	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
IRRIGATION	JEFFERSON	NECHES	3,809	3,809	3,809	3,809	3,809	3,809
IRRIGATION	JEFFERSON	NECHES-TRINITY	64,624	64,624	64,624	64,624	64,624	64,624
JEFFERSON COUNTY WCID #10	JEFFERSON	NECHES	0	0	0	0	0	0
JEFFERSON COUNTY WCID #10	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
LIVESTOCK	JEFFERSON	NECHES	22	22	22	22	22	22
LIVESTOCK	JEFFERSON	NECHES-TRINITY	8	8	8	8	8	8
MANUFACTURING	JEFFERSON	NECHES	0	0	0	0	0	0
MANUFACTURING	JEFFERSON	NECHES-TRINITY	1,073	1,073	1,073	893	1,073	1,073
MEEKER MUD	JEFFERSON	NECHES	0	0	0	0	0	0
MEEKER MUD	JEFFERSON	NECHES-TRINITY	251	197	153	116	79	0
MINING	JEFFERSON	NECHES	8	6	4	3	1	0
MINING	JEFFERSON	NECHES-TRINITY	20	11	6	0	-5	-9
NEDERLAND	JEFFERSON	NECHES	0	0	0	0	0	0
NEDERLAND	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
NOME	JEFFERSON	NECHES	0	0	0	0	0	0
NOME	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
PORT ARTHUR	JEFFERSON	NECHES	0	0	0	0	0	0
PORT ARTHUR	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
PORT NECHES	JEFFERSON	NECHES	0	0	0	0	0	0
PORT NECHES	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0

Region I Water User Group Needs
(Ac-ft per year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
STEAM ELECTRIC POWER	JEFFERSON	NECHES	0	-13,426	-15,696	-18,464	-21,838	-25,951
WEST JEFFERSON COUNTY MWD	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
APPLEBY WSC	NACOGDOCHES	NECHES	109	47	47	47	47	47
COUNTY-OTHER	NACOGDOCHES	NECHES	1,361	1,282	1,216	1,131	940	723
CUSHING	NACOGDOCHES	NECHES	108	102	97	90	75	58
D&M WSC	NACOGDOCHES	NECHES	0	0	-21	-70	-182	-310
GARRISON	NACOGDOCHES	NECHES	416	418	421	424	426	426
IRRIGATION	NACOGDOCHES	NECHES	1,230	1,230	1,230	1,230	1,230	1,230
LILLY GROVE SUD	NACOGDOCHES	NECHES	338	228	120	9	-221	-463
LIVESTOCK	NACOGDOCHES	NECHES	266	31	-242	-559	-926	-1,347
MANUFACTURING	NACOGDOCHES	NECHES	0	0	0	0	0	0
MELROSE WSC	NACOGDOCHES	NECHES	441	413	391	362	296	221
MINING	NACOGDOCHES	NECHES	-2,495	-6,993	8	9	10	11
NACOGDOCHES	NACOGDOCHES	NECHES	9,823	8,210	6,588	5,010	2,537	188
STEAM ELECTRIC POWER	NACOGDOCHES	NECHES	-2,588	-190	-1,358	-2,783	-11,241	-13,358
SWIFT WSC	NACOGDOCHES	NECHES	183	99	26	-64	-237	-427
WODEN WSC	NACOGDOCHES	NECHES	528	508	490	469	419	363
COUNTY-OTHER	NEWTON	SABINE	250	246	275	278	258	224
IRRIGATION	NEWTON	SABINE	1,917	1,917	1,917	1,917	1,917	1,917
LIVESTOCK	NEWTON	SABINE	14	14	14	14	14	14
MANUFACTURING	NEWTON	SABINE	-149	-264	-370	-477	-574	-667
MAURICEVILLE SUD	NEWTON	SABINE	2	2	2	2	1	0
MINING	NEWTON	NECHES	2	2	2	2	2	2
MINING	NEWTON	SABINE	2	2	2	2	2	2
NEWTON	NEWTON	SABINE	206	191	197	189	177	162
SOUTH NEWTON WSC	NEWTON	SABINE	396	394	400	400	396	388
STEAM ELECTRIC POWER	NEWTON	SABINE	8,255	47	-2,343	-5,257	-8,808	-13,138
BRIDGE CITY	ORANGE	NECHES	43	41	43	47	47	45
BRIDGE CITY	ORANGE	NECHES-TRINITY	40	38	41	44	44	42
BRIDGE CITY	ORANGE	SABINE	219	211	223	242	240	233
COUNTY-OTHER	ORANGE	NECHES	-132	-93	-53	-7	1	-6
COUNTY-OTHER	ORANGE	NECHES-TRINITY	0	0	0	0	0	0
COUNTY-OTHER	ORANGE	SABINE	44	91	139	194	203	195
IRRIGATION	ORANGE	NECHES	3	3	3	3	3	3
IRRIGATION	ORANGE	SABINE	31	31	31	31	31	31

Region I Water User Group Needs
(Ac-ft per year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
LIVESTOCK	ORANGE	NECHES	0	0	0	0	0	0
LIVESTOCK	ORANGE	SABINE	4	4	4	4	4	4
MANUFACTURING	ORANGE	NECHES	3,239	3,092	2,963	2,834	2,720	2,592
MANUFACTURING	ORANGE	SABINE	1,684	-5,006	-10,855	-16,686	-21,863	-27,686
MAURICEVILLE SUD	ORANGE	SABINE	119	-37	-81	-96	-158	-202
MINING	ORANGE	NECHES	1	0	0	0	0	0
MINING	ORANGE	SABINE	0	0	0	0	0	0
ORANGE	ORANGE	SABINE	290	353	416	478	520	520
PINE FOREST	ORANGE	NECHES	55	57	59	61	63	63
PINEHURST	ORANGE	SABINE	354	361	369	377	382	382
ROSE CITY	ORANGE	NECHES	219	220	222	224	225	225
SOUTH NEWTON WSC	ORANGE	SABINE	97	85	81	82	78	74
STEAM ELECTRIC POWER	ORANGE	NECHES	12,067	13,329	12,490	11,466	10,218	8,697
VIDOR	ORANGE	NECHES	58	66	85	112	111	103
VIDOR	ORANGE	SABINE	300	302	307	314	314	312
WEST ORANGE	ORANGE	SABINE	375	389	403	417	426	426
BECKVILLE	PANOLA	SABINE	448	448	449	450	450	449
CARTHAGE	PANOLA	SABINE	1,682	1,599	1,538	1,487	1,438	1,341
COUNTY-OTHER	PANOLA	CYPRESS	0	0	0	0	0	0
COUNTY-OTHER	PANOLA	SABINE	989	1,006	1,031	1,062	1,080	1,068
GILL WSC	PANOLA	SABINE	19	17	16	14	13	13
LIVESTOCK	PANOLA	CYPRESS	0	0	0	0	0	0
LIVESTOCK	PANOLA	SABINE	282	282	282	282	282	282
MANUFACTURING	PANOLA	SABINE	-96	-116	-132	-147	-161	-187
MINING	PANOLA	SABINE	932	726	599	472	343	220
TATUM	PANOLA	SABINE	65	66	66	66	67	66
CORRIGAN	POLK	NECHES	284	234	196	176	165	146
COUNTY-OTHER	POLK	NECHES	-208	-417	-578	-681	-745	-828
IRRIGATION	POLK	NECHES	151	151	151	151	151	151
LIVESTOCK	POLK	NECHES	21	21	21	21	21	21
MANUFACTURING	POLK	NECHES	42	-64	-164	-269	-365	-449
COUNTY-OTHER	RUSK	NECHES	294	261	249	276	236	97
COUNTY-OTHER	RUSK	SABINE	265	225	211	243	196	34
EASTON	RUSK	SABINE	53	72	84	89	105	142
ELDERVILLE WSC	RUSK	SABINE	69	57	58	66	61	20
HENDERSON	RUSK	NECHES	4,190	4,209	4,235	4,265	4,277	4,249
HENDERSON	RUSK	SABINE	511	513	516	520	521	517
IRRIGATION	RUSK	NECHES	74	74	74	74	74	74

Region I Water User Group Needs
(Ac-ft per year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
IRRIGATION	RUSK	SABINE	116	116	116	116	116	116
KILGORE	RUSK	SABINE	231	211	189	167	133	87
LIVESTOCK	RUSK	NECHES	89	79	68	55	40	26
LIVESTOCK	RUSK	SABINE	78	71	63	52	41	29
MANUFACTURING	RUSK	NECHES	45	37	30	24	20	12
MANUFACTURING	RUSK	SABINE	6	6	6	6	5	5
MINING	RUSK	NECHES	293	206	155	105	55	8
MINING	RUSK	SABINE	83	31	0	-30	-60	-88
MOUNT ENTERPRISE	RUSK	NECHES	300	300	301	303	302	298
NEW LONDON	RUSK	NECHES	317	317	316	317	314	305
NEW LONDON	RUSK	SABINE	293	290	289	290	289	282
OVERTON	RUSK	NECHES	24	23	22	22	21	16
OVERTON	RUSK	SABINE	179	164	160	160	145	104
SOUTHERN UTILITIES COMPANY	RUSK	NECHES	24	21	21	20	18	10
STEAM ELECTRIC POWER	RUSK	SABINE	18,402	15,704	11,060	5,400	-1,501	-9,912
TATUM	RUSK	SABINE	252	256	259	262	264	264
WEST GREGG WSC	RUSK	SABINE	0	0	0	0	0	0
COUNTY-OTHER	SABINE	NECHES	-3	-12	-18	-24	-31	-43
COUNTY-OTHER	SABINE	SABINE	99	96	95	93	91	88
G-M WSC	SABINE	SABINE	30	27	33	40	29	9
HEMPHILL	SABINE	SABINE	717	706	699	691	682	670
LIVESTOCK	SABINE	NECHES	-8	-15	-22	-32	-42	-54
LIVESTOCK	SABINE	SABINE	-29	-65	-107	-154	-210	-270
MANUFACTURING	SABINE	NECHES	483	415	352	288	231	180
PINELAND	SABINE	NECHES	80	74	71	69	64	57
COUNTY-OTHER	SAN AUGUSTINE	NECHES	77	79	84	88	78	65
COUNTY-OTHER	SAN AUGUSTINE	SABINE	0	0	0	0	0	0
G-M WSC	SAN AUGUSTINE	SABINE	15	17	18	18	17	16
IRRIGATION	SAN AUGUSTINE	NECHES	-100	-100	-100	-100	-100	-100
IRRIGATION	SAN AUGUSTINE	SABINE	10	10	10	10	10	10
LIVESTOCK	SAN AUGUSTINE	NECHES	-77	-145	-224	-315	-422	-538
LIVESTOCK	SAN AUGUSTINE	SABINE	-14	-24	-36	-50	-65	-83
MANUFACTURING	SAN AUGUSTINE	NECHES	3	2	1	0	-1	-2
MINING	SAN AUGUSTINE	NECHES	-1,500	-7,000	0	0	0	0
SAN AUGUSTINE	SAN AUGUSTINE	NECHES	167	157	143	125	103	83
CENTER	SHELBY	SABINE	1,577	1,358	1,177	1,026	882	701
COUNTY-OTHER	SHELBY	NECHES	280	267	257	254	248	236
COUNTY-OTHER	SHELBY	SABINE	-126	-190	-244	-253	-288	-344

Region I Water User Group Needs
(Ac-ft per year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
IRRIGATION	SHELBY	NECHES	7	6	5	4	3	1
IRRIGATION	SHELBY	SABINE	88	86	83	81	78	75
JOAQUIN	SHELBY	SABINE	52	45	42	40	37	32
LIVESTOCK	SHELBY	NECHES	-314	-463	-644	-865	-1,134	-1,463
LIVESTOCK	SHELBY	SABINE	-463	-1,244	-2,197	-3,357	-4,773	-6,498
MANUFACTURING	SHELBY	SABINE	21	14	7	2	-5	-12
MINING	SHELBY	NECHES	-500	-1,500	0	0	0	0
TENAHA	SHELBY	SABINE	144	148	151	155	157	157
TIMPSON	SHELBY	NECHES	3	3	3	3	3	3
TIMPSON	SHELBY	SABINE	290	288	288	289	288	285
ARP	SMITH	NECHES	124	119	114	109	97	79
BULLARD	SMITH	NECHES	17	-13	-42	-71	-124	-195
COMMUNITY WATER COMPANY	SMITH	NECHES	-37	-88	-111	-132	-171	-227
COUNTY-OTHER	SMITH	NECHES	78	85	93	96	95	90
CRYSTAL SYSTEMS INC	SMITH	NECHES	0	0	0	0	0	0
DEAN WSC	SMITH	NECHES	438	394	347	303	215	87
IRRIGATION	SMITH	NECHES	-6	-36	-68	-100	-133	-168
JACKSON WSC	SMITH	NECHES	53	11	-38	-83	-118	-157
LINDALE	SMITH	NECHES	69	0	0	0	0	0
LINDALE RURAL WSC	SMITH	NECHES	278	230	181	134	47	-73
LIVESTOCK	SMITH	NECHES	46	46	46	46	46	46
MANUFACTURING	SMITH	NECHES	207	94	-6	-101	-182	-295
MINING	SMITH	NECHES	-47	-126	-159	-215	-255	-288
NEW CHAPEL HILL	SMITH	NECHES	0	0	0	0	0	0
NOONDAY	SMITH	NECHES	0	0	0	0	0	0
OVERTON	SMITH	NECHES	0	0	0	0	0	0
R P M WSC	SMITH	NECHES	18	16	14	12	8	3
SOUTHERN UTILITIES COMPANY	SMITH	NECHES	2,027	1,763	1,522	1,252	581	110
TROUP	SMITH	NECHES	146	135	121	110	81	39
TYLER	SMITH	NECHES	14,490	13,093	11,772	10,489	8,131	4,340
WHITEHOUSE	SMITH	NECHES	-27	-54	-79	-105	-155	-224
COUNTY-OTHER	TRINITY	NECHES	46	12	8	-9	-32	-57
GROVETON	TRINITY	NECHES	0	0	0	0	0	0
LIVESTOCK	TRINITY	NECHES	82	82	82	82	82	82
COLMESNEIL	TYLER	NECHES	299	291	287	287	288	288
COUNTY-OTHER	TYLER	NECHES	23	-142	-239	-251	-232	-232
IRRIGATION	TYLER	NECHES	98	98	98	98	98	98

Region I Water User Group Needs
(Ac-ft per year)

WUG Name	County	Basin	2010	2020	2030	2040	2050	2060
LAKE LIVINGSTON WATER SUPPLY & SEWER SERVICE COMPANY	TYLER	NECHES	1	1	0	0	0	0
LIVESTOCK	TYLER	NECHES	37	37	37	37	37	37
MANUFACTURING	TYLER	NECHES	34	27	20	13	7	2
TYLER COUNTY WSC	TYLER	NECHES	497	439	407	409	420	420
WOODVILLE	TYLER	NECHES	1,260	1,171	1,119	1,103	1,107	1,107

Region I Wholesale Water Supplier Needs
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	2010	2020	2030	2040	2050	2060
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	CHEROKEE	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	ARP	SMITH	NECHES	-428	-428	-428	-428	-428	-428
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	SMITH	NECHES	-855	-855	-855	-855	-855	-855
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	NACOGDOCHES	NECHES	-428	-428	-428	-428	-428	-428
ANGELINA & NECHES RIVER AUTHORITY	ALTO	CHEROKEE	NECHES	-428	-428	-428	-428	-428	-428
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	CHEROKEE	NECHES	-3,848	-3,848	-3,848	-3,848	-3,848	-3,848
ANGELINA & NECHES RIVER AUTHORITY	COUNTY-OTHER	JASPER	NECHES	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	JACKSON WSC	SMITH	NECHES	-855	-855	-855	-855	-855	-855
ANGELINA & NECHES RIVER AUTHORITY	JACKSONVILLE	CHEROKEE	NECHES	-4,275	-4,275	-4,275	-4,275	-4,275	-4,275
ANGELINA & NECHES RIVER AUTHORITY	NACOGDOCHES	NACOGDOCHES	NECHES	-8,551	-8,551	-8,551	-8,551	-8,551	-8,551
ANGELINA & NECHES RIVER AUTHORITY	NEW LONDON	RUSK	SABINE	-855	-855	-855	-855	-855	-855
ANGELINA & NECHES RIVER AUTHORITY	NEW SUMMERFIELD	CHEROKEE	NECHES	-2,565	-2,565	-2,565	-2,565	-2,565	-2,565
ANGELINA & NECHES RIVER AUTHORITY	NORTH CHEROKEE WSC	CHEROKEE	NECHES	-4,275	-4,275	-4,275	-4,275	-4,275	-4,275
ANGELINA & NECHES RIVER AUTHORITY	RUSK	CHEROKEE	NECHES	-4,275	-4,275	-4,275	-4,275	-4,275	-4,275
ANGELINA & NECHES RIVER AUTHORITY	RUSK RURAL WSC	CHEROKEE	NECHES	-855	-855	-855	-855	-855	-855
ANGELINA & NECHES RIVER AUTHORITY	MANUFACTURING	ANGELINA	NECHES	-8,551	-8,551	-8,551	-8,551	-8,551	-8,551
ANGELINA & NECHES RIVER AUTHORITY	TROUP	SMITH	NECHES	-4,275	-4,275	-4,275	-4,275	-4,275	-4,275
ANGELINA & NECHES RIVER AUTHORITY	WHITEHOUSE	SMITH	NECHES	-8,551	-8,551	-8,551	-8,551	-8,551	-8,551
ANGELINA NACOGDOCHES WCID #1	COUNTY-OTHER	CHEROKEE	NECHES	11,270	10,846	9,716	8,520	13,965	12,590
ANGELINA NACOGDOCHES WCID #1	HENDERSON	RUSK	NECHES	0	0	0	0	0	0
ANGELINA NACOGDOCHES WCID #1	STEAM ELECTRIC POWER	CHEROKEE	NECHES	0	0	0	0	0	0
ANGELINA NACOGDOCHES WCID #1	STEAM ELECTRIC POWER	NACOGDOCHES	NECHES	0	0	0	0	0	0
ANGELINA NACOGDOCHES WCID #1	WHITEHOUSE	SMITH	NECHES	0	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	COUNTY-OTHER	HENDERSON	NECHES	160	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	ATHENS	HENDERSON	TRINITY	0	-1,529	-1,913	-2,399	-3,081	-3,977
ATHENS MUNICIPAL WATER AUTHORITY	ATHENS	HENDERSON	NECHES	4	-52	-70	-88	-117	-155
ATHENS MUNICIPAL WATER AUTHORITY	IRRIGATION	HENDERSON	NECHES	12	-70	-83	-95	-108	-121
ATHENS MUNICIPAL WATER AUTHORITY	LIVESTOCK	HENDERSON	NECHES	229	-1,288	-1,477	-1,647	-1,820	-1,983
ATHENS MUNICIPAL WATER AUTHORITY	MANUFACTURING	HENDERSON	TRINITY	0	-45	-59	-74	-93	-115
BEAUMONT CITY OF	BEAUMONT	JEFFERSON	NECHES	634	553	496	469	377	67
BEAUMONT CITY OF	BEAUMONT	JEFFERSON	NECHES-TRINITY	1,050	907	808	761	601	59
BEAUMONT CITY OF	BEAUMONT	JEFFERSON	NECHES-TRINITY	9,692	9,691	9,692	9,690	9,691	9,691
BEAUMONT CITY OF	COUNTY-OTHER	JEFFERSON	NECHES	0	0	0	0	0	0
BEAUMONT CITY OF	COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
BEAUMONT CITY OF	MANUFACTURING	JEFFERSON	NECHES	0	0	0	0	0	0
BEAUMONT CITY OF	MEEKER MUD	JEFFERSON	NECHES	0	0	0	0	0	0
CARTHAGE CITY OF	CARTHAGE	PANOLA	SABINE	7,981	7,597	7,223	6,856	6,487	6,100
CARTHAGE CITY OF	CARTHAGE	PANOLA	SABINE	1,860	1,808	1,768	1,730	1,697	1,633
CARTHAGE CITY OF	COUNTY-OTHER	PANOLA	CYPRESS	0	0	0	0	0	0
CARTHAGE CITY OF	COUNTY-OTHER	PANOLA	SABINE	0	0	0	0	0	0
CARTHAGE CITY OF	MANUFACTURING	PANOLA	SABINE	0	0	0	0	0	0
CENTER CITY OF	CENTER	SHELBY	SABINE	1,577	1,358	1,177	1,026	882	701

Region I Wholesale Water Supplier Needs
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	2010	2020	2030	2040	2050	2060
CENTER CITY OF	MANUFACTURING	SHELBY	SABINE	0	0	0	1	0	0
CENTER CITY OF	COUNTY-OTHER	SHELBY	SABINE	0	0	0	0	0	0
CENTER CITY OF	COUNTY-OTHER	SHELBY	SABINE	0	0	0	0	0	0
HOUSTON COUNTY WCID #1	CONSOLIDATED WSC	HOUSTON	NECHES	0	0	0	0	0	0
HOUSTON COUNTY WCID #1	CONSOLIDATED WSC	ANDERSON	TRINITY	0	0	0	0	0	0
HOUSTON COUNTY WCID #1	CONSOLIDATED WSC	HOUSTON	TRINITY	-19	-19	-19	-19	-19	-19
HOUSTON COUNTY WCID #1	CONSOLIDATED WSC	ANDERSON	NECHES	0	0	0	0	0	0
HOUSTON COUNTY WCID #1	COUNTY-OTHER	HOUSTON	TRINITY	-5	-7	-7	-8	-9	-10
HOUSTON COUNTY WCID #1	CROCKETT	HOUSTON	TRINITY	-110	-125	-139	-152	-165	-180
HOUSTON COUNTY WCID #1	GRAPELAND	HOUSTON	TRINITY	-24	-28	-31	-33	-36	-40
HOUSTON COUNTY WCID #1	COUNTY-OTHER	HOUSTON	TRINITY	82	84	84	83	84	84
HOUSTON COUNTY WCID #1	LOVELADY	HOUSTON	TRINITY	-26	-26	-26	-26	-26	-26
HOUSTON COUNTY WCID #1	MANUFACTURING	HOUSTON	TRINITY	-10	-13	-16	-19	-22	-26
JACKSONVILLE CITY OF	BULLARD	SMITH	NECHES	4	3	2	2	1	1
JACKSONVILLE CITY OF	COUNTY-OTHER	CHEROKEE	NECHES	85	59	37	17	9	4
JACKSONVILLE CITY OF	CRAFT-TURNEY WSC	CHEROKEE	NECHES	196	185	177	165	133	79
JACKSONVILLE CITY OF	JACKSONVILLE	CHEROKEE	NECHES	1,329	1,094	892	699	531	308
JACKSONVILLE CITY OF	MANUFACTURING	CHEROKEE	NECHES	272	236	200	163	126	76
JACKSONVILLE CITY OF	NORTH CHEROKEE WSC	CHEROKEE	NECHES	147	132	115	95	76	46
LOWER NECHES VALLEY AUTHORITY	BEAUMONT	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	BOLIVAR PENINSULAR SUD	GALVESTON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	COUNTY-OTHER	GALVESTON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JASPER	NECHES	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	GROVES	JEFFERSON	NECHES	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	GROVES	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	CHAMBERS	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	LIBERTY	NECHES	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	LIBERTY	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	JEFFERSON	NECHES	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	IRRIGATION	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	JEFFERSON COUNTY WCID #10	JEFFERSON	NECHES	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	JEFFERSON COUNTY WCID #10	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	COUNTY-OTHER	JEFFERSON	NECHES	654,065	356,247	164,679	220,665	123,832	105,420
LOWER NECHES VALLEY AUTHORITY	COUNTY-OTHER	GALVESTON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JASPER	NECHES	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JEFFERSON	NECHES	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	NEDERLAND	JEFFERSON	NECHES	0	0	0	0	0	0

Region I Wholesale Water Supplier Needs
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	2010	2020	2030	2040	2050	2060
LOWER NECHES VALLEY AUTHORITY	NEDERLAND	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	NOME	JEFFERSON	NECHES	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	NOME	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	PORT ARTHUR	JEFFERSON	NECHES	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	PORT ARTHUR	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	PORT NECHES	JEFFERSON	NECHES	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	PORT NECHES	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	TRINITY BAY CONSERVATION DISTRICT	CHAMBERS	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	TRINITY BAY CONSERVATION DISTRICT	CHAMBERS	TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	WEST JEFFERSON COUNTY MWD	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	MANUFACTURING	JASPER	NECHES	0	0	0	0	0	0
LOWER NECHES VALLEY AUTHORITY	WOODVILLE	TYLER	NECHES	0	0	0	0	0	0
LUFKIN CITY OF	LUFKIN	ANGELINA	NECHES	-3,244	-5,117	-6,057	-7,116	-8,416	-9,965
LUFKIN CITY OF	COUNTY-OTHER	ANGELINA	NECHES	-56	-90	-105	-119	-137	-160
LUFKIN CITY OF	DIBOLL	ANGELINA	NECHES	-834	-1,176	-1,244	-1,307	-1,366	-1,422
LUFKIN CITY OF	HUNTINGTON	ANGELINA	NECHES	-9	-16	-21	-24	-28	-32
LUFKIN CITY OF	MANUFACTURING	ANGELINA	NECHES	-4,105	-10,456	-12,172	-14,063	-16,173	-18,512
LUFKIN CITY OF	REDLAND WSC	ANGELINA	NECHES	-46	-63	-65	-66	-68	-71
NACOGDOCHES CITY OF	APPLEBY WSC	NACOGDOCHES	NECHES	0	0	0	0	0	0
NACOGDOCHES CITY OF	NACOGDOCHES	NACOGDOCHES	NECHES	9,823	8,210	6,588	5,010	2,537	188
NACOGDOCHES CITY OF	D&M WSC	NACOGDOCHES	NECHES	0	0	0	0	0	0
NACOGDOCHES CITY OF	MANUFACTURING	NACOGDOCHES	NECHES	0	0	0	0	0	0
PANOLA COUNTY FWSD #1	CARTHAGE	PANOLA	SABINE	8,311	7,875	7,461	7,056	6,655	6,203
PANOLA COUNTY FWSD #1	COUNTY-OTHER	PANOLA	SABINE	0	0	0	0	0	0
PANOLA COUNTY FWSD #1	MANUFACTURING	PANOLA	SABINE	0	0	0	0	0	0
PANOLA COUNTY FWSD #1	MINING	PANOLA	SABINE	0	0	0	0	0	0
PANOLA COUNTY FWSD #1	COUNTY-OTHER	PANOLA	SABINE	6,448	5,903	5,479	5,053	4,623	4,205
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	0	0	0	0	0	0
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	0	0	0	0	0	0
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	0	0	0	0	0	0
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	0	0	0	0	0	0
PORT ARTHUR CITY OF	PORT ARTHUR	JEFFERSON	NECHES	0	0	0	0	0	0
PORT ARTHUR CITY OF	PORT ARTHUR	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	0	0	0	0	0	0
PORT ARTHUR CITY OF	MEEKER MUD	JEFFERSON	NECHES	0	0	0	0	0	0
PORT ARTHUR CITY OF	COUNTY-OTHER	JEFFERSON	NECHES-TRINITY	0	0	0	0	0	0
PORT ARTHUR CITY OF	MANUFACTURING	JEFFERSON	NECHES	0	0	0	0	0	0

Region I Wholesale Water Supplier Needs
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	2010	2020	2030	2040	2050	2060
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	ABLES SPRINGS WSC	KAUFMAN	TRINITY	-27	-27	-33	-46	-74	-105
SABINE RIVER AUTHORITY	ABLES SPRINGS WSC	HUNT	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	ABLES SPRINGS WSC	VAN ZANDT	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	COUNTY-OTHER	SABINE	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	CASH SUD	ROCKWALL	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	CASH SUD	HOPKINS	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	CASH SUD	HUNT	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	CASH SUD	RAINS	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	COMMERCE	HUNT	SULPHUR	0	0	0	0	0	0
SABINE RIVER AUTHORITY	DALLAS	DALLAS	TRINITY	-11,069	-11,917	-12,765	-13,614	-14,462	-15,310
SABINE RIVER AUTHORITY	EDGEWOOD	VAN ZANDT	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	EMORY	RAINS	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	GREENVILLE	HUNT	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	POINT	RAINS	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	QUITMAN	WOOD	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	TERRELL	KAUFMAN	TRINITY	-363	-435	-508	-580	-653	-725
SABINE RIVER AUTHORITY	WEST TAWAKONI	HUNT	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	COMBINED CONSUMERS WSC	HUNT	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	COMBINED CONSUMERS WSC	VAN ZANDT	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	STEAM ELECTRIC POWER	NEWTON	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	MANUFACTURING	HARRISON	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	COUNTY-OTHER	SABINE	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	STEAM ELECTRIC POWER	ORANGE	NECHES	0	0	0	0	0	0
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	HEMPHILL	SABINE	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	HENDERSON	RUSK	NECHES	0	0	0	0	0	0
SABINE RIVER AUTHORITY	HENDERSON	RUSK	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	COUNTY-OTHER	SHELBY	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	IRRIGATION	ORANGE	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	COUNTY-OTHER	GREGG	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	KILGORE	GREGG	SABINE	-1,189	-1,149	-1,109	-1,070	-1,031	-992
SABINE RIVER AUTHORITY	KILGORE	RUSK	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	LONGVIEW	GREGG	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	LONGVIEW	HARRISON	SABINE	0	0	0	0	0	0

Region I Wholesale Water Supplier Needs
(Ac-ft per Year)

WWP Name	WUG Name	WUG County	WUG Basin	2010	2020	2030	2040	2050	2060
SABINE RIVER AUTHORITY	MACBEE SUD	HUNT	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	MACBEE SUD	VAN ZANDT	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	MACBEE SUD	VAN ZANDT	TRINITY	0	0	0	0	0	0
SABINE RIVER AUTHORITY	MACBEE SUD	KAUFMAN	SABINE	0	0	4	10	15	19
SABINE RIVER AUTHORITY	MANUFACTURING	ORANGE	NECHES	0	0	0	0	0	0
SABINE RIVER AUTHORITY	COUNTY-OTHER	SABINE	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	MINING	HARRISON	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	ROSE CITY	ORANGE	NECHES	0	0	0	0	0	0
SABINE RIVER AUTHORITY	SOUTH TAWAKONI WSC	VAN ZANDT	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	COUNTY-OTHER	NEWTON	SABINE	803,978	803,978	803,978	803,978	803,978	803,978
SABINE RIVER AUTHORITY	COUNTY-OTHER	KAUFMAN	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	STEAM ELECTRIC POWER	NEWTON	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	WILLS POINT	VAN ZANDT	SABINE	0	0	0	0	0	0
SABINE RIVER AUTHORITY	WILLS POINT	VAN ZANDT	TRINITY	0	0	0	0	0	0
TYLER CITY OF	COUNTY-OTHER	SMITH	NECHES	0	0	0	0	0	0
TYLER CITY OF	IRRIGATION	SMITH	NECHES	0	0	0	0	0	0
TYLER CITY OF	MANUFACTURING	SMITH	NECHES	0	0	0	0	0	0
TYLER CITY OF	SOUTHERN UTILITIES COMPANY	SMITH	NECHES	0	0	0	0	0	0
TYLER CITY OF	TYLER	SMITH	SABINE	0	0	0	0	0	0
TYLER CITY OF	TYLER	SMITH	NECHES	14,490	13,093	11,772	10,489	8,131	4,340
TYLER CITY OF	WHITEHOUSE	SMITH	NECHES	0	0	0	0	0	0
UPPER NECHES MWD	DALLAS	DALLAS	TRINITY	-1,456	-2,561	-3,667	-4,774	-5,882	-6,990
UPPER NECHES MWD	PALESTINE	ANDERSON	TRINITY	-357	-627	-898	-1,169	-1,440	-1,712
UPPER NECHES MWD	TYLER	SMITH	NECHES	-856	-1,506	-2,155	-2,806	-3,457	-4,108
UPPER NECHES MWD	COUNTY-OTHER	SMITH	NECHES	-2	-2	-4	-3	-3	-3
UPPER NECHES MWD	COUNTY-OTHER	SMITH	NECHES	-1	-2	-3	-4	-5	-6
UPPER NECHES MWD	IRRIGATION	CHEROKEE	NECHES	-4	-7	-10	-13	-15	-18
UPPER NECHES MWD	COUNTY-OTHER	HENDERSON	NECHES	-1	-2	-3	-4	-5	-6
UPPER NECHES MWD	COUNTY-OTHER	ANDERSON	NECHES	0	0	0	0	0	0

Region I Water User Group Potentially Feasible Water Management Strategy Supply
(Ac-ft per Year)

WUG Name	WUG County	WUG Basin	Project Name	Source Name	Source County	Source Basin	Selected	2010	2020	2030	2040	2050	2060
COUNTY-OTHER	ANDERSON	TRINITY	NEW WELLS - QUEEN CITY AQUIFER	QUEEN CITY AQUIFER	ANDERSON	TRINITY	Recommended	0	0	0	0	0	100
COUNTY-OTHER	ANDERSON	NECHES	OVERDRAFT CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANDERSON	NECHES	Recommended	0	0	0	100	100	100
FRANKSTON	ANDERSON	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	ANDERSON	NECHES	Recommended	0	0	6	7	8	9
FRANKSTON	ANDERSON	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANDERSON	NECHES	Recommended	0	0	121	121	121	121
MINING	ANDERSON	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANDERSON	NECHES	Recommended	0	86	86	86	86	87
MINING	ANDERSON	TRINITY	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANDERSON	TRINITY	Recommended	18	34	34	34	34	33
STEAM ELECTRIC POWER	ANDERSON	NECHES	PURCHASE WATER FROM PROVIDER (2)	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	21853	21853	21853	21853	21853
COUNTY-OTHER	ANGELINA	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	Considered	404	404	404	404	404	1211
COUNTY-OTHER	ANGELINA	NECHES	NEW WELLS - YEGUA JACKSON AQUIFER	YEGUA-JACKSON AQUIFER	ANGELINA	NECHES	Recommended	0	0	150	150	300	300
COUNTY-OTHER	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	Recommended	0	0	1100	1100	600	600
COUNTY-OTHER	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	Recommended	0	0	0	0	500	500
DIBOLL	ANGELINA	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	ANGELINA	NECHES	Recommended	11	20	26	34	53	72
DIBOLL	ANGELINA	NECHES	NEW WELLS - YEGUA JACKSON AQUIFER	YEGUA-JACKSON AQUIFER	ANGELINA	NECHES	Recommended	600	600	600	600	600	600
DIBOLL	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	Recommended	800	800	800	800	1600	1600
FOUR WAY WSC	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	Recommended	0	0	0	0	0	225
HUDSON	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (1)	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	Recommended	0	0	125	400	800	1200
HUDSON WSC	ANGELINA	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	Recommended	0	0	600	600	2000	2000
LIVESTOCK	ANGELINA	NECHES	EXPAND LOCAL SURFACE WATER SUPPLIES	LIVESTOCK LOCAL SUPPLY	ANGELINA	NECHES	Recommended	0	0	0	90	90	90
LUFKIN	ANGELINA	NECHES	LAKE KURTH REGIONAL SYSTEM	KURTH LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	5600	5600	4300	5600	5600
LUFKIN	ANGELINA	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	ANGELINA	NECHES	Recommended	50	117	189	249	319	408
LUFKIN	ANGELINA	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	Recommended	2955	2555	2465	2384	2301	2215
LUFKIN	ANGELINA	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	Recommended	750	750	750	750	750	750
LUFKIN	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (3)	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	Recommended	0	0	0	0	7200	5200
MANUFACTURING	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	8551	8551	8551	8551	8551
MANUFACTURING	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	KURTH LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	6800	12800	12800	14100	12800	12800
MANUFACTURING	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	Recommended	0	0	0	0	4000	6000
MINING	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	2000	4000	0	0	0	0
STEAM ELECTRIC POWER	ANGELINA	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	Recommended	1000	1000	1000	1000	1000	1000
JACKSONVILLE	CHEROKEE	NECHES	INFRASTRUCTURE IMPROVEMENTS	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	1000	1000	1000	1000	1000	1000
JACKSONVILLE	CHEROKEE	NECHES	PURCHASE WATER FROM PROVIDER (3)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	1700	1700	1700	1700	1700
MINING	CHEROKEE	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	500	1500	0	0	0	0
NEW SUMMERFIELD	CHEROKEE	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	CHEROKEE	NECHES	Recommended	0	10	18	21	23	26
NEW SUMMERFIELD	CHEROKEE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	Considered	0	0	121	242	242	242
NEW SUMMERFIELD	CHEROKEE	NECHES	PURCHASE WATER FROM PROVIDER (1)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	1000	1000	1000	1000	1000
RUSK	CHEROKEE	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	CHEROKEE	NECHES	Recommended	0	0	0	51	66	76
RUSK	CHEROKEE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	CHEROKEE	NECHES	Alternate	0	0	0	212	212	212
RUSK	CHEROKEE	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	3000	3000	3000	3000	3000
COUNTY-OTHER	HARDIN	TRINITY	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	HARDIN	TRINITY	Recommended	0	0	0	1	1	2
COUNTY-OTHER	HARDIN	NECHES	OVERDRAFT GULF COAST AQUIFER	GULF COAST AQUIFER	HARDIN	NECHES	Recommended	154	306	306	306	459	459
IRRIGATION	HARDIN	NECHES	PURCHASE WATER FROM PROVIDER (2)	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	Recommended	1002	1002	1002	1002	1002	1002
MANUFACTURING	HARDIN	NECHES	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	HARDIN	NECHES	Recommended	114	114	114	114	114	114
ATHENS	HENDERSON	TRINITY	FOREST GROVE RESERVOIR PROJECT	FOREST GROVE LAKE/RESERVOIR	RESERVOIR	TRINITY	Recommended	0	0	0	0	0	0
ATHENS	HENDERSON	NECHES	INDIRECT REUSE	INDIRECT REUSE	HENDERSON	NECHES	Recommended	0	19	29	42	65	94
ATHENS	HENDERSON	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	HENDERSON	NECHES	Recommended	1	6	12	17	22	30
BROWNSBORO	HENDERSON	NECHES	OVERDRAFT CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	Recommended	0	0	0	0	0	40
COUNTY-OTHER	HENDERSON	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	HENDERSON	NECHES	Recommended	31	57	74	92	108	129
COUNTY-OTHER	HENDERSON	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	Recommended	50	50	50	50	50	50
COUNTY-OTHER	HENDERSON	NECHES	NEW WELLS - QUEEN CITY AQUIFER	QUEEN CITY AQUIFER	HENDERSON	NECHES	Recommended	50	50	50	100	200	500
COUNTY-OTHER	HENDERSON	NECHES	OVERDRAFT CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	Recommended	100	0	0	0	0	0
COUNTY-OTHER	HENDERSON	NECHES	PURCHASE WATER FROM PROVIDER (2)	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	150	200	300	400	500
IRRIGATION	HENDERSON	NECHES	INDIRECT REUSE	INDIRECT REUSE	HENDERSON	NECHES	Recommended	0	70	83	95	108	121
LIVESTOCK	HENDERSON	NECHES	INDIRECT REUSE	INDIRECT REUSE	HENDERSON	NECHES	Recommended	0	1288	1477	1647	1820	1983
CONSOLIDATED WSC	HOUSTON	TRINITY	PURCHASE WATER FROM PROVIDER (1)	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	Recommended	1050	1050	1050	1050	1050	1050

Region I Water User Group Potentially Feasible Water Management Strategy Supply
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WUG Name	WUG County	WUG Basin	Project Name	Source Name	Source County	Source Basin	Selected	2010	2020	2030	2040	2050	2060
IRRIGATION	HOUSTON	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	HOUSTON	NECHES	Recommended	766	766	766	873	1149	1149
IRRIGATION	HOUSTON	TRINITY	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	HOUSTON	TRINITY	Recommended	0	383	383	766	766	1149
LIVESTOCK	HOUSTON	TRINITY	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	HOUSTON	TRINITY	Recommended	111	111	221	363	542	665
LIVESTOCK	HOUSTON	NECHES	NEW WELLS - YEGUA JACKSON AQUIFER	YEGUA-JACKSON AQUIFER	HOUSTON	NECHES	Recommended	110	130	221	300	342	416
MANUFACTURING	HOUSTON	TRINITY	PURCHASE WATER FROM PROVIDER (1)	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	Recommended	30	30	30	30	30	30
COUNTY-OTHER	JASPER	SABINE	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	JASPER	SABINE	Recommended	82	82	82	82	82	82
COUNTY-OTHER	JASPER	NECHES	OVERDRAFT GULF COAST AQUIFER	GULF COAST AQUIFER	JASPER	NECHES	Recommended	550	550	550	550	550	550
KIRBYVILLE	JASPER	SABINE	MUNICIPAL CONSERVATION	CONSERVATION	JASPER	SABINE	Recommended	3	4	5	6	7	7
MINING	JEFFERSON	NECHES-TRINITY	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	JEFFERSON	NECHES-TRINITY	Recommended	0	0	0	0	5	9
STEAM ELECTRIC POWER	JEFFERSON	NECHES	PURCHASE WATER FROM PROVIDER (1)	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	Recommended	0	25951	25951	25951	25951	25951
APPLEBY WSC	NACOGDOCHES	NECHES	LAKE NACONICHE REGIONAL WATER SUPPLY SYSTEM	LAKE NACONICHE LAKE/RESERVOIR	NACOGDOCHES	NECHES	Recommended	0	300	300	300	300	300
APPLEBY WSC	NACOGDOCHES	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	NACOGDOCHES	NECHES	Recommended	0	0	0	22	39	62
COUNTY-OTHER	NACOGDOCHES	NECHES	LAKE NACONICHE REGIONAL WATER SUPPLY SYSTEM	LAKE NACONICHE LAKE/RESERVOIR	NACOGDOCHES	NECHES	Recommended	0	500	500	500	500	500
COUNTY-OTHER	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (1)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	428	428	428	428	428
D&M WSC	NACOGDOCHES	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	Recommended	0	0	310	310	310	310
LILLY GROVE SUD	NACOGDOCHES	NECHES	LAKE NACONICHE REGIONAL WATER SUPPLY SYSTEM	LAKE NACONICHE LAKE/RESERVOIR	NACOGDOCHES	NECHES	Recommended	0	0	0	0	500	500
LILLY GROVE SUD	NACOGDOCHES	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	Recommended	0	0	0	0	500	500
LIVESTOCK	NACOGDOCHES	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	Recommended	0	0	322	644	966	1350
MINING	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	2500	7000	0	0	0	0
NACOGDOCHES	NACOGDOCHES	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	NACOGDOCHES	NECHES	Recommended	0	229	425	514	654	787
NACOGDOCHES	NACOGDOCHES	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	Recommended	2800	2800	2800	2800	2800	2800
NACOGDOCHES	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (3)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	8551	8551	8551	8551	8551
NACOGDOCHES	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (3)	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	Recommended	0	0	0	0	5175	5175
STEAM ELECTRIC POWER	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	5000	5000	5000	13400	13400
STEAM ELECTRIC POWER	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (2)	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	Recommended	0	340	340	340	340	340
SWIFT WSC	NACOGDOCHES	NECHES	LAKE NACONICHE REGIONAL WATER SUPPLY SYSTEM	LAKE NACONICHE LAKE/RESERVOIR	NACOGDOCHES	NECHES	Recommended	0	0	400	400	400	400
SWIFT WSC	NACOGDOCHES	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	Recommended	350	350	350	350	350	350
SWIFT WSC	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (1)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Alternate	0	688	688	688	688	688
MANUFACTURING	NEWTON	SABINE	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	NEWTON	SABINE	Recommended	400	400	400	800	800	800
MANUFACTURING	NEWTON	SABINE	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	Considered	700	700	700	700	700	700
STEAM ELECTRIC POWER	NEWTON	SABINE	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	Recommended	0	0	15000	15000	15000	15000
COUNTY-OTHER	ORANGE	NECHES	OVERDRAFT GULF COAST AQUIFER	GULF COAST AQUIFER	ORANGE	NECHES	Recommended	140	140	140	140	140	140
MANUFACTURING	ORANGE	SABINE	PURCHASE WATER FROM PROVIDER (1)	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	Recommended	5000	15000	20000	25000	25000	28000
MANUFACTURING	ORANGE	SABINE	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	Recommended	0	0	0	0	5000	8000
MAURICEVILLE SUD	ORANGE	SABINE	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	NEWTON	SABINE	Recommended	0	203	203	203	203	203
MANUFACTURING	PANOLA	SABINE	PURCHASE WATER FROM PROVIDER (1)	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	Recommended	96	116	132	147	161	187
COUNTY-OTHER	POLK	NECHES	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	POLK	NECHES	Recommended	208	417	624	832	832	832
MANUFACTURING	POLK	NECHES	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	POLK	NECHES	Recommended	0	225	225	450	450	450
MINING	RUSK	SABINE	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	RUSK	SABINE	Recommended	0	0	0	158	158	158
STEAM ELECTRIC POWER	RUSK	SABINE	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	0	0	0	0	8500
STEAM ELECTRIC POWER	RUSK	SABINE	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	Recommended	0	0	0	0	1501	1500
COUNTY-OTHER	SABINE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	SABINE	NECHES	Recommended	32	32	32	64	64	64
COUNTY-OTHER	SABINE	NECHES	PURCHASE WATER FROM PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	Alternate	100	100	100	100	100	100
LIVESTOCK	SABINE	SABINE	EXPAND LOCAL SURFACE WATER SUPPLIES	LIVESTOCK LOCAL SUPPLY	SABINE	SABINE	Recommended	50	100	107	200	210	300
LIVESTOCK	SABINE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	SABINE	SABINE	Recommended	50	50	50	100	100	100
IRRIGATION	SAN AUGUSTINE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	SAN AUGUSTINE	NECHES	Recommended	100	100	100	100	100	100
LIVESTOCK	SAN AUGUSTINE	NECHES	EXPAND LOCAL SURFACE WATER SUPPLIES	LIVESTOCK LOCAL SUPPLY	SAN AUGUSTINE	NECHES	Recommended	0	50	100	200	200	300
LIVESTOCK	SAN AUGUSTINE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	SAN AUGUSTINE	NECHES	Recommended	100	100	200	200	300	300
LIVESTOCK	SAN AUGUSTINE	SABINE	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	SAN AUGUSTINE	SABINE	Recommended	50	50	50	100	100	100
MANUFACTURING	SAN AUGUSTINE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	SAN AUGUSTINE	NECHES	Recommended	10	10	10	10	10	10
MINING	SAN AUGUSTINE	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	500	500	0	0	0	0

Region I Water User Group Potentially Feasible Water Management Strategy Supply
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WUG Name	WUG County	WUG Basin	Project Name	Source Name	Source County	Source Basin	Selected	2010	2020	2030	2040	2050	2060
MINING	SAN AUGUSTINE	NECHES	PURCHASE WATER FROM PROVIDER (2)	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	Recommended	1000	6500	0	0	0	0
CENTER	SHELBY	SABINE	MUNICIPAL CONSERVATION	CONSERVATION	HENDERSON	NECHES	Recommended	15	34	47	60	67	75
COUNTY-OTHER	SHELBY	SABINE	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	SHELBY	SABINE	Recommended	100	200	300	300	350	350
COUNTY-OTHER	SHELBY	SABINE	PURCHASE WATER FROM PROVIDER (1)	CENTER LAKE/RESERVOIR	RESERVOIR	SABINE	Recommended	50	50	50	50	50	50
COUNTY-OTHER	SHELBY	SABINE	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	Recommended	150	150	150	150	150	150
LIVESTOCK	SHELBY	SABINE	EXPAND LOCAL SURFACE WATER SUPPLIES	LIVESTOCK LOCAL SUPPLY	SHELBY	SABINE	Recommended	0	0	500	500	500	500
LIVESTOCK	SHELBY	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	SHELBY	NECHES	Recommended	500	500	1000	1000	1500	1500
LIVESTOCK	SHELBY	SABINE	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	SHELBY	SABINE	Recommended	1000	2000	2000	2000	2000	2000
LIVESTOCK	SHELBY	SABINE	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	Recommended	0	0	0	4000	4000	4000
MANUFACTURING	SHELBY	SABINE	PURCHASE WATER FROM PROVIDER (1)	CARRIZO-WILCOX AQUIFER	SHELBY	SABINE	Recommended	0	0	0	0	5	12
MINING	SHELBY	NECHES	PURCHASE WATER FROM PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	Recommended	250	1250	0	0	0	0
MINING	SHELBY	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	250	250	0	0	0	0
BULLARD	SMITH	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	SMITH	NECHES	Recommended	0	3	4	5	6	8
BULLARD	SMITH	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	Recommended	0	100	100	100	200	200
COMMUNITY WATER COMPANY	SMITH	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	Recommended	121	121	121	227	227	227
IRRIGATION	SMITH	NECHES	NEW WELLS - QUEEN CITY AQUIFER	QUEEN CITY AQUIFER	HENDERSON	NECHES	Recommended	40	40	80	120	168	168
JACKSON WSC	SMITH	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	600	600	600	600	600
LINDALE RURAL WSC	SMITH	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	SMITH	NECHES	Recommended	0	0	5	7	9	12
LINDALE RURAL WSC	SMITH	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	SMITH	NECHES	Recommended	0	0	0	0	0	80
MANUFACTURING	SMITH	NECHES	PURCHASE WATER FROM PROVIDER (2)	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	0	294	294	294	295
MINING	SMITH	NECHES	NEW WELLS - QUEEN CITY AQUIFER	QUEEN CITY AQUIFER	HENDERSON	NECHES	Recommended	47	141	188	235	282	329
TYLER	SMITH	NECHES	LAKE PALESTINE INFRASTRUCTURE	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	0	16815	16815	16815	16815
WHITEHOUSE	SMITH	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	0	1200	1200	1200	1200	1200
WHITEHOUSE	SMITH	NECHES	PURCHASE WATER FROM PROVIDER (3)	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	Recommended	27	0	0	0	0	0
COUNTY-OTHER	TRINITY	NECHES	NEW WELLS - YEGUA JACKSON AQUIFER	YEGUA-JACKSON AQUIFER	TRINITY	NECHES	Recommended	0	0	0	60	60	60
COUNTY-OTHER	TYLER	NECHES	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	TYLER	NECHES	Recommended	0	251	251	251	251	251
WOODVILLE	TYLER	NECHES	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	TYLER	NECHES	Recommended	0	300	300	300	300	300

Region I Wholesale Water Provider Potentially Feasible Water Managment Strategy Supply
(Ac-ft per Year)

WWP Name	Project Name	Source Name	Source County	Source Basin	WUG Name	Selected	2010	2020	2030	2040	2050	2060
ANGELINA & NECHES RIVER AUTHORITY	ANRA TREATMENT AND DISTRIBUTION SYSTEM	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	ARP	Recommended	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	ANRA TREATMENT AND DISTRIBUTION SYSTEM	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	COUNTY-OTHER	Recommended	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	ANRA TREATMENT AND DISTRIBUTION SYSTEM	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	COUNTY-OTHER	Recommended	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	ANRA TREATMENT AND DISTRIBUTION SYSTEM	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	JACKSON WSC	Recommended	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	ANRA TREATMENT AND DISTRIBUTION SYSTEM	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	NEW LONDON	Recommended	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	ANRA TREATMENT AND DISTRIBUTION SYSTEM	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	NEW SUMMERFIELD	Recommended	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	ANRA TREATMENT AND DISTRIBUTION SYSTEM	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	TROUP	Recommended	0	0	0	0	0	0
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	COUNTY-OTHER	Recommended	0	21,830	21,830	21,830	21,830	21,830
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	ARP	Recommended	0	428	428	428	428	428
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	COUNTY-OTHER	Recommended	0	855	855	855	855	855
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	COUNTY-OTHER	Recommended	0	428	428	428	428	428
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	ALTO	Recommended	0	428	428	428	428	428
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	COUNTY-OTHER	Recommended	0	3,848	3,848	3,848	3,848	3,848
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	JACKSON WSC	Recommended	0	855	855	855	855	855
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	JACKSONVILLE	Recommended	0	4,275	4,275	4,275	4,275	4,275
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	NACOGDOCHES	Recommended	0	8,551	8,551	8,551	8,551	8,551
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	NEW LONDON	Recommended	0	855	855	855	855	855
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	NEW SUMMERFIELD	Recommended	0	2,565	2,565	2,565	2,565	2,565
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	NORTH CHEROKEE WSC	Recommended	0	4,275	4,275	4,275	4,275	4,275
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	RUSK	Recommended	0	4,275	4,275	4,275	4,275	4,275
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	RUSK RURAL WSC	Recommended	0	855	855	855	855	855
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	MANUFACTURING	Recommended	0	8,551	8,551	8,551	8,551	8,551
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	TROUP	Recommended	0	4,275	4,275	4,275	4,275	4,275
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	WHITEHOUSE	Recommended	0	8,551	8,551	8,551	8,551	8,551
CENTER CITY OF	MUNICIPAL CONSERVATION	CONSERVATION	HENDERSON	NECHES	CENTER	Recommended	15	34	47	60	67	75
HOUSTON COUNTY WCID #1	PERMIT AMENDMENT - HOUSTON COUNTY LAKE	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	CONSOLIDATED WSC	Recommended	0	0	0	0	0	0
HOUSTON COUNTY WCID #1	PERMIT AMENDMENT - HOUSTON COUNTY LAKE	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	CONSOLIDATED WSC	Recommended	1,050	1,050	1,050	1,050	1,050	1,050
HOUSTON COUNTY WCID #1	PERMIT AMENDMENT - HOUSTON COUNTY LAKE	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	COUNTY-OTHER	Recommended	10	10	10	10	10	10
HOUSTON COUNTY WCID #1	PERMIT AMENDMENT - HOUSTON COUNTY LAKE	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	CROCKETT	Recommended	194	194	194	194	194	194
HOUSTON COUNTY WCID #1	PERMIT AMENDMENT - HOUSTON COUNTY LAKE	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	GRAPELAND	Recommended	40	40	40	40	40	40
HOUSTON COUNTY WCID #1	PERMIT AMENDMENT - HOUSTON COUNTY LAKE	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	COUNTY-OTHER	Recommended	2,150	2,150	2,150	2,150	2,150	2,150
HOUSTON COUNTY WCID #1	PERMIT AMENDMENT - HOUSTON COUNTY LAKE	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	LOVELADY	Recommended	26	26	26	26	26	26
HOUSTON COUNTY WCID #1	PERMIT AMENDMENT - HOUSTON COUNTY LAKE	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	MANUFACTURING	Recommended	30	30	30	30	30	30
JACKSONVILLE CITY OF	INFRASTRUCTURE IMPROVEMENTS	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	JACKSONVILLE	Recommended	1,000	1,000	1,000	1,000	1,000	1,000
JACKSONVILLE CITY OF	PURCHASE WATER FROM PROVIDER (3)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	JACKSONVILLE	Recommended	0	1,700	1,700	1,700	1,700	1,700
LOWER NECHES VALLEY AUTHORITY	PERMIT AMMENDMENT FOR SAM RAYBURN	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	COUNTY-OTHER	Recommended	0	28,000	28,000	28,000	28,000	28,000
LOWER NECHES VALLEY AUTHORITY	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	COUNTY-OTHER	Recommended	0	0	0	0	36,000	36,000
LOWER NECHES VALLEY AUTHORITY	REALLOCATION OF FLOOD STORAGE (RAYBURN)	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	COUNTY-OTHER	Recommended	0	0	0	0	122,000	122,000
LOWER NECHES VALLEY AUTHORITY	SALTWATER BARRIER CONJUNCTIVE OPERATION WITH RAYBURN/STEINHAGEN	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	COUNTY-OTHER	Recommended	0	111,000	111,000	111,000	111,000	111,000
LOWER NECHES VALLEY AUTHORITY	SEDIMENT REDUCTION	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	COUNTY-OTHER	Recommended	0	0	0	0	5,000	5,000
LOWER NECHES VALLEY AUTHORITY	WHOLESALE CUSTOMER CONSERVATION	NECHES RIVER RUN-OF-RIVER PINE ISLAND BAYOU	JASPER	NECHES	IRRIGATION	Recommended	20,000	30,000	33,000	35,000	40,000	40,000
LUFKIN CITY OF	ANGELINA COUNTY REGIONAL PROJECT	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	LUFKIN	Recommended	0	0	0	7,210	7,210	5,210
LUFKIN CITY OF	ANGELINA COUNTY REGIONAL PROJECT	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	MANUFACTURING	Recommended	0	0	0	4,000	4,000	6,000
LUFKIN CITY OF	LAKE KURTH REGIONAL SYSTEM	KURTH LAKE/RESERVOIR	RESERVOIR	NECHES	LUFKIN	Recommended	0	5,600	5,600	4,300	5,600	5,600
LUFKIN CITY OF	LAKE KURTH REGIONAL SYSTEM	KURTH LAKE/RESERVOIR	RESERVOIR	NECHES	MANUFACTURING	Recommended	6,800	12,800	12,800	14,100	12,800	12,800
LUFKIN CITY OF	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	LUFKIN	Recommended	2,955	2,555	2,464	2,384	2,301	2,215
LUFKIN CITY OF	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	COUNTY-OTHER	Recommended	56	90	106	119	137	160
LUFKIN CITY OF	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	DIBOLL	Recommended	834	1,176	1,244	1,307	1,366	1,422
LUFKIN CITY OF	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	HUNTINGTON	Recommended	9	16	21	24	28	32
LUFKIN CITY OF	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	MANUFACTURING	Recommended	0	0	0	0	0	0
LUFKIN CITY OF	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	REDLAND WSC	Recommended	46	63	65	66	68	71
LUFKIN CITY OF	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	LUFKIN	Recommended	750	750	750	750	750	750
NACOGDOCHES CITY OF	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	NACOGDOCHES	Recommended	2,800	2,800	2,800	2,800	2,800	2,800
NACOGDOCHES CITY OF	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	MANUFACTURING	Recommended	0	0	0	0	0	0
NACOGDOCHES CITY OF	PURCHASE WATER FROM PROVIDER (3)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	APPLEBY WSC	Recommended	0	0	0	0	0	0
NACOGDOCHES CITY OF	PURCHASE WATER FROM PROVIDER (3)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	NACOGDOCHES	Recommended	0	8,551	8,551	8,551	8,551	8,551

Region I Wholesale Water Provider Potentially Feasible Water Managment Strategy Supply
(Ac-ft per Year)

WWP Name	Project Name	Source Name	Source County	Source Basin	WUG Name	Selected	2010	2020	2030	2040	2050	2060
NACOGDOCHES CITY OF	PURCHASE WATER FROM PROVIDER (3)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	MANUFACTURING	Recommended	0	0	0	0	0	0
NACOGDOCHES CITY OF	PURCHASE WATER FROM PROVIDER (3)	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	NACOGDOCHES	Alternative	0	0	0	0	5,175	5,175
TYLER CITY OF	LAKE PALESTINE INFRASTRUCTURE	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	TYLER	Recommended	0	0	16,815	16,815	16,815	16,815
ATHENS MUNICIPAL WATER AUTHORITY	FOREST GROVE RESERVOIR PROJECT	FOREST GROVE LAKE/RESERVOIR	RESERVOIR	TRINITY	ATHENS	Recommended	0	0	0	155	933	1,894
ATHENS MUNICIPAL WATER AUTHORITY	FOREST GROVE RESERVOIR PROJECT	FOREST GROVE LAKE/RESERVOIR	RESERVOIR	TRINITY	MANUFACTURING	Recommended	0	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	FOREST GROVE RESERVOIR PROJECT	FOREST GROVE LAKE/RESERVOIR	RESERVOIR	TRINITY	COUNTY-OTHER	Recommended	0	0	0	2,085	1,307	346
ATHENS MUNICIPAL WATER AUTHORITY	FOREST GROVE RESERVOIR PROJECT	FOREST GROVE LAKE/RESERVOIR	RESERVOIR	TRINITY	ATHENS	Recommended	0	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	FOREST GROVE RESERVOIR PROJECT	FOREST GROVE LAKE/RESERVOIR	RESERVOIR	TRINITY	IRRIGATION	Recommended	0	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	FOREST GROVE RESERVOIR PROJECT	FOREST GROVE LAKE/RESERVOIR	RESERVOIR	TRINITY	LIVESTOCK	Recommended	0	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	INDIRECT REUSE	INDIRECT REUSE	HENDERSON	NECHES	ATHENS	Recommended	0	621	829	1,013	786	554
ATHENS MUNICIPAL WATER AUTHORITY	INDIRECT REUSE	INDIRECT REUSE	HENDERSON	NECHES	MANUFACTURING	Recommended	0	45	59	74	93	119
ATHENS MUNICIPAL WATER AUTHORITY	INDIRECT REUSE	INDIRECT REUSE	HENDERSON	NECHES	COUNTY-OTHER	Recommended	0	829	395	1	0	1
ATHENS MUNICIPAL WATER AUTHORITY	INDIRECT REUSE	INDIRECT REUSE	HENDERSON	NECHES	ATHENS	Recommended	0	19	29	42	65	94
ATHENS MUNICIPAL WATER AUTHORITY	INDIRECT REUSE	INDIRECT REUSE	HENDERSON	NECHES	IRRIGATION	Recommended	0	70	83	95	108	121
ATHENS MUNICIPAL WATER AUTHORITY	INDIRECT REUSE	INDIRECT REUSE	HENDERSON	NECHES	LIVESTOCK	Recommended	0	1,288	1,477	1,647	1,820	1,983
ATHENS MUNICIPAL WATER AUTHORITY	MUNICIPAL CONSERVATION	CONSERVATION	HENDERSON	NECHES	ATHENS	Recommended	1	6	12	17	22	30
ATHENS MUNICIPAL WATER AUTHORITY	NEW WTP	FOREST GROVE LAKE/RESERVOIR	RESERVOIR	TRINITY	ATHENS	Recommended	0	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	NEW WTP	FOREST GROVE LAKE/RESERVOIR	RESERVOIR	TRINITY	MANUFACTURING	Recommended	0	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	NEW WTP	FOREST GROVE LAKE/RESERVOIR	RESERVOIR	TRINITY	COUNTY-OTHER	Recommended	0	0	0	0	0	2,240
ATHENS MUNICIPAL WATER AUTHORITY	NEW WTP	FOREST GROVE LAKE/RESERVOIR	RESERVOIR	TRINITY	ATHENS	Recommended	0	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	OVERDRAFT CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	ATHENS	Recommended	0	803	801	801	800	799
ATHENS MUNICIPAL WATER AUTHORITY	OVERDRAFT CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	MANUFACTURING	Recommended	0	0	0	0	0	0
ATHENS MUNICIPAL WATER AUTHORITY	OVERDRAFT CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	COUNTY-OTHER	Recommended	0	570	570	570	570	570
ATHENS MUNICIPAL WATER AUTHORITY	OVERDRAFT CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	ATHENS	Recommended	0	27	29	29	30	31

WUG Name	WUG County	WUG Basin	Project Name	Source Name	Capital Cost	AC 2010	AC 2020	AC 2030	AC 2040	AC 2050	AC 2060
COUNTY-OTHER	ANDERSON	TRINITY	NEW WELLS - QUEEN CITY AQUIFER	QUEEN CITY AQUIFER	$212,732	$0	$0	$0	$0	$0	$3,211,000
COUNTY-OTHER	ANDERSON	NECHES	OVERDRAFT CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$262,189	$0	$0	$0	$40,631	$40,631	$17,772
FRANKSTON	ANDERSON	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	$0	$0	$0	$1,600	$1,600	$1,600	$1,600
FRANKSTON	ANDERSON	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$255,951	$0	$0	$42,846	$42,846	$20,531	$20,531
MINING	ANDERSON	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$168,417	$0	$20,610	$20,610	$6,053	$6,053	$6,053
MINING	ANDERSON	TRINITY	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$60,313	$7,623	$7,623	$2,239	$2,239	$2,239	$2,239
STEAM ELECTRIC POWER	ANDERSON	NECHES	PURCHASE WATER FROM PROVIDER (2)	PALESTINE LAKE/RESERVOIR	$24,917,413	$0	$7,500,615	$7,500,615	$5,328,201	$5,328,201	$5,328,201
COUNTY-OTHER	ANGELINA	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$911,640	$83,395	$83,395	$56,901	$56,901	$223,690	$223,690
COUNTY-OTHER	ANGELINA	NECHES	NEW WELLS - YEGUA JACKSON AQUIFER	YEGUA-JACKSON AQUIFER	$419,717	$0	$0	$41,291	$41,291	$64,285	$64,285
COUNTY-OTHER	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	CARRIZO-WILCOX AQUIFER	$10,604,000	$0	$0	$1,790,000	$1,790,000	$865,000	$865,000
COUNTY-OTHER	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	SAM RAYBURN-STEINHAGEN LAK	$0	$0	$0	$0	$0	$0	$0
DIBOLL	ANGELINA	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	$0	$7,500	$7,500	$7,500	$7,500	$7,500	$7,500
DIBOLL	ANGELINA	NECHES	NEW WELLS - YEGUA JACKSON AQUIFER	YEGUA-JACKSON AQUIFER	$576,576	$140,344	$140,344	$90,075	$90,075	$90,075	$90,075
DIBOLL	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	CARRIZO-WILCOX AQUIFER	$6,195,000	$1,144,900	$1,144,900	$604,800	$604,800	$1,749,700	$1,749,700
FOUR WAY WSC	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	SAM RAYBURN-STEINHAGEN LAK	$669,192	$0	$0	$0	$0	$0	$211,421
HUDSON	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (1)	CARRIZO-WILCOX AQUIFER	$0	$0	$0	$39,657	$126,901	$140,522	$210,784
HUDSON WSC	ANGELINA	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$3,274,192	$0	$0	$190,352	$190,352	$553,289	$553,289
LIVESTOCK	ANGELINA	NECHES	EXPAND LOCAL SURFACE WATER SUPPLIES	LIVESTOCK LOCAL SUPPLY	$168,800	$0	$0	$0	$14,700	$14,700	$0
LUFKIN	ANGELINA	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	$0	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000
LUFKIN	ANGELINA	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$0	$0	$0	$0	$0	$0	$0
LUFKIN	ANGELINA	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$0	$0	$0	$0	$0	$0	$0
LUFKIN	ANGELINA	NECHES	LAKE KURTH REGIONAL SYSTEM	KURTH LAKE/RESERVOIR	$0	$0	$0	$0	$0	$0	$0
LUFKIN	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (3)	SAM RAYBURN-STEINHAGEN LAK	$0	$0	$0	$0	$0	$0	$0
MANUFACTURING	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	$7,602,950	$0	$2,736,000	$2,736,000	$2,073,000	$2,073,000	$2,073,000
MANUFACTURING	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	KURTH LAKE/RESERVOIR	$18,573,800	$3,015,000	$4,554,000	$2,935,000	$3,798,000	$2,935,000	$2,935,000
MANUFACTURING	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	SAM RAYBURN-STEINHAGEN LAK	$0	$0	$0	$0	$0	$2,655,000	$3,982,000
MINING	ANGELINA	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	$5,793,150	$1,060,000	$1,527,000	$0	$0	$0	$0
STEAM ELECTRIC POWER	ANGELINA	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$1,724,909	$230,665	$230,665	$80,280	$80,280	$80,280	$80,280
JACKSONVILLE	CHEROKEE	NECHES	INFRASTRUCTURE IMPROVEMENTS	JACKSONVILLE LAKE/RESERVOIR	$0	$0	$0	$0	$0	$0	$0
JACKSONVILLE	CHEROKEE	NECHES	PURCHASE WATER FROM PROVIDER (3)	COLUMBIA LAKE/RESERVOIR	$0	$0	$0	$0	$0	$0	$0
MINING	CHEROKEE	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	$3,619,300	$490,000	$728,000	$0	$0	$0	$0
NEW SUMMERFIELD	CHEROKEE	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	$0	$0	$2,000	$2,000	$2,000	$2,000	$2,000
NEW SUMMERFIELD	CHEROKEE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$299,452	$0	$0	$63,329	$63,329	$37,221	$37,221
NEW SUMMERFIELD	CHEROKEE	NECHES	PURCHASE WATER FROM PROVIDER (1)	COLUMBIA LAKE/RESERVOIR	$0	$0	$1,140,000	$1,140,000	$1,140,000	$1,140,000	$1,140,000
RUSK	CHEROKEE	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	$0	$0	$0	$0	$8,000	$8,000	$8,000
RUSK	CHEROKEE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$299,452	$0	$0	$0	$60,386	$60,386	$34,279
RUSK	CHEROKEE	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	$28,435,800	$0	$3,968,000	$3,968,000	$1,489,000	$1,489,000	$1,489,000
COUNTY-OTHER	HARDIN	TRINITY	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	$0	$0	$0	$0	$0	$0	$0
COUNTY-OTHER	HARDIN	NECHES	OVERDRAFT GULF COAST AQUIFER	GULF COAST AQUIFER	$556,888	$65,857	$131,714	$83,162	$34,610	$100,467	$100,467
IRRIGATION	HARDIN	NECHES	PURCHASE WATER FROM PROVIDER (2)	SAM RAYBURN-STEINHAGEN LAK	$2,405,001	$296,920	$296,920	$0	$0	$0	$0
MANUFACTURING	HARDIN	NECHES	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	$429,542	$43,444	$43,444	$5,995	$5,995	$5,995	$5,995
ATHENS	HENDERSON	NECHES	INDIRECT REUSE	INDIRECT REUSE	$0	$0	$4,400	$6,600	$9,600	$15,000	$21,500
ATHENS	HENDERSON	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	$0	$0	$1,694	$2,776	$3,516	$4,197	$4,985
ATHENS	HENDERSON	TRINITY	FOREST GROVE RESERVOIR PROJECT	FOREST GROVE LAKE/RESERVOIR	$0	$0	$0	$0	$106,900	$647,600	$523,200
BROWNSBORO	HENDERSON	NECHES	OVERDRAFT CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$148,600	$0	$0	$0	$0	$0	$16,100
COUNTY-OTHER	HENDERSON	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	$0	$3,600	$6,700	$8,700	$10,800	$12,600	$15,100
COUNTY-OTHER	HENDERSON	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$609,900	$64,900	$64,900	$11,700	$11,700	$11,700	$11,700
COUNTY-OTHER	HENDERSON	NECHES	NEW WELLS - QUEEN CITY AQUIFER	QUEEN CITY AQUIFER	$4,420,100	$84,067	$84,067	$19,833	$103,900	$272,033	$375,933
COUNTY-OTHER	HENDERSON	NECHES	OVERDRAFT CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$0	$4,900	$0	$0	$0	$0	$0
COUNTY-OTHER	HENDERSON	NECHES	PURCHASE WATER FROM PROVIDER (2)	PALESTINE LAKE/RESERVOIR	$8,937,350	$0	$867,900	$884,200	$137,800	$170,400	$203,000
IRRIGATION	HENDERSON	NECHES	INDIRECT REUSE	INDIRECT REUSE	$0	$0	$2,300	$2,100	$3,100	$3,500	$4,000
LIVESTOCK	HENDERSON	NECHES	INDIRECT REUSE	INDIRECT REUSE	$0	$0	$42,000	$48,000	$53,700	$59,300	$64,600
CONSOLIDATED WSC	HOUSTON	TRINITY	PURCHASE WATER FROM PROVIDER (1)	HOUSTON COUNTY LAKE/RESERV	$0	$684,000	$384,000	$684,000	$684,000	$684,000	$684,000
IRRIGATION	HOUSTON	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$1,602,780	$158,307	$158,307	$65,150	$66,150	$144,304	$144,304

Region I Potentially Feasible Water Management Strategy Cost

WUG Name	WUG County	WUG Basin	Project Name	Source Name	Capital Cost	AC 2010	AC 2020	AC 2030	AC 2040	AC 2050	AC 2060
IRRIGATION	HOUSTON	TRINITY	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$1,602,780	$0	$79,154	$79,154	$111,729	$111,729	$144,304
LIVESTOCK	HOUSTON	TRINITY	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$1,335,649	$39,577	$39,577	$55,864	$95,441	$111,728	$128,016
LIVESTOCK	HOUSTON	NECHES	NEW WELLS - YEGUA JACKSON AQUIFER	YEGUA-JACKSON AQUIFER	$1,335,649	$39,577	$39,577	$55,864	$95,441	$111,728	$128,016
MANUFACTURING	HOUSTON	TRINITY	PURCHASE WATER FROM PROVIDER (1)	HOUSTON COUNTY LAKE/RESERV	$0	$19,500	$19,500	$19,500	$19,500	$19,500	$19,500
COUNTY-OTHER	JASPER	SABINE	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	$393,088	$174,438	$174,438	$140,167	$140,167	$140,167	$140,167
COUNTY-OTHER	JASPER	NECHES	OVERDRAFT GULF COAST AQUIFER	GULF COAST AQUIFER	$1,369,957	$236,113	$236,113	$150,945	$150,945	$150,945	$150,945
KIRBYVILLE	JASPER	SABINE	MUNICIPAL CONSERVATION	CONSERVATION	$0	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
MINING	JEFFERSON	NECHES-TRINITY	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	$103,083	$0	$0	$0	$0	$12,746	$12,746
STEAM ELECTRIC POWER	JEFFERSON	NECHES	PURCHASE WATER FROM PROVIDER (1)	SAM RAYBURN-STEINHAGEN LAK	$13,647,296	$0	$3,060,104	$3,060,104	$1,870,270	$1,870,270	$2,346,204
APPLEBY WSC	NACOGDOCHES	NECHES	LAKE NACONICHE REGIONAL WATER SUPPLY SYS	LAKE NACONICHE LAKE/RESERVO	$4,392,350	$0	$505,765	$505,765	$127,500	$127,500	$127,500
APPLEBY WSC	NACOGDOCHES	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	$0	$0	$0	$0	$0	$0	$0
COUNTY-OTHER	NACOGDOCHES	NECHES	LAKE NACONICHE REGIONAL WATER SUPPLY SYS	LAKE NACONICHE LAKE/RESERVO	$7,320,600	$0	$843,000	$843,000	$212,500	$212,500	$212,500
COUNTY-OTHER	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (1)	COLUMBIA LAKE/RESERVOIR	$0	$0	$327,848	$327,848	$327,848	$327,848	$327,848
D&M WSC	NACOGDOCHES	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$492,348	$0	$0	$100,361	$100,361	$57,436	$57,436
LILLY GROVE SUD	NACOGDOCHES	NECHES	LAKE NACONICHE REGIONAL WATER SUPPLY SYS	LAKE NACONICHE LAKE/RESERVO	$7,320,600	$0	$0	$0	$0	$843,000	$843,000
LILLY GROVE SUD	NACOGDOCHES	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$580,504	$0	$0	$0	$0	$134,877	$134,877
LIVESTOCK	NACOGDOCHES	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$1,969,392	$0	$0	$100,361	$200,722	$258,158	$315,594
MINING	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	$9,593,450	$1,539,643	$2,574,000	$0	$0	$0	$0
NACOGDOCHES	NACOGDOCHES	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	$0	$0	$40,000	$40,000	$40,000	$40,000	$40,000
NACOGDOCHES	NACOGDOCHES	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$0	$0	$0	$0	$0	$0	$0
NACOGDOCHES	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (3)	COLUMBIA LAKE/RESERVOIR	$0	$0	$0	$0	$0	$0	$0
NACOGDOCHES	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (3)	TOLEDO BEND LAKE/RESERVOIR	$0	$0	$0	$0	$0	$0	$0
STEAM ELECTRIC POWER	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	$10,718,000	$0	$2,252,254	$2,252,254	$1,318,254	$3,291,000	$3,291,000
STEAM ELECTRIC POWER	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (2)	HOUSTON COUNTY LAKE/RESERV	$2,012,400	$0	$263,000	$263,000	$88,000	$88,000	$88,000
SWIFT WSC	NACOGDOCHES	NECHES	LAKE NACONICHE REGIONAL WATER SUPPLY SYS	LAKE NACONICHE LAKE/RESERVO	$5,856,500	$0	$0	$674,370	$674,370	$170,000	$170,000
SWIFT WSC	NACOGDOCHES	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$498,171	$107,277	$107,277	$63,844	$63,844	$63,844	$63,844
SWIFT WSC	NACOGDOCHES	NECHES	PURCHASE WATER FROM PROVIDER (1)	COLUMBIA LAKE/RESERVOIR	$0	$0	$784,649	$784,649	$784,649	$784,649	$784,649
MANUFACTURING	NEWTON	SABINE	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	$891,529	$120,954	$120,954	$82,091	$203,045	$203,045	$164,181
MANUFACTURING	NEWTON	SABINE	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	$1,389,500	$199,500	$199,500	$78,400	$78,400	$78,400	$78,400
STEAM ELECTRIC POWER	NEWTON	SABINE	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	$12,515,350	$0	$0	$3,991,000	$3,991,000	$2,900,000	$2,900,000
COUNTY-OTHER	ORANGE	NECHES	OVERDRAFT GULF COAST AQUIFER	GULF COAST AQUIFER	$432,222	$57,756	$57,756	$20,073	$20,073	$20,073	$20,073
MANUFACTURING	ORANGE	SABINE	PURCHASE WATER FROM PROVIDER (1)	SABINE RIVER RUN-OF-RIVER	$0	$407,500	$1,222,500	$1,630,000	$2,037,500	$2,037,500	$2,282,000
MANUFACTURING	ORANGE	SABINE	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	$0	$0	$0	$0	$0	$407,500	$652,000
MAURICEVILLE SUD	ORANGE	SABINE	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	$550,848	$0	$106,749	$106,749	$58,724	$58,724	$58,724
MANUFACTURING	PANOLA	SABINE	PURCHASE WATER FROM PROVIDER (1)	MURVAUL LAKE/RESERVOIR	$0	$93,845	$113,396	$129,037	$143,700	$156,408	$182,802
COUNTY-OTHER	POLK	NECHES	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	$2,991,138	$75,513	$151,026	$161,344	$171,662	$106,466	$41,271
MANUFACTURING	POLK	NECHES	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	$581,344	$0	$32,678	$32,678	$40,014	$40,014	$14,672
MINING	RUSK	SABINE	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$241,600	$0	$0	$0	$27,550	$27,550	$6,486
STEAM ELECTRIC POWER	RUSK	SABINE	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	$8,640,450	$0	$0	$0	$0	$0	$2,396,000
STEAM ELECTRIC POWER	RUSK	SABINE	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	$1,318,500	$0	$0	$0	$0	$305,000	$305,000
COUNTY-OTHER	SABINE	NECHES	PURCHASE WATER FROM PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR	$1,021,000	$148,200	$148,200	$59,200	$59,200	$59,200	$59,200
COUNTY-OTHER	SABINE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$328,840	$27,356	$27,356	$7,944	$35,300	$35,300	$15,888
LIVESTOCK	SABINE	SABINE	EXPAND LOCAL SURFACE WATER SUPPLIES	LIVESTOCK LOCAL SUPPLY	$562,700	$8,200	$16,400	$8,200	$16,400	$16,400	$16,400
LIVESTOCK	SABINE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$226,430	$31,224	$31,224	$11,483	$42,707	$42,707	$22,965
IRRIGATION	SAN AUGUSTINE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$224,690	$43,639	$43,639	$24,049	$24,049	$24,049	$24,049
LIVESTOCK	SAN AUGUSTINE	NECHES	EXPAND LOCAL SURFACE WATER SUPPLIES	LIVESTOCK LOCAL SUPPLY	$562,700	$0	$8,200	$16,400	$24,600	$16,400	$16,400
LIVESTOCK	SAN AUGUSTINE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$379,140	$30,875	$30,875	$49,356	$49,356	$67,836	$67,836
LIVESTOCK	SAN AUGUSTINE	SABINE	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$189,570	$10,293	$10,293	$16,452	$16,452	$22,612	$22,612
MANUFACTURING	SAN AUGUSTINE	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$33,300	$3,130	$3,130	$230	$230	$230	$230
MINING	SAN AUGUSTINE	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	$2,627,850	$363,000	$363,000	$0	$0	$0	$0
MINING	SAN AUGUSTINE	NECHES	PURCHASE WATER FROM PROVIDER (2)	SAM RAYBURN-STEINHAGEN LAK	$8,212,450	$1,011,462	$1,993,000	$0	$0	$0	$0
CENTER	SHELBY	SABINE	MUNICIPAL CONSERVATION	CONSERVATION	$0	$11,200	$11,200	$11,200	$11,200	$11,200	$11,200
COUNTY-OTHER	SHELBY	SABINE	PURCHASE WATER FROM PROVIDER (1)	CENTER LAKE/RESERVOIR	$0	$48,878	$48,878	$48,878	$48,878	$48,878	$48,878
COUNTY-OTHER	SHELBY	SABINE	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	$3,024,150	$347,400	$347,400	$83,700	$83,700	$83,700	$83,700

Region I Potentially Feasible Water Management Strategy Cost

WUG Name	WUG County	WUG Basin	Project Name	Source Name	Capital Cost	AC 2010	AC 2020	AC 2030	AC 2040	AC 2050	AC 2060
COUNTY-OTHER	SHELBY	SABINE	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$2,278,400	$91,699	$183,398	$208,898	$142,699	$76,497	$76,497
LIVESTOCK	SHELBY	SABINE	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	$4,763,200	$0	$0	$0	$1,177,000	$1,177,000	$762,000
LIVESTOCK	SHELBY	SABINE	EXPAND LOCAL SURFACE WATER SUPPLIES	LIVESTOCK LOCAL SUPPLY	$689,600	$0	$0	$60,100	$60,100	$60,100	$60,100
LIVESTOCK	SHELBY	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$1,040,800	$53,233	$53,233	$83,900	$83,900	$114,567	$114,567
LIVESTOCK	SHELBY	SABINE	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$1,387,600	$106,500	$213,000	$152,500	$92,000	$92,000	$92,000
MANUFACTURING	SHELBY	SABINE	PURCHASE WATER FROM PROVIDER (1)	CARRIZO-WILCOX AQUIFER	$0	$0	$0	$0	$0	$4,888	$11,731
MINING	SHELBY	NECHES	PURCHASE WATER FROM PROVIDER (1)	TOLEDO BEND LAKE/RESERVOIR	$3,847,950	$455,700	$619,000	$0	$0	$0	$0
MINING	SHELBY	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	$1,543,400	$209,000	$209,000	$0	$0	$0	$0
BULLARD	SMITH	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	$0	$0	$2,000	$2,000	$2,000	$2,000	$2,000
BULLARD	SMITH	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$305,674	$0	$51,736	$51,736	$25,086	$76,822	$76,822
COMMUNITY WATER COMI	SMITH	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$1,640,776	$197,781	$197,781	$126,255	$324,036	$324,036	$252,511
IRRIGATION	SMITH	NECHES	NEW WELLS - QUEEN CITY AQUIFER	QUEEN CITY AQUIFER	$357,794	$9,833	$9,833	$11,868	$21,701	$23,736	$15,937
JACKSON WSC	SMITH	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	$0	$0	$741,000	$741,000	$741,000	$741,000	$741,000
LINDALE RURAL WSC	SMITH	NECHES	MUNICIPAL CONSERVATION	CONSERVATION	$0	$0	$0	$3,000	$3,000	$3,000	$3,000
LINDALE RURAL WSC	SMITH	NECHES	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	$347,259	$0	$0	$0	$0	$0	$65,938
MANUFACTURING	SMITH	NECHES	PURCHASE WATER FROM PROVIDER (2)	PALESTINE LAKE/RESERVOIR	$1,476,152	$0	$0	$438,811	$438,811	$310,113	$310,113
MINING	SMITH	NECHES	NEW WELLS - QUEEN CITY AQUIFER	QUEEN CITY AQUIFER	$655,416	$10,301	$30,903	$33,041	$27,016	$29,154	$31,292
TYLER	SMITH	NECHES	LAKE PALESTINE INFRASTRUCTURE	PALESTINE LAKE/RESERVOIR	$0	$0	$0	$0	$0	$0	$0
WHITEHOUSE	SMITH	NECHES	PURCHASE WATER FROM PROVIDER (2)	COLUMBIA LAKE/RESERVOIR	$0	$0	$1,368,000	$1,368,000	$1,368,000	$1,368,000	$1,368,000
WHITEHOUSE	SMITH	NECHES	PURCHASE WATER FROM PROVIDER (3)	PALESTINE LAKE/RESERVOIR	$0	$26,394	$0	$0	$0	$0	$0
COUNTY-OTHER	TRINITY	NECHES	NEW WELLS - YEGUA JACKSON AQUIFER	YEGUA-JACKSON AQUIFER	$249,851	$0	$0	$0	$36,990	$36,990	$15,207
COUNTY-OTHER	TYLER	NECHES	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	$366,241	$0	$49,441	$49,441	$17,510	$17,510	$17,510
WOODVILLE	TYLER	NECHES	NEW WELLS - GULF COAST AQUIFER	GULF COAST AQUIFER	$511,400	$0	$72,700	$72,700	$28,100	$28,100	$28,100

WWP Name	Project Name	Source Name	Source County	Source Basin	Capital Cost	AC 2010	AC 2020	AC 2030	AC 2040	AC 2050	AC 2060
LUFKIN CITY OF	ANGELINA COUNTY REGIONAL PROJECT	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	$53,164,000	$0	$0	$0	$17,679,000	$17,679,000	$13,044,000
ANGELINA & NECHES RIVER AUTHORITY	ANRA TREATMENT AND DISTRIBUTION SYSTEM	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	$35,127,250	$0	$5,868,950	$5,868,950	$2,805,950	$2,805,950	$2,805,950
ATHENS MUNICIPAL WATER AUTHORITY	FOREST GROVE RESERVOIR PROJECT	FOREST GROVE LAKE/RESERVOIR	RESERVOIR	TRINITY	$26,619,000	$0	$0	$0	$2,628,600	$2,628,600	$694,600
ATHENS MUNICIPAL WATER AUTHORITY	INDIRECT REUSE	INDIRECT REUSE	HENDERSON	NECHES	$0	$0	$93,600	$93,600	$93,600	$93,600	$93,600
JACKSONVILLE CITY OF	INFRASTRUCTURE IMPROVEMENTS	JACKSONVILLE LAKE/RESERVOIR	RESERVOIR	NECHES	$1,000,000	$97,200	$97,200	$97,200	$97,200	$97,200	$97,200
LUFKIN CITY OF	LAKE KURTH REGIONAL SYSTEM	KURTH LAKE/RESERVOIR	RESERVOIR	NECHES	$56,488,600	$8,387,700	$837,700	$5,777,600	$5,777,600	$5,777,600	$5,777,600
TYLER CITY OF	LAKE PALESTINE INFRASTRUCTURE	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	$79,389,250	$0	$0	$13,957,000	$13,957,000	$7,035,000	$7,035,000
ATHENS MUNICIPAL WATER AUTHORITY	MUNICIPAL CONSERVATION	CONSERVATION	HENDERSON	NECHES	$0	$0	$0	$0	$0	$0	$0
CENTER CITY OF	MUNICIPAL CONSERVATION	CONSERVATION	HENDERSON	NECHES	$0	$0	$0	$0	$0	$0	$0
ANGELINA & NECHES RIVER AUTHORITY	NEW SOURCE - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	$231,865,000	$0	$16,280,500	$16,280,500	$16,280,500	$16,280,500	$870,500
LUFKIN CITY OF	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	$14,097,000	$1,986,800	$1,986,800	$757,800	$757,800	$757,800	$757,800
LUFKIN CITY OF	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	$0	$0	$0	$0	$0	$0	$0
NACOGDOCHES CITY OF	NEW WELLS - CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	$2,727,000	$724,600	$724,600	$486,887	$486,887	$486,887	$486,887
ATHENS MUNICIPAL WATER AUTHORITY	NEW WTP	FOREST GROVE LAKE/RESERVOIR	RESERVOIR	TRINITY	$12,387,000	$0	$0	$0	$0	$0	$1,254,220
ATHENS MUNICIPAL WATER AUTHORITY	OVERDRAFT CARRIZO WILCOX AQUIFER	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	$3,799,000	$0	$513,900	$513,900	$237,900	$237,900	$237,900
HOUSTON COUNTY WCID #1	PERMIT AMENDMENT - HOUSTON COUNTY LAKE	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	$0	$0	$0	$0	$0	$0	$0
LOWER NECHES VALLEY AUTHORITY	PERMIT AMMENDMENT FOR SAM RAYBURN	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	$0	$0	$4,312,000	$4,312,000	$4,312,000	$4,312,000	$4,312,000
LOWER NECHES VALLEY AUTHORITY	PURCHASE WATER FROM PROVIDER (2)	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	$39,168,200	$0	$0	$0	$0	$5,967,000	$5,967,000
JACKSONVILLE CITY OF	PURCHASE WATER FROM PROVIDER (3)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	$19,133,700	$0	$2,503,000	$2,503,000	$835,000	$835,000	$835,000
NACOGDOCHES CITY OF	PURCHASE WATER FROM PROVIDER (3)	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	$37,282,050	$7,287,000	$7,287,000	$4,037,000	$4,037,000	$4,037,000	$4,037,000
NACOGDOCHES CITY OF	PURCHASE WATER FROM PROVIDER (3)	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	$114,418,981	$0	$0	$0	$0	$10,602,000	$10,602,000
LOWER NECHES VALLEY AUTHORITY	REALLOCATION OF FLOOD STORAGE (RAYBURN)	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	$0	$0	$0	$0	$0	$3,090,260	$3,090,260
LOWER NECHES VALLEY AUTHORITY	SALTWATER BARRIER CONJUNCTIVE OPERATION WITH RAYBURN/STEINHAGEN	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	$0	$0	$0	$0	$0	$9,768,000	$9,768,000
LOWER NECHES VALLEY AUTHORITY	SEDIMENT REDUCTION	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	$161,333,000	$0	$0	$0	$0	$14,066,000	$14,066,000
LOWER NECHES VALLEY AUTHORITY	WHOLESALE CUSTOMER CONSERVATION	NECHES RIVER RUN-OF-RIVER PINE ISLAND BAYOU	JASPER	NECHES	$1,400,000	$30,000	$30,000	$30,000	$30,000	$30,000	$30,000

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Appendix 4D-A

Water Management Strategy Evaluation

Water management strategies identified to meet water needs during the planning period were evaluated based on criteria described in Chapter 4D.

The evaluation was undertaken through the development of a matrix to rate the above consideration from most desirable (1) to least desirable (5). Rating of the Environmental Factors was evaluated using a separate matrix with consideration of nine factors; total acres impacted, wetland acres, environmental water needs, habitat, threatened and endangered species, cultural resources, bays and estuaries, environmental water quality and other noted factors.

Table 4D-A.1 depicts the summary of evaluation of WMSs in the ETRWPA. Table 4D-A.2 depicts the summary of environmental assessment.

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Table 4D-A.1 Summary of Evaluation of Water Management Strategies

County	Entity	Basin Used	Strategy	Strategy Key	Quantity (Ac-Ft/Yr)	Reliability	Cost ($/Ac-Ft)	Impacts of Strategy on: Environmental Factors	Water Resources and Other WMS	Agricultural Resources/ Rural Areas	Other Natural Resources	Key Water Quality Parameters	Political Feasibility	Implementation Issues	Comments
Name	Name(s)	Name	Name	Name	#	(1-5)	$	(1-5)	(1-5)	(1-5)	(1-5)	(1-5)	(1-5)		
Anderson	County-Other	Neches	Increase supply from Queen City	ADC-1	100	3	$321	1	1	1	2	2	1		
Anderson	County-Other	Neches	Increase supply from Carrizo-Wilcox	ADC-2	100	2	$406	1	3	1	2	2	1		
Anderson	Frankston	Neches	Increase supply from Carrizo-Wilcox	FR-1	120	2	$357	1	3	1	2	1	1		
Anderson	Mining	Neches	Increase supply from Carrizo-Wilcox	ADN-1	120	2	$233	1	2	1	2	1	1		
Anderson	Steam-Electric	Neches	Water from Lake Palestine	ADS-1	21,853	2	$343	1	1	1	2	2	2	Requires agreement with City of Palestine	
Anderson	Steam-Electric	Neches	Water from Lake Fastrill Replacement Project	ADS-2	21,853	1	$343	See UNRMWA Lake Fastrill Strategy						Requires agreement with UNRMWA	
Angelina	County-Other	Neches	Voluntary Redistribution from City of Lufkin	ANC-1	1,100	1	$1,627	1	1	1	1	1	2	Requires contract with Lufkin	
Angelina	County-Other	Neches	Increase supply from Yegua-Jackson	ANC-2A	300	2	$214	1	1	1	2	1	1		
Angelina	Diboll	Neches	Purchase water from the City of Lufkin (Phase I-II)	DI-1	1,600	1	$1,431	1	1	1	1	1	1		
Angelina	Diboll	Neches	Increase supply from Yegua-Jackson	DI-3	600	3	$234	1	1	1	2	2	2		
Angelina	Four Way WSC	Neches	Obtain water from the City of Lufkin	FW-1	225	1	$940	1	1	1	1	1	2	Requires contract with Lufkin	
Angelina	Hudson	Neches	Purchase Water from Hudson WSC	HU-1A	1,200	2	$317	1	1	1	2	1	1		
Angelina	Hudson WSC	Neches	Increase supply from Carrizo-Wilcox (Phase I)	HW-1A	600	2	$317	1	1	1	2	1	1		
Angelina	Hudson WSC	Neches	Increase supply from Carrizo-Wilcox (Phase II)	HW-1B	1,400	2	$320	1	1	1	2	1	1		
Angelina	Manufacturing	Neches	Obtain water from City of Lufkin	ANM-1	18,800	1	$454	1	1	1	1	1	2		
Angelina	Manufacturing	Neches	Obtain raw water from Lake Columbia via contract with ANRA	ANM-2	8,551	1	$320	See ANRA Lake Columbia Strategy							
Angelina	Livestock	Neches	Increase stock Ponds	ANL-1	90	3	$163	1	1	2	1	1	1		
Angelina	Mining	Neches	Obtain Water from ANRA (Lake Columbia or Angelina River)	ANMI-1	4,000	1	$382	2	1	1	1	1	3		
Angelina	Mining	Neches	Obtain water from Lufkin (Lake Kurth)	ANMI-2	4,000	1		1	1	1	1	1	1		
Angelina	Steam-Electric	Neches	New wells in the Carrizo-Wilcox	ANP-1	1,000	1	$1,538	1	1	1	2	2	1		
Cherokee	Mining	Neches	Purchase water from ANRA (Lake Columbia or Angelina River)	CHMI-1	1,500	1	$485	2	1	1	1	1	3	Requires contract with ANRA	
Cherokee	New Summerfield	Neches	Obtain treated water from Lake Columbia via contract with ANRA	NS-1	1,000	1	$1,140	See ANRA Lake Columbia Strategy						Requires contract with ANRA	
Cherokee	New Summerfield	Neches	Increase supply from Carrizo-Wilcox	NS-3	242	1	$262	1	1	1	2	1	1		
Cherokee	Rusk	Neches	Obtain treated water from Lake Columbia via contract with ANRA	RU-1	3,000	1	$1,323	See ANRA Lake Columbia Strategy						Requires contract with ANRA	
Cherokee	Rusk	Neches	Increase supply from Carrizo-Wilcox	RU-3	212	1	$285	1	1	1	2	1	1		
Hardin	County-Other	Neches	Increase supply from Gulf Coast Aquifer (Phases I-III)	HAC-1	459	2	$430	1	3	1	2	1	1		May place additional stress on aquifer
Hardin	Manufacturing	Neches	Use additional water from Gulf Coast Aquifer	HAM-1	114	2	$381	1	3	1	2	1	1		
Hardin	Irrigation	Neches	Use surface water sources	HAI-1	1,002	2	$296	1	1	1	3	2	1		
Henderson	Athens	Neches	Water from Athens MWA	AT-3	See Athens MWA Below.										
Henderson	County-Other	Neches	Expand use of Carrizo-Wilcox	HECo-2	50	3	$1,298	1	3	1	3	1	3	Requires coordination with Neches	May place additional stress on aquifer
Henderson	County-Other	Neches	Expand use of Queen City	HECo-3	500	3	$1,009	1	1	1	1	2	2	Requires coordination with Neches	
Henderson	County-Other	Neches	Water from UNRMWA	HECo-4	500	5	$1,964	1	1	1	1	1	1	Requires agreement with UNRMWA	
Henderson	Irrigation	Neches	Obtain water Lake Athens	HEI-1	121	1	$163	1	1	1	1	1	1		
Henderson	Livestock	Neches	Fish Hatchery Reuse	HEL-1	2,872	1	$0	1	1	1	1	1	1		
Houston	Irrigation	Neches/Trinity	Increase supply from Carrizo-Wilcox (Phase I-VI)	HOI-1	2,298	2	$207	1	1	1	2	1	1		
Houston	Livestock	Neches/Trinity	Increase supply from Carrizo-Wilcox (Phase I-V)	HOL-1	1,080	2	$375	1	1	1	2	1	1		
Houston	Manufacturing	Neches/Trinity	Obtain water from Houston County WCID	HOMa-1	15	1	$163	1	1	1	1	1	1		
Jasper	County-Other	Neches	Use additional supply from Gulf Coast Aquifer	JAC-1	632	3	$650	1	3	1	2	1	1		May place additional stress on aquifer
Jefferson	Mining	Neches	Use additional supply from Gulf Coast Aquifer	JEM-1	9	2	$1,416	1	3	1	1	1	1		May place additional stress on aquifer
Jefferson	Steam-Electric	Neches	Use water from the Neches River	JESE-1	25,951	3	$92	2	1	2	3	2	2		
Nacogdoches	D&M WSC	Neches	Increase supply from Carrizo-Wilcox	DM-1	310	1	$324	1	1	1	1	1	1		
Nacogdoches	Lilly Grove SUD	Neches	Increase supply from Carrizo-Wilcox	LG-2	500	1	$270	1	1	1	2	1	1		
Nacogdoches	Livestock	Neches	Increase supply from Carrizo-Wilcox	NCL-1	1,350	2	$234	1	1	1	2	1	1		
Nacogdoches	Mining	Neches	Purchase water from ANRA (Lake Columbia or Angelina River)	NCMI-1	7,000	1	$368	2	1	1	1	1	3		
Nacogdoches	Mining	Neches	Purchase water from LNVA	NCMI-2	7,000	1		1	1	1	1	1	1		
Nacogdoches	Nacogdoches	Neches	Additional groundwater from Carrizo-Wilcox	NA-1	2,800	1	$259	1	1	1	1	1	2		Minimal impacts to downstream water rights
Nacogdoches	Nacogdoches	Neches	Obtain and treat water from Lake Columbia	NA-3	8,551	1	$852	See ANRA Lake Columbia Strategy						Requires contract with ANRA	
Nacogdoches	Nacogdoches	Sabine	Obtain and treat water from Toledo Bend	NA-4	5,175	1	$2,049	2	1	1	2	1	1	Requires agreement with SRA	Highly renewable resource should minimize impacts.
Nacogdoches	Steam-Electric	Neches	Obtain raw water from Lake Columbia	NCS-1	13,358	1	$315	See ANRA Lake Columbia Strategy						Requires contract with ANRA	
Nacogdoches	Steam-Electric	Neches	Obtain raw water from Houston County Lake	NCS-2	340	2	$774	1	1	1	1	1	1		
Nacogdoches	Swift WSC	Neches	Increase supply from Carrizo-Wilcox	SW-1	350	2	$307	1	1	1	2	1	1		
Nacogdoches	Swift WSC	Neches	Obtain Treated water from Lake Columbia via contract with ANRA	SW-3	688	1	$1,140	See ANRA Lake Columbia Strategy							
Nacogdoches	Multiple	Neches	Lake Naconiche Regional System	Multiple	3,239	1	$1,686	2	2	1	1	1	2	Requires WR permit amendment	
Newton	Manufacturing	Sabine	Additional groundwater Well Gulf Coast Aquifer	NWM-1	800	1	$254	1	1	1	1	1	2	Requires coordination with Southeast Texas GCD	
Newton	Manufacturing	Sabine	Purchase water from SRA	NWM-2	700	1	$285	1	1	1	1	1	1	Requires agreement with SRA.	Highly renewable resource should minimize impacts.
Newton	Steam-Electric	Sabine	Purchase water from SRA	NWP-1	15,000	1	$266	1	1	1	1	1	1		
Orange	County-Other	Sabine	Use additional supply from Gulf Coast Aquifer	ORC-1	140	2	$413	1	3	1	1	1	1		May place additional stress on aquifer
Orange	Manufacturing	Sabine	Raw surface water supply from SRA Canal	OR-1SRA	36,000	1	$82	1	1	1	1	1	1	Requires agreement with SRA.	Highly renewable resource should minimize impacts.
Orange	Manufacturing	Sabine	Raw Water from Toledo Bend Reservoir	ORM-2	5,000	1	$81	1	1	1	1	1	1		
Orange	Mauriceville WSC	Sabine	New well in Gulf Coast aquifer	ORMa-1	203	2	$526	1	3	1	1	1	2	Requires coordination with Southeast Texas GCD	Highly renewable resource should minimize impacts.
Panola	Manufacturing		Purchase water from Carthage		187	1	$978	1	1	1	1	1	1		May place additional stress on aquifer
Polk	County-Other	Neches	Use additional supply from Gulf Coast Aquifer (Phase I-IV)	POC-1	832	2	$363	1	1	1	2	1	1		
Polk	Manufacturing	Neches	Expand existing supplies form Gulf-Coast aquifer (Phase I-II)	POM-1	450	2	$884	1	1	1	3	2	1		

Table 4D-A.1 Summary of Evaluation of Water Management Strategies (Cont.)

County	Entity	Basin Used	Strategy	Strategy Key	Quantity (Ac-Ft/Yr)	Reliability	Cost ($/Ac-Ft)	Impacts of Strategy on: Environmental Factors	Impacts of Strategy on: Water Resources and Other WMS	Impacts of Strategy on: Agricultural Resources/ Rural Areas	Impacts of Strategy on: Other Natural Resources	Impacts of Strategy on: Key Water Quality Parameters	Political Feasibility	Implementation Issues	Comments
Rusk	Mining	Neches	Increase supply from Carrizo-Wilcox	RUL-1	158	2	$174	1	1	1	2	1	1		
Rusk	Steam-Electric	Neches	Supply from SRA, Toledo Bend Reservoir	RUSE-1	1,500	1	$203	1	1	1	2	1	3		
Rusk	Steam-Electric	Neches	Supply from ANRA (Lake Columbia)	RUSE-2	8,500	1	$282	See ANRA Lake Columbia Strategy							
Sabine	County-Other	Sabine	Increase supply from Carrizo-Wilcox, Additional groundwater (Phase I-II)	SBC-1	64	1	$552	1	1	1	1	1	1		
Sabine	County-Other	Sabine	Purchase water from Hemphill	SBC-2	100	1	$1,482	1	1	1	1	1	1	Requires water contract with City of Hemphill	
Sabine	Livestock	Sabine	Expand Carrizo-Wilcox supplies (Sabine)	SBL-1	100	1	$427	1	1	1	1	1	1		
Sabine	Livestock	Sabine	Expand local surface water (stock ponds)	SBL-2	300	2	$164	1	1	1	2	1	1	Implemented by local users	
San Augustine	Irrigation	Neches	Obtain Water from Carrizo-Wilcox Aquifer	SAI-1	100	1	$485	1	1	1	1	1	1		
San Augustine	Livestock	Neches	Increase local surface water supplies (stock ponds)	SAL-1	300	3	$164	1	1	2	1	1	1		
San Augustine	Livestock	Sabine	Increase groundwater supply from Carrizo-Wilcox Aquifer (Sabine)	SAL-2	100	1	$528	1	1	1	1	1	1		
San Augustine	Livestock	Neches	Increase groundwater supply from Carrizo-Wilcox Aquifer (Neches)	SAL-3	300	1	$528	1	1	1	1	1	1		
San Augustine	Mining	Neches	Purchase water from ANRA (Angelina river)	SAMi-1	500	2	$726	2	1	1	1	1	1		
San Augustine	Mining	Neches	Purchase water from LNVA (Sam Rayburn)	SAMi-2	6,500	1	$307	1	1	1	1	1	1		
Shelby	County-Other	Sabine	Expand groundwater from Carrizo-Wilcox (wells)	SHCo-1	350	1	$786	1	1	1	1	1	1		
Shelby	County-Other	Sabine	Purchase water from City of Center	SHCo-2	50	1	$978	1	1	1	1	1	1	Requires water contract with City of Center	
Shelby	County-Other	Sabine	Purchase water from SRA (Toledo Bend Reservoir)	SHCo-3	150	1	$2,316	1	1	1	1	1	1	Requires agreement with SRA.	Highly renewable resource should minimize impacts.
Shelby	Livestock	Sabine	Additional groundwater wells (Sabine Basin)	SHL-1	2,000	2	$107	1	1	1	1	1	1		
Shelby	Livestock	Neches	Additional groundwater wells (Neches Basin)	SHL-2	1,500	2	$106	1	1	1	1	1	1		
Shelby	Livestock	Sabine	Increase local supplies	SHL-3	500	2	$120	1	1	1	2	1	1	Implemented by local users	
Shelby	Livestock	Sabine	Purchase raw water from SRA (Toledo Bend)	SHL-4	4,000	1	$294	1	1	1	1	1	1	Requires agreement with SRA.	Highly renewable resource should minimize impacts.
Shelby	Manufacturing	Sabine	Purchase surface water from City of Center	SHM-1	12	1	$978	1	1	1	1	1	1	Requires water contract with City of Center	
Shelby	Mining	Neches	Purchase water from ANRA (Attoyac Bayou)	SHMi-1	250	2	$836	3	1	1	1	1	1		
Shelby	Mining	Sabine	Purchase water from SRA (Toledo Bend)	SHMi-2	1,250	1	$495	1	1	1	1	1	1		
Smith	Bullard	Neches	Increase supply from Carrizo-Wilcox	BU-1A	200	3	$517	1	3	1	2	1	1		May place additional stress on aquifer
Smith	Community Water Co.	Neches	Purchase water from the City of Tyler or other local provider	CW-1A	227	1	$1,743	1	1	1	2	1	1		
Smith	Jackson WSC	Neches	Purchase water from ANRA (Lake Columbia)	JA-1	600	1	$1,235	See ANRA Lake Columbia Strategy							
Smith	Lindale Rural WSC	Neches	Increase supply from Carrizo-Wilcox	LIR-1	80	3	$824	1	3	1	2	1	1		
Smith	Irrigation	Neches	Increase supply from Queen City	SMI-1	168	2	$234	1	1	1	2	2	1		May place additional stress on aquifer
Smith	Manufacturing	Neches	Purchase water from City of Tyler	SMMa-1	295	1	$1,493	1	1	1	1	1	1		
Smith	Mining	Neches	Increase supply from Queen City	SMM-1	329	2	$219	1	1	1	2	2	1		
Smith	Whitehouse	Neches	Purchase water from ANRA	WH-1	1,200	1	$1,140	See ANRA Lake Columbia Strategy							
Smith	Whitehouse	Neches	Purchase additional water from Tyler	WH-2	27	1		1	1	1	1	1	1		
Trinity	County-Other	Neches/Trinity	Increase supply from Yegua-Jackson	TRC-1	60	2	$616	1	2	1	2	2	2		
Tyler	County-Other	Neches	Increase supply from Gulf Coast Aquifer	TYC-1	251	1	$197	1	1	1	2	1	1		
Tyler	Woodville	Neches	Increase supply from Gulf Coast Aquifer	WDV-1	300	1	$242	1	1	1	1	1	2		
Multiple	ANRA	Neches	Lake Columbia Reservoir	ANRA-1	75,700	1	$215	3	2	2	2	1	3		
Multiple	ANRA	Neches	Water Treatment Plant and Distribution	ANRA-2	5,100	1	$1,151	1	1	1	1	1	3		
Henderson	Athens MWA	Multiple	Fish Hatchery Reuse to Lake Athens	AMWA-1	2,872	1	$0	1	1	1	1	1	1	Requires agreement with Fish Hatchery	
Henderson	Athens MWA	Multiple	Water from Forest Grove	AMWA-2	2,240	1	$1,173	2	2	1	1	1	2	Requires agreement with Luminant, TRWD and modification of water rights permit	
Henderson	Athens MWA	Multiple	Additional Lake Athens	AMWA-3	1,000	1	$643	1	1	1	1	1	2	Requires modification of hatchery intake	
Cherokee	Jacksonville	Neches	Water from Lake Columbia	JAC-02	1,700	1	$1,472	1	1	1	1	1	3		
Multiple	LNVA	Neches	Saltwater Barrier conjunctive operation with Rayburn/Steinhagen	LNVA-2	111,000	2	$5	1	1	1	1	2	3		
Multiple	LNVA	Neches	Permit Amendment for Sam Rayburn	LNVA-3	28,000	1	$0	1	1	1	1	1	2		
Multiple	LNVA	Neches	Sediment Reduction	LNVA-5	5,000	2	$2,813	2	2	1	2	2	3		
Multiple	LNVA	Neches	Purchase of water from SRA	LNVA-6	36,000	1	$166	1	1	1	1	1	2		
Multiple	LNVA	Neches	Rockland Reservoir	LNVA-7	614,400	2	$115	4	4	3	2	2	3		
Multiple	LNVA	Neches	Reallocation of Flood Storage	LNVA-4	122,000	1	$25	2	1	1	1	1	1		
Angelina	Lufkin	Neches	Develop Sam Rayburn Reservoir Water Rights	LU-1	11,200	1	$1,577	1	1	1	1	1	1		
Angelina	Lufkin	Neches	Develop additional groundwater Carrizo-Wilcox	LU-2	4,650	1	$427	1	1	1	1	1	1		
Angelina	Lufkin	Neches	Develop Lake Kurth Surface Water	LU-3	18,400	1	$455	1	1	1	1	1	2	Requires water right ammendment	
Multiple	SRA	Sabine	Toledo Bend Pipeline Project	SRA-1	100,000	2	$598	2	1	2	1	1	3		
Tyler	Tyler	Neches/Sabine	Lake Palestine	TYL-2	16,815	1	$830	1	1	1	1	1	1		
Multiple	UNRMWA	Neches/ Trinty	Lake Fastrill Replacement Project		134,500	1	$1,437	3	2	2	3	1	5		

1 **Most desirable**
5 **Least desirable**

Table 4D-A.2 Summary of Environmental Assessment

County	Entity	Basin	Strategy	Strategy Key	Environmental Factors										Comments
					Total Acres Impacted	Wetland Acres[1]	Environmental Water Needs	Habitat	Threatened & Endangered Species	Cultural Resources	Bays & Estuaries	Environmental Water Quality	Other	Overall Environmental Impacts	
Name	Name(s)	Name	Name	Name	#	#	(1-5)	(1-5)	#	(1-5)	(1-5)	(1-5)	(1-5)	(1-5)	
Anderson	County-Other	Neches	Increase supply from Queen City	ADC-1	0	NA	1	1	5	1	1	2	1	1	Pending water quality of Queen City, may increase TDS of wastewater discharges
Anderson	County-Other	Neches	Increase supply from Carrizo-Wilcox	ADC-2	0	NA	1	1	5	1	1	1	1	1	
Anderson	Frankston	Neches	Increase supply from Carrizo-Wilcox	FR-1	0	NA	1	1	5	1	1	1	1	1	
Anderson	Mining	Neches	Increase supply from Carrizo-Wilcox	ADN-1	0	NA	1	1	5	1	1	1	1	1	
Anderson	Steam-Electric	Neches	Water from Lake Palestine	ADS-1	40	NA	2	1	5	1	2	1	1	1	
Anderson	Steam-Electric	Neches	Water from Lake Fastrill	ADS-2	NA	NA	See UNRMWA Lake Fastrill Srategy								
Angelina	County-Other	Neches	Voluntary Redistribution from City of Lufkin	ANC-1	46	NA	1	1	8	1	1	1	1	1	
Angelina	County-Other	Neches	Increase supply from Yegua-Jackson	ANC-2A	0	NA	1	1	8	1	1	1	1	1	
Angelina	Diboll	Neches	Purchase water from the City of Lufkin (Phase I-II)	DI-1	28	NA	1	1	8	1	1	1	1	1	
Angelina	Diboll	Neches	Increase supply from Yegua-Jackson	DI-3	0	NA	1	1	8	1	1	1	1	1	
Angelina	Four Way WSC	Neches	Obtain water from the City of Lufkin	FW-1	0	NA	1	1	8	1	1	1	1	1	
Angelina	Hudson	Neches	Purchase Water from Hudson WSC	HU-1A	0	NA	1	1	8	1	1	1	1	1	
Angelina	Hudson WSC	Neches	Increase supply from Carrizo-Wilcox (Phase I)	HW-1A	0	NA	1	1	8	1	1	1	1	1	
Angelina	Hudson WSC	Neches	Increase supply from Carrizo-Wilcox (Phase II)	HW-1B	0	NA	1	1	8	1	1	1	1	1	
Angelina	Manufacturing	Neches	Obtain water from City of Lufkin	ANM-1	24	NA	1	1	8	1	1	1	1	1	
Angelina	Manufacturing	Neches	Obtain raw water from Lake Columbia via contract with ANRA	ANM-2	7	NA	See ANRA Lake Columbia Strategy								
Angelina	Livestock	Neches	Increase stock Ponds	ANL-1	3	NA	1	1	8	1	1	1	1	1	
Angelina	Mining	Neches	Obtain Water from ANRA (Lake Columbia or Angelina River)	ANMI-1	12	NA	2	2	8	2	2	2	2	2	
Angelina	Mining	Neches	Obtain water from Lufkin (Lake Kurth)	ANMI-2	0	NA	1	1	8	1	1	1	1	1	
Angelina	Steam-Electric	Neches	New wells in the Carrizo-Wilcox	ANP-1	0	NA	1	1	8	1	1	1	1	1	
Cherokee	Mining	Neches	Purchase water from ANRA (Lake Columbia or Angelina River)	CHMI-1	12	NA	2	2	4	2	2	2	2	2	
Cherokee	New Summerfield	Neches	Obtain treated water from Lake Columbia via contract with ANRA	NS-1	6	NA	See ANRA Lake Columbia Strategy								
Cherokee	New Summerfield	Neches	Increase supply from Carrizo-Wilcox	NS-3	0	NA	1	1	4	2	2	1	1	1	
Cherokee	Rusk	Neches	Obtain treated water from Lake Columbia via contract with ANRA	RU-1	23	NA	See ANRA Lake Columbia Strategy								
Cherokee	Rusk	Neches	Increase supply from Carrizo-Wilcox	RU-3	0	NA	1	1	4	1	1	1	1	1	
Hardin	County-Other	Neches	Increase supply from Gulf Coast Aquifer (Phases I-III)	HAC-1	2	NA	1	1	6	1	1	1	3	1	May place additional stress on aquifer
Hardin	Manufacturing	Neches	Use additional water from Gulf Coast Aquifer	HAM-1	2	NA	1	1	6	1	1	1	1	1	
Hardin	Irrigation	Neches	Use surface water sources	HAI-1	6	NA	2	2	6	1	2	1	1	1	
Henderson	Athens	Neches	Water from Athens MWA	AT-3	NA	NA	see Athen MWA strategies							1	
Henderson	County-Other	Neches	Expand use of Carrizo-Wilcox	HECo-2	4	NA	1	1	7	1	1	1	3	1	May place additional stress on aquifer
Henderson	County-Other	Neches	Expand use of Queen City	HECo-3	11	NA	1	1	7	1	1	1	2	1	Pending water quality of Queen City, may increase TDS of wastewater discharges
Henderson	County-Other	Neches	Water from UNRMWA	HECo-4	12	NA	1	1	7	1	1	1	1	1	
Henderson	Irrigation	Neches	Obtain water Lake Athens	HEI-1	see Athens MWA	NA	1	1	7	1	1	1	1	1	
Henderson	Livestock	Neches	Fish Hatchery Reuse	HEL-1	0	NA	1	1	7	1	1	2	1	1	
Houston	Irrigation	Neches/Trinity	Increase supply from Carrizo-Wilcox (Phase I-VI)	HOI-1	2	NA	1	1	8	1	1	1	1	1	
Houston	Livestock	Neches/Trinity	Increase supply from Carrizo-Wilcox (Phase I-V)	HOL-1	2	NA	1	1	8	1	1	1	1	1	
Houston	Manufacturing	Neches/Trinity	Obtain water from Houston County WCID	HOMa-1	0	NA	1	1	8	1	1	1	1	1	
Jasper	County-Other	Neches	Use additional supply from Gulf Coast Aquifer	JAC-1	2	NA	1	1	7	1	1	1	3	1	May place additional stress on aquifer
Jefferson	Mining	Neches	Use additional supply from Gulf Coast Aquifer	JEM-1	0	NA	1	1	7	1	1	1	3	1	May place additional stress on aquifer
Jefferson	Steam-Electric	Neches	Use water from the Neches River	JESE-1	12	NA	2	2	9	1	2	1	1	2	
Nacogdoches	D&M WSC	Neches	Increase supply from Carrizo-Wilcox	DM-1	0	NA	1	1	8	1	1	1	1	1	
Nacogdoches	Lilly Grove SUD	Neches	Increase supply from Carrizo-Wilcox	LG-2	0	NA	1	1	8	1	1	1	1	1	
Nacogdoches	Livestock	Neches	Increase supply from Carrizo-Wilcox	NCL-1	0	NA	1	1	8	1	1	1	1	1	
Nacogdoches	Mining	Neches	Purchase water from ANRA (Lake Columbia or Angelina River)	NCMI-1	12	NA	2	2	8	2	2	2	2	2	
Nacogdoches	Mining	Neches	Purchase water from LNVA	NCMI-2	12	NA	1	1	8	1	1	1	1	1	
Nacogdoches	Nacogdoches	Neches	Additional groundwater from Carrizo-Wilcox	NA-1	0	NA	1	1	8	1	1	1	1	1	
Nacogdoches	Nacogdoches	Neches	Obtain and treat water from Lake Columbia	NA-3	0	NA	See ANRA Lake Columbia Strategy								
Nacogdoches	Nacogdoches	Sabine	Obtain and treat water from Toledo Bend	NA-4	165	NA	2	2	8	1	2	1	1	2	
Nacogdoches	Steam-Electric	Neches	Obtain raw water from Lake Columbia	NCS-1	12	NA	See ANRA Lake Columbia Strategy								
Nacogdoches	Steam-Electric	Neches	Obtain raw water from Houston County Lake	NCS-2	12	NA	1	1	12	1	1	1	1	1	
Nacogdoches	Swift WSC	Neches	Increase supply from Carrizo-Wilcox	SW-1	0	NA	1	1	8	1	1	1	1	1	
Nacogdoches	Swift WSC	Neches	Obtain Treated water from Lake Columbia via contract with ANRA	SW-3		NA	See ANRA Lake Columbia Strategy								
Nacogdoches	Multiple	Neches	Lake Naconiche Regional System	Multiple	0	NA	1	1	1	1	1	1	1	1	
Newton	Manufacturing	Sabine	Additional Groundwater Well Gulf Coast Aquifer	NWM-1	2	NA	1	1	6	1	1	1	1	1	

Table 4D-A.2 Summary of Environmental Assessment (Cont.)

County	Entity	Basin	Strategy	Strategy Key	Environmental Factors										Comments
					Total Acres Impacted	Wetland Acres[1]	Environmental Water Needs	Habitat	Threatened & Endangered Species	Cultural Resources	Bays & Estuaries	Environmental Water Quality	Other	Overall Environmental Impacts	
Name	Name(s)	Name	Name	Name	#	#	(1-5)	(1-5)	#	(1-5)	(1-5)	(1-5)	(1-5)	(1-5)	
Newton	Manufacturing	Sabine	Purchase water from SRA	NWM-2	12	NA	1	2	6	1	1	1	1	1	
Newton	Steam-Electric	Sabine	Purchase water from SRA	NWP-1		NA	1	1	6	1	1	1	1	1	
Orange	County-Other	Sabine	Use additional supply from Gulf Coast Aquifer	ORC-1	0	NA	1	1	8	1	1	1	3	1	May place additional stress on aquifer
Orange	Manufacturing	Sabine	Raw surface water supply from SRA Canal	OR-1SRA	0	NA	2	1	8	1	2	1	1	1	
Orange	Manufacturing	Sabine	Raw Water from Toledo Bend Reservoir	ORM-2	2	NA	1	1	8	1	1	1	1	1	
Orange	Mauriceville WSC	Sabine	New well in Gulf Coast aquifer	ORMa-1	0	NA	1	1	8	1	1	1	3	1	May place additional stress on aquifer
Panola	Manufacturing		Purchase water from Carthage		0	NA	1	1	4	1	1	1	1	1	
Polk	County-Other	Neches	Use additional supply from Gulf Coast Aquifer (Phase I-IV)	POC-1	2	NA	1	1	8	1	1	1	1	1	
Polk	Manufacturing	Neches	Expand existing supplies form Gulf-Coast aquifer	POM-1	0	NA	1	1	8	1	1	1	1	1	
Rusk	Mining	Neches	Increase supply from Carrizo-Wilcox	RUL-1	0	NA	1	1	8	1	1	1	1	1	
Rusk	Steam-Electric	Neches	Supply from SRA, Toledo Bend Reservoir	RUSE-1	0	NA	1	1	8	1	1	1	1	1	
Rusk	Steam-Electric	Neches	Supply from ANRA (Lake Columbia)	RUSE-2	NA	NA				See ANRA Lake Columbia Strategy					
Sabine	County-Other	Sabine	Increase supply from Carrizo-Wilcox (Neches)	SBC-1	0	NA	1	1	5	1	1	1	1	1	
Sabine	County-Other	Sabine	Purchase water from Hemphill	SBC-2	9	NA	1	1	5	1	1	1	1	1	
Sabine	Livestock	Sabine	Expand Carrizo-Wilcox supplies (Sabine)	SBL-1	0	NA	1	1	5	1	1	1	1	1	
Sabine	Livestock	Sabine	Expand current surface water supplies (Neches and Sabine)	SBL-2	20	NA	2	2	5	1	1	1	1	1	
San Augustine	Irrigation	Neches	Obtain Water from Carrizo-Wilcox Aquifer	SAI-1	12	NA	1	1	8	1	1	1	1	1	
San Augustine	Livestock	Neches	Increase local surface water supplies (stock ponds)	SAL-1	3	NA	1	1	8	1	1	1	1	1	
San Augustine	Livestock	Sabine	Increase groundwater supply from Carrizo-Wilcox Aquifer (Sabine)	SAL-2	0	NA	1	1	8	1	1	1	1	1	
San Augustine	Livestock	Neches	Increase groundwater supply from Carrizo-Wilcox Aquifer (Neches)	SAL-3	0	NA	1	1	8	1	1	1	1	1	
San Augustine	Mining	Neches	Purchase water from ANRA (Angelina river)	SAMI-1	12	NA	2	2	8	2	2	2	2	2	Run of River
San Augustine	Mining	Neches	Purchase water from LNVA (Sam Rayburn)	SAMI-2	12	NA	1	1	8	1	1	1	1	1	
Shelby	County-Other	Sabine	Expand groundwater from Carrizo-Wilcox (Sabine)	SHCo-1	12	NA	1	1	8	1	1	1	1	1	
Shelby	County-Other	Sabine	Purchase water from City of Center	SHCo-2	0	NA	1	1	8	1	1	1	1	1	
Shelby	County-Other	Sabine	Purchase water from SRA (Toledo Bend Reservoir)	SHCo-3	9	NA	1	1	8	1	1	1	1	1	
Shelby	Livestock	Sabine	Additional groundwater wells (Sabine Basin)	SHL-1	0	NA	1	1	8	1	1	1	1	1	Potential impacts to stream flows.
Shelby	Livestock	Neches	Additional groundwater wells (Neches Basin)	SHL-2	0	NA	1	1	8	1	1	1	1	1	Potential impacts to stream flows.
Shelby	Livestock	Sabine	Increase local supplies	SHL-3	33	NA	2	2	8	1	1	1	1	1	May decrease runoff to local streams
Shelby	Livestock	Sabine	Purchase raw water from SRA (Toledo Bend)	SHL-4	12	NA	1	1	8	1	2	1	1	1	
Shelby	Manufacturing	Sabine	Purchase surface water from City of Center	SHM-1	0	NA	1	1	8	1	1	1	1	1	
Shelby	Mining	Neches	Purchase water from ANRA (Attoyac Bayou)	SHMI-1	5	NA	3	4	8	3	3	2	3	3	Run of River
Shelby	Mining	Sabine	Purchase water from SRA (Toledo Bend)	SHMI-2	12	NA	1	1	8	1	1	1	1	1	
Smith	Bullard	Neches	Increase supply from Carrizo-Wilcox	BU-1A	2	NA	1	1	8	1	1	1	3	1	May place additional stress on aquifer
Smith	Community Water Co.	Neches	Purchase water from the City of Tyler or other local provider	CW-1A	2	NA	1	1	8	1	1	1	1	1	
Smith	Jackson WSC	Neches	Purchase water from ANRA (Lake Columbia)	JA-1	2	NA				See ANRA Lake Columbia Strategy					
Smith	Lindale Rural WSC	Neches	Increase supply from Carrizo-Wilcox	LIR-1	2	NA	1	1	8	1	1	1	1	1	
Smith	Irrigation	Neches	Increase supply from Queen City	SMI-1	0	NA	1	1	8	1	1	1	3	1	May place additional stress on aquifer
Smith	Manufacturing	Neches	Purchase water from City of Tyler	SMMA-1	7	NA	1	1	8	1	1	1	1	1	
Smith	Mining	Neches	Increase supply from Queen City	SMM-1	0	NA	1	1	8	1	1	1	1	1	
Smith	Whitehouse	Neches	Purchase water from ANRA	WH-1		NA				See ANRA Lake Columbia Strategy					
Smith	Whitehouse	Neches	Purchase additional water from Tyler	WH-2		NA	1	1	8	1	1	1	1	1	
Trinity	County-Other	Neches/Trinity	Increase supply from Yegua-Jackson	TRC-1	2	NA	1	1	8	1	1	1	1	1	
Tyler	County-Other	Neches	Increase supply from Gulf Coast Aquifer	TYC-1	2	NA	1	1	5	1	1	1	1	1	
Multiple	ANRA	Neches	Lake Columbia Reservoir	ANRA-1	10,200	5,900	3	4	12	3	2	2	2	3	
Multiple	ANRA	Neches	Water Treatment Plant and Distribution	ANRA-2	86	NA	1	2	12	1	1	1	1	1	
Henderson	Athens MWA	Multiple	Fish Hatchery Reuse to Lake Athens	AMWA-1	0	NA	2	1	7	1	1	1	1	1	Will decrease flows in current receiving stream and increase flows in Lake Athens watershed
Henderson	Athens MWA	Multiple	Water from Forest Grove	AMWA-2	9	NA	2	2	7	1	2	2	1	2	
Henderson	Athens MWA	Multiple	Additional Lake Athens	AMWA-3	0	NA	2	1	7	1	1	1	1	1	
Cherokee	Jacksonville	Neches	Water from Lake Columbia	JAC-02	12	NA	1	2	12	1	1	1	1	1	
Multiple	LNVA	Neches	Saltwater Barrier conjunctive operation with Rayburn/Steinhagen	LNVA-2	0	NA	2	1	8	1	2	1	1	1	
Multiple	LNVA	Neches	Permit Amendment for Sam Rayburn	LNVA-3	0	NA	1	1	8	1	1	1	1	1	
Multiple	LNVA	Neches	Sediment Reduction	LNVA-4	0	N/A	3	3	2	1	1	2	2	2	
Multiple	LNVA	Neches	Purchase of water from SRA	LNVA-6	35	NA	1	1	13	1	1	1	1	1	
Multiple	LNVA	Neches	Rockland Reservoir	LNVA-7	99,102	NA	3	5	8	3	5	3	5	4	
Multiple	LNVA	Neches	Reallocation of Flood Storage	LNVA-4		NA	3	3	8	1	3	2	2	2	
Angelina	Lufkin	Neches	Develop Sam Rayburn Reservoir Water Rights	LU-1	30	NA	1	1	8	1	2	1	1	1	
Angelina	Lufkin	Neches	Develop additional groundwater Carrizo-Wilcox	LU-2	22	NA	1	1	8	1	1	1	1	1	
Angelina	Lufkin	Neches	Develop Lake Kurth Surface Water	LU-3	17	NA	2	1	8	1	1	1	1	1	
Multiple	SRA	Sabine	Toledo Bend Pipeline Project	SRA-1	2,077	NA	2	2	13	2	2	2	1	2	
Smith	Tyler	Neches/Sabine	Lake Palestine	TYL-2	12	NA	1	1	7	1	1	1	1	1	
Multiple	UNRMWA	Neches/ Trinity	Lake Fastrill Replacement Project		24,948	2,377	3	5	9	3	3	2	3	3	
Multiple	Multiple	Multiple	Water Conservation	Multiple	0	NA	1	1	0	1	1	1	1	1	

Appendix 8-A

Proposed Reservoir Site Locations

Appendix 8-A provides a description of proposed reservoirs in the ETRWPA. This appendix includes maps showing the locations of these proposed reservoirs.

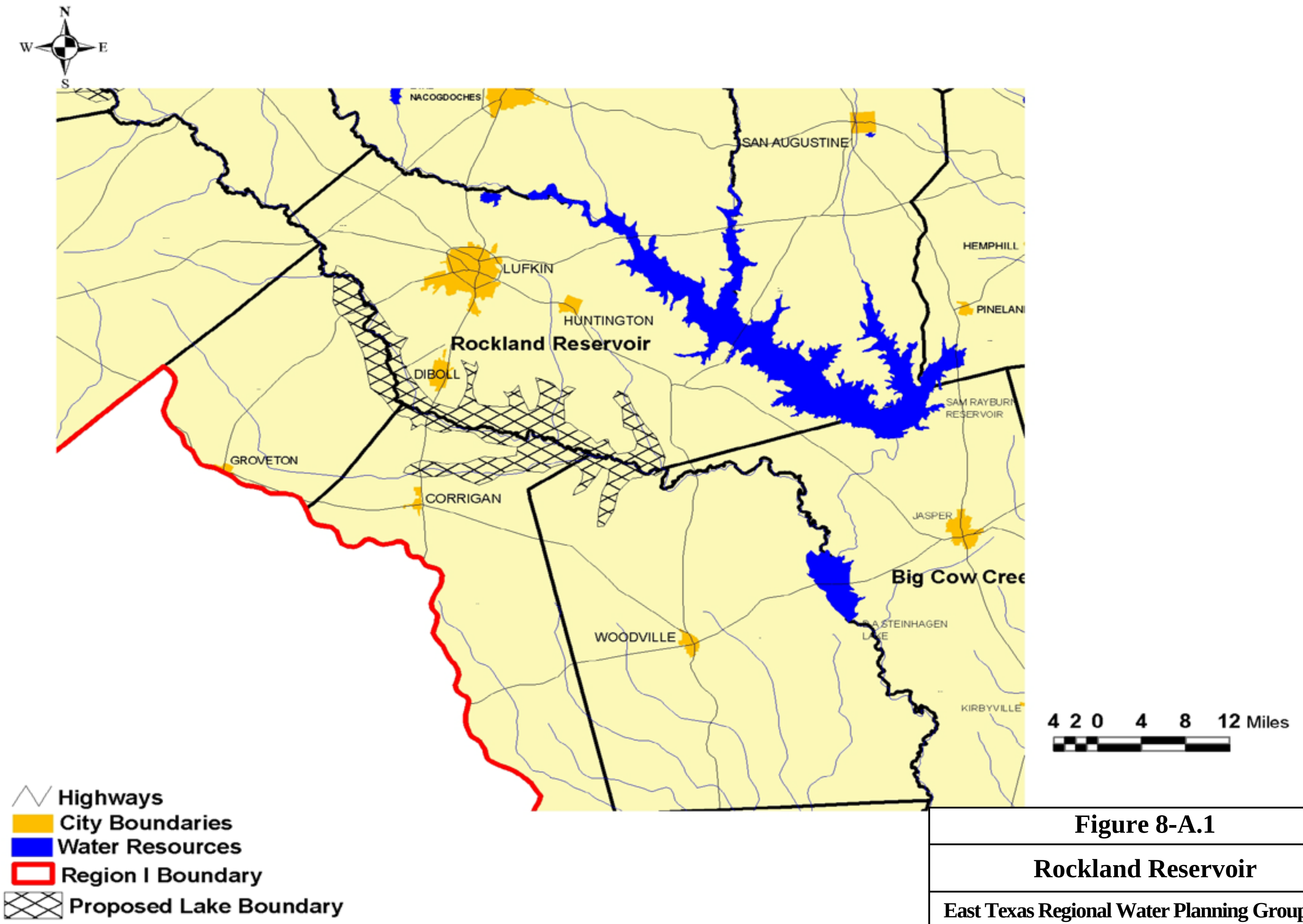

Figure 8-A.1

Rockland Reservoir

East Texas Regional Water Planning Group 1/10

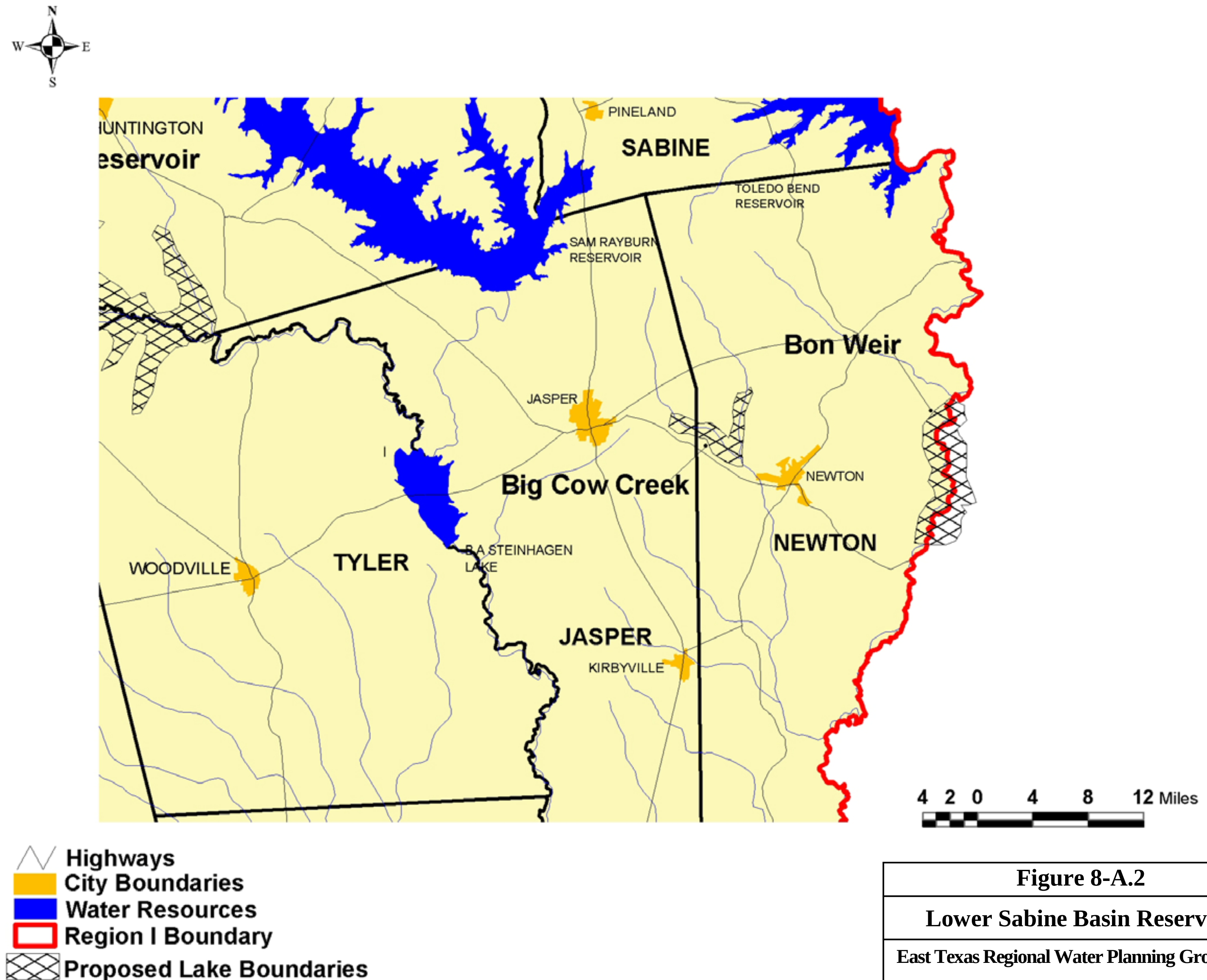

Figure 8-A.2
Lower Sabine Basin Reservoir
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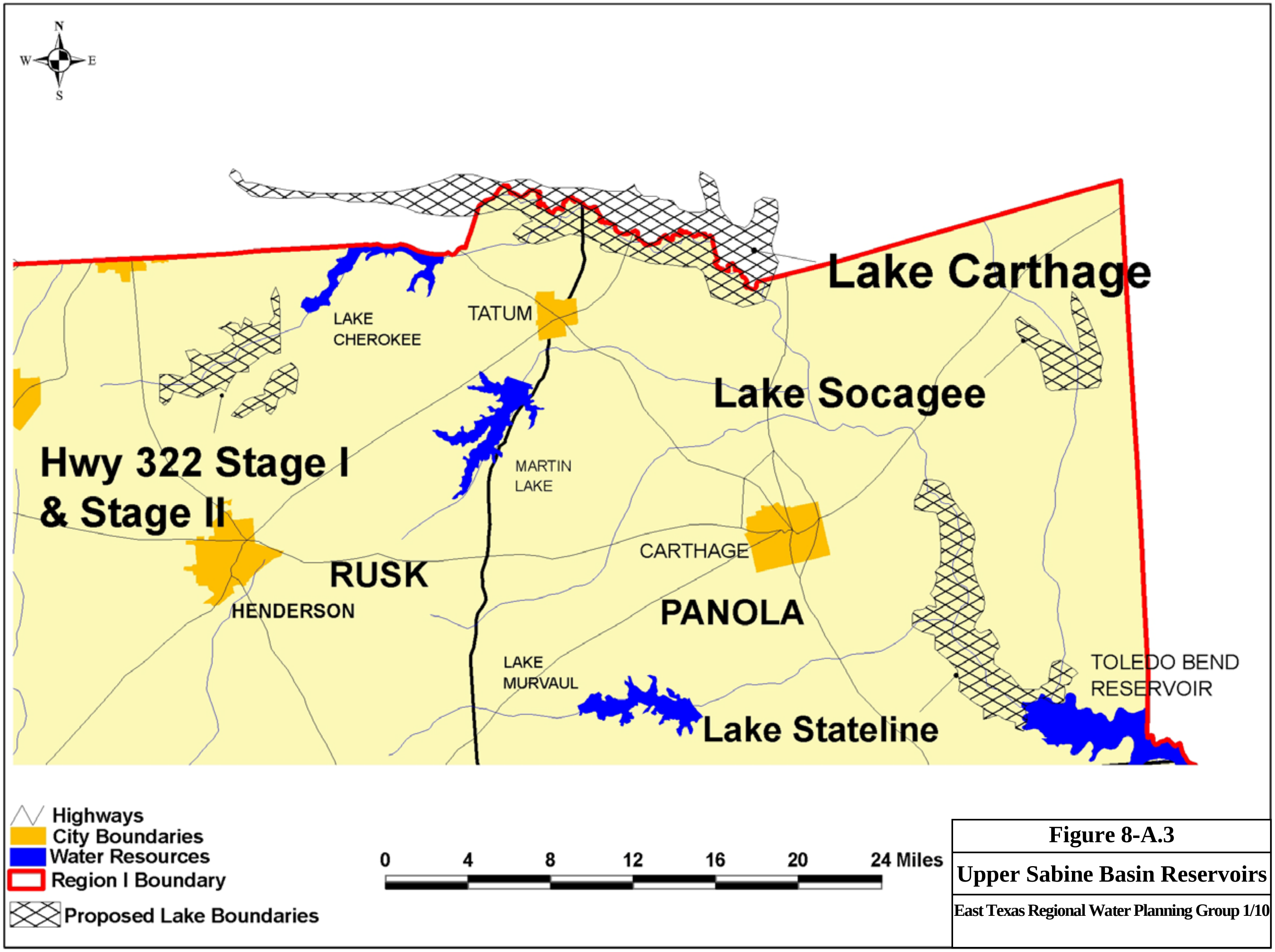

Figure 8-A.3

Upper Sabine Basin Reservoirs

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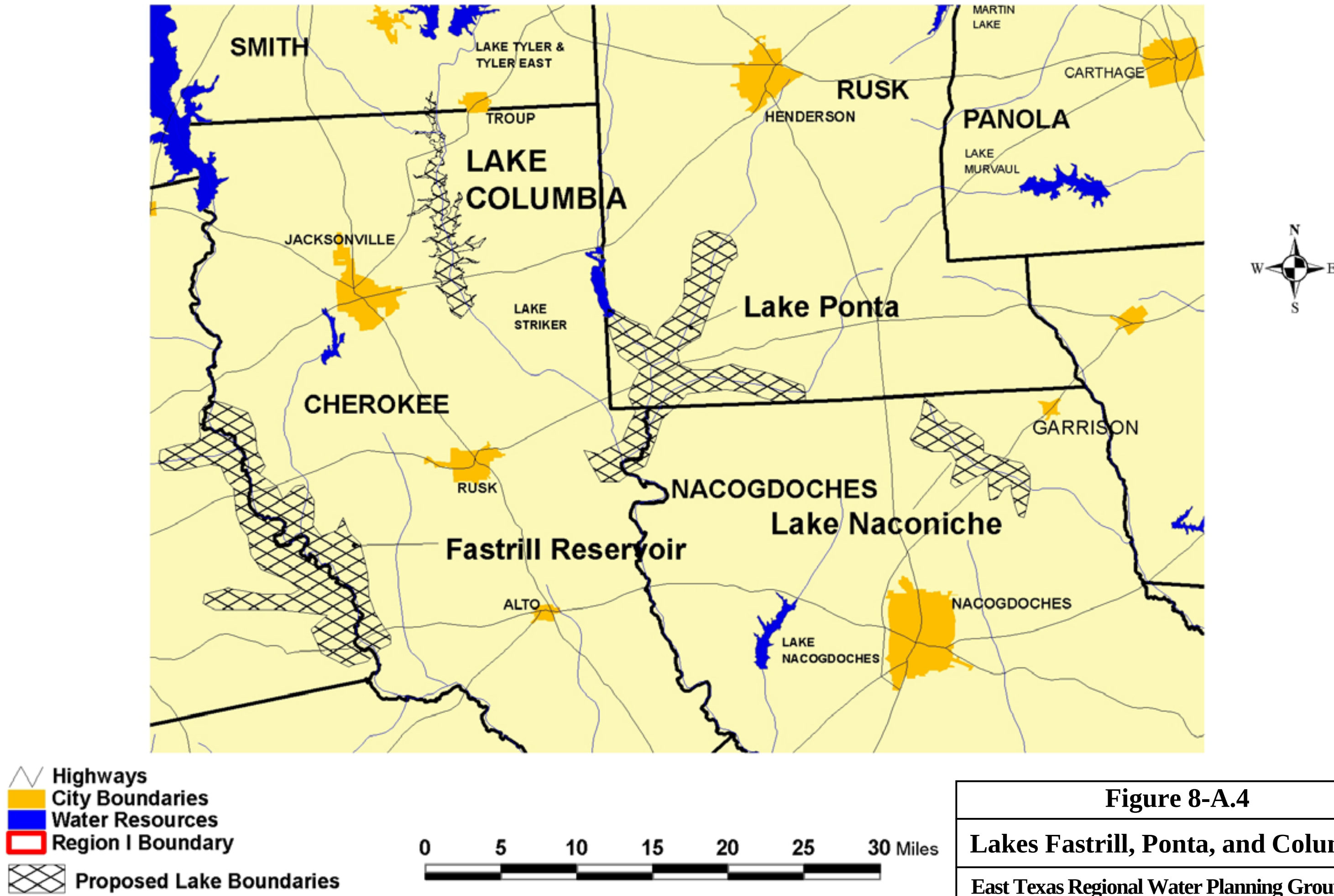

Figure 8-A.4

Lakes Fastrill, Ponta, and Columbia

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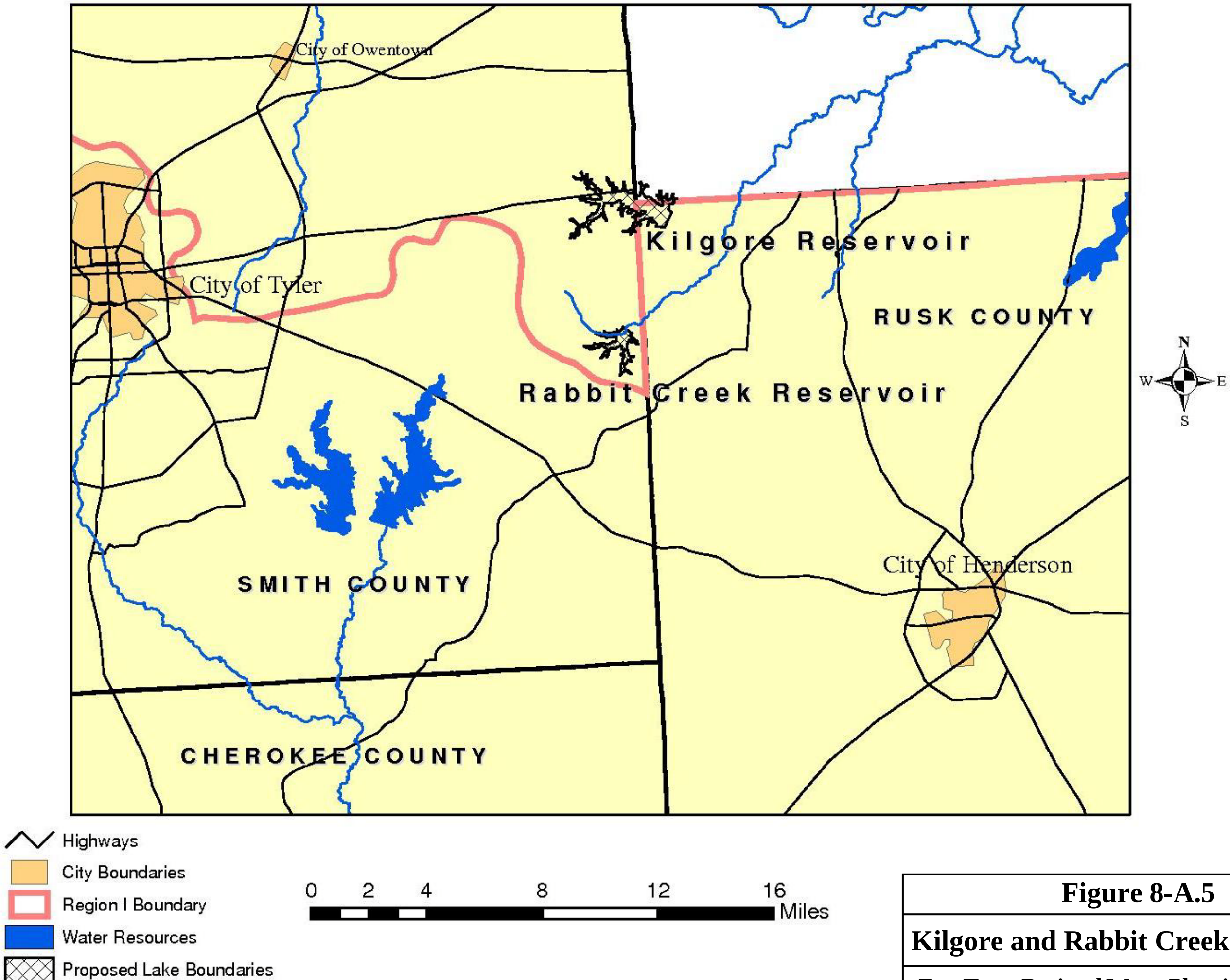

Figure 8-A.5

Kilgore and Rabbit Creek Reservoirs

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Appendix 9-A

Infrastructure Financing Survey Results

A survey of WUGs with identified needs was conducted to determine infrastructure costs and potential funding sources for infrastructure projects. Survey results are included in this appendix.

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Table 9-A.1 WMS Cost Summary

County	Entity		Basin Used	Strategy		Strategy Key	Capital Cost		Municipal Cost	Surface Water
Name	Name(s)		Name	Name		Name				
Anderson	County-Other	1	Neches	Expanded use of Queen City		ADC-1	$ 212,732.00		$ 212,732.00	$ -
Anderson	County-Other	1	Neches	Expanded use of Carrizo		ADC-2	$ 262,189.00		$ 262,189.00	$ -
Anderson	Frankston	1	Neches	Increase supply from Carrizo-Wilcox		FR-1	$ 42,846.00		$ 42,846.00	$ -
Anderson	Mining		Neches	Increase supply from Carrizo-Wilcox		AND-1	$ 228,730.00		$ -	$ -
Anderson	Steam-Electric		Neches	Water from Lake Palestine	1	ADS-1	$ 24,917,400.00		$ -	$ 24,917,400.00
Angelina	County-Other	1	Neches	Obtain water from Lufkin	1	ANC-1A	$ 10,604,000.00	$ 10,604,000.00	$ 10,604,000.00	$ 10,604,000.00
Angelina	County-Other	1	Neches	Increase supply from Carrizo-Wilcox		ANC-2A	$ 419,717.00		$ 419,717.00	$ -
Angelina	Diboll	1	Neches	Purchase Water from Lufkin	1	DI-1	$ 6,195,000.00	$ 6,195,000.00	$ 6,195,000.00	$ 6,195,000.00
Angelina	Diboll	1	Neches	Increase supply from Yegua		DI-3	$ 576,576.00		$ 576,576.00	$ -
Angelina	Four Way WSC	1	Neches	Obtain water from Lufkin	1	FW-1	$ 669,192.00		$ 669,192.00	$ 669,192.00
Angelina	Hudson	1	Neches	Increase supply from Carrizo-Wilcox		HU-1A	$ 380,703.00		$ 380,703.00	$ -
Angelina	Hudson WSC	1	Neches	Increase supply from Carrizo-Wilcox		HW-1A	$ 974,482.00		$ 974,482.00	$ -
Angelina	Lufkin	1	Neches	Construct pipeline to Sam Rayburn Reservoir	1	LU-1			$ -	$ -
Angelina	Manufacturing		Neches	Obtain water from City of Lufkin	1	ANM-1	$ 15,609,700.00	$ 15,609,700.00	$ -	$ 15,609,700.00
Angelina	Manufacturing		Neches	Obtain raw water from Lake Columbia	1	ANM-2	$ 7,603,000.00		$ -	$ 7,603,000.00
Angelina	Live Stock			Stock Ponds			$ 168,000.00		$ -	$ -
Angelina	Mining			Lake Columbia	1		$ 5,793,150.00		$ -	$ 5,793,150.00
Angelina	Steam & Electric			Wells			$ 1,724,909.00		$ -	$ -
Cherokee	Irrigation		Neches	Queen City		CH-1			$ -	$ -
Cherokee	Manufacturing		Neches	Obtain water from City of Jacksonville		CHM-1			$ -	$ -
Cherokee	Mining		Neches	Lake Columbia	1	CHN-1	$ 3,619,300.00		$ -	$ 3,619,300.00
Cherokee	New Summerfield	1	Neches	Obtain treated water from Lake Columbia	1	NS-1			$ -	$ -
Cherokee	New Summerfield	1	Neches	Increase supply from Carrizo-Wilcox		NS-3	$ 299,452.00		$ 299,452.00	$ -
Cherokee	Rusk	1	Neches	Obtain treated water from Lake Columbia	1	RU-1	$ 28,435,800.00	$ 28,435,800.00	$ 28,435,800.00	$ 28,435,800.00
Cherokee	Rusk	1	Neches	Increase supply from Carrizo-Wilcox		RU-3	$ 299,452.00		$ 299,452.00	$ -
Hardin	County-Other	1	Neches	Use additional water from Gulf Coast Aquifer		HAC-1A	$ 1,670,664.00		$ 1,670,664.00	$ -
									$ -	$ -
									$ -	$ -
Hardin	Manufacturing		Neches	Use additional water from Gulf Coast Aquifer		HAM-1	$ 429,542.00		$ -	$ -
Hardin	Irrigation		Neches	Use surface water sources	1	HAI-1	$ 2,405,001.00		$ -	$ 2,405,001.00
Henderson	Athens	1	Neches	Purchase water from Athens MWA	1	AT-2			$ -	$ -
Henderson	Bethel Ash WSC	1	Neches	Overdraft and drill new well in Carrizo-Wilcox		BA-1			$ -	$ -
Henderson	County-Other	1	Neches	Overdraft Carrizo-Wilcox		HECo-2	$ 609,900.00		$ 609,900.00	$ -
Henderson	County-Other	1	Neches	Expanded use of Queen City		HECo-3	$ 4,420,100.00		$ 4,420,100.00	$ -
Henderson	County-Other	1	Neches	Water from UNRMWA	1	HECo-4	$ 8,937,350.00		$ 8,937,350.00	$ 8,937,350.00
									$ -	$ -
Henderson	Irrigation		Neches	Obtain water through Athens MWA strategies	1	HEI-1			$ -	$ -
Henderson	Livestock		Neches	Temporary Pumping		HEL-1	$ -		$ -	$ -
Henderson	Livestock		Neches	Obtain water through Athens MWA strategies	1	AMWA-1			$ -	$ -
Houston	Irrigation		Neches/Trinity	Increase supply from Carrizo-Wilcox		HOI-1	$ 3,205,560.00		$ -	$ -
Houston	Livestock		Neches/Trinity	Increase supply from Carrizo-Wilcox		HOL-1	$ 2,671,300.00		$ -	$ -
Jasper	County-Other	1	Neches	Use of additional water from Gulf Coast Aquifer		JAC-1	$ 1,369,957.00		$ 1,369,957.00	$ -
									$ -	$ -
Jefferson	Mining		Neches	Use additional supply from Gulf Coast Aquifer		JEM-1	$ 103,083.00		$ -	$ -
Jefferson	Steam-Electric		Neches	Use additional water from the Neches River	1	JESE-1	$ 13,647,296.00		$ -	$ 13,647,296.00
Nacogdoches	Appleby WSC	1	Neches	Increase supply from Carrizo-Wilcox		AP-1	$ 4,392,350.00		$ 4,392,350.00	$ -
Nacogdoches	D&M WSC	1	Neches	Increase supply from Carrizo-Wilcox		DM-1	$ 492,348.00		$ 492,348.00	$ -
Nacogdoches	County-Other	1	Neches	Obtain raw water from Lake Columbia	1	NC-2			$ -	$ -

Table 9-A.1 WMS Cost Summary

County	Entity		Basin Used	Strategy		Strategy Key	Capital Cost		Municipal Cost	Surface Water
Nacogdoches	Lilly Grove SUD	1	Neches	Increase supply from Carrizo-Wilcox		LG-2	$ 580,504.00		$ 580,504.00	$ -
	Lilly Grove SUD	1	Neches	Lake Naconiche		LG-1	$ 7,320,600.00	$ 7,320,600.00	$ 7,320,600.00	$ -
Nacogdoches	Livestock		Neches	Increase supply from Carrizo-Wilcox		NCL-1	$ 1,969,392.00		$ -	$ -
Nacogdoches	Mining		Neches	Water from ANRA	1	NCMI-1	$ 9,593,450.00		$ -	$ 9,593,450.00
Nacogdoches	Nacogdoches		Neches	Acquire agreement w/ downstream water rights holders		NA-1			$ -	$ -
Nacogdoches	Nacogdoches		Neches	Obtain and treat water from Lake Columbia	1	Alt. Str. NA-3			$ -	$ -
Nacogdoches	Nacogdoches		Neches	Obtain and treat water from Toledo Bend	1	Alt. Str. NA-4			$ -	$ -
Nacogdoches	Steam-Electric		Neches	Obtain raw water from Lake Columbia	1	NCS-1	$ 10,718,000.00	$ 10,718,000.00	$ -	$ 10,718,000.00
Nacogdoches	Steam-Electric		Neches	Obtain raw water from Houston County Lake	1	NCS-1	$ 2,012,400.00		$ -	$ 2,012,400.00
Nacogdoches	Swift WSC	1	Neches	Increase supply from Carrizo-Wilcox		SW-1	$ 498,171.00		$ 498,171.00	$ -
Nacogdoches	Swift WSC	1	Neches	Lake Naconiche	1	SW-2	$ 5,856,500.00	$ 5,856,500.00	$ 5,856,500.00	$ 5,856,500.00
Nacogdoches	Swift WSC	1	Neches	Lake Columbia	1	SW-3			$ -	$ -
Newton	Manufacturing		Sabine	Purchase additional water from SRA (Toledo Bend)	1	NWM-2	$ 1,389,500.00	$ 1,389,500.00	$ -	$ 1,389,500.00
Newton	Manufacturing		Sabine	Install Wells in Gulf Coast Aquifer		NWM-1	$ 891,529.00		$ -	$ -
Newton	Steam & Electric		Sabine	Water from SRA	1	NWP-1	$ 12,515,350.00		$ -	$ 12,515,350.00
Orange	Manufacturing		Sabine	Water from SRA	1	OR-1	$ -		$ -	$ -
Orange	County-Other	1	Sabine	Additional Wells		ORC-1	$ 432,222.00		$ 432,222.00	$ -
Orange	Mauriceville WSC	1	Sabine	Increase groundwater supply (install well in Jasper County)		ORMa-1	$ 550,848.00		$ 550,848.00	$ -
Polk	County-Other	1	Neches	Use additional supply from Gulf Coast Aquifer		POC-1A	$ 2,991,140.00		$ 2,991,140.00	$ -
Polk	Manufacturing		Neches	Expand existing supplies		POM-1	$ 581,344.00		$ -	$ -
Polk	City of Woodville	1	Neches	New Wells Gulf Coast Aquifer			$ 511,400.00		$ 511,400.00	$ -
Rusk	Mining		Neches	Increase supply from Carrizo-Wilcox		RUL-1	$ 241,600.00		$ -	$ -
Rusk	Steam-Electric		Neches	Toledo Bend	1	RUSE-1	$ 1,318,500.00		$ -	$ 1,318,500.00
Rusk	Steam-Electric		Neches	Obtain water from Lake Columbia	1	RUSE-2	$ 8,640,450.00		$ -	$ 8,640,450.00
Sabine	County-Other	1	Sabine	Increase groundwater supply from Carrizo-Wilcox Aquifer		SBC-1	$ 328,840.00		$ 328,840.00	$ -
Sabine	County-Other	1	Sabine	Purchase water from City of Hemphill	1	SBC-2	$ 809,000.00		$ 809,000.00	$ 809,000.00
Sabine	Livestock		Sabine	Increase groundwater supply from Carrizo-Wilcox Aquifer		SBL-1	$ 226,430.00		$ -	$ -
Sabine	Livestock		Sabine	Increase supply from local sources		SBL-2	$ 562,700.00		$ -	$ -
San Augustine	County-Other	1	Neches	Increase groundwater supply from Carrizo-Wilcox Aquifer		SAC-1			$ -	$ -
San Augustine	County-Other	1	Neches	Expand contracts with San Augustine		SAC-2			$ -	$ -
San Augustine	Irrigation		Neches	Increase groundwater supply from Carrizo-Wilcox Aquifer		SAL-1	$ 224,690.00		$ -	$ -
San Augustine	Livestock		Sabine	Stock Ponds		SAL-1	$ 562,700.00		$ -	$ -
San Augustine	Livestock		Sabine	Increase groundwater supply from Carrizo-Wilcox Aquifer		SAL-2	$ 189,570.00		$ -	$ -
San Augustine	Livestock		Neches	Increase groundwater supply from Carrizo-Wilcox Aquifer		SAL-3	$ 379,140.00		$ -	$ -
San Augustine	Mining		Neches	From ANRA	1	SAMi-1	$ 2,627,850.00		$ -	$ 2,627,850.00
San Augustine	Mining		Neches	From LNVA	1	SAMi-2	$ 8,212,450.00	$ 8,212,450.00	$ -	$ 8,212,450.00
Shelby	City of Center	1	Sabine	Agreements with senior downstream water rights holders		SHC-2			$ -	$ -
Shelby	County-Other	1	Sabine	Purchase water from City of Center		SHCo-2			$ -	$ -
Shelby	County-Other	1	Sabine	Increase groundwater supply from Carrizo-Wilcox Aquifer		SHCo-1	$ 2,278,400.00		$ 2,278,400.00	$ -
Shelby	County-Other	1	Sabine	Purchase water from SRA	1	SHCo-3	$ 3,024,150.00		$ 3,024,150.00	$ 3,024,150.00
Shelby	Livestock		Sabine	Increase groundwater supply from Carrizo-Wilcox Aquifer		SHL-1	$ 1,387,600.00		$ -	$ -
Shelby	Livestock		Neches	Increase groundwater supply from Carrizo-Wilcox Aquifer		SHL-2	$ 1,040,800.00		$ -	$ -

Table 9-A.1 WMS Cost Summary

County	Entity		Basin Used	Strategy		Strategy Key	Capital Cost		Municipal Cost	Surface Water
Shelby	Livestock		Sabine	Purchase additional water from SRA (Toledo Bend)	1	SHL-4	$ 4,763,200.00		$ -	$ 4,763,200.00
Shelby	Livestock		Sabine	Increase local supplies		SHL-3	$ 689,600.00		$ -	$ -
Shelby	Mining		Neches	Attoyac Water	1	SHMi-1	$ 1,543,400.00		$ -	$ 1,543,400.00
Shelby	Mining		Sabine	Toledo Bend Water	1	SHMi-2	$ 3,847,950.00		$ -	$ 3,847,950.00
Shelby	Manufacturing		Sabine	Purchase water from City of Center		SHM-1	$ -		$ -	$ -
Smith	Bullard	1	Neches	Increase supply from Carrizo-Wilcox		BU-1	$ 305,640.00		$ 305,640.00	$ -
Smith	Community Water Co	1	Neches	Increase supply from Carrizo-Wilcox		CW-1A	$ 1,640,776.00		$ 1,640,776.00	$ -
Smith	Dean WSC	1	Neches	Increase supply from Carrizo-Wilcox		DE-1A			$ -	$ -
Smith	Jackson WSC	1	Neches	Increase supply from Carrizo-Wilcox		JA-1	$ 741,000.00		$ 741,000.00	$ -
Smith	City of Lindale	1	Neches	Increase supply from Carrizo-Wilcox		LI-1	$ -		$ -	$ -
Smith	Lindale Rural WSC	1	Neches	Increase supply from Carrizo-Wilcox		LIR-1	$ 347,259.00		$ 347,259.00	$ -
Smith	Whitehouse	1	Neches	Tyler Water	1	WH-2	$ -		$ -	$ -
Smith	Whitehouse	1	Neches	Lake Columbia Water	1	WH-1			$ -	$ -
Smith	Irrigation		Neches	Increase supply from Queen City		LI-1	$ 357,794.00		$ -	$ -
Smith	Manufacturing		Neches	City of Tyler Water	1	SMMa-1	$ 1,476,152.00		$ -	$ 1,476,152.00
Smith	Mining		Neches	Increase supply from Queen City		SMM-1	$ 655,416.00		$ -	$ -
Trinity	County-Other	1	Neches	Increase supply from Yegua-Jackson		TRC-1	$ 249,851.00		$ 249,851.00	$ -
Tyler	County-Other	1	Neches	Increase supply from Gulf Coast Aquifer		TYC-1	$ 366,241.00		$ 366,241.00	$ -
						WUG Total	**$ 260,842,280.00**			
								Muni-Total	**$ 100,097,352.00**	
									WUG Surface	**$ 206,784,491.00**
Wholesale Water Providers				**WWP Recommended WMS**			**WWP WMS Cost**			**WWP Surface Water WMS Cost**
ANRA					1		$ 266,992,250.00			$ 266,992,250.00
Athens MWA				Forest Grove Reservoir	1		$ 26,619,000.00			$ 26,619,000.00
Athens MWA				New WTP	1		$ 12,387,000.00			$ 12,387,000.00
Athens MWA				Overdraft Carrizo Wilcox			$ 3,799,000.00			$ -
City of Jacksonville				Infrastructure Imp	1		$ 1,000,000.00			$ 1,000,000.00
City of Jacksonville				Purchase Water	1		$ 19,133,700.00			$ 19,133,700.00
LNVA				Purchase Water from SRA	1		$ 39,168,200.00			$ 39,168,200.00
City of Lufkin				Rayburn Water System	1		$ 53,164,000.00			$ 53,164,000.00
City of Lufkin				Lake Kurth System	1		$ 56,488,600.00			$ 56,488,600.00
City of Lufkin				New Well Carrizo Wilcox			$ 14,097,000.00			
City of Nacogdoches				New Wells			$ 2,727,000.00			$ -
City of Nacogdoches				Purchase Water from Provider	1		$ 37,282,050.00			
Sabine River Authority				Toledo Water to Upper Sabine Basin	1		$ 475,648,000.00			$ 475,648,000.00
City of Tyler				Lake Palestine Infrastructure	1		$ 79,389,250.00			$ 79,389,250.00
UNRMWA										
						Wholesale Total	**$ 1,087,895,050.00**		**Wholesale Surface**	**$ 1,029,990,000.00**
						Grand Total	**$ 1,348,737,330.00**		**Surface Water**	**$ 1,236,774,491.00**
									Other than Surface	**$ 111,962,839.00**

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Table 9-A.2 2011 WMS Summary

Sum of sumCapCost		EarliestOnline / entityType														
		2010		2010 Total	2020		2020 Total	2030	2030 Total	2040	2040 Total	2050	2050 Total	2060	2060 Total	Grand Total
Entity Name	Project Name	WUG	WWP		WUG	WWP		WWP		WWP		WWP		WWP		
ANGELINA & NECHES RIVER AUTHORITY	ANRA TREATMENT AND DISTRIBUTION SYSTEM					$ 35,127,250.00	$ 35,127,250.00									$ 35,127,250.00
	NEW SOURCE - LAKE COLUMBIA					$ 231,865,000.00	$ 231,865,000.00									$ 231,865,000.00
ANGELINA & NECHES RIVER AUTHORITY Total						$ 266,992,250.00	$ 266,992,250.00									$ 266,992,250.00
APPLEBY WSC	LAKE NACONICHE REGIONAL WATER SUPPLY SYSTEM				$ 4,392,350.00		$ 4,392,350.00									$ 4,392,350.00
APPLEBY WSC Total					$ 4,392,350.00		$ 4,392,350.00									$ 4,392,350.00
ATHENS MUNICIPAL WATER AUTHORITY	FOREST GROVE RESERVOIR PROJECT									$ 26,619,000.00	$ 26,619,000.00					$ 26,619,000.00
	NEW WTP													$ 12,387,000.00	$ 12,387,000.00	$ 12,387,000.00
	OVERDRAFT CARRIZO WILCOX AQUIFER		$ 3,799,000.00	$ 3,799,000.00												$ 3,799,000.00
ATHENS MUNICIPAL WATER AUTHORITY Total			$ 3,799,000.00	$ 3,799,000.00						$ 26,619,000.00	$ 26,619,000.00			$ 12,387,000.00	$ 12,387,000.00	$ 42,805,000.00
BROWNSBORO	OVERDRAFT CARRIZO WILCOX AQUIFER	$ 148,600.00		$ 148,600.00												$ 148,600.00
BROWNSBORO Total		$ 148,600.00		$ 148,600.00												$ 148,600.00
BULLARD	NEW WELLS - CARRIZO WILCOX AQUIFER	$ 305,674.00		$ 305,674.00												$ 305,674.00
BULLARD Total		$ 305,674.00		$ 305,674.00												$ 305,674.00
CONSOLIDATED WSC	EXPANDED USE OF GW	$ 2,357.00		$ 2,357.00												$ 2,357.00
CONSOLIDATED WSC Total		$ 2,357.00		$ 2,357.00												$ 2,357.00
D&M WSC	NEW WELLS - CARRIZO WILCOX AQUIFER	$ 492,348.00		$ 492,348.00												$ 492,348.00
D&M WSC Total		$ 492,348.00		$ 492,348.00												$ 492,348.00
DIBOLL	NEW WELLS - YEGUA JACKSON AQUIFER	$ 576,576.00		$ 576,576.00												$ 576,576.00
	PURCHASE WATER FROM PROVIDER (2)	$ 6,195,000.00		$ 6,195,000.00												$ 6,195,000.00
DIBOLL Total		$ 6,771,576.00		$ 6,771,576.00												$ 6,771,576.00
FOUR WAY WSC	PURCHASE WATER FROM PROVIDER (2)	$ 669,192.00		$ 669,192.00												$ 669,192.00
FOUR WAY WSC Total		$ 669,192.00		$ 669,192.00												$ 669,192.00
FRANKSTON	NEW WELLS - CARRIZO WILCOX AQUIFER	$ 255,951.00		$ 255,951.00												$ 255,951.00
FRANKSTON Total		$ 255,951.00		$ 255,951.00												$ 255,951.00
HUDSON WSC	NEW WELLS - CARRIZO WILCOX AQUIFER	$ 3,274,192.00		$ 3,274,192.00												$ 3,274,192.00
HUDSON WSC Total		$ 3,274,192.00		$ 3,274,192.00												$ 3,274,192.00
JACKSONVILLE	INFRASTRUCTURE IMPROVEMENTS		$ 1,000,000.00	$ 1,000,000.00												$ 1,000,000.00
	PURCHASE WATER FROM PROVIDER (3)		$ 19,133,700.00	$ 19,133,700.00												$ 19,133,700.00
JACKSONVILLE Total			$ 20,133,700.00	$ 20,133,700.00												$ 20,133,700.00
LILLY GROVE SUD	LAKE NACONICHE REGIONAL WATER SUPPLY SYSTEM				$ 7,320,600.00		$ 7,320,600.00									$ 7,320,600.00
	NEW WELLS - CARRIZO WILCOX AQUIFER	$ 580,504.00		$ 580,504.00												$ 580,504.00
LILLY GROVE SUD Total		$ 580,504.00		$ 580,504.00	$ 7,320,600.00		$ 7,320,600.00									$ 7,901,104.00
LINDALE RURAL WSC	DRILL NEW WELL	$ 413,194.29		$ 413,194.29												$ 413,194.29
	NEW WELLS - CARRIZO WILCOX AQUIFER	$ 347,259.00		$ 347,259.00												$ 347,259.00
LINDALE RURAL WSC Total		$ 760,453.29		$ 760,453.29												$ 760,453.29
LOWER NECHES VALLEY AUTHORITY	PURCHASE WATER FROM PROVIDER (2)		$ 39,168,200.00	$ 39,168,200.00												$ 39,168,200.00
	SEDIMENT REDUCTION		$ 161,333,000.00	$ 161,333,000.00												$ 161,333,000.00
	WHOLESALE CUSTOMER CONSERVATION		$ 1,400,000.00	$ 1,400,000.00												$ 1,400,000.00
LOWER NECHES VALLEY AUTHORITY Total			$ 201,901,200.00	$ 201,901,200.00												$ 201,901,200.00
LUFKIN	ANGELINA COUNTY REGIONAL PROJECT									$ 53,164,000.00	$ 53,164,000.00					$ 53,164,000.00
	LAKE KURTH REGIONAL SYSTEM		$ 56,488,600.00	$ 56,488,600.00												$ 56,488,600.00
	NEW WELLS - CARRIZO WILCOX AQUIFER		$ 14,097,000.00	$ 14,097,000.00												$ 14,097,000.00
LUFKIN Total			$ 70,585,600.00	$ 70,585,600.00						$ 53,164,000.00	$ 53,164,000.00					$ 123,749,600.00
MAURICEVILLE SUD	NEW WELLS - GULF COAST AQUIFER	$ 550,848.00		$ 550,848.00												$ 550,848.00
MAURICEVILLE SUD Total		$ 550,848.00		$ 550,848.00												$ 550,848.00
NACOGDOCHES	NEW WELLS - CARRIZO WILCOX AQUIFER		$ 2,727,000.00	$ 2,727,000.00												$ 2,727,000.00
	PURCHASE WATER FROM PROVIDER (3)		$ 37,282,050.00	$ 37,282,050.00												$ 37,282,050.00
NACOGDOCHES Total			$ 40,009,050.00	$ 40,009,050.00												$ 40,009,050.00
RUSK	PURCHASE WATER FROM PROVIDER (2)	$ 28,435,800.00		$ 28,435,800.00												$ 28,435,800.00
RUSK Total		$ 28,435,800.00		$ 28,435,800.00												$ 28,435,800.00
SABINE RIVER AUTHORITY	TOLEDO BEND PROJECT (500,000)											$ 475,648,000.00	$ 475,648,000.00			$ 475,648,000.00
SABINE RIVER AUTHORITY Total												$ 475,648,000.00	$ 475,648,000.00			$ 475,648,000.00
SWIFT WSC	LAKE NACONICHE REGIONAL WATER SUPPLY SYSTEM				$ 5,856,500.00		$ 5,856,500.00									$ 5,856,500.00
	NEW WELLS - CARRIZO WILCOX AQUIFER	$ 498,171.00		$ 498,171.00												$ 498,171.00
SWIFT WSC Total		$ 498,171.00		$ 498,171.00	$ 5,856,500.00		$ 5,856,500.00									$ 6,354,671.00
TYLER	LAKE PALESTINE INFRASTRUCTURE							$ 79,389,250.00	$ 79,389,250.00							$ 79,389,250.00
TYLER Total								$ 79,389,250.00	$ 79,389,250.00							$ 79,389,250.00
WEST HARDIN WSC	EXPANDED USE OF GW	$ 80,123.00		$ 80,123.00												$ 80,123.00
WEST HARDIN WSC Total		$ 80,123.00		$ 80,123.00												$ 80,123.00
WOODVILLE	NEW WELLS - GULF COAST AQUIFER	$ 511,400.00		$ 511,400.00												$ 511,400.00
WOODVILLE Total		$ 511,400.00		$ 511,400.00												$ 511,400.00
Grand Total		$ 43,337,189.29	$ 336,428,550.00	$ 379,765,739.29	$ 17,569,450.00	$ 266,992,250.00	$ 284,561,700.00	$ 79,389,250.00	$ 79,389,250.00	$ 79,783,000.00	$ 79,783,000.00	$ 475,648,000.00	$ 475,648,000.00	$ 12,387,000.00	$ 12,387,000.00	$ 1,311,534,689.29

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Appendix 10-A

Media and Public Outreach

The ETRWPG utilized various media outlets to keep the public informed of the Regional Water Planning Process in the ETRWPA. Included in this appendix copies of the following:

- Newspaper Articles
- Press Releases
- Newsletters

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PRESS RELEASE FROM OCTOBER 4, 2007, MEETING

Directors of the East Texas Regional Water Planning Group have given their approval to sixteen recommendations for a new round of planning for twenty counties in the region.

Outlined by Gary Graham of Beaumont, the Group's engineering consultant, at a meeting in Nacogdoches, the recommendations include:

- A review of population, water demands and supplies, and the proposal of new water management strategies
- A new review of water conservation strategies.
- An examination of a Texas Water Development Board (TWDB) study on electrical generation with amendments to the new East Texas water plan.
- Completion of a study comparing TWDB and Texas Commission on Environmental Quality databases for small water suppliers in an attempt to reconcile differences.
- A review of new TWDB work on environmental resources with possible amendments to the East Texas plan.
- The updating of groundwater availability for the Gulf Coast aquifer.
- A study of environmental protection strategies for wetlands and fresh water associated with bays and estuaries.
- The evaluation of the effects of in-stream environmental flows on water planning.
- A review of alternatives for capturing, treating and storing flood flows.
- A review of water bodies impacted by water quality and the impact on surface water treatment facilities.
- A study of the role of reusing water in water conservation strategies.
- The study of the impact of environmental flows on existing water rights permits.
- A review of groundwater management predictive data.

- Consideration of the formation of groundwater conservation districts in areas uncovered by existing districts.

- A review and updating of agriculture water needs.

- The refinement of groundwater availability impacted by water quality and geographic restrictions.

The Planning Group also suggested sixteen nominees to the TWDB's new river basin and bay area stake holders committee.

Nominated were Mel Swoboda, agriculture and irritation; Josh W. David,free-range livestock; David Alders, concentrated animal feeding; George Goehringer, recreational water usage; Mike Norris, municipalities; Jerry D. Nichols, soil and water conservation; Darla Smith, refining; Olan Webb, chemical manufacturing; Dale Peddy, electrical generation; Mike Harbordt, paper products or timber; Wade Butler, commercial fishermen; John D. Stover, public interest groups; Kelley Holcomb, regional water planning; Walter Glenn, groundwater conservation districts; Jerry Clark, river authorities; and Dr. Matthew McBroom, environmental interests.

The Planning Group also acknowledged receipt of the resignation of the Deep East Texas Council of Governments of Jasper as its administrative agent and authorized the Group's executive committee to begin the process of negotiation with a new agent..

January 23, 2008

PRESS RELEASE FROM JANUARY 23 MEETING

Officials of the Lower Neches River Authority have told members of the East Texas Regional Water Planning Group that the authority does not seek to control water rights in the upper river basin, but does want to protect its existing rights to serve planned industrial development in the Beaumont area.

Robert Stroder, LNVA's general manager, and members of his staff told the Group at a meeting in Nacogdoches "it was never our intent to damage existing water rights in the upper basin, but we don't want to step back from our own rights."

The Angelina & Neches River Authority, joined by municipalities and other water users above Sam Rayburn Reservoir, announced last year that it would take legal action to protect the water rights it holds for participants in the Lake Columbia project on Mud Creek in Cherokee and Smith counties.

In documents filed with the Texas Commission on Environmental Quality, the LNVA sought to make its 1963 water rights to water flowing into Rayburn Reservoir override the rights of other users, including municipalities, after 1963.

Stroder said LNVA has filed an amendment to its TCEQ request that he said should alleviate upstream concerns.

Members of the Planning Group had numerous questions for LNVA. "We need to work out something that's fair to the entire Neches basin," said Monty Shank, a Group member, "because there is an impact to what was proposed."

Kelley Holcomb of Lufkin, chairman of the Planning Group, said the concerns by the water planners "are examples of competing water interests all over Texas, but I hope we can find common answers to solve all of the water needs in East Texas."

"As planners, we need to look at our entire region and keep in mind that our job is to assure that everyone has adequate water supplies for the future," said Holcomb.

He said the LNVA's amended request to the TCEQ does not require the approval of the Planning Group because it affects an existing rights permit.

As it began its new round of planning for twenty East Texas counties, the Planning Group appointed the City of Nacogdoches as its new administrative entity, replacing the Deep East Texas Council of Governments of Jasper, which resigned the position.

The Group also elected a new slate of officers, including Holcomb as chairman again; Worth Whitehead of Henderson as first vice-chairman, Mike Harbordt of Diboll as second vice-chairman; Jerry Clark of Orange, secretary; David Brock of Jacksonville, assistant secretary; and Leon Young and David Alders, both of Nacogdoches, at- large members of the executive committee.

George Campbell of Nacogdoches will chair the nominating committee, David Alders will chair the by-laws committee; Darla Smith of Beaumont will head the finance committee, and Harbordt will chair the technical committee.

Gary Graham of Beaumont, the Planning Group's engineering consultant, said engineers are working on several tasks assigned by the Group.

Terry Stelly of the Texas Parks and Wildlife Department told the Group that biologists have a growing concern about a "dead zone" in the Gulf of Mexico, which he said is affecting marine life and commercial fishing.

He said the dead zone is the result of oxygen depletions ultimately caused by excessive nitrate levels carried into the gulf by the Mississippi River . Storm water discharges from farming operations upstream from the Gulf of Mexico carry the nutrients into the gulf which eventually results in depressed dissolved oxygen levels off of the Texas and Louisiana coastlines.

The Group's next meeting will be on April 9 in Nacogdoches. The Group serves all or parts of Anderson, Angelina, Cherokee, Hardin, Henderson, Houston, Jasper, Jefferson, Nacogdoches, Newton, Orange, Panola, Polk, Rusk, Sabine, San Augustine, Shelby, Smith, Trinity and Tyler counties.

East Texas Regional Water Planning Group (Region I)
April 9, 2008
Contact: Kelley Holcomb, 936-632-7795

FOR IMMEDIATE RELEASE

The East Texas Regional Water Planning Group (Region I) will submit to the Texas Water Development Board a $231,510 budget for planning purposes in 2008 and 2009.

The budget includes $88,050 for population and water demand projections, the identification of water needs, the selection of water management strategies, and the impact of the strategies on water quality.

The 20-county region's planning efforts will also include $10,000 for conservation and drought management, $10,000 for ways to achieve consistency in long-term protection of natural resources, $15,000 for the identification of unique reservoir and stream segments, $9,400 for water infrastructure and funding, and $109,000 for the adoption of the plan, administration and public participation.

The Group also discussed ways to identify "small water users" in a category of their own, but agreed the region needs more information. Group chairman Kelley Holcomb of Lufkin said the challenge "is that there is no cohesive strategy to track small water groups or their usage."

Temple McKinnon of the Texas Water Development Board said the state agency is "getting better" at tracking small water usage, but doesn't survey the users and doesn't have sufficient information.

Group members agreed there isn't enough data from farming, poultry, cattle uses and other agriculture users to develop strategies.

In outlining the Group's seventeen planning strategies, engineering consultant Gary Graham of Beaumont said he has identified 186 water users in the region. He said 56 of the users have deficiencies in water supplies and 18 have deficiencies in water storage facilities.

The $231,510 budget will be submitted to the state agency, but the Legislature will have to approve the funds during its 2009 session starting in January.

In other business, the Group:

- Heard a presentation on groundwater management from Len Luscomb of the Rusk County Groundwater Conservation District. Luscomb said groundwater planning is difficult "because it is only an approximation" and depends on variables such as rainfall amounts, evaporation, transpiration, spring flows, pumpage, and the aquifers' recharge abilities.

- Gave approval to the City of Diboll for seeking an amendment to its water management strategies. City Manager Kenneth Williams said the city wants to seek permission to use groundwater from the Yegua-Jackson groundwater aquifer at Eason Lake northwest of the city to supplement the city's current water supplies.

- Reviewed copies of water management strategies by the TWDB. Group chairman Holcomb said "while the strategies may be good for other parts of the state, but are not necessarily good for East Texas."

Holcomb also introduced Lila Fuller and Stacey Corley from the City of Nacogdoches, which has become the Group's administrator, replacing the Deep East Texas Council of Government in Jasper.

Holcomb also called the Group's attention to its new web site: etexwaterplan.org, and selected Wednesday, June 4 for its next meeting at the Nacogdoches Recreation Center.

Region I serves all or parts of Anderson, Angelina, Cherokee, Hardin, Henderson, Houston, Jasper, Jefferson, Nacogdoches, Newton, Orange, Panola, Polk, Rusk, Sabine, San Augustine, Shelby, Smith, Trinity and Tyler counties.

6A ■ Wednesday, April 16, 2008 ■ Cherokeean Herald ■ thecherokeean.com

East Texas water group submits $231,000 budget

20-county region's planning effort includes conservation and drought measurements

The East Texas Regional Water Planning Group (Region I) will submit to the Texas Water Development Board a $231,510 budget for planning purposes in 2008-09.

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Diboll to tap aquifer to aid water shortage

Posted: Tuesday, August 26, 2008 1:00 am | Updated: 3:10 pm, Thu Jan 21, 2010.

STEVEN ALFORD The Lufkin Daily News **jalford@coxnews.com**

A draft by the East Texas Region I Water Planning Group allowing the city to tap into the large underground aquifer is an amendment to the original 2006 regional water plan. "The regional water plan that was currently in place and approved by us showed that the city of Diboll was to use surface water to meet their future needs," said Kelly Holcomb, chairman of group. "This new amendment requested that they be able to use additional groundwater as well as surface water to meet current and future needs." A pre-existing agreement with the city of Lufkin to share surface water was pushed out because of rising costs, forcing Diboll to look for other means to supply their future water needs, Holcomb said. According to a group press release, preliminary work on the Yegua wells shows they can produce 200 to 300 gallons of water per minute for the city. John Nelson, a hydrologist from the firm L.B. Guyton & Associates in Austin, who was hired to test the wells, said "the aquifer appears to be capable of sustaining the additional pumping required to meet Diboll's needs." The Yegua Aquifer, which currently provides more than 10 counties with water, runs from the Louisiana border in East Texas down to the bottom tip of the state near Brownsville. Diboll City Manager Kenneth Williams said the change in the Regional Water Plan was aimed to add the city's ideas into current strategies for their water supply. "We wanted to be included in the Region I water plan. There had not been an identified source for the city of Diboll," Williams said. "There were some things put into plan, but the input didn't come from us. We're looking at future needs and development and we need it for now." Williams said the city is operating at close to peak levels for daily demand, and that a new source is needed soon. Due to a lack of supply and summertime demands, Diboll is currently operating under the state's Water Conservation and Emergency Water Demand Management Plan. According to the city Web site, the current conditions require citizens to look for ways to voluntarily reduce water usage, if not, they may face fines for wasting water. Voluntary reduction includes limiting residential car washing, window washing and pavement washing, unless a bucket is used, and cutting out non-essential water usage such as street washing, filling pools and athletic field watering. Williams said the current conservation efforts were a result of two of the city's wells being out, with one back up and running and another one on the way pending data from water tests. "As Diboll continues to grow we're just going to have to find additional water sources," Williams said. "We're being proactive to plan for the future and to find water sources that will sustain us for the next fifty years."

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EAST TEXAS REGIONAL WATER PLANNING GROUP

Board hears proposal to transfer water from Toledo Bend to North Texas in 2060

Members of the East Texas Regional Water Planning Group (Region I) recently heard a series of reports focusing on planning projects underway in the 20-county area.

The reports were part of the group's continuing work on Round 3 of Phase I of regional planning in East Texas.

The group also authorized its administrative agent, the City of Nacogdoches, to solicit requests for qualifications for consulting engineering services. The region's current consultant is the Schaumburg & Polk engineering firm of Beaumont.

David Meesey of the Texas Water Development Board said the region has been allocated $300,000 by the TWDB for Round 3 planning. The region had requested $345,000.

A report by Simone Keil dealt with a proposal to transfer water from Toledo Bend Reservoir on the Sabine River to North Texas. The proposal would carry water via a pipeline from the middle of Toledo Bend to lakes serving the Dallas Water Utility System, the Tarrant Regional Water System and the North Texas Municipal Water System. The project is not expected to be completed until around 2060.

Terry Steely of the Texas Parks & Wildlife Department said the transfers of Toledo Bend water could affect the ecology and fisheries of Sabine Lake, which is fed by the Sabine and Neches Rivers.

Rex Hunt reported that additional studies are needed on mitigation factors involved in moving water from one river basin to another.

He said a certain quality of freshwater is needed to support a sound ecology for Sabine Lake, near Beaumont and Orange, but he said the recommended targets for freshwater inflows have not been determined.

George P. Campbell of Nacogdoches, a Region I member, said Rayburn Lake, in the Neches-Angelina river basin would likely have to be emptied two times a year to meet the goals of Sabine Lake.

In another report, Rick Borque said a study of regional solutions for small water suppliers has been hampered by responses from only 30 percent of the suppliers. He said regional solutions for small water suppliers can produce lower costs and greater efficiencies.

A report by Stuart Norvell discussed water needs for a new liquified natural gas facility for electricity generation in the Beaumont area. For every kilowatt of power, he said 258,000 gallons of water may be needed.

The next meeting of the Region I group is expected to be in early February, but an exact date has not been set.

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6A ■ Wednesday, February 18, 2009 ■ Cherokeean Herald ■ thecherokeean.com

NACOGDOCHES

East Texas water group plans 'tasks' for 2009-10

Engineering consultant will guide 20-county region

NACOGDOCHES – Engineers for the East Texas Regional Water Planning Group last week outlined proposed planning tasks for the 20-county region in 2009-10.

Meeting in Nacogdoches, the group heard a summary of the tasks from Rex Hunt of Allan Plummer Associates, Inc., which was chosen to lead the engineering consulting team.

Tasks include an update of the group's 2006 regional plan, the incorporation of special studies undertaken in 2008 and other factors which could include the outcome of the planning work.

Tasks also include:

- A description of the region, which will include new population projections, incorporation of new water users and water demands for steam electric needs.
- Update of water supply numbers from the previous plan including groundwater availability models and changes due to water transmission, surface water rights, the effects of environmental flow policies and water quality impacts and direct and indirect water reuse.
- Water management strategies focused on new water usage.
- Impacts of water management strategies on key parameters of water quality and the impacts of moving water from rural and agricultural areas.
- Water conservation and drought management recommendations.
- A description of how the regional water plan is consistent with long-term protection of the state's overall water resources, agricultural resources and natural resources.
- Unique stream segments and reservoir sites and legislative recommendations.
- Infrastructure financing recommendations and funding mechanisms for groups with no political subdivision, such as livestock, mining and irrigation.
- Public participation in the adoption of the final plan.

The East Texas Group also agreed to make a formal request to the Texas Water Development Board to use a revised water availability model and use water supply yields other than the firm yield of reservoirs in East Texas for surface water supply.

The group also agreed to hold planning group meetings or technical committee conference calls in March, April, June, July, August, September, October, November and December in 2009 and January and February in 2010, as well as other meetings which may be needed. The group plans to adopt its final water plan in September of 2010.

The group's next scheduled meeting will be on April 8 in Nacogdoches.

Region I includes all or portions of Anderson, Angelina, Cherokee, Hardin, Henderson, Houston, Jasper, Jefferson, Nacogdoches, Newton, Orange, Panola, Polk, Rusk, Sabine, San Augustine, Shelby, Smith, Trinity and Tyler counties.

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Beaumont Enterprise

A thirsty Texas looks to region's water, and local advocates want to keep it here

By LLUVIA RUEDA

March 1, 2009
Posted: February 27, 2009, 6:53 PM CST

Hardin County has faced its fair share of "dry county" battles, but the latest doesn't revolve around alcohol.

Instead, water is the hot topic for this 81st Texas legislative session, as urban areas face off against rural regions regarding property rights.

But it's not the first time the topic has boiled over. The fight began when northern parts of Texas experienced dwindling water supplies, local officials said.

"The problem is that the water in some of the surrounding areas, such as Houston or even farther such as San Antonio, Austin, Fort Worth and Dallas, are experiencing a lack in water resources.

"We have more than we need, since we have both groundwater and surface water. As a result, they take some of our resources and we experience negative consequences," County Judge Billy Caraway said.

During the 80th Texas legislative session in 2007 and 2008, lawmakers debated the advantages of the State Water Plan, which proposed that water supplies should be distributed voluntarily.

The high cost of redistribution and required technologies, combined with the reluctance of local governments, discouraged most proposals. As the need for water continues to increase, however, governments in parched areas of Texas continue to pursue the issue.

On Jan. 13, a $3.4 billion pipeline was listed as a top priority on the legislative agenda by some Central Texas officials, an item local governments view, along with the push for water redistribution, as a possible threat to Southeast Texas.

Caraway and a group of officials from Hardin, Jasper, Tyler and Newton counties recently went to Austin to defend local concerns, but some believe any agreement that is passed ultimately will not favor rural areas.

"Originally, ground water belongs to the property owner and surface water belongs to the state, unless there are water shortages. In that case, the water rights go to local governments," said Walter Glenn, president of the Southeast Texas Groundwater Conservation District.

"But laws have been developing and changing for years," he said.

And water shortages have become a dramatic factor in the race to obtain water because of persistent droughts, Glenn said.

According to the state and the U.S. Drought Monitor, more than 100 of the state's 254 counties now are rated "abnormally dry," and more than 24 Central Texas counties are struggling with extreme drought. About 90 counties have outdoor burn bans in place as a result.

Since the future of an available water supply is questionable, Hardin County officials took action to preserve local groundwater reserves in 2003 by forming the groundwater conservation district, Glenn said.

Evolution of water rights

In 1967, the state began to control surface water and issued permits for its use.

Those with permits were considered to have "senior" water rights.

But those rights became subordinate, or "junior" to the rights of users in the basin of origin, such as rivers and lakes in East Texas and Southeast Texas, without consent of all the permit holders, or users, within the basin.

Scott Hall, general manager of the Lower Neches Valley Authority, said junior rights safeguard the region's water supply.

"It helps maintain the instream flow and (keeps) the surrounding estuaries healthy, which is vital to the ecological (water) health of the area. It also safeguards the region from people who are in it (the water industry) for profit, or those who do not use the water supply safely," Hall stated.

"I think that we need to have it, and we need to consider all the ecological effects, make sure local needs are met and find future estimates for available water levels before we can go to Congress or the Legislature and provide water for the rest of the state."

The Lower Neches Valley Authority provides fresh water - mostly from Lake Sam Rayburn - to municipalities, agriculture and industry in Jefferson County, the Bolivar Peninsula and toward Trinity Bay.

Although current estimates remain murky, the 2007 Texas State Water Plan predicts that water demand will increase by 18 percent over the next 50 years from 18.3 million acre-feet to 21.6 million acre-feet per year in 2060.

An acre-foot is equal to 325,851 gallons of water, according to the Texas Water Development Board. It's figured as the amount of water needed to cover an acre of land by a foot of water.

A family of four would use an acre-foot of water per year if each person used 223 gallons per day.

Southeast Texas needs water to continue growth

Regina Lindsey, Silsbee Economic Development Corp. executive director, said continuing local development depends on water.

"We are just going to have to go before the Legislature and fight for these rights. The population is increasing in the cities that are requesting the water, but our own populations are increasing, and we have to make sure our own water supplies don't run out in the future," she said.

Kelley Holcomb, interim general manager for Angelina and Neches River Authority, and chairman for the Region I Water Planning Group, said responses to surveys the group sends out are a trickle that should be a torrent.

Just 27 percent of the surveys are returned, he said.

Because of it, the needs of some counties go unaddressed, Holcomb said.

"Local governments and their water suppliers need to be involved in the planning. Otherwise, we don't know what they need or how many individuals to plan for and problems ensue," Holcomb said.

In one case, a municipality that had not been involved in the planning process needed more groundwater resources. Its attempt to get them ended up costing the planning group $8,100 and four months of extra labor, according to Holcomb.

The Region I chairman also said the districts need to realize the true need for water and the power of political clout.

"The first issue is that nobody really owns available water resources. The state of Texas acts as the 'caretaker,' if you will, and it takes a bottoms-up approach as to where the demand is and how to go about solving it," Holcomb said.

So far, the biggest contenders are the bigger districts, since rural areas of Texas have little to no representation, Holcomb said.

"If you have enough political connections, you can get that water in your area in some point in the process," Holcomb said.

The Texas Legislature is scrambling to address the issue and Washington is also keeping up with the situation, U.S. Rep. Kevin Brady, R-The Woodlands, said.

"Protecting Southeast Texas water is really the highest priority at the moment. That's your growth, that's your quality of life, that's your everything. The Legislature has really pushed regions to start addressing their water needs and resources," Brady said, when asked about its importance.

Where the water is

About two-thirds of the available, unclaimed water resources exist in the Region I area. Two-thirds of the Texas population in need of that water exists outside of that region, according to estimates by the Texas Water Development Board.

That is alarming, considering the fact that the Texas population is predicted to double over the next few years, Holcomb said.

Water volumes and dollars also are at stake.

"This is what presents a major portion of the problem. We got it, they need it. The questions that local governments should have are: How do we - Region I - have to get fairly compensated for the use of our resources, and are we going to be allowed to allocate a portion of the available water supply to meet unidentified future needs?" Holcomb said.

After that issue is resolved, questions then surface around the transportation of those volumes of water and the money required to move them.

Holcomb offered the example of the pipeline to illustrate the problem.

"The idea for the pipeline came from a study we did for the Sabine River Authority for the transportation of water from the Toledo Bend area to the Dallas-Fort Worth metropolis area. Over 70 percent of the cost results from the electricity needed to generate the movement of the water," he said.

Brady agreed, and said that most of the solutions presented to the Legislature and Congress lacked practicality.

"Right now, they (the Legislature) put procedures in place for local communities to be engaged, and I want to encourage more of that in the area. As for the dry states, I don't know what's going to happen. It's very costly to shift water from one area to another. The answers that we have been seeing lately, like new reservoirs, lakes, pipelines and canals can drive the cost of water through the roof. They are trying to come up with better plans."

The Texas Legislature approved a water plan for the state in 2001, but a lack of funding has stopped the plan from being carried out. About $260 million dollars would be required to kick start construction for the 16 allotted reservoir sites, according to a recent press release from Gov. Rick Perry's office.

Other options for water reserves include desalinization, which some experts say might still remain too pricey for most local governments.

All officials and organizations involved in the dispute agree that there is no set solution so the fight for water rights continues.

"All we can do right now is to keep a close eye on the matter and make sure that the county is taken care of," Cara-way said.

Find this article at:
http://www.beaumontenterprise.com/news/local/a_thirsty_texas_looks_to_region_s_water__and_local_advocates_want_to_keep_it_here_02-27-2009.html?showFullArticle=y

EAST TEXAS
Regional Water Planning Group

April/May/June, 2009

Region I WPG

Region I group focuses on water issues

Members of the East Texas Regional Water Planning Group (Region I) are focusing on population trends, groundwater usage, unique stream segments, and potential reservoir sites.

During a meeting in Nacogdoches April 8, the group, for planning purposes, approved population projections made for the region earlier during the planning process, but agreed to adjust some population figures in Smith, Franklin, Jasper, Shelby and Angelina counties, if the water usage rises among some groups.

Group chairman Kelley Holcomb of Lufkin suggested a broader look at water usage and growth in the region as the group's planning continues.

Group to designate stream and reservoir sites

Engineering consultant Rex Hunt of Alan Plummer Associates, Inc. of Austin said the Texas Legislature has included provisions in water planning laws that regional planning groups designate unique stream segments and unique reservoir sites. In July, he said, Region I will be asked for decisions on the two segments.

Unique stream segments, he said, have five criteria: biological functions, hydraulic functions, riparian conservation, high water quality, and high aesthetic values.

He said Region I consultants will define each steam segment using locations, maps, photos and site characteristics.

The designation of unique stream segments will start when Region I identifies potential segments, followed by its submissions to the Texas Parks and Wildlife Department, evaluation of each segment by the Department, and incorporation of the segments into the state water plan.

The designation of unique reservoir sites will begin when Region I identifies unique sites for potential construction, followed by incorporation of the sites into the regional water plan, incorporation of the plan by the Texas Water Development Board into the state water plan, and designation of the sites by the Texas Legislature.

Groundwater issues explained

James Beach of LBG Guyton, Region I's groundwater consultant, gave the regional group a history of groundwater management in Texas. He recommended that Region I continue to work with groundwater conservation districts in East Texas, summarize the desired future conditions for each district, and develop estimates for the groundwater management area within the region.

Following the presentations, final approval of Region I's population projections were approved. The group also approved steam electric water demands for the region, excluding Angelina County, where a new biomass power plant is being proposed.

The group also gave its final approval of Round III of Phase I Special Studies.

Chairman Kelley Holcomb appointed George Campbell as chair of the nominating committee, David Alders as chair of the bylaws committee, Darla Smith as finance chair, and Michael Harbordt as chair of the technical committee.

East Texas Regional Water Planning Group (RWPG I)

Officers

Kelley Holcomb, Lufkin, Chair
Worth Whitehead, Henderson, First Vice-Chair
Michael Harbordt, Diboll, Second Vice-Chair
Jerry Clark, Orange, Secretary
David Brock, Jacksonville, Assistant Secretary
David Alders, Nacogdoches, At-Large Executive Committee Member
Leon Young, Nacogdoches, At-Large Executive Committee Member

Directors and Group Representation

David Alders, Nacogdoches, Agriculture
Jeff Branick, Beaumont, Counties
David Brock, Jacksonville, Municipalities
George P. Campbell, Nacogdoches, Other
Jerry Clark, Orange, River Authorities
Josh Wilson David, Chester, Other
Chris Davis, Rusk, Counties
Scott Hall, Beaumont, River Authorities
Michael Harbordt, Diboll, Industries
William Heugel, Hemphill, Public
Kelley Holcomb, Lufkin, Water Utilities
Bill Kimbrough, Beaumont, Other
Glenda Kindle, Frankston, Public
Duke Lyons, San Augustine, Municipalities
Dale R. Peddy, Beaumont, Electric Power
Harmon Reed, Carthage, Agriculture
Monty D. Shank, Palestine, River Authorities
Darla Smith, Beaumont, Industries
Melvin Swoboda, Orange, Industries
Worth Whitehead, Henderson, Water Districts
John Windham, Center, Small Business
Dr. J. Leon Young, Nacogdoches, Environmental

Region I includes all or parts of Anderson, Angelina, Cherokee, Hardin, Henderson, Houston, Jasper, Jefferson, Nacogdoches, Newton, Orange, Panola, Polk, Rusk, Sabine, San Augustine, Shelby, Smith, Trinity and Tyler counties.

Meetings planned

The Planning Group agreed that in order to complete the tasks outlined, it would be necessary to meet frequently in order to consider various elements of the plan. The following meeting schedule for the RWPG is planned:

Proposed Meeting/ Conference Call	Purpose	Proposed Time Frame
Technical Committee Conference Call	Review draft Chapters 1, 2, and 3	June 2009
RWPG Meeting	Approve Chapters 1, 2, and 3	July 2009
Technical Committee Conference Call	Review draft Chapter 4	August 2009
Technical Committee Conference Call	Review draft Chapters 5 and 6	September 2009
RWPG Meeting	Approve chapters 4 through 6	October 2009
Technical Committee Conference Call	Review draft Chapters 7 through 9	November 2009
RWPG Meeting	Approve Chapters 7 through 9	December 2009
Technical Committee Conference Call	Review Initially Prepared Plan	January 2010
RWPG Meeting	Adopt Initially Prepared Plan	February 2010
Public Meetings	Discuss the Initially Prepared Plan and receive comments.	As needed from March through August 2010
RWPG Meeting	Adopt 2010 Regional Water Plan	September 2010

The Planning Group's next scheduled meeting will be on July 8 in Nacogdoches at the Nacogdoches Recreational Center at 1112 North Street, starting at 10 a.m.

Windham, Hall Named Directors

The group also named Center Mayor John Windham to succeed Edwin McCoy of Anderson County as a voting member, representing small businesses, and named Scott Hall to succeed Robert Stroder of Beaumont, who resigned. Hall will represent river authorities, as did Stroder.

Lila Fuller
PO Box 635030
Nacogdoches TX 75963

East Texas Regional Water Planning Group (RWPG I)
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LUFKIN TX 759 PM 20 APR 2009

April 8, 2009

East Texas Regional Water Planning Group (Region I)
Contact: Bob Bowman, 936-634-7444, or Kelley Holcomb, 936-632-7795

FOR IMMEDIATE RELEASE

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The tasks will include an update of the Group's 2006 regional plan, the incorporation of special studies undertaken in 2008, and other factors which could include the outcome of the planning work.
The tasks will also include:

• A description of the region, which will include new population projections, the incorporation of new water users, and water demands for steam electric needs.

• An update of water supply numbers from the previous plan, the updating of groundwater availability models, and changes due to water transmission, surface water rights, the effects of environmental flow policies and water quality impacts, and direct and indirect water reuse.

• Water management strategies focused on new water usage.

• Impacts of water management strategies on key parameters of water quality and the impacts of moving water from rural and agricultural areas.

• Water conservation and drought management recommendations.

• A description of how the regional water plan is consistent with long-term protection of the state's overall water resources, agricultural resources and natural resources.

• Unique stream segments and reservoir sites and legislative recommendations.

• Infrastructure financing recommendations and funding mechanisms for groups with no political subdivision, such as livestock, mining and irrigation.

• Public participation in the adoption of the final plan.

The East Texas Group also agreed to make a formal request to the Texas Water Development Board to use a revised water availability model and use water supply yields other than the firm yield of reservoirs in East Texas for surface water supply.

The Group also agreed to hold Planning Group meetings or Technical Committee conference calls in March, April June, July, August, September, October, November, and December in 2009 and January and February in 2010, as well as other meetings which may be needed. The Group plans to adopt its final water plan in September of 2010.

The Group's next scheduled meeting will be on April 8 in Nacogdoches
Region I includes all or portions of Anderson, Angelina, Cherokee, Hardin, Henderson, Houston, Jasper, Jefferson, Nacogdoches, Newton, Orange, Panola, Polk, Rusk, Sabine, San Augustine, Shelby, Smith, Trinity and Tyler counties.

NACOGDOCHES

Region I group tackles stream, reservoir designations

Updated population estimates and 13 new water user groups discussed by board members

◄ Rex Hunt, an engineer with Alan Plummer Associates, explains a PowerPoint slide show to board members on the Region I water group. Unique stream and unique reservoir designations will be discussed at the July 6 meeting.

Members of the East Texas Regional Water Planning Group (Region I) focused on population estimates, groundwater, unique stream segments and unique sites for construction of reservoirs during their meeting in Nacogdoches April 8.

The group discussed population projections including the addition of 13 new water user groups from six counties in Region I: Anderson, Angelina, Jasper, Nacogdoches, Shelby and Smith Counties.

Incorporation of the new population projections into the 2011 Regional Water Plan will be considered at the July meeting.

Group chairman Kelley Holcomb of Lufkin suggested a broader look at water uses and growth in the region as the group's planning continues.

Engineering consultant Rex Hunt of Alan Plummer Associates, Inc. said the Texas Legislature originally approved the designation of unique stream segments and unique reservoir sites by regional water planning groups.

He said the Region I group will decide whether to recommend unique stream segments or unique reservoir sites in July.

"Recommendations of unique stream segments are based on five criteria," he said. "Biological function, hydrologic function, riparian conservation areas, high water quality/exceptional aquatic life/high aesthetic value and threatened or endangered species/unique communities."

He said the regional water planning group may elect to submit a recommendation package to the Texas Parks and Wildlife Department (TPWD), identifying each recommended stream segment by location with maps, photos and site characteristics.

TPWD will return an evaluation of each segment to the group, which will be incorporated into the regional water plan in addition to the stream segment recommendations. Upon approval by the Texas Water Development Board, the regional water plan will be incorporated into the state water plan.

Hunt explained that, like unique stream segments, unique reservoir sites are designated by the Texas Legislature.

James Beach, Region I's groundwater consultant of LBG-Guyton, reviewed the history of groundwater management in Texas. He recommended that Region I continue to work with groundwater conservation districts in East Texas, summarize the desired future conditions and develop groundwater availability estimates for the groundwater management area within the region.

Following the presentations, final approval of the Round III, Phase I special studies were approved.

The group also approved steam electric water demand projections for the region, including new Angelina County water demands where a new biomass power plant is scheduled to be built.

The group chairman reappointed George Campbell as chair of the nominating committee, David Alders as chair of the by-laws committee, Darla Smith as finance chair, and Michael Harbordt as chair of the technical committee.

The group named Center Mayor John Windham to succeed Edwin McCoy of Anderson County as a voting member, representing small businesses, and named Scott Hall to succeed Robert Stroder of Beaumont, who resigned. Hall will represent river authorities, as did Stroder.

The next Region I meeting will be July 8 at the Nacogdoches Recreation Center at 1112 North Street in Nacogdoches. The public is invited to attend. For more information, call (936)560-2505 or visit www.etexwaterplan.org.

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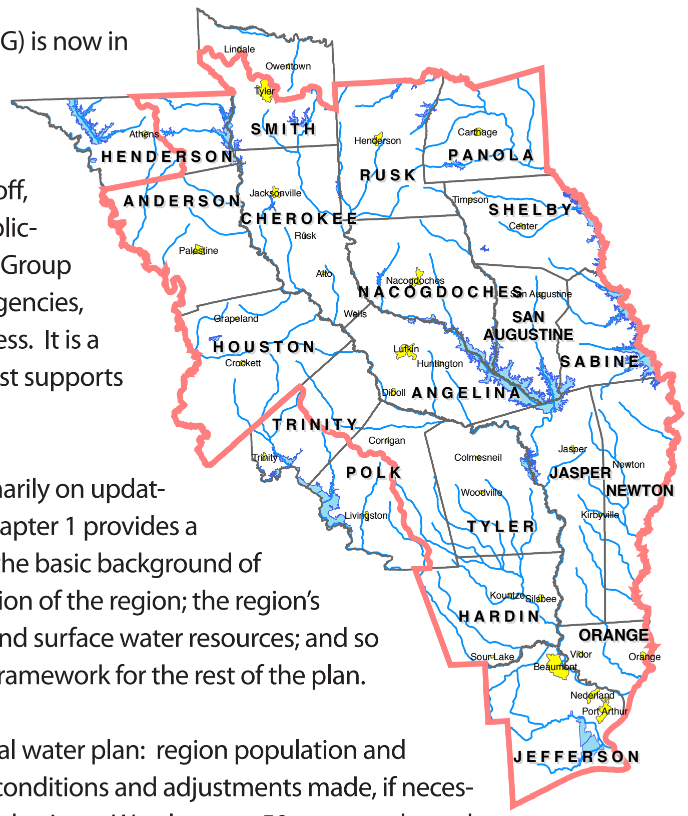
EAST TEXAS
Regional Water Planning Group

VOL. 3, NO. 4 — *Region I* — JULY 2009

WHAT'S UP IN REGIONAL WATER PLANNING?



The East Texas Regional Water Planning Group (ETRWPG) is now in the fifth month of the third round of water planning for Region I. This process began in February of this year and will culminate in a new, updated regional water plan in January 2011. That sounds like a long way off, but there is a lot to do in the interim. This is, by law, a public-oriented planning process. The Regional Water Planning Group must seek out comments from water providers, public agencies, environmental groups, and citizens throughout the process. It is a time-consuming effort, but one that yields a plan that best supports the people and resources of the region.

Since February 2009, the ETRWPG has been focused primarily on updating the first three chapters of the regional water plan. Chapter 1 provides a general description of the region. This chapter provides the basic background of the area, including region population; a physical description of the region; the region's climate; a description of its natural, agricultural, ground and surface water resources; and so on. The information provided in this chapter provides a framework for the rest of the plan.

Chapter 2 describes two essential elements of the regional water plan: region population and water demand. These elements are updated for current conditions and adjustments made, if necessary, to projections out to the end of the current planning horizon. We plan on a 50+ year cycle, and currently out to the year 2060. For this update, population and water demand projections have not changed much since the previous plan. We expect more significant changes in the next round, which will include the results of the 2010 United States Census.

Water availability – that is, ground water and surface water supplies in the region – are reviewed and updated in Chapter 3 of the plan. Efforts are underway at this time to ensure that an accurate picture of the condition of the region's water resources is reflected in this chapter.

It is the intent of the ETRWPG to consider preliminary drafts of these chapters at the July 8 meeting. Once consensus is reached on the content of these chapters, work on matching water demands and water supplies can begin. In addition, the ETRWPG will begin to consider wider issues, such as water conservation, unique stream segments, potential threats to water resources, and recommendations for legislative action relative to regional water supplies and water planning. The goal of the ETRWPG is to have a draft of the regional water plan by January 2010. This draft will go through an extensive public comment process, as well as a review by the Texas Water Development Board. The final plan should be adopted by January 2011.

THE REGION CONTINUES WATER PLANNING ON JULY 8

The East Texas Regional Water Planning Group will meet again soon to continue the process of updating the current water plan for the region. At this meeting, several important issues will be addressed. These include the preliminary approval of the first three chapters of the updated plan and approval of changes to population projections and water demand projections for the region. The chapters under consideration provide a description of the region, projections of population and water demand, and a discussion of available surface water and groundwater resources. In addition, the RWPG will deliberate its approach to the issue of identification of unique stream segments and unique reservoir sites for this round.

The next meeting will be held on July 8, 2009, beginning at 10 a.m. It will be held in Nacogdoches, at the Nacogdoches Recreation Center, located at 1112 North Street. For more information, contact Lila Fuller, City of Nacogdoches, at (936) 559-2504 or lfuller@ci.nacogdoches.tx.us.

Lila Fuller, City Secretary
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EAST TEXAS REGION CONDUCTS SPECIAL STUDY OF MUNICIPAL WATER USE

As part of the current round of regional water planning, the East Texas region conducted several special studies authorized by the Regional Water Planning Group and the Texas Water Development Board. Among these was a study of municipal water use in the region, known as Study No. 3. This study included a survey of water user groups (WUGs) in Region I. The survey was intended to provide a better understanding of current water conservation practices in the region. The findings could be used in the development of conservation strategies and projections of water conservation savings in the region.

In August 2008, surveys were mailed to 65 WUGs in Region I with 1,000 connections or more. Of the surveys submitted to the WUGs, a total of 27 were completed and returned information, constituting a 42% response rate.

From the information provided in the returned surveys, water use for each WUG was determined. The State of Texas has recommended a goal for Texas water suppliers of an average water use of 140 gallons per capita per day (gpcd). Median water use per resident for Region I in 2006 and 2007 was calculated based on total water production and on water delivered for residential use. For total water production, the median water use per resident was 86 gpcd. For residential use, the median water use per resident was found to be 68 gpcd. Based on the responding WUGs, Region I falls below the municipal water conservation goal set by the task force. The survey results indicate that current municipal water use among responding WUGs in Region I is relatively low. The survey suggests that water use is generally efficient and lower than other areas of the state on a per capita basis. The following recommendations were made as a result of this study:

- The region's WUGs should continue implementing existing water conservation plans.
- WUGs should consider implementation of additional water conservation efforts recommended by the Water Conservation Implementation Task Force, if implementation can be accomplished in a cost-effective manner.
- Water conservations efforts should be re-assessed after additional data become available, including data from the next Census.

While the survey indicates good news for water use in the Region, it should be noted that participation in the survey could have been much better. Greater participation in the regional water planning process through these types of surveys will improve the process of water planning in the region. The East Texas Regional Water Planning Group will continue to gather new information and data about water use within the region in order to improve planning for this critical resource.

COMPREHENSIVE TEXAS DROUGHT INFORMATION WEB SITE LAUNCHED

Source: The Aquifer Monitor, a publication of the Texas Water Development Board

The Drought Joint Information Center made up of state and federal agency public information officers from Texas AgriLife Extension Service, Texas Water Development Board, Texas Parks and Wildlife Department, U.S. Department of Agriculture, Texas Forest Service, Texas Animal Health Commission, Texas Department of Agriculture, Texas Department of Public Safety, Texas Department of Transportation and Texas Commission on Environmental Quality have created a comprehensive Texas drought information Web site.

The Web site is divided into two distinct areas: "Resources on Drought" provides static and changing information on drought ranging from stream flow data and weather information to links provided by the participating agencies; and "News Updates/Situational Reports" features the latest items provided by the participating agencies.

All information on the Web site is public information and is available for producers, industry groups, county officials, the media and anyone needing creditable, consistent Texas drought-related information.
The new web site can be found at http://agrilife.tamu.edu/drought/

Cherokeean Herald

4A ■ Wednesday, July 15, 2009

NACOGDOCHES

Revisions to state's water plan discussed

Region I planning group examines unique stream, unique reservoir site recommendations

NACOGDOCHES – The East Texas Regional Water Planning Group (ETRWPG) met July 8 at the Nacogdoches Recreation Center to discuss revisions to the Regional Water Plan for Region I.

Among the topics discussed at the meeting were population and water demand revisions, Draft Chapters 1-3 of the Regional Plan, future plan revisions, unique stream segment and unique reservoir site recommendations and the 2010 annual budget.

Members from the engineering team and the Texas Water Development Board (TWDB) reviewed upcoming additions to the 2011 Regional Water Plan and new legislation from the 81st session of the Texas Legislature.

Engineering consultant Rex Hunt of Alan Plummer Associates, Inc., discussed anticipated changes to three chapters of the Regional Water Plan to be presented to the ETRWPG at the next meeting. Chapters 4-6 will address water management strategies within the region and their effect on water quality and give recommendations on water conservation and drought management strategies.

"For these chapters, we will look at current water conservation and management strategies already in place. We will refer to Special Study #3, which analyzed water use in Region I. The study was conducted last October and found that Region I has a much lower water use per person than other water planning regions," said Rex Hunt.

Temple McKinnon, Texas Water Development Board, gave an educational presentation on recent legislation from the 2009 Legislative Session impacting the water planning process.

The engineering consultant team also presented drafts of the first three chapters to the ETRWPG for consideration and approval.

"We will only be voting on the drafts of Chapters 1-3 today. In February 2011, we will have the opportunity to give final approval on these chapters before we adopt the entire plan," said Kelley Holcomb, chairperson of the ETRWPG.

The group approved Draft Chapter 1, "Description of the East Texas Region" and Draft Chapter 2, "Current and Projected Population and Water Demand."

The group took no action regarding Draft Chapter 3, "Evaluation of Current Water Supplies in the Region." The consultant team will finalize water supply availability and present Chapter 3 again at the next meeting.

The ETRWPG also approved the 2010 annual budget and methodology for adopting water management strategies and alternative management strategies for the 2011 Regional Water Plan.

The group discussed possible identification of unique stream segments and unique reservoir sites within the region. For this round of planning, no streams will be recommended by the group for designation as a unique stream segment. The group did not take action on unique reservoir sites, but instructed the consulting team to prepare a recommendation package for consideration by the group at a future meeting.

The Regional Water Planning Group meets once every three months to discuss revisions to the 2011 East Texas Regional Water Plan. Once the plan is adopted by the ETRWPG in February, it will be considered for approval by the TWDB to be incorporated into the State Water Plan.

The 20-county regional water planning area includes all or parts of Henderson, Smith, Anderson, Cherokee, Rusk, Nacogdoches, Panola, Shelby, San Augustine, Sabine, Angelina, Houston, Trinity, Polk, Tyler, Jasper, Newton, Orange Hardin and Jefferson counties.

The next meeting is scheduled for 10 a.m. Oct. 7 at the Nacogdoches Recreation Center, 1112 North Street. The public is encouraged to attend and participate. For more information, visit www.etexwaterplan.org or call Lila Fuller at (936) 559-2504.

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EAST TEXAS
Regional Water Planning Group

VOL. 3, NO. 5 — Region I — SEPTEMBER 2009

EAST TEXAS REGIONAL WATER PLAN UPDATE

The Regional Water Planning Group will convene in October to discuss updates to Chapters 4, 5 and 6 of the 2011 East Texas Regional Water Plan. The consulting team has been preparing these three chapters since July and will present them at the next meeting.

Chapter 4 identifies water needs based on changed conditions in demand or supply as described in Chapter 2. Chapter 4 also updates recommended water management strategies and cost estimates for each strategy.

The consulting team has also been preparing Chapter 5. This chapter assesses water quality impacts of the water management strategies outlined in Chapter 4. The chapter includes an analysis of moving water from agricultural areas to urban areas.

Chapter 6 consolidates water conservation recommendations and reviews water conservation and drought contingency strategies employed by water users in Region I. The chapter incorporates water use findings from a water conservation study prepared by Region I last year and suggests strategies for water conservation.

The next meeting will be held on October 14, 2009, at 10am at the Nacogdoches Recreation Center, located at 1112 North Street in Nacogdoches. A detailed agenda will be available on the region's website etexwaterplan.org prior to the October meeting. For more information, contact Lila Fuller, City of Nacogdoches, at (936) 559-2504 or lfuller@ci.nacogdoches.tx.us.

SCIENCE ADVISORY GROUP WEIGHS ISSUES OF ENVIRONMENTAL FLOWS

Environmental flows include river flows that are necessary to support an ecologically sound environment. Senate Bill 3, passed in 2007, called for the development of stakeholder groups for various river basins in the state to consider development of recommendations for environmental flows. A stakeholder's group for the Sabine and Neches Rivers and Sabine Lake Estuary was appointed in the summer of 2008. The group is comprised of a wide range of stakeholders, including Region I Regional Water Planning Group members Kelley Holcomb and Jerry Clark. Mr. Clark serves as the stakeholder group's chairman.

The Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Expert Science Team (SNBBEST) is a science advisory group appointed by the stakeholders group in November 2008 to consider recommendations for environmental flows for the Sabine and Neches Rivers and for Sabine Lake Estuary. The SNBBEST has been working diligently toward a goal of making such recommendations since that time.

The SNBBEST includes hydrologists, engineers, aquatic biologists, and other scientists. The East Texas Regional Water Planning Group is well represented on this committee, including planning group member Scott Hall and consultant team members Gary Graham and Rex Hunt.

The SNBBEST is currently evaluating flow data at selected locations in the Neches and Sabine Rivers. Hydrologic analyses of flow data along with biological and water quality data will be used to develop appropriate flow scenarios throughout the year that will be adequate to support sound ecological environments in the basins and in Sabine Lake estuary. Over the next two months, a report will emerge providing recommendations for environmental flows to be presented to the stakeholder's group for consideration.

This is not an easy task. Despite extensive daily flow data throughout both river basins, biological, sediment transport, and water quality data are more limited at this time. Specific recommendations will need to consider the limitations of data. The recommendations may include further studies to obtain additional data to refine recommendations in the future.

Preliminary results of the SNBBEST's work might be incorporated into the 2011 Region I planning update, which is underway at this time. Final recommendations by the stakeholders may be incorporated into future water planning.

DID YOU KNOW ?

- *It takes 3 liters of water to produce 1 liter of plastic bottled water?*
- *The average 1 liter bottle of water costs $0.87? That's equivalent to paying $3,293.31 per 1,000 gallons of water!*
- *1,000 gallons of water from your faucet costs on average $2.35. That's over 1,400 times less expensive than the same amount of bottled water! Even with the added cost of a filter, water from the faucet is much less expensive than buying bottled water from the store.*

UPCOMING EVENTS

- *East Texas (Region I) Regional Water Planning Group Meeting will be held at 10am on October 14, 2009, at the Nacogdoches Recreation Center in Nacogdoches.*
- *Water for Texas forum hosted by Senator Averitt, Representative Ritter, and the Texas Water Foundation will be held on November 16 and 17, 2009, at the Omni Hotel in Ft. Worth. More information is available at www.texaswater.org/waterfortexas.*
- *The River Systems Institute will hold their "Land, Water, People" conference at the San Marcos Convention Center on November 16 through 18, 2009. More information is available at www.rivers.txstate.edu/projects/conferences/Land-Water-People-09.html*

Lila Fuller, City Secretary
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ZEBRA MUSSELS SPREADING IN TEXAS: INVASIVE THREAT BELIEVED TO BE ENTERING TRINITY RIVER VIA LAKE LAVON

By Tom Harvey, TPWD

Invasive zebra mussels have been confirmed to have spread from Lake Texoma into the head waters of Lake Lavon, and experts fear they could eventually spread throughout the Red River and Trinity River watersheds.

Zebra mussels multiply rapidly and can block water treatment plant intakes and pipes as well as attach themselves to boats, ropes or anything else left in the water. They can cause declines in fish populations, native mussels and birds. They can also restrict water flow in pipes, foul swimming beaches, damage boat engine cooling systems and cause navigation buoys to sink. The financial cost of controlling and removing zebra mussels from fouled water intake structures can be significant.

Since 2006, there have been five documented cases of zebra mussels being found on boats at Lake Texoma that were trailered in from other states. All five boats were quarantined and cleaned of all mussels prior to being allowed to launch into Lake Texoma. However, April 3 of this year marked the first time that an adult zebra mussel was documented as living in Texas waters. Since that time, additional live specimens have been reported in Lake Texoma and are now believed to be well-established.

According to the online National Atlas of the United States, "Once zebra mussels become established in a water body, they are impossible to eradicate with the technology currently available. The cost of dealing with zebra mussels varies widely, [but] for many plants, costs average hundreds of thousands of dollars a year."

Zebra mussels originated in the Balkans, Poland, and the former Soviet Union and were first introduced in North America in 1988 in Lake St. Clair, a small water body connecting Lakes Huron and Erie.

Boaters and anglers can help slow the spread of zebra mussels from one water body to another by practicing the following steps when leaving any water suspected of having zebra mussels.

- Drain all water from the boat, such as the engine, bilge, livewells and bait buckets before leaving the lake.
- Inspect the boat and trailer and remove any zebra mussels, vegetation or foreign objects that are found.
- Wash your boat and trailer at a commercial carwash using high pressure and hot (140-degree) soapy water. Hot water will kill zebra mussel larvae.
- Open all compartments and livewells and allow the boat and trailer to dry for a week before entering another water body. Boaters and anglers can also help by reporting sightings of suspected zebra mussels to the Operation Game Thief toll-free hotline at (800) 792-4263.

This August news release is republished in-part with permission from the Texas Parks and Wildlife Department.

EL NIÑO AND IMPACTS IN TEXAS IN 2009-2010

Scientists at the National Oceanic and Atmospheric Administration announced in July the arrival of El Niño, a climate phenomenon causing global influences on weather, oceanic conditions and marine fisheries.

El Niño occurs every two to five years and is characterized by the warming of central and eastern tropical Pacific waters. The warming of these waters can cause some parts of the globe to be inundated with water, while turning other areas into deserts.

Scientists are predicting strengthening of El Niño in the upcoming months, becoming most intense from December through March.

For Texans, this means more rain and cooler than normal temperatures could be headed in their direction during Winter of 2009-2010. Historically, precipitation totals average from 130% to 160% of normal. In south Texas, precipitation amounts could be almost two times the normal rainfall amount. In east Texas, rainfall totals are typically 115% of normal. East Texas could see 1-3 inches more rain from December through March. Colder temperatures usually accompany El Niño events. East Texas could see average temperatures decrease by 1 to 3 degrees Fahrenheit.

East Texas Regional Water Planning Group
Contact: Kelley Holcomb (936) 633-7543

NACOGDOCHES – (October 14, 2009) – The East Texas Regional Water Planning Group (ETRWPG) met at the Nacogdoches Recreation Center on Wednesday to discuss updates to the 2011 East Texas Regional Water Plan.

Among the topics discussed at the meeting were future revisions to the Regional Plan, status and methodology of Chapter 4 updates, population and water demand projections, Draft Chapters 3, 5, and 6 of the Regional Water Plan, and amendments to the contract between the City of Nacogdoches and Texas Water Development Board (TWDB).

Engineering consultant Rex Hunt of Alan Plummer Associates, Inc., discussed anticipated changes to Chapters 7-9 of the Regional Water Plan to be presented to the ETRWPG at the next meeting in December. These chapters will address how the plan is consistent with protection of natural resources, provide recommendations regarding unique stream segments and reservoir sites, and outline anticipated infrastructure funding requirements for the region.

"Chapter 7 will describe consistency of the plan with protection of water resources, agricultural resources and natural resources. Chapter 8 addresses ETRWPG recommendations for Unique Stream Segments and Unique Sites for reservoir construction. Chapter 9 tasks include sending surveys to water user groups in the region to determine infrastructure development and funding sources," said Mr. Hunt.

Consultant Simone Kiel of Freese and Nichols, Inc., explained the status of Draft Chapter 4 and methodology for evaluation of water user groups' (WUGs) supply and demand and projected needs.

Current projections for the region indicate an anticipated shortfall on meeting water demands of approximately 174,000 acre-feet per year by the year 2060. This projected shortage will be met by implementation of water management strategies, which will be implemented by the region's WUGs.

"There are currently 63 individual WUGs in Region I with water shortages. Approximately half of the projected shortfall is due to anticipated steam-electric power water demands in the planning cycle," said Mrs. Kiel.

The ETRWPG heard and approved a request to include an allocation of 3,500 acre-feet per year of additional water supply for Houston County Water Control and Improvement District No. 1 in the 2011 Regional Water Plan. This action enables the District to proceed with a request to the Texas Commission on Environmental Quality for additional water rights in Houston County Lake.

The consultant team presented information on population and water demand revisions to the ETRWPG and requested approval. The group approved the addition of new WUGs in Angelina and Nacogdoches Counties to the 2011 Plan, along with population and municipal water demand projections associated with the new WUGs. In addition, the group approved changes to manufacturing water demands in Angelina and Jefferson Counties, and to irrigation demands in Hardin, Orange and Jefferson Counties.

Revisions to Chapters 3, 5 and 6 of the plan were described by Mr. Hunt. The group approved Draft Chapter 3 "Evaluation of Current Water Supplies in the Region," Draft Chapter 5, "Impacts of Selected Water Management Strategies on Key Parameters of Water Quality and Impacts of Moving Water from Rural and Agricultural Areas" and Draft Chapter 6 "Water Conservation and Drought Management Recommendations."

The next meeting is scheduled for 10 a.m. Dec. 9 at the Nacogdoches Recreation Center, 1112 North Street. The public is encouraged to attend and participate. For more information, visit www.etexwaterplan.org or call Lila Fuller at 936-559-2504.

Regional water group considers updates to 2011 plan

Board members review chapters that will become part of state water plan

NACOGDOCHES – The East Texas Regional Water Planning Group (ETRWPG) met at the Nacogdoches Recreation Center on Oct. 14 to discuss updates to the 2011 East Texas Regional Water Plan.

Among the topics discussed at the meeting were future revisions to the Regional Plan, status and methodology of Chapter 4 updates, population and water demand projections, Draft Chapters 3 and 5-6 of the Regional Water Plan, and amendments to the contract between the City of Nacogdoches and Texas Water Development Board (TWDB).

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Revisions to chapters 3 and 5-6 of the plan were described by Mr. Hunt. The group approved Draft Chapter 3, "Evaluation of Current Water Supplies in the Region;" Draft Chapter 5, " Impacts of Selected Water Management Strategies on Key Parameters of Water Quality and Impacts of Moving Water from Rural and Agricultural Areas;" and Draft Chapter 6, "Water Conservation and Drought Management Recommendations."

The next meeting is scheduled for 10 a.m. Dec. 9 at the Nacogdoches Recreation Center, 1112 North St. The public is invited. For more information, visit www.etexwaterplan.org or call Lila Fuller at (936) 559-2504.

REGION I

continued from pg. 1A

for made many in this group uncomfortable."

LNVA wants to keep construction options viable for 2nd plant

Scott Hall, LNVA general manager, asked the group to accept the water demand revisions "as an opportunity for today" to keep "a viable project still moving forward."

He distributed copies of a letter he received from the director of commercial Development at Sempra, regarding the company's interest in constructing a LNG and crude oil terminal. Marvin L. Ivey wrote, "The availability of LNVA-supplied water is part of the attraction to develop theses projects in SE Texas. We would encourage LNVA to preserve industry's access to quality water resources in the region."

LNVA proposed increased water allocation to these facilities as a heat transfer fluid for warming the LNG. LNG facilities store liquid natural gas at -260 degrees F because in its liquid form, it takes up 1/600th of the volume compared to its gaseous state. These plants will require water to warm liquid natural gas at transfer points and return it to a gaseous state for pipeline movement.

Because of the significant temperature increase required, LNVA estimated that approximately 179,225 acre-feet per year of water will be necessary for each of the two plants. According to LNVA, the Golden Pass plant will need this volume of water annually by 2020. LNVA estimates that the Sempra plant will need this annual volume by 2030.

A Sept. 21 memorandum which served as a public notice of demand revisions, discussed Jefferson County's 151,672 acre-feet of water usage for 2010. After the first LNG plant goes on-line, the 2020 water needs increase to 423,258 acre-feet.

Once the second plant begins operations in 2030, that demand jumps to 603,321 acre-feet a year, representing a 397 percent increase over 2010 anticipated usage. That volume of water would cover a 940 square-mile area with one foot of water, representing an area approximately 2/3 the size of Rhode Island.

Open loop vs. closed loop systems

Both LNG plants are permitted for water use in a closed loop network which burns natural gas to warm a heat transfer fluid, such as water, which then warms the LNG into a gaseous state.

In the noticed memorandum, the discrepancy between the LNG plants and LNVA's request was noted: "... neither of the LNG plants is currently planning to utilize water to warm the LNG in the manner proposed by LNVA.

Mr. Campbell asked for further clarification on why LNVA's request did not match the design plan of the LNG plants, which currently call for a closed-loop piping system to re-circulate a heat transfer fluid through the LNG.

Mr. Campbell continued, "In the Sept. 21 memo, the consultants indicated that LNG facilities were not using water in the manner that the Lower Neches Valley Authority proposed. If we are taking their word for that fact, then we should use another method for heat transfer."

Monty Shanks, general manager of the Upper Neches River Authority, read from a prepared statement suggesting that if the LNG plants change the method used for heat generation, then a new permit and environmental impact statement would be required.

LNVA attempted to plug in numbers at the regional water planning group level which would allocate massive amounts of freshwater from the Neches basin instead of a relatively small amount of water for a closed loop system.

Cherokee County Judge Chris Davis, who was unable to attend the quarterly meeting, anticipated the controversial agenda and assigned a proxy vote to Mr. Campbell to protect water interests in the upper basin and to vote against the LNVA request to get increased water allotments for industrial use.

LNVA's current water rights extend north as far as Cherokee County and include Pine Island Bayou, the Neches River, Sam Rayburn Reservoir and B.A. Steinhagen Lake.

"Basically, the Lower Neches Valley Authority is trying to take our water," said Mr. Davis. "They want our fresh drinking water to warm the liquefied natural gas, and then they are just going to dump it into the gulf. This is not a good use of our fresh water."

On a vote near the end of the meeting, the group accepted the increased irrigation and manufacturing projections with a caveat that Jefferson County cannot use more water than the current water rights permit allows.

If LNVA pursues water that exceeds amounts allocated in their current permit, members of Region I said they will attend the contested case hearing at TCEQ in Austin to explain their concerns.

"They have a huge petro complex down there and the largest (agricultural) irrigation network in the area," said Mr. Campbell. "I am sensitive to that and appreciative of that. But we need to make sure that decisions materially benefit the entire area in the long run. Jefferson County shouldn't rule the roost."

The drafts and recommendations made by Region I at the local level will become integrated into the 2012 State Water Plan.

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Update has county needing less water for manufacturing

Posted: Wednesday, October 21, 2009 1:00 am | Updated: 2:42 pm, Thu Jan 21, 2010.

ANDY ADAMS

A proposed update to the 2011 Texas water plan has Angelina County needing much less water for manufacturing needs in the coming years something Lufkin officials hope to change. A consultant hired by the East Texas Regional Water Planning Group has recommended that Angelina County's proposed manufacturing water demand for the year 2020 be lowered from 34,359 acre feet to 9,082 acre feet a drop of 74 percent from the 2006 Texas water plan and that Jefferson County's demand be increased by 58 percent, to 423,258 acre feet, in the same year. Projections for 2030, 2040, 2050 and 2060 have similar drops for Angelina County and increases for Jefferson County, where Beaumont is the county seat. While the projections do not represent limits on the amount of water the counties can use, they are important because they could affect financing and/or permitting on new water projects. The decrease in Lufkin's proposed manufacturing demand changes is the result of the closure of the AbitibiBowater paper mill, according to a technical memorandum prepared by Rex Hunt of Alan Plummer Associates, Inc., for the regional water group. Lufkin purchased the company's water rights earlier this year. City officials said they hope the regional planning group reconsiders changing Lufkin's proposed manufacturing water demands when it meets Dec. 9. "We are in disagreement with that," said Keith Wright, assistant city manager for Lufkin. "We've contacted them, asking them to up those numbers. We feel like it's a real possibility we can have an industrial user at the old Abitibi site within five years and another one at the industrial park that is being planned out state Highway 103 east." Wright said he e-mailed the engineer working on the 2011 water plan to ask that Lufkin's figure be increased by 13,500 acre feet by 2020. "Hopefully they'll change it," Wright said. "We'll see." Nobody spoke on behalf of Lufkin's water interests at the East Texas Regional Water Planning Group's meeting last Wednesday in Nacogdoches. The city of Lufkin does not have a representative on the group, which is a regional entity of the Texas Water Development Board and includes all or parts of Anderson, Angelina, Cherokee, Hardin, Henderson, Houston, Jasper, Jefferson, Nacogdoches, Newton, Orange, Panola, Polk, Rusk, Sabine, San Augustine, Shelby, Smith, Trinity and Tyler counties. Wright said the city is trying to get a representative on the panel. Attempts to reach Kelley Holcomb of Lufkin, the chairman of the group, for comment have been unsuccessful. Holcomb is general manager of the Angelina and Neches River Authority.

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East Texas Regional Water Planning Group
Contact: Kelley Holcomb (936) 633-7543

NACOGDOCHES – (December 9, 2009) - The East Texas Regional Water Planning Group (ETRWPG) met on Wednesday at the Nacogdoches Recreation Center to discuss updates to the 2011 Regional Water Plan.

The group heard reports from standing committees and engineering consultants, and comments from the public.

Engineering consultants Rex Hunt of Alan Plummer Associates, Inc., and Simone Kiel, of Freese and Nichols, Inc., presented changes to population and water demands projections, and discussed updates to Chapters 4, 7, 8, and 9 of the East Texas Regional Water Plan.

"Population and water demands projections through 2060 have been modified since the 2006 Plan for municipal, manufacturing, irrigation, and mining uses," said Rex Hunt. "Today, the group must consider final proposed changes to water demands developed as a result of public comments received during the 14-day comment period following the October 14th ETRWPG meeting.

The group received comments from four entities during the comment period. These comments and proposed demand changes were presented in a Technical Memorandum dated November 13, 2009.

Comments received from Lufkin Deputy City Manager, Keith Wright, requested Angelina County Manufacturing demands be increased to account for new industrial projects slated for the city. The group voted to approve this request and increased demand for Angelina County.

Based on comments received from Lower Neches Valley Authority General Manager, Scott Hall, the group voted to decrease Irrigation demands in Jefferson County to 140,000 acre-feet per year through 2060.

Angelina & Neches River Authority General Manager, Kelley Holcomb, requested a change to Mining demands for Angelina, Cherokee, Nacogdoches, Shelby and San Augustine Counties. The additional demand reflects a need for water to support increased gas production in these counties. The group approved this request.

In addition, the group voted to retain Irrigation water demands from the 2006 Plan for Orange County. The Executive Committee will prepare a transmittal letter to the TWDB requesting these changes.

Mrs. Kiel gave a status update to Chapter 4 of the Regional Water Plan. "Based on direction given on October 14th by the ETRWPG, we have looked at demand data and no additional shortages have been identified in the region," said Mrs. Kiel. "We have coordinated with Wholesale Water Providers and are continuing to update cost estimates and text of this report.

Mr. Hunt presented Draft Chapter 7 to the group for consideration and approval. The chapter outlines how the plan is consistent with the protection of natural resources in the region and demonstrates how the plan complies with current regulations. The group approved Draft Chapter 7.

Mrs. Kiel gave an update to Chapter 8 regarding potential legislative recommendations to be submitted by the ETRWPG. The Executive Committee will develop legislative recommendations to be presented at the February meeting of the ETRWPG.

Mr. Hunt presented a list of proposed reservoirs for consideration of the group to recommend for designation as unique reservoir sites. The group voted to not recommend unique reservoir sites in the 2011 Regional Water Plan. The plan will retain language from the 2006 plan regarding unique reservoir sites.

Mr. Hunt also discussed Chapter 9 of the Regional Water Plan. The chapter includes an infrastructure needs survey developed by the Texas Water Development Board (TWDB), which will be sent to water user groups with needs. This chapter will be completed after the Initially Prepared Plan (IPP) is submitted.

The IPP is to be submitted to the TWDB prior to March 1, 2010. Following submittal of the IPP, there is a 6-month public comment period where meetings will be held and comments received from the public. Following the comment period, the East Texas Regional Water Plan may be adopted by the group.

ETRWPG member David Alders proposed an amendment to the group's by-laws and the group approved the motion.

The ETRWPG will meet Feb. 17th, 2010, at 10 a.m. at the Nacogdoches Recreation Center at 1112 North Street to discuss further updates and to consider approval of the IPP. The public is encouraged to attend and participate. For more information, visit www.etexwaterplan.org or call Lila Fuller at 936-559-2504.

February 10, 2010

East Texas Regional Water Planning Group, Region I
Contact: Kelley Holcomb (936) 633 - 7543

FOR IMMEDIATE RELEASE

NACOGDOCHES - The East Texas Regional Water Planning Group (ETRWPG) met Wednesday morning at the Nacogdoches Recreation Center to discuss revisions to the 2011 Regional Water Plan for Region I.

Among the topics discussed at the meeting were population and water demand revisions, updates to the first three chapters of the Regional Plan, future revisions to the Regional Plan and the 2010 annual budget.

Members from the engineering team and the Texas Water Development Board gave presentations on the upcoming additions to the 2011 Regional Water Plan and the 2009 Legislative Session.

Engineering consultant Rex Hunt of Alan Plummer Associates, Inc., discussed three chapters to be presented to the ETRWPG at the next meeting. Chapters 4, 5 and 6 will address water management strategies within the region and their effect on water quality and give recommendations on water conservation and drought management strategies.

“For these chapters, we will look at current water conservation and management strategies already in place. For these chapters, we will be referring to Special Study #3 which analyzed water use in Region I. The study was conducted in October of last year and found that Region I has a much lower water use per person than other water planning regions.” said Rex Hunt.

Temple McKinnon of the Texas Water Development Board, gave an educational presentation on recent legislation impacting the water planning process during the 2009 Legislative Session.

The engineering consultant team presented drafts of the first three chapters to the ETRWPG for consideration and approval.

“We will only be voting on the drafts of Chapters 1-3 today. In February, 2011, we will have the opportunity to give final approval on these chapters before we adopt the entire plan,” said Kelley Holcomb, chairperson of the ETRWPG.

The group approved Draft Chapter 1 entitled “Description of the East Texas Region.” Draft Chapter 2 “Current and Projected Population and Water Demand” and also Draft Chapter 3 “Evaluation of Current Water Supplies in the Region” were approved as well.

The ETRWPG also approved the 2010 annual budget and methodology for adopting management strategies and alternative management strategies for the 2011 Regional

Water Plan. The group discussed and approved methodologies for recommending unique stream segments and unique reservoir sites.

The group voted to not recommend any unique stream segments in the 2011 Regional Water Plan. The group, however, would like further review of potential reservoirs within the region and will vote on the recommendation of unique reservoir sites in October when the consulting team presents this information.

The Regional Water Planning Group meets once every three months to discuss revisions to the 2011 East Texas Regional Water Plan. Once the plan is adopted by the ETRWPG in February, it will then be considered for approval by the Texas Water Development Board to be incorporated into the State Water Plan.

The 20-county regional water planning area includes all or parts of Henderson, Smith, Anderson, Cherokee, Rusk, Nacogdoches, Panola, Shelby, San Augustine, Sabine, Angelina, Houston, Trinity, Polk, Tyler, Jasper, Newton, Orange Hardin and Jefferson Counties.

The next meeting is scheduled for October 7, 2009, at the Nacogdoches Recreation Center at 1112 North Street at 10 a.m. The public is encouraged to attend and participate. For more information, visit www.etexwaterplan.org or call Lila Fuller at (936) 559-2504.

East Texas Regional Water Planning Group
Contact: Kelley Holcomb (936) 633-7543

NACOGDOCHES – (February 17, 2010) – The East Texas Regional Water Planning Group (ETRWPG) met at the Nacogdoches Recreation Center on Wednesday and adopted the initially prepared 2011 East Texas Regional Water Plan.

Among the topics discussed at the meeting were changes to the Regional Plan, adoption of the initially prepared plan (IPP), public comment period and public hearing, and a request for the Texas Water Development Board (TWDB) to conduct a socio-economic analysis.

Engineering consultant Rex Hunt of Alan Plummer Associates, Inc., discussed changes to the 2011 Plan since the last update in 2006. Since February 2009, ten chapters have been developed for the Regional Plan. Over the past year, the ETRWPG has considered and approved seven of the chapters, leaving Chapters 4, 9, and 10 to finalize.

Mr. Hunt presented Chapter 4 and reviewed changes, including modified water management strategies for entities in the region, updated cost analyses for water management strategies, and revised impacts of water management strategies. He also discussed anticipated changes to Chapters 9 and 10.

"The TWDB will develop a survey and the planning group will distribute surveys to entities in the region with identified water needs. The responses to this survey will be included in Chapter 9: Infrastructure Financing Report. Chapter 10 is a summary of public involvement in the planning process and will be completed once all public comments are received," said Mr. Hunt.

The consultant team presented the upcoming schedule for the public comment period and suggested dates for the public hearing.

"The plan is to have one hearing held on consecutive evenings at three locations. This public hearing is another opportunity for the public to submit comments on the 2011 Region I Water Plan," said Mr. Hunt.

The ETRWPG chose to schedule the hearing for April 20, 21 and 22 in Jacksonville, Nacogdoches, and Beaumont. Times and building locations are to be determined at a later date.

The group considered and approved a request to the TWDB to conduct a socio-economic analysis of the impact of not meeting water needs in the region. Temple McKinnon of the TWDB said, "The plan requires a socio-economic analysis be conducted. If the group would like for the TWDB to conduct this analysis, we have to receive a request from the Group." ETRWPG Chairman Kelley Holcomb pointed out that the analysis should be conducted considering the specific needs of East Texas. While the model used by the TWDB is the same throughout the State, Ms. McKinnon indicated that it would take into account the needs of the East Texas Region.

The group considered and approved appointments to the FY 2010 Executive Committee and other committee appointments. The ETRWPG also approved the addition of a new member of the ETRWPG. George Campbell, chair of the Nominations Committee, reported that Dr. Joseph Holcomb of Houston County has met the criteria to fill one of two Small Business vacancies. The group unanimously approved the appointment of Dr. Holcomb.

The next regularly scheduled meeting of the ETRPWG will be10 a.m. May 12 at the Nacogdoches Recreation Center, 1112 North Street. A public hearing is scheduled for April 20, 21 and 22 in Jacksonville, Nacogdoches, and Beaumont. Exact times and locations will be announced in a public notice. The public is encouraged to attend and participate. For more information, visit www.etexwaterplan.org or call Lila Fuller at 936-559-2504.

Preliminary regional water plan adopted

NACOGDOCHES – After almost a year of work involving review of a single chapter at a time, the East Texas Regional Water Planning Group (ETRWPG) adopted the initially prepared 2011 East Texas Regional Water Plan.

The final document is more than 500 pages with another 300 pages of appendices and documentation. It will eventually be incorporated into the five-year State Water Plan, which will be presented to the Texas Legislature in 2011 for review and adoption.

The next phase after the board's adoption is a comment period.

Copies will be placed at local libraries and at court houses in the 19-county region.

Three public hearings will be held April 20-22 in Jacksonville, Nacogdoches and Beaumont. Times and dates will be finalized and released at a later date.

Among the topics discussed at the Feb. 17 meeting were changes to the Regional Plan, adoption of the initially prepared plan (IPP), public comment period and public hearing, and a request for the Texas Water Development Board (TWDB) to conduct a socio-economic analysis.

Engineering consultant Rex Hunt of Alan Plummer Associates, Inc., discussed changes to the 2011 Plan since the last update in 2006. Since February 2009, 10 chapters have been developed for the Regional Plan. Over the past year, the ETRWPG has considered and approved seven of the chapters, leaving Chapters 4, 9, and 10 to finalize.

Mr. Hunt presented Chapter 4 and reviewed changes, including modified water management strategies for entities in the region, updated cost analyses for water management strategies and revised impacts of water management strategies. He also discussed anticipated changes to Chapters 9 and 10.

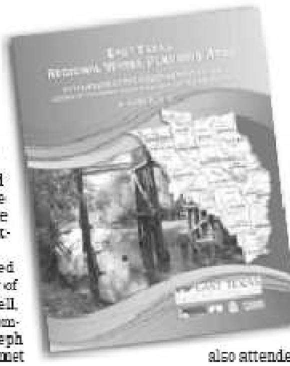
"The TWDB will develop a survey and the planning group will distribute surveys to entities in the region with identified water needs.

The responses to this survey will be included in Chapter 9: Infrastructure Financing Report. Chapter 10 is a summary of public involvement in the planning process and will be completed once all public comments are received," said Mr. Hunt.

The consultant team presented the upcoming schedule for the public comment period and suggested dates for the public hearing.

"The plan is to have one hearing held on consecutive evenings at three locations. This public hearing is another opportunity for the public to submit comments on the 2011 Region I Water Plan," said Mr. Hunt.

The group considered and approved a request to the TWDB to conduct a socio-economic analysis of the impact of not meeting water needs in the region. Temple McKinnon of the TWDB said, "The plan requires a socio-economic analysis be conducted. If the group would like for the TWDB to conduct this analysis, we have to receive a request from the group." ETRWPG Chairman Kelley Holcomb pointed out that the analysis should be conducted considering the specific needs of East Texas. While the model used by the TWDB is the same throughout the state, Ms. McKinnon indicated that it would take into account the needs of the East Texas Region.



The group considered and approved appointments to the FY 2010 executive committee and other committee appointments.

The ETRWPG also approved the addition of a new member of the ETRWPG. George Campbell, chair of the nominations committee, reported that Dr. Joseph Holcomb of Houston County met the criteria to fill one of two small business vacancies.

The group unanimously approved the appointment.

Cherokee County Judge Chris Davis is a member of the group, and he attended the Feb. 17 meeting.

County Attorney Craig Caldwell also attended.

The next meeting of the ETRPWG will be10 a.m. May 12 at the Nacogdoches Recreation Center, 1112 North Street.

For more information, visit www.etexwaterplan.org or call Lila Fuller at (936) 559-2504.

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NOTICE OF PUBLIC HEARING

THE EAST TEXAS REGIONAL WATER PLANNING GROUP 2011 INITIALLY PREPARED REGIONAL WATER PLAN

The East Texas Regional Water Planning Group (ETRWPG) Region I is providing notice that a public hearing will be held to accept written and oral public comment on the 2011 Initially Prepared Plan (IPP) for the East Texas Regional Water Planning area. The public hearing will be held from **5:30 p.m. to 8:30 p.m.** as follows:

Tuesday, April 20, 2010 – Norman Center, 526 E. Commerce St., **Jacksonville, TX**

Wednesday, April 21, 2010 – Nacogdoches County Courthouse Annex, 203 W. Main, **Nacogdoches, TX**

Wednesday, April 22, 2010 – Beaumont Convention Center, 701 Main Street, **Beaumont, TX**

The East Texas RWPG was established under provisions of Texas Senate Bill 1 (7th Texas Legislature) to develop a regional water plan for the East Texas Regional Water Planning Area (TWDB Region I) which includes the following counties: Angelina, Anderson, Cherokee, Hardin, Henderson, Houston, Jasper, Jefferson, Nacogdoches, Newton, Orange, Panola, Polk, Rusk, Sabine, San Augustine, Shelby, Smith, Trinity and Tyler.

Copies of the IPP are available for review at the following County Clerk offices:

Angelina County, 215 E. Lufkin Avenue, Lufkin, TX 75901

Anderson County, 500 N. Church Street #10, Palestine, TX 75801

Cherokee County Clerk, 502 N. Main St, Rusk, TX 75785

Hardin County, 300 Monroe, Kountze, TX 77625

Henderson County, 100 East Tyler, Athens, TX 75751

Houston County, 401 E Houston, Crockett, TX 75835

Jasper County, 121 N. Austin, Jasper, TX 75951

Jefferson County, 1149 Pearl Street, Beaumont, TX 77701

Nacogdoches County, 101 W. Main Street, Nacogdoches, TX 75961

Newton County, 115 Court Street, Newton, TX 75966

Orange County, 123 S. 6th Street, Orange, TX 77630

Panola County, 110 S. Sycamore Street #201, Carthage, TX 75633

Polk County, 101 W. Church Street, #100, Livingston, TX 77351

Rusk County, 115 N. Main Street, #206, Henderson, TX 75652

Sabine County, 201 Main Street, Hemphill, TX 75948

San Augustine County, 100 W. Columbia, Room 106, San Augustine, TX 75972

Shelby County, 124 Austin Street, Center, TX 75935

Smith County, 200 E. Ferguson, Suite 300, Tyler, TX 75702

Trinity County, 162 W. First Street, Groveton, TX 75845

Tyler County, 116 S. Charlton, Woodville, TX 75979

Copies of the IPP are also available for review at the following public libraries:

Kurth Memorial Library, 706 S. Raguet, Lufkin, TX 75904

Palestine Public Library, 1101 N. Cedar St., Palestine TX 75801

Singleton Memorial Library, 207 E. 6th Street, Rusk, TX 75785

Kountze Public Library, 835 Redwood, Kountze, TX 77625

Clint W. Murchison Memorial Library, 121 S. Prairieville St, Athens, TX 75751

J.H. Wooters Crockett Public Library, 709 E. Houston, Crockett, TX 75835

Jasper Public Library, 175 E Water Street, Jasper, TX 75951

Beaumont Public Library, 801 Pearl Street, Beaumont, TX 77701

Nacogdoches Public Library, 1112 North Street, Nacogdoches, TX 75961

Newton County Library, 212 High Street, Newton, TX 75966

Orange Public Library, 220 N. 5th St, Orange, TX 77630

Sammy Brown Public Library, 522 W. College St, Carthage, TX 75633

Murphy Memorial Library, 601 W. Church St, Livingston, TX 77351

Rusk County Library, 106 E. Main St, Henderson, TX 75652

J.R. Huffman Public Library, Hwy 87 N. Hemphill, TX 75948

San Augustine Public Library, 413 E. Columbia, San Augustine, TX 75972

Fannie Brown Booth Memorial Library, 619 Tenaha St, Center, TX 75935

Tyler Public Library, 201 S. College Ave, Tyler, TX 75702

Ethel R. Reese Public Library, 115 Front Street, Groveton, TX 75845

Allan Shivers Library, 302 N. Charlton, Woodville, TX 75979

Copies of the IPP are also available for review on the East Texas Regional Water Planning Group website at www.etexwaterplan.org and at the City of Nacogdoches, Office of the City Secretary, 202 E. Pilar Street, Room 315, Nacogdoches, TX 75961. Written and oral comments will be accepted at the public hearing. Written comments will also be accepted through June 22, 2010 and may be emailed to rhunt@apaienv.com or mailed to the address below:

FOR MORE INFORMATION CONTACT:

Rex H. Hunt, P.E.

Alan Plummer and Associates, Inc.

6300 La Calma, Suite 400

Austin, Texas 78752

Phone: 512.452.5905 or rhunt@apaienv.com

Public hearing scheduled for regional water planning | www.thecherokeean.com | Cherok...

Public hearing scheduled for regional water planning

The East Texas Regional Water Planning Group (ETRWPG) Region I has announced that public hearings will be held from 5:30-8:30 p.m. Tuesday, April 20 at the Norman Center, 526 E. Commerce, Jacksonville; Apil 21 at the Nacogdoches County Courthouse Annex and April 22 at the Beaumont Convention Center. The hearings are being held to accept written and oral public comment on the 2011 Initially Prepared Plan (IPP) for the East Texas Regional Water Planning area.

The East Texas RWPG was established under provisions of Texas Senate Bill 1 (7th Texas Legislature) to develop a regional water plan for the East Texas Regional Water Planning Area (TWDB Region I) which includes the following counties: Angelina, Anderson, Cherokee, Hardin, Henderson, Houston, Jasper, Jefferson, Nacogdoches, Newton, Orange, Panola, Polk, Rusk, Sabine, San Augustine, Shelby, Smith, Trinity and Tyler.

Copies of the IPP are available at the county clerk's offices in the participating counties and county libraies including the Singletary Memorial Library in Rusk.

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April 18, 2010

Tyler Paper

Public Input On Water Plan Requested
By KELLY GOOCH

Staff Writer

JACKSONVILLE -- Officials with the East Texas Regional Water Planning Group Region I are seeking written and oral public comments on the 2011 Initially Prepared Plan for its regional water planning area.

The ETRWPG, a regional entity of the Texas Water Development Board, is responsible for putting together a regional water plan for multiple East Texas counties, including Angelina, Anderson, Cherokee, Hardin, Henderson, Houston, Jasper, Jefferson, Nacogdoches, Newton, Orange, Panola, Polk, Rusk, Sabine, San Augustine, Shelby, Smith, Trinity and Tyler.

Members of the public can give input on the group's plan at a public hearing next week.

The hearing is scheduled for 5:30 to 8:30 p.m. Tuesday at the Norman Activity Center in Jacksonville, 526 E. Commerce St.; Wednesday at the Nacogdoches County Courthouse Annex in Nacogdoches, 203 W. Main St.; and Thursday in Beaumont at the Beaumont Convention Center, 701 Main St.

"The planning process is designed where there is public input, and this is one of the opportunities for the public to voice their opinion and get involved in the process," said Lauren Gonzalez, with the regional water planning consulting team Alan Plummer Associates.

Ms. Gonzalez said the IPP looks at water supply in the region and compares those numbers to water demand.

From that, the group can establish what water needs will be in the next 50 years.

"Generally speaking, as we go forward in time, population in the state of Texas is expected to double and, as a result, we're going to have to spread the water resources around to an ever-increasing population," ETRWPG Chairman Kelley Holcomb said. That "means it is vital the water providers use this planning process to meet the demands of a growing population. Essentially, that is what the water planning process is all about."

Lake Columbia, a proposed regional water supply project, is one of the items in the regional water plan.

The lake is projected to be 10,000 surface acres and about 14 miles long, with the dam site about 2 miles east of Jacksonville.

Its anticipated yield is 85,507 acre-feet annually for use by water supply customers.

The IPP "talks about what the plans are and where it stands right now in the planning process ... and with participants," Ms. Gonzalez said.

She said the plan also looks at population projections through 2060.

Those population projections are based on Texas Water Development Board guidelines and helps the ETRWPG determine what water demands will be, she said.

Additionally, the plan contains information on steam electric power demand and Lake Fastrill -- a reservoir the city of Dallas had planned to build in the same area as the Neches River National Wildlife Refuge.

In February, U.S. Supreme Court justices rejected petitions for writ of certiorari from Dallas and the Texas Water Development Board, which had been filed in efforts to appeal a March 2009 ruling in favor of the refuge.

The ETRWPG already was finished with the plan when the ruling came down, so Lake Fastrill remains part of it.

Ms. Gonzalez said that once the IPP public comment period closes, group members will respond to all of the comments they receive, and those that are deemed appropriate can be incorporated into the plan.

The final adoption of the IPP is expected to take place in mid-August so it can be submitted to the Texas Water Development Board by Sept. 1.

For those who can't make it to the public hearing next week, there are other opportunities to view the document.

Copies of the IPP are available at county clerk offices in the group's coverage area and at local libraries, including the Palestine Public Library and the Tyler Public Library.

Copies are also available for review on the East Texas Regional Water Planning Group website, www.etexwaterplan.org

Written comments will be accepted through June 22 and may be e-mailed to rhunt@apaienv.com or mailed to Rex H. Hunt, P.E. Alan Plummer and Associates, Inc., 6300 La Calma, Suite 400 Austin, TX 78752.

For more information, call 512-452-5905.

The Daily Sentinel

Group seeking public input on water plan

Posted: Wednesday, April 21, 2010 2:00 am | Updated: 10:18 pm, Tue Apr 20, 2010.

Erin McKeon |

Nacogdoches County residents will have a chance tonight to comment publicly on the East Texas Water Planning Group Region I 2011 Initially Prepared Regional Water Plan, which outlines the projected water use in East Texas for the next 50 years, officials said.

The meeting is from 5:30 to 8:30 p.m. in the Nacogdoches County Courthouse Annex at 203 S. Main.

The plan includes demands in the region, cities, water development boards and more and compares them with the supplies, whether groundwater or surface water, to make sure the demands are met, said Rex Hunt, the project manager for the consulting team on the project.

"They meet every five years and produce a regional water plan that, once it's finalized, goes to the state," he said. "Then the state plans a statewide water plan based off the regional plans altogether."

The planning group also meets with all the entities in the area to develop alternatives that might be used to meet the shortages.

"It's really a night for public comments ... to hear from the people for whom the plan is prepared," he said. "This is a local plan, and we encourage people to participate in that process as much as possible."

Copies of the water plan are available for review at the Nacogdoches County Clerk's Office, 101 W. Main, and in the Nacogdoches Public Library, 1112 North Street.

Copies are also available for review at www.etexwaterplan.org.

Written and oral comments will be accepted at the public hearing, and written comments will be accepted through June 22 and may be e-mailed to rhunt@apaienv.com or mailed to Rex H. Hunt, P.E., Allan Plummer and Associates, Inc., 6300 La Calma, Suite 400, Austin, Texas 78752.

Erin McKeon's e-mail address is emckeon@dailysentinel.com.

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Daily Progress, Jacksonville, TX

April 21, 2010

Region water plan presented

Nathan Straus
Jacksonville Daily Progress

JACKSONVILLE — The Region I water planning group presented its plan for the region to Jacksonville Tuesday evening. Jacksonville Public Works Utilities Director David Brock said the plan covering an area of most of East Texas was presented in the form of a public hearing.

"This is the plan for ensuring the region's water needs are met," Brock said. "A public hearing was held to determine if anyone had any comments about it."

Brock said though the meeting at the Norman Activity Center was open to the public, only the planning members and their spouses attended.

Public Works Director Will Cole said the meetings, which will be repeated throughout the rest of the large region, don't often bring a lot of people in.

"These are not hot button issues," Cole said. "Our region's water supply is in good shape. There is less demand and more water."

Cole also said the public hearings for the plan such as those conducted in Jacksonville and Nacogdoches are required by law.

Brock said the water plan deals with a lot of information put out by the Texas Water Development Board, such as the population of the region in question and the demands of the area.

"We make a plan to see if the water needs are met," Brock added. "The water needs are varied."

He added some of the issues facing Region I's water supply involve the city of Dallas and its water needs coming from Lake Palestine and negotiations about where the water in Region I goes. He also said Dallas has around 60 percent of the water rights to Lake Palestine and, once the city of Dallas installs a pipeline to the lake, will begin using a great deal of the lake's water.

"It's about ensuring Region I has enough water to ensure its growth and its industries," Brock said.

Brock also said all 16 of the state's water regions go through the same process of completing a water plan, holding public hearings on it and submitting it to the water development board.

The process, he added, started when the finished plan was accepted to go to public hearing on Feb. 17. From there the plan travels through the region as citizens are given a chance to comment on it either orally or by written means. The plan is then submitted to the water development board. Brock said it must get there by May 22.

“If they have any questions the plan will be presented back to us,” he added. “If all goes well the plan should be accepted by 2011.”

Cole said the water regions were established by the Texas legislature and are regulated so they do not come into conflict with each other.

Any wanting more information about the region or commenting on the water plan may contact a Region I consultant, Rex Hunt, by e-mailing him at rhunt@apaienv.com.

Cole added the region’s water plan information is available at the county courthouses within the region.

Attendance sparse at water planning meeting

Posted: Thursday, April 22, 2010 2:00 am | Updated: 9:56 pm, Wed Apr 21, 2010.

Erin McKeon |

Either East Texas folks aren't interested or they really trust the water planning board that's making decisions 50 years into the future, officials said following Wednesday's public hearing in Nacogdoches in which none of the mere handful of residents chose to comment.

The public hearing of the East Texas Regional Water Planning Group Region I for the 2011 Initially Prepared Regional Water Plan, one of three such hearings in the region, brought low attendance, said Temple McKinnon, the Texas Water Development Board's project manager over the Water Resources Planning Division in Austin.

Meetings in the Houston area region had a higher turnout because of a controversial project that would effect the area, but San Antonio area region meetings brought small crowds also, McKinnon said.

The water plan, which includes demands, supplies and shortages in the region from municipalities, agriculture, industry and other water user groups, is part of a statewide plan for the next 50 years, said Rex Hunt, the project manager for the consulting team on the project.

"It's kind of like government for the people, of the people, by the people," said Kelley Holcomb, the Region I Planning group chair. "Well, this is water by the water professionals and we're providing for the public - and to not have any public input certainly doesn't complete the process."

The 2011 plan is updating the 2006 plan with regard to new industrial projects, mining projects, population demands, irrigation demands and steam-electric water demands, Hunt said.

The water planning group, which meets quarterly each year, had more public comments and input in previous years when people weren't sure what was going on, Holcomb said.

The East Texas Region does have a projected water shortage of 179,300 acre feet per year scattered throughout the region. But while that's a significant number, it's nowhere near the deficit other regions are facing, Hunt said.

"I think this region is very fortunate in the amount of water it has," he said.

Ways to correct or compensate for the shortage might be to dig wells, build reservoirs or simply funnel the water from outlying areas to those in need, said Mike Harbordt, who is a member of the water planning group.

"It's not that the water's not here, it's just not developed in some areas," he said.

There is a final meeting for public comment Thursday at the Beaumont Convention Center, 701 Main St. from 5:30 to 8:30 p.m.

The final plan will be submitted in September, and the water development board will use the plan to compile the statewide water plan.

Copies of the water plan are available for review at the Nacogdoches County clerk's office, 101 W. Main, and at the Nacogdoches Public Library, 1112 North St.

Copies are also available for review at www.etexwaterplan.org.

Written and oral comments will be accepted through June 22 by e-mailing rhunt@apaienv.com or by mailing Rex Hunt, P.E., Allan Plummer and Associates, Inc.,

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Appendix 10-B

Public Hearing Transcripts

A fundamental element of the planning process is input from the public. A public hearing was scheduled to provide the public with a forum to comment on the IPP. The public hearing was held on three consecutive days in three cities in the upper, central, and lower portions of the ETRWPA. Provided in this appendix are transcripts from the public hearing in the following cities:

- April 20 – Jacksonville, Texas
- April 21 – Nacogdoches, Texas
- April 22 – Beaumont, Texas

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EAST TEXAS REGIONAL WATER PLANNING GROUP

PUBLIC HEARING

APRIL 20, 2010

JACKSONVILLE, TEXAS

5:35 P.M.

COPY

MR. HOLCOMB: Okay. I have 5:35. I'd like to go ahead and call this public hearing to order. We don't have much of a turnout tonight from the general public, so I think I would like to deviate somewhat and have us go around the room and introduce ourselves. And the reason for that is that everyone here is either with Region I or a resource agency, so I think it's important to have that documentation for the record.

My name is Kelley Holcomb. I'm the chair of Region I, Regional Water Planning Group. So I'd like to go ahead and start. I introduced myself. Rex, go ahead.

MR. HUNT: My name is Rex Hunt. I'm with Alan Plummer Associates located in Austin, Texas and we are part of the consulting team for the Region I.

MS. GONZALEZ: I'm Lauren Gonzalez. I also work for Alan Plummer Associates on the consulting team.

MR. HOLCOMB: We'll let you introduce yourself, Terrie.

MS. GONZALEZ: I'm Terrie Gonzalez with the Cherokeean Herold Newspaper in Rusk.

MR. HOLCOMB: Worth?

MR. WHITEHEAD: I'm Worth Whitehead. I'm from Henderson. I'm a member of the board of Region I.

MR. HOLCOMB: Jackie?

MS. HARPER: I'm Jackie Harper and I'm Mike's traveling companion.

MR. HARPER: I'm Mike Harper, Region I.

MR. BLANCHARD: Paul Blanchard, with the Northwest Bank out of Vancouver, Washington.

MR. BOOKOUT: Lann Bookout with the water public work planning group.

MS. KIEL: I'm Simone Kiel. I'm with Freese & Nichols. I'm on the consulting team.

MR. KIEL: I'm Dave Kiel. I'm Simone's traveling companion.

MS. MCKINNON: Temple McKinnon. I'm with the water development board.

MR. SHANK: Monty Shank. I'm with Region I.

MR. BROCK: David Brock with Region I.

MR. HOLCOMB: And Stacy?

MS. CORLEY: Stacy Corley with the City of Nacogdoches.

MR. HOLCOMB: Thank you, ma'am. I think that takes care of all of our introductions.

David, since I don't see anyone from the city here, you're representing the city as well tonight. If you would, thank the city manager and the mayor for allowing us to use the facilities tonight. We do appreciate it. Our funds are limited, so all the free gratis we can stand is always good.

For any of you, the restrooms are out this way. We have no elected officials here tonight. I'd like to remind everyone to sign in.

If you're a member of the general public, if you would like to speak, we have a comment sheet that we would like you to fill out so that we can have a record of your attendance and as well a record of your comments or at least generally what you're wanting to talk about.

I would like to remind everyone that we will be receiving written comments on our draft -- 2010 draft regional water plan until June 22nd, correct, Lauren?

MS. GONZALEZ: Yes, sir.

MR. HOLCOMB: So you can make those comments in writing to Rex Hunt. We'll provide information to any of those that request it.

Again, we don't have a very big crowd tonight, so we're probably not going to go through the formal process.

Sir, no comments? We'd let you. We'd be happy for somebody to comment.

All right. Well, at this time, I am going to suspend the rest of the introductions and activities and make a call for public comments. Do we have anyone wishing to speak, Stacy?

MS. CORLEY: No.

MR. HOLCOMB: No? Do not have any members of the public at this time who are wishing to speak.

Any comments from the planning group members? Last call for a request to make a public comment.

Hearing none, we'll recess this meeting. We will recess it to the City of Nacogdoches at the parks and rec facility tomorrow night 5:30 where we will reconvene this public hearing. We'll do so -- we'll recess that meeting and reconvene in Beaumont. If any of you need this information, we've got lots of details in the back.

Thank you. You-all have a good evening.

(End of Proceedings.)

05:40 THE STATE OF TEXAS

COUNTY OF CHEROKEE

I, Liesa Kliman, Certified Shorthand Reporter in and for the State of Texas, do hereby certify that the above and foregoing contains a true and correct transcription of my shorthand notes taken during the Public Hearing on April 20, 2010.

WITNESS my hand on this 30th day of April, 2010.

05:40

LIESA KLIMAN, CSR#2248
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EAST TEXAS REGIONAL WATER PLANNING GROUP

PUBLIC HEARING

APRIL 21, 2010

NACOGDOCHES, TEXAS

5:55 P.M.

COPY

MR. HOLCOMB: I'd like to go ahead and call the public hearing to order. It is 5:55. I do apologize for starting late, but we are all waiting around waiting for the public to come join us.

As I understand in talking around the room tonight, we don't have anyone that wants to make public comments. We're looking for a dry run on the activities tonight. We had same turnout last night. No one showed up, no one wanted to make comments, so we want to have a dry run tonight.

We have no elected officials in the room? No? Planning group members -- oh, I'm sorry. Judge --

JUDGE BLANCHETTE: Blanchette.

MR. HOLCOMB: I'm sorry. Judge Blanchette from Tyler County. Forgive me.

I want to go around the room and acknowledge the regional planning group members and I'll start with me. My name is Kelley Holcomb. I'm chair of Region I planning group. Duke?

MR. LYONS: Duke Lyons, City of San Augustine.

MR. HARBORDT: I'm Mike Harbordt, Region I.

MR. DAVID: Josh David, Chester, Texas.

MR. YOUNG: I'm Leon Young. I live here in Nacogdoches.

MR. CAMPBELL: George Campbell, Nacogdoches.

MR. HOLCOMB: Thank you all. I would like to remind you, if you would like to sign in so we have a record of your attendance. Again, we -- if you're planning on making a public comment, there is a comment sheet we would like you to fill out so we can have a record of what you would like to comment about. I would also like to remind you that written comments can be submitted to the planning group until June 22nd of 2010.

Rex Hunt with Alan Plummer Associates will be making a presentation in a few minutes and will give you some more information on that, on where to submit those.

We're here tonight to receive public comments, not necessarily to discuss the plan. As I alluded to a moment ago, Rex Hunt is going to be making a brief presentation. I can assure you that we're going to break with tradition since we have some students with us tonight. Jeri, I forgot to mention you, shame on me, with Lane Christian's office. We're going to break from tradition tonight and do a little bit of discussion and so forth just to help you-all understanding what we're talking about, regional planning. That is a good thing because most people do not know what we do and do not know why we're here.

So in lieu of any public comments you're wanting to make, we'll take care of those activities.

The order of events tonight are that Rex Hunt is going to give us a short presentation. We will recess this meeting tonight and we'll reconvene tomorrow night 5:30 in Beaumont, Texas to have our third in a series of three public hearings.

When we start the public comment portion of the meeting, we will basically follow a standardized process. I'll call your name, you come to the podium. When you state your name for the record, your three minute time limit will begin. We would also like you to state any organization or affiliations that you have.

Once we -- Lila will be our timekeeper, by the way. Once we start that countdown of three minutes, when you have one minute remaining, Lila will hold up a card stating that you have one minute remaining. When your time has expired, she'll hold the card time expired. We would ask that you acknowledge that and respect the process and take your seat. We'll continue on until we've taken all the public comments that are desired to be presented and then we will recess the meeting promptly at 8:30, if not sooner.

So with that, I want to introduce Rex Hunt. Rex Hunt is with Alan Plummer Associates. Alan Plummer Associates is the lead firm providing consulting services to the planning group, and he will go through a short presentation for us. Rex.

MR. HUNT: Thank you. Good evening, everybody.

I am going to give a short presentation and I think anybody that's on the water planning group could probably give this same presentation. Because as I was telling Dr. Young earlier that this -- I've only taken slides from previous presentations and brought them together, so pretty much it's all stuff that we've seen before. But for those of you who haven't been a part of this, maybe this will be not too boring.

Just a quick note on the regional water planning process. In Texas, water planning is done by region rather than at a state level. The state is divided back in -- just in the turn of the century and divided the state into 16 different regions. Region I is one of those. You can see this slightly squashed map here. I didn't adjust my thing here. It's slightly squashed.

You can see the shape of the region here in East Texas is basically everything from Tyler down to Beaumont among the eastern boundary of the State of Texas, from pretty much the Trinity River over. It includes both the Neches and Sabine watersheds in East Texas. So this region, along with the other regions, every five years does an update on their regional water plan. This is the second update, the third incarnation of the plan.

What you have with you today is the executive summary from that draft plan and a couple of other tables. The entire plan -- there's a copy of the entire plan over here if you want to see that. I've got another copy over here if you want to see it afterwards. It's fairly thick. But at any rate, it's just one of the 16 plans that are coming together for the state.

Tonight I want to talk just a little bit -- give you just a brief description of the 2011 or what we call the Initially Prepared Plan or the IPP, and then talk a little bit about the updates of this plan since 2006. I want to talk about the tasks that we have remaining to be done to complete this process and then a quick schedule and milestones here for the rest of the plan.

This is what we call an off census cycle. The first plan that was done used population data from 2000 census that had just been done. Since then we've used that same data trying to update it as the -- as we could between census -- between the census taking. But it's not as good as having the real data, so at this next incarnation in the next five years, the census that we're taking now will be fairly new information and we'll update populations more in a greater way than what we've done for this plan.

This plan is just really an update. That's not to say that we haven't done a lot of work, but we have tried to minimize the amount of work in preparation for this next cycle.

There were some studies that were done prior to this -- to this process back in 2008. There was one on small systems and one on some industrial applications down in the Port Arthur area, and another study on the Toledo Bend pipeline project. And these are all special studies that have been incorporated into this update.

The plan includes ten chapters, and you can see a discussion of those in the executive summary. I'm not going to go through all of these, the names, but basically the first chapter is a description of the region, the second chapter discusses the demands, the water demands in the region, the third chapter goes into supplies that are available, and then in the fourth chapter, which is really kind of the guts of the whole plan, tries to bring the demands and the supplies together to see where the shortages are. And then we work on developing strategies to meet any shortages that we identify.

The rest of the chapters after Chapter 4 -- 5 through 8 are various discussions of different aspects, environmental issues and conservation issues and issues related to the -- whether the plan meets the regulations or not. So I'll go through those as we get to them. And then the last two chapters actually have not been done yet. The infrastructure financing and recommendation has to be completed with the survey that's being done now. And then Chapter 10 is -- is just where we gather all the information about things like this meeting tonight, the public participation process.

So as I said, Chapter 1 is the general

description of the region. What we've done is updated the descriptions of the watersheds and ground water resources in the region, updated some of the wholesale water providers and that sort of thing. We've changed -- changed a lot of numbers in this plan. It's just a process of getting everything right. There's always things that need to be changed. We've updated the maps. But there's nothing really massive about the change in Chapter 1.

Chapter 2, which was the demand. This is where we look at for the next 50 years what the water demands for the various water supply entities, cities, water supply corporations, water authorities in the region, where those -- where those demands are.

What we've done in this plan is after looking at everything, we've increased steam electric demands in Angelina County for a proposed power plant there. We added some new water user groups, what we call WUGs, water user groups in Angelina and Nacogdoches County. These are small systems. They were there before, but they have to be a certain size before we actually start identifying them individually. So these are ones that have grown.

We've changed the manufacturing demands for Angelina County and Jefferson County. We've reduced irrigation demands for Hardin and Jefferson Counties. In other words, we found after talking to some of the water providers in these regions that they weren't providing as much irrigation water in these two counties as we thought they were, so we made those adjustments. And then we've added or increased new -- or provided new mining demands for Angelina, Cherokee, Nacogdoches, Shelby and San Augustine counties.

These are primarily -- these new demands for mining are primarily associated with the natural gas drilling that's going on in East Texas. The shale -- I don't know the name of the shale, but there's a shale formation here that they are using water to fracture the formation, so we've added some demands in these counties to account for that.

Chapter 3, this is where we look at the supplies, the surface water supplies and the ground water supplies in the region. The handout that you have has some graphs that show some of the -- has a summary of all the ground water and surface water supplies in the region. We've updated those numbers.

We've assessed impacts of water quality on these supplies in the region. We've discussed the affects of environmental flow policies. And I can go into that in more detail later. We're starting to have to look at environmental flows, the flow that's left in the river, in more detail now. And we've refind the ground water availability based on water quality and geographic restrictions in the region.

Chapter 4, again, this is where we bring the demands and the supplies together. You look at who's got water and who doesn't have water over the next 50 years. And where there are shortages, we've tried to identify water management strategies that will meet those shortages. In other words, in 2030 if a particular town shows that they're going to start having a shortage in water in that period, we start looking at, well, maybe they could drill another well, maybe they could bring in some surface water from somebody else, maybe they could purchase water from a larger city. Those are different water management strategies. So this is where we bring those together.

Haven't been a lot of changes in that in this update, but we did identify 68 water user groups that have needs. We have a total shortage in 2060 of approximately -- well, not quite 180,000 acre feet per year. That's scattered throughout the region. And we found some new mining shortages now that we've identified some new mining demands, and some water user groups that no longer have needs were identified, and we took those off as far as having shortages.

Just a word on this 180,000 acre feet of shortage. That sounds like a lot of water. It is a lot of water. But I was at a meeting with Region H, which is the Houston area, and their shortages are huge compared to here, so I think this region is very fortunate in the amount of water that it has.

Some other changes to Chapter 4. We've updated a list of water management strategies under each category. We've removed a -- some reuse opportunities in Athens because they've decided they're not going to do that. And we've added -- we said we added Fastill two new reservoirs. I probably should have taken that off because Fastill probably will be coming out of the picture here. So that's one of the things that we have added in there right now.

And then other changes. The cost of water management strategies were updated. We have to do costs for all these water management strategies. So we updated it to September 2008, the cost levels, and provided new strategies for water user groups with needs and developed new strategies for what we call wholesale water providers. And those are typically large providers that provided water to other cities or other industries or entities on a wholesale basis.

Chapter 5 -- as I said, after Chapter 4 we get into some of the more specifics of the plan. Chapter 5 talks about the impact of water management strategies and water quality and impacts of moving water from rural areas into urban uses. And not many changes in this chapter. We've expanded the discussion of some of these impacts on water quality, provided some new tabular information and updated descriptions of these impacts of moving water from rural areas.

In East Texas, there's a lot of water. There's not a lot of impacts that we've seen from moving water from agricultural uses into urban areas. That typically is a problem -- gets to be more of a problem in the dryer areas.

Chapter 6 has to do with water conservation. Water conservation is an important concept in making sure that we have enough water. It's not the only thing we do, but it is -- it is an important strategy for insuring a sufficient amount of water. So this chapter talks about water conservation that's being done in this region.

We've updated the water users that are required to submit water conservation and drought contingency plans. That's a requirement pretty much of all the water user groups in this region.

We've updated conservation strategies. We have to do a tabulation of the different strategies that are being used. We have to do a tabulation of the triggers for drought contingency. In other words, a trigger is what causes you to go into a particular drought contingency. You know, when they tell you to quit watering your lawn because it's dry, those are different triggers that happened. So we had to update those in the plan. And we included the results of this special study concerning water conservation trends in the -- that ETRWPA -- that stands for East Texas Regional Water Planning Area.

Chapter 7 is just the chapter where we look at how the plan is consistent with the protection of water resources in the state. There are several issues that we have to look at. There's very few changes in this chapter from the 2006 plan. We've just updated the text. We've looked at modifying regulations to make sure that we're still in compliance with the new changes to the regulations. And so that's pretty much all we did in this chapter.

Chapter 8 has really three things it looks at. One issue, the extreme segments; another issue, unique reservoir sites; and the third is legislative recommendations that we end up sending to the state representatives for them to consider.

The Regional Water Planning Group elected to not identify any unique stream segments in the region in this round and made no recommendations for new unique reservoir sites either, so that's pretty much as it was in the last plan, so we've made no real changes there.

We also updated and provided new legislative recommendations bringing those forward. We used some of the ones from last time that haven't been acted on but had a few additional ones from the -- since the previous plans. And I think that those are all summarized in the handout as well.

Chapter 9 is the infrastructure financing report. What we're doing now is we're preparing to do a survey of the water users in this -- in this area to see what kind of financing they are intending to use, what kind of financing needs they have in the next -- in the planning horizon. And this survey will be used to bring back into Chapter 9 to summarize these issues related to financing.

This is important for the water development board because they provide a lot of the money that is out there to help make improvements to water systems. And so this is important information for them.

And so that chapter, obviously, can't be finalized at this point. It will be done during this process of finalizing this draft plan.

And, finally, as I said, Chapter 10 is just a compilation of all the public input. We will summarize all of the public comments. If you were to make comments tonight, those would be summarized and responded to in the plan. If you make written comments or if I get written comments from anybody, we will respond to every comment that comes in and try to consider those comments and how they might affect the plan. And we will bring all that back to the Regional Water Planning Group for their consideration as well.

So the remaining tasks, as I said, is this infrastructure financing survey and to receive public comments from citizens, from agencies, such as other cities and other water user groups, and from other state agencies as well, and also comments from the water development board. Lann said there was nothing wrong with it. And we will -- as I said, we'll include all these responses in Chapter 10.

Just some dates here. The public comment period for citizens to comment, the period lasts from March 15th through June 22nd. The water development board will be commenting through the end of June or almost the end of June. Other public agencies have until July 14th to comment. And so we'll bring all of these written comments together.

And in July and August we will be working with our technical committee, and Dr. Harbordt here is the chairman of the technical committee for the Regional Water Planning Group. We will be working with them to work out, you know, what changes we might need to make to the draft plan to respond to these comments.

And then we will finalize the plan during July and August. On August 12th, the Regional Water Planning Group will meet and hopefully adopt the plan. If they don't, I don't know what I'm going to do. And then by -- we will make any final changes. And on September 1st, we intend to submit this plan to the water development board for their final review and finishing up.

So with that, it's public comment time. If any of you have decided you would like to make comments, you're welcome to do so. It's your turn.

MR. HOLCOMB: Thank you, Rex.

At this time I'd like to enter into our public comment portion of the meeting. Because we're a small crowd and you're all over here, if you have -- does anyone have any public comments that they would like to enter into the record? No? Okay.

JUDGE BLANCHETTE: How about questions?

MR. HOLCOMB: No, sir. The public comment period is to receive comments from the general public. What we will do is we are now going to take a very long break and we will go into a one-on-one where we'll be happy to answer any questions that you might have. Thank you.

(Recess from 6:18 to 7:02.)

MR. HOLCOMB: It's 7:00. I'm going to call the meeting back to order, the public hearing back to order.

We have last call for public comments. Last call for public comments. Hearing none, I'll declare this meeting recessed. We'll reconvene this meeting tomorrow night 5:30 at the Beaumont Convention Center in Beaumont.

Thank you. You-all have a nice night.

(End of Proceedings.)

THE STATE OF TEXAS

COUNTY OF NACOGDOCHES

I, Liesa Kliman, Certified Shorthand Reporter in and for the State of Texas, do hereby certify that the above and foregoing contains a true and correct transcription of my shorthand notes taken during the Public Hearing on April 21, 2010.

WITNESS my hand on this 30th day of April, 2010.

Liesa Kliman

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EAST TEXAS REGIONAL WATER PLANNING GROUP

PUBLIC COMMENTS HEARING

REGION I

APRIL 22, 2010

BEAUMONT, TEXAS

REPORTED BY:

Cristy Burnett, CSR, RPR

Certificate No. 3568

Orange County Courthouse

801 W. Division

Orange, Texas 77630

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COPY

(APRIL 22, 2010 - 5:32 P.M.)

MR. HOLCOMB: Good afternoon -- evening. Glad to be here in Beaumont tonight. I would like to go ahead and call this public hearing to order at 5:32. I want to thank you all for coming. We are here tonight to receive comments -- public comments on our 2010 Draft Region I Water Plan. I did not have any elected officials, that I know of, that came into the room.

Again, it's a small crowd. So, I'm going to deviate just a little bit. I want to introduce everybody in the room and have you introduce yourself. We've got several planning group members here tonight. We'll start with him, Scott Hall. Stand up. Everybody knows you. I know they all know you already. Thank you.

Darla Smith. Thanks, Darla.

And myself.

MR. HARREL: Let's have what these people do when they introduce themselves. It don't do much good just to get a name.

MR. HOLCOMB: Scott Hall and Darla, both, are members of the Region I Planning Group. Scott's the general manager for the Neches Valley Authority and Darla works for --

MS. SMITH: Chemical plant.

MR. HARREL: Which one?

MS. SMITH: Does it matter?

MR. HARREL: Yes.

MS. SMITH: Why?

MS. HARREL: I just want to know.

MS. SMITH: BASF. I'm just giving you a hard time.

MR. HOLCOMB: Represents Industry for the planning group.

MS. SMITH: I represent everybody.

MR. HOLCOMB: So, we also have members of the Texas Water Development Board here tonight, Lann Bookout, who is our representative, our -- Texas Water Development Board. We also have Temple McKinnon from the Texas Water Development Board. And we also have Terry Stelly. Terry is with Texas Parks & Wildlife. Everybody knows him, as well.

I also want to introduce Rex Hunt. Rex Hunt is the principal for Alan Plummer Associates. Alan Plummer Associates does the work -- the bulk of the work for the Region I Planning Group.

We also have Lila Fuller. Lila Fuller works for the City of Nacogdoches, and she represents our administration with regard to the planning group. She takes care of making sure we all get to where we need to go, when we need to be there, and has the right information upon our arrival.

With that being said, I would like to remind everybody to sign in. I know most of you have. It's a small crowd tonight. If you do wish to make a public comment, we have a form that we would like you to fill out. We only have one comment at this time -- or one individual wishing to make a public comment at this time. We will be receiving public comments, written public comments through June 22nd of this year when Rex goes through his presentation. He will have an address for you to send those written comments in to.

Also, we would look to remind everyone that we're here to receive public comments tonight. This is our opportunity to hear from you. It's not a question and answer type event, and that we will be following the standardized three-minute rule for public comments. When we get to that portion of the event, I'll call your name. Once you come up to the microphone in the middle, you'll have three minutes. State your name for the court reporter so we can get that on the official record. State your affiliation, organization affiliation, if you have one. When you are down to one minute remaining, Lila Fuller will hold up a card, "one minute remaining." When your time expires, she'll hold up a card, "time expired." We would ask you to respect that process and move on and allow other individuals to make their comments.

With that being said, we're going to move on. We're going to have a short presentation from Rex Hunt regarding a brief overview of the water plan. And then we'll move into the public comment portion of the hearing. Rex?

MR. HUNT: I'm going to operate from over here. Every place we've gone, the facilities have gotten better with each night; but each one you have to do a little bit differently. So, this one I get to do it from here. And Lila has promised she'll hold up the "time expired" if I go too long. So, I have -- hopefully she'll give me more than three minutes, but it shouldn't take too much longer.

I think that most people here are quite familiar with the planning process, but some of you aren't. So, what I'm going to do tonight is a brief overview of this process that we've gone through, primarily pointing to some of the changes we've made in the plans since the last time. And then, as Kelley was saying, comments are welcome.

We do have this handout that I think most of you have gotten, which is the executive summary of the plan. There is one copy of the plan outside on the table if you want to look at that. And there's also on the East Texas Regional Planning web site there's a copy of the plan if you want to look at it electronically.

The agenda for tonight, we're going to talk about -- I'm going to give, as I said, a brief description of what we call the 2011 Initially Prepared Plan, that's region water planning speak for draft plan, and the updates to that plan since 2006, which is the last time we did that. And then we'll talk about the remaining tasks that we have left to do this plan -- planning process and then the plan development schedule and milestones that are coming up.

Before I launch into this too much, let me just say briefly that the planning process in Texas, the water planning process in Texas is a regional process now. It used to be done at a state level, but they've now broken the state into regions. And one of those regions -- let me back up here. You can see this map of East Texas, basically; and that red line encompasses the Region I. It's 20 some-odd counties and it covers basically the eastern boundary of Texas over to pretty much the Trinity River. So, that includes obviously the Neches River Basin and the Lower Sabine River Basin, as well.

This 2011 update is -- it's the third incarnation of this plan. It's the second revision of the original plan that was done ten years ago. It's what we call an off-census site. In other words, we are taking this census data from 2000 and without really making a lot of changes to it -- obviously, we don't have any new data yet. They have just done the census. So, we have done the basic update through the Texas database -- population database but nothing more than that for the population changes. That's caused a few problems with people because there's obviously some cities out there who think that their population is different, probably is, than what the State shows. But we're not going to try to address all of those problems until this next cycle.

The planning horizon we're looking at is 2010 through 2060, a 50-year planning horizon. And in this cycle -- this off-census cycle, the changes were intended to be limited to some basic updating of water management strategies and demands and supplies and that sort of thing. There are ten chapters in this plan, and I'm going to briefly go through each one of them and talk about the changes.

The first chapter is a description of the region. It provides just the general physical and economic description of this East Texas region as it is today. It talks about groundwater and surface water.

Chapter 2 is the population and water demand projections. This is where we talk about what the demands in the region are for water from cities, from water supply corporations, from wholesale water providers. People who need water out there, we get these demands put into this chapter.

For municipal demands it's based on the population projections; but then there's other categories of water usage, as well, industrial and -- industrial irrigation and so on and so forth.

Chapter 3 is the chapter where we look at the supplies in the region, groundwater and surface water supplies.

Chapter 4 is where we take those supplies and demands that we looked at in Chapters 2 and 3 and we marry those together and come up with what the shortages are in the region. And there are shortages in the region. There's a lot of water in the East Texas region; but in any particular location, there will be shortages. And if you look at this handout that you've got, there's a graph in there that does a pretty good job of showing out the region overall has plenty of water but not all of that water is developed yet so that there are shortages in particular places.

So, those first four chapters are really the guts of this plan. The Chapters 5 through 10 provide important information, but they are ancillary issues to the overall planning process.

Chapter 5 is where we look at the impact of water management strategies and water quality and the impacts of moving water from rural areas into urban areas.

Chapter 6 we look at water conservation throughout management strategies in the region. Every entity in the region of any size has to have a water management or a conservation plan and a drought management plan. So, we look at what those plans are in this chapter.

Chapter 7 is where we review the plan that we put together and determine its consistency with protecting the natural resources in the State -- or the region, anyhow, and its consistency of the plan with the regulations.

Chapter 8 we look at extreme segments, unique reservoir sites, and then legislative recommendations that the Region Water Planning Group would like to make for the Legislature to consider in the interim before the next planning site.

Chapter 9 is the chapter we call infrastructure financing recommendations and it's -- all of this water planning -- all of this implementation of water management strategies costs money; and so, this infrastructure financing chapter, we go out to the various cities and try to determine what kind of financing needs they have. And that's all information that goes back to the Board and they use that to help them make their plans for financing in the future.

And then finally Chapter 10 is just a compilation of all the public input that we have that -- you folks that are here that make comments, all of those comments get put into this plan and responded to, written comments will get put into the plan. So, this chapter just kind of describes that process and describes our responses to comments.

So, going through the -- briefly through the chapters: Chapter 1, Description. We really have just updated the description of the region. We changed some numbers for supplies where we needed to. We've updated the maps, tried to improve on those a little bit and we've included information that -- compiled by the Water Development Board from their water moss pods that they do periodically.

Chapter 2, again, this is the demand chapter.

In this region, in this cycle, we've increased steam-electric demands in Angelina County on the basis of a proposed power plant in that region -- in that county. We've added water user groups -- that's the WUGs there -- in Angelina and Nacogdoches County. Now, these are water user groups. They were there before, but they've grown large enough to actually be named specifically. We've made changes to manufacturing demands in Angelina and Jefferson County -- increases, in fact.

We've reduced irrigation demands for Hardin and Jefferson County on the basis of new information and we've increased mining demands -- or added new mining demands for Angelina, Cherokee, Nacogdoches, Shelby and San Augustine counties. This mining demand increases -- associated with the natural gas -- primarily associated with the natural gas drilling that's going on in East Texas. The shale formation drilling requires water for fracturing the formation; and so, we've added some demands in there that we expect to occur within these counties in the coming next decade or two.

Chapter 3, we've -- again, the supply chapter. This is where we look at groundwater and surface water supplies that are existing. We've updated water supply volumes for surface water and groundwater, the wholesale water providers and local supplies and reuse categories of water supplies.

We've also assessed the impact of water quality on supplies; and that gets translated into one of the later chapters, as well. And we've discussed the effects of environmental flow policies. The last round is Senate Bill 3. I had a lengthy requirement for looking at environmental flows; and so, while the recommendations have come from late -- too late to incorporate into this plan, we've tried to acknowledge that process here. And then we've refined groundwater availability based on water quality and geographic restrictions in the region.

Chapter 4 began to marry the supplies and demands and tried to come up with where the shortages are. We also -- once we've identified shortages in this chapter, we developed water management strategies to meet those shortages. So, we've updated water shortages. Again, there are water shortages in the region. There's 68 water user groups in the region that leads total shortage by 2060, that's about 180,000 acre-feet per year. That sounds like a lot. It is a lot, but it is a lot less than most other -- many of the other regions that are out there. We've identified some new mining shortages for mining -- the mining category.

We've updated costs for all the water management strategies. That's one of the things we have to do is to prepare a cost -- a cost analysis for these strategies. And so, we've updated this cost to new numbers, to more recent inflation factors. And we've developed new strategies for these water user groups with needs where we needed to do that. There's been a few out there. And then we've developed new strategies for the wholesale water providers where we needed to do so.

Chapter 5, that, again, is the chapter where we talk about the impacts of water management strategies and water quality and the impacts of moving water from agricultural areas into urban areas. Very little changes here as far as water quality issues because the basic water management strategies didn't change just a whole lot, but we did update that a little bit. As far as moving water from agricultural areas to urban areas, in this region we found it's not really much of an issue. There's plenty of water out there for irrigation, and it continues. So, while some water does get moved into urban areas, it's not going to impact any agriculture at this point and not expected to.

Chapter 6 is water conservation. We updated the list of water user groups that are required to submit conservation and drought contingency plans. We've updated those strategies in the plans, and we've updated the triggers. When you have a drought contingency plan, you know, if you -- if your water provider tells you you can't water in the afternoons, that's based on a drought trigger, a certain amount of drought and you have to start restricting your water use. So, we have to update what those triggers are that the water user groups have established.

Chapter 7, again, this is the consistency of the plan with protection of resources in the state and consistency with regulations. Almost no changes to this chapter other than we went back and reviewed everything. There are a few new regulations out there. So, we had to update the regulations and then make sure they are consistent with that.

Chapter 8 is the ecologically -- the unique stream segments. The region elected -- or the Regional Water Planning Group elected to not recommend any stream segments as unique this time, this round. They also chose not to recommend any sites as unique reservoir sites. So, both of those issues were tabled at this point.

And then as far as legislative recommendations, we've brought forward some of the recommendations from the last plan that had not been acted on and added some new ones in there and the recommendation -- the recommended -- the recommendations to the Legislature are listed in the -- in the handout in that executive summary.

Chapter 9 has not been done yet. We have to do this chapter during this process of review of the plan. So, what we will be doing is sending a survey out to the various water user groups that have needs and asking what their expectations for financing are. The survey says it will be ready approximately March 1st. I know it was ready, but I'm not sure that we've been able to fully get it out yet. So, we will be getting that out pretty soon. And then once that survey is completed, we can complete this chapter.

And then, finally, Chapter 10, again, we will be summarizing your comments and putting them into this plan and then responding to each and every one of the comments that comes through.

Dates, June 22nd -- as Kelley indicated, June 22nd is the end of the public comment period. The Water Development Board has basically until June 29th to comment on the plan. I'm sure they will make that deadline.

And July 14th, other agencies such as the cities -- the city and state agencies and that sort of other agencies have until July 14th to complete their comments. So, during July and August, we will be preparing responses to each of the comments that we receive, updating the plan as we need to based on those comments and getting it ready for this August 12th meeting of the East Texas Regional Water Planning Group where it is my hope that they will adopt the final plan so that I can take a vacation.

And then on September 1st -- we will spend the rest of August finalizing anything we need to on the plan and then submitting it to the Water Development Board on September 1st.

That's pretty much it. Kelley, back to you.

MR. HOLCOMB: Thanks, Rex. Rex, I mentioned earlier about an address of where to send public written comments to.

MR. HUNT: The address is on the bottom of the comment form, and it's also -- it's on the notice, I'm sure, right?

And so, the notice is on the East Texas Water Planning Group web site, if they want to go to that; but the address is on the bottom of this comment form.

MR. STELLY: How about e-mail? Do you take e-mail?

MR. HUNT: I will take any sort of written comments or e-mails, if you want to send me an e-mail; but I do need something in writing so I would know what -- how to respond.

MR. STELLY: E-mail would work?

MR. HUNT: It could be handwritten. It could be typed. It could be e-mailed, whatever you want to do.

MR. HOLCOMB: Thanks, Rex. We'll now hear the public comment portion of the public hearing. One last call for public comment requests. Are there any? Nobody else has come in the room except John Stover. John, are you going to make a comment tonight?

MR. STOVER: It's been a pretty day.

MR. HOLCOMB: All right. We do have one from Richard Harrel -- Dr. Harrell. I'm sorry. So...

MR. HARREL: My name is Richard Harrel. I'm the president of Clean Air & Water, Inc.

MR. HOLCOMB: Sir, can we get you the microphone, please?

MR. HARREL: No.

MR. HOLCOMB: Please.

MR. HARREL: Where is it?

MR. HOLCOMB: It's right behind you.

MR. HUNT: I moved it.

MR. HOLCOMB: Rex snuck it out.

MR. HARREL: My name is Richard Harrel, and I am the president of the citizen's environmental organization, Clean Air & Water, Inc. And Clean Air & Water, Inc., has been active since 1966. And Clean Air & Water, Inc., the Board of Directors, is opposed to construction of any new reservoirs in either of the drainage basins concerned. We think that construction of reservoirs, which would include -- especially Fastrill reservoir but also the old Rockland reservoir, would have untold environmental affects that would all be harmful. And so, we want to go down on the record that we are opposed to taking water from our upper basins and moving it to Houston, Dallas or the Fort Worth area. We need the water. There are shortages in this region; and we will need the water, especially during those times. That's all.

MR. HOLCOMB: Thank you, sir. The last call for public comments. Hearing none -- having none, we will adjourn the public hearing at 5:55. Thank you.

MR. HARREL: Aren't you supposed to be here until 8:30?

MR. HOLCOMB: We're going to stay here, yes, sir.

MR. HOLMES: If you stay, so are we.

Thank you.

* * * * *

REPORTER'S CERTIFICATE

THE STATE OF TEXAS)
COUNTY OF JEFFERSON)

I, Cristy Burnett, Official Court Reporter in and for the County Court At Law No. 2 of Orange County, State of Texas, do hereby certify that the above and foregoing hearing held in Beaumont, Jefferson County, Texas, contains a true and correct transcription of all portions of evidence and other proceedings requested by the East Texas Regional Water Planning Group.

WITNESS MY OFFICIAL HAND this the 12th day of May, 2010.

Cristy Burnett, RPR, CSR No. 3568
Expiration Date: 12/31/2011
Official Court Reporter
County Court At Law No. 2
801 Division
Orange County, Texas
(409) 670-4192

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Appendix 10-C

Public Comments

Opportunities for public comment are provided throughout the regional water planning process. The public are invited to provide comments at regularly scheduled meetings of the ETRWPG. Comments may be received in person, as well as in the form of letters, emails, or by telephone. During an official comment period, comments regarding the IPP were received from entities or individuals. This appendix includes copies of all written comments, and a transcript of one oral comment. Chapter 10, Section 4 includes responses to all comments received during the 2011 IPP comment period.

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001

EAST TEXAS
Regional Water Planning Group
Region I WPG

PUBLIC COMMENT REQUEST FORM
East Texas Regional Water Planning Area

I would like to offer public comments during the public comment sessions on April 20, 21 and 22, 2010.

My comments will be (check one or both) X delivered in person ____written and submitted.

Name: Richard C Harrel

Title: Citizen

Entity/Organization Represented: Clean Air + Water, Inc

Mailing Address: 750 Wade
Beaumont, TX 77706

Telephone: 409 892-4764 **Email:** ———

Hearing you are attending (check): ________ **Jacksonville, TX (April 20)**

________ **Nacogdoches, TX (April 21)**

X **Beaumont, TX (April 22)**

My comments are regarding:

Please use additional pages or the back of this page for additional comments. If you choose to mail your comments, please mail to: Rex H. Hunt, P.E., Alan Plummer Associates, Inc., 6300 La Calma, Suite 400, Austin, TX 78752 or to rhunt@apaienv.com.

EAST TEXAS REGIONAL WATER PLANNING AREA (REGION I)
PUBLIC COMMENTS HEARING ON THE 2011 INTIALLY PREPARED PLAN
APRIL 22, 2010
BEAUMONT, TEXAS

The following is an excerpt of the transcript from the April 22, 2010 public hearing in Beaumont, Texas. Oral comment provided by Richard Harrel, President of Clean Air and Water, Inc.

"My name is Richard Harrel, and I am the president of the citizen's environmental organization, Clean Air & Water, Inc. And Clean Air & Water, Inc., has been active since 1966. And Clean Air & Water, Inc., the Board of Directors, is opposed to construction of any new reservoirs in either of the drainage basins concerned. We think that construction of reservoirs, which would include – especially Fastrill reservoir but also the old Rockland reservoir, would have untold environmental affects that would all be harmful. And so, we want to go down on the record that we are opposed to taking water from our upper basins and moving it to Houston, Dallas or the Fort Worth area. We need the water. There are shortages in this region; and we will need the water, especially during those times. That's all."

Q
002

EAST TEXAS
Regional Water Planning Group
Region I WPG

PUBLIC COMMENT REQUEST FORM
East Texas Regional Water Planning Area

I would like to offer public comments during the public comment sessions on April 20, 21 and 22, 2010.

My comments will be (check one or both) ______ delivered in person ✓ written and submitted.

Name: Bruce Drury

Title: Pres. Big Thicket Association

Entity/Organization Represented: BTA

Mailing Address: 3555 Long
Beaumont, TX 77706

Telephone: 409 892 9108 **Email:** bdrury@gt.rr.com

Hearing you are attending (check): ______ **Jacksonville, TX (April 20)**

______ **Nacogdoches, TX (April 21)**

✓ **Beaumont, TX (April 22)**

My comments are regarding:

Strike the provisions for Fastrill & Rockland. Impoundment of the Neches will do great harm to the floodplain — the core of the Big Thicket

Please use additional pages or the back of this page for additional comments. If you choose to mail your comments, please mail to: Rex H. Hunt, P.E., Alan Plummer Associates, Inc., 6300 La Calma, Suite 400, Austin, TX 78752 or to rhunt@apaienv.com.

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EAST TEXAS
Regional Water Planning Group
Region I WPG

PUBLIC COMMENT REQUEST FORM
East Texas Regional Water Planning Area

I would like to offer public comments during the public comment sessions on April 20, 21 and 22, 2010 or through the end of the public comment period to June 22, 2010.

Name: **Fred Manhart**

Title: **Manager, Environmental Support**

Entity/Organization Represented: **Entergy Texas, Inc.**

Mailing Address: **10055 Grogans Mill Road, Suite 4B**

The Woodlands, TX 77380

Telephone: **(281) 297-3304** **Email:** **fmanhar@entergy.com**

My comments are regarding: Please see attached in re: Regional Water Planning Group IPP-2011 Water Plan

Please use additional pages or the back of this page for additional comments. If you choose to mail your comments, please mail to: Rex H. Hunt, P.E., Alan Plummer Associates, Inc., 6300 La Calma, Suite 400, Austin, TX 78752 or to rhunt@apaienv.com.

Entergy®

Fossil Operations
Entergy Services, Inc.
10055 Grogans Mill Road
Parkwood Two, Suite 4B
The Woodlands, TX 77380
Tel. 281-297-3304
Fax 281-297-3251

Fred Manhart
Manager
Environmental Support

Via Courier: Fed Ex #7936 4612 1771

June 17, 2010

East Texas Regional Water Planning Group
Region I WGP
c/o Rex H. Hunt, P.E. rhunt@apainv.com
Alan Plummer Associates, Inc.
6300 La Calma
Suite 400
Austin, Texas 78752

RE: Comments to the Regional Water Planning Group IPP-2011 Water Plan

Dear Mr. Hunt:

In accordance with the public comment provisions of the Texas Administrative Code and as allowed by the Initially Prepared Plan (IPP) for the East Texas Regional Water Planning Group (ETRWPA), Entergy Texas, Inc. hereby respectfully submits its comments for Region I's consideration.

Entergy Texas, Inc. (ETI) is an investor owned public utility providing generation, transmission and distribution electric utility service to residential, commercial and industrial customers in southeast Texas. As a regulated electric utility company, ETI is subject to the regulations of the Public Utility Commission of Texas.

While reserving the right to submit additional comments to the IPP at a future date, ETI submits at this time its comment to Executive Summary Section 8.3 (ES.8.3) as found on ES-20. In the first bullet found on ES-20, the ETRWPG "...encourages all areas in the ETRWPG not presently a part of a Groundwater Management District to either create one or join an existing district."

ETI is concerned with this recommendation and its "one-size-fits-all approach". Region I covers a twenty county area that is very diverse in its accessibility to and use of its water resources. Several of the counties within the ETRWPG already are members of groundwater conservation districts. To the extent that some of the counties are not members of groundwater conservation districts, one must conclude that the individual counties have determined that such are not necessary or desired.

While ETI fully supports the protection of all natural resources, including groundwater resources, ETI believes that individual areas should be responsible for selecting the methods by which the area is best able to address the existing and future use of its resources and the protection of those natural resources. Whether the protection of groundwater resources is left in the hands of the individual residents within the area or submitted to the auspices of a groundwater conservation district, the means by which the local area chooses to protect its resources, particularly those that do not fall within the ETRWPG, should be left to the local area's choosing.

ETI greatly appreciates this opportunity to provide these comments and is willing to discuss in greater detail the information contained herein.

Sincerely,

Fred Manhart

Fred Manhart

Cc: East Texas Regional Water Planning Group, Region I Fed Ex #
Attn. Mr. Kelley Holcomb, Chairman 7987 6883 5835
P.O. Box 635030
Nacogdoches, TX 75963-5030

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KNOWLEDGE • SERVICE • ANSWERS

107 W. Lufkin Avenue, Suite 200
P.O. Box 151508
Lufkin, Texas 75915-1508
T 936.637.6061 F 936.637.6239 www.ksaeng.com

KSA ENGINEERS

June 21, 2010

Rex H. Hunt, P.E.
Alan Plummer and Associates, Inc.
6300 La Calma, Suite 400
Austin, Texas 78752

Re: Region I 2011 IPP Comments:

Dear Mr. Hunt:

I represent the City of Woodville as a consultant engineer for their water supply. Due to his absence and that comments are due tomorrow, I have been asked by Chuck Comte, City Administrator, to comment on the Region I IPP. The City of Woodville is in need of a new water well. However, the Region I IPP does not identify the need for the well. This is due primarily to the plan not including 2, 1500 bed prisons in its water demand. The demand also is a yearly demand which is an average daily demand. Although this is what the aquifer sees, TCEQ regulations require that well capacity meet maximum day demands or 0.6 gpm per tap equivalent. According to TCEQ regulation 290.38(41), if there is a lack of verifiable historical data, this maximum day factor should be 2.4. When this factor is applied to the average daily demands it will exceed their well production capabilities. Therefore, we disagree with the projected water demands and request that the plan be changed to more accurately reflect our water demand and our need for a new well in the Jasper aquifer.

Also, the East Texas Electric Cooperative (ETEC) is currently planning to construct a bio-mass power plant south of Woodville in Tyler County. ETEC will need 920,000 gpd or 1040 ac-ft/year of water. The current plan is to provide most of that need with effluent reuse from the city's wastewater treatment plant. An additional supply will be two new water wells to be drilled by ETEC in the Jasper aquifer. Currently the Region I IPP does not include any demands for power production in Tyler County. The City requests that the Region I Plan be revised to include this power production demand in Tyler County.

If you have any questions, please contact me or Chuck Comte, City Administrator of Woodville.

Sincerely,

Billy D. Sims, P.E.
Senior Project Manger

Cc: Chuck Comte, City of Woodville
Dan Wittliff, P.E., GDS Associates
File: WV020 Correspondence

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TEXAS PARKS & WILDLIFE

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June 21, 2010

Mr. Kelley Holcomb
Angelina & Neches River Authority
P.O. Box 387
Lufkin, Texas 75902-0387

Re: 2010 East Texas Region I Initially Prepared Plan

Dear Mr. Holcomb:

Thank you for the opportunity to review and comment on the 2010 Initially Prepared Regional Water Plan (IPP) for Region I. Texas Parks and Wildlife (TPW) acknowledges the time, money and effort required to produce the regional water plan as mandated by Senate Bill 1 of the 75th Legislature. A number of positive steps have been taken since the first planning cycle to advance the issue of environmental protection. For example, the regional water planning groups are required by TAC §357.7(a)(8)(A), to perform a "quantitative reporting of environmental factors including effects on environmental water needs, wildlife habitat, cultural resources, and effect of upstream development on bays, estuaries, and arms of the Gulf of Mexico" when evaluating water management strategies (WMS). Quantification of environmental impacts is a critical step in planning for our state's future water needs while also protecting environmental resources.

TPW staff has reviewed the IPP with a focus on the following questions:

- Does the plan include a quantitative reporting of environmental factors including the effects on environmental water needs, and habitat?
- Does the plan include a description of natural resources and threats to natural resources due to water quantity or quality problems?
- Does the plan discuss how these threats will be addressed?
- Does the plan describe how it is consistent with long-term protection of natural resources?
- Does the plan include water conservation as a water management strategy? Reuse?
- Does the plan recommend any stream segments be nominated as ecologically unique?
- If the plan includes strategies identified in the 2006 regional water plan, does it address concerns raised by TPW at that time?

The East Texas Region I IPP includes a limited quantitative reporting of environmental factors. Appendix 4D-A presents a table entitled "Summary of Environmental Assessment" that scores different categories of environmental impact on a scale of 1-5, with 5 being the greatest impact. The acreage of habitat impacted is also included. Appendix 3-A presents the SB3 "Environmental

Flows Recommendations Report Executive Summary for the Sabine and Neches Rivers and Sabine Lake Bay Basin and Bay Area Stakeholders Committee" which includes numeric recommendations for instream and freshwater inflows.

The East Texas Region I IPP also includes a description of natural resources. Aquatic resources (Neches River, Sabine River, Neches-Trinity River Coastal Basin, Sabine Lake, aquifers, springs), terrestrial habitats (Piney Woods, Oak Woods and Prairies, Coastal Prairies, Blackland Prairies, State/federal parkland/preserves, farmland, and wetlands), natural resources (oil, natural gas, sand and gravel, lignite, salt and clay), archeological resources, endangered and threatened species, and ecologically significant streams are discussed. Several mollusk species included in Table 1-A.1 Species of Special Concern should be denoted as state threatened. These species include Texas pigtoe, Louisiana pigtoe, Texas heelsplitter, Triangle pigtoe, Sandbank pocketbook and Southern hickorynut. These species should also be included in Table 1.13.

Threats to natural resources due to water quantity or quality problems are also discussed, including aquifer depletion, saltwater intrusion and mercury contamination. Conversion from groundwater sources to surface water was suggested as a means to address aquifer depletion and saltwater contamination. It should be noted that fish consumption advisories due to mercury contamination have been issued by Texas Department of State Health Services for Village Creek in Hardin County and the Neches River in Angelina, Hardin, Houston, Jasper, Polk, Trinity and Tyler counties.

Water conservation and drought management as well as wastewater reuse were considered and evaluated as water management strategies. According to the IPP, 57% of municipal water user groups currently meet the Water Conservation Task Force goal of 140 gallons per person per day. In addition, since municipal use accounts for only about 20% of the total regional demand, expected savings from advanced conservation would be relatively small.

The East Texas Region I IPP discusses Ecologically Significant Stream Segments. TPW notes that the plan does not recommend nomination of any stream segments as ecologically unique. TPW has identified several stream segments in the region that meet at least one of the criteria for classification as ecologically unique should the regional planning group decide to pursue nomination of an ecologically significant stream in the future.

The East Texas Region I IPP recommends Lake Columbia and Fastrill Reservoir as strategies for meeting future water needs. TPWD recognizes the value of Lake Columbia in meeting certain local water supply needs and is committed to assisting the Angelina-Neches River Authority (ANRA) in attenuating impacts to fish and wildlife from reservoir construction, as well as working with ANRA to develop compatible recreational and natural resources plans for the reservoir once constructed. Given the recent court rulings related to Fastrill Reservoir, TPWD does wonder whether that particular reservoir strategy should continue to be recommended as a viable one.

TPWD does wish to reiterate its perspective that there are other conservation alternatives that are favorable to wildlife and the environment, such as water conservation, wastewater reuse, full use of existing supplies, and good land stewardship, to name a few. Construction of off-channel reservoirs can also help to minimize wildlife impacts if reservoirs are located to minimize inundation of habitats and diversions are modified to avoid impacts to environmental flows.

Thank you for your consideration of these comments. TPW looks forward to continuing to work with the planning group to develop water supply strategies that not only meet the future water supply needs of the region but also preserve the ecological health of the region's aquatic resources. Please contact Cindy Loeffler at (512) 389-8715 if you have any questions or comments.

Sincerely,

Ross Melinchuk,
Deputy Executive Director, Natural Resources

RM:CL:ch

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Nacogdoches
the oldest town in Texas

By U.S. Mail and email: Rhunt@apaienv.com

June 22, 2010

Rex H. Hunt, P.E.
Alan Plummer and Associates, Inc.
6300 La Calma, Suite 400
Austin, Texas 78752

Re: Region I 2011 IPP Comments:

Dear Mr. Hunt

The City of Nacogdoches requests that Section 4C.2.7 of the Region I draft 2011 IPP be revised to more accurately reflect the alternative water management strategies that the city plans to pursue. The city's proposed revision to Section 4C.2.7 would delete Toledo Bend Reservoir as an alternate water supply for the City of Nacogdoches and replace the proposed Toledo Bend project with a proposed project from Lake Sam Rayburn as an alternate water supply. This supply should begin in 2020 and provide the same amount as Columbia, that is 8,551 ac-ft, through the planning period.

The reasons for the requested change are:

1. Sam Rayburn Reservoir is in the same watershed as Nacogdoches and is a closer source of water supply than Toledo Bend Reservoir.
2. A Sam Rayburn project is significantly less costly than a Toledo Bend project. See the attached cost estimate and map. Toledo Bend water in the IPP is very expensive at $6.29/1,000 gals. Sam Rayburn water would cost $3.39/ 1,000 gals.
3. Although Columbia is the recommended strategy, it does not currently exist and is still in the 404 permitting process. There is a chance it could not be permitted and, therefore, not constructed. Sam Rayburn Reservoir is an existing water supply project and based on Table 3.3 of the 2011 Region I IPP has unpermitted yields of 108,290 acre feet. Should Columbia not get built, the City would want to develop a water supply from Sam Rayburn Reservoir of at least as much as it would get from Lake Columbia if it were constructed. That is 8,551 ac-ft. The City would seek that amount of water right from the unpermitted yield identified in Table 3.3 of the Region I Plan or through contracting with the Corps of Engineers for the right to storage of water in the reservoir and a water rights permit for the yield provided from the contractual storage right.

To assist in making the changes, this letter transmits to you the following documents:

1. A revised section 4C.2.7 in both a clean and redline format.

2. Cost estimate for City's Lake Sam Rayburn alternative based on the methodology used in the draft IPP at **Chapter 4C, Appendix A: East Texas Region Cost Estimates.**

3. A proposed figure IV-10 showing the Sam Rayburn Reservoir alternative.

We also think the water demand projections for Nacogdoches in the draft 2011 IPP are too low. We understand that the TWDB policy is to not make changes to projections in this planning cycle but that projections will be reviewed in the next planning cycle when 2010 census data are available. We wanted to be on record as not agreeing with the projections.

The City of Nacogdoches respectfully requests approval of the changes described herein. If you have any questions, please feel free to contact me.

Sincerely,

Jim Jeffers, City Manager
City of Nacogdoches

Enclosures (4)

TEXAS WATER DEVELOPMENT BOARD

June 28, 2010

Mr. Kelley Holcomb
Chairman, East Texas Regional Water Planning Group
c/o Angelina & Neches River Authority
P.O. Box 387
Lufkin, Texas 75902-0387

Mr. Jim Jeffers, City Manager
City of Nacogdoches
P.O. Box 635030
Nacogdoches, Texas 75963-5030

Re: Texas Water Development Board Comments for the East Texas Regional Water Planning Group (Region I) Initially Prepared Plan, Contract No. 0904830868

Dear Mr. Holcomb and Mr. Jeffers:

Texas Water Development Board (TWDB) staff completed a review of the Initially Prepared Plan (IPP) submitted by March 1, 2010 on behalf of the Region I Regional Water Planning Group. The attached comments (Attachments A and B) follow this format:

- Level 1: Comments, questions, and online planning database revisions that must be satisfactorily addressed in order to meet statutory, agency rule, and/or contract requirements; and
- Level 2: Comments and suggestions for consideration that may improve the readability and overall understanding of the regional plan.

The TWDB's statutory requirement for review of potential interregional conflicts under Title 31, Texas Administrative Code (TAC) §357.14 will not be completed until submittal and review of adopted regional water plans.

Title 31, TAC §357.11(b) requires the Regional Water Planning Group to consider timely agency and public comment. Section 357.10(a)(3) of the TAC requires the final adopted plan include summaries of all timely written and oral comments received, along with a response explaining any resulting revisions or why changes are not warranted.

Copies of TWDB's Level 1 and 2 written comments and the region's responses must be included in the final, adopted regional water plan.

If you have any questions, please do not hesitate to contact Mr. Lann Bookout of my staff at (512) 936-9439.

Sincerely,

Carolyn L. Brittin
Deputy Executive Administrator
Water Resources Planning and Information

Attachments (3)

c w/att: Mr. Rex Hunt, APAI Environmental

ATTACHMENT A

TWDB Comments on Initially Prepared 2011 Region I Regional Water Plan

LEVEL 1. Comments and questions must be satisfactorily addressed in order to meet statutory, agency rule, and/or contract requirements.

Chapter 1

1. Please describe the plan's impact to navigation. *[Title 31 Texas Administrative Code (TAC) §357.5(e)(8)]*

2. Please describe how the plan considered existing regional water plans, existing recommendations in state water plan and existing local water plans. *[31 TAC 31§357.7(a)(1)(I), (J), and (K)]*

3. Provide a list of potentially feasible water management strategies that were considered and evaluated by the planning group. *[Contract Exhibit "C" Section 11.1]*

4. Page 1-24, Figure 1.12; Page 3-15, Figure 3.5: Complete outcrop areas of minor aquifers in the region are not displayed and sub-crop areas overlap and cover the outcrop areas of younger units. Please review plan text to reflect the accurate locations. For example: In chapter 1, page 1-26, although the Yegua-Jackson aquifer is located in the southern portion of Houston county it is not shown on the map (Figure 1.12) or discussed in text. *[31 TAC §357.7(a)(1)(D)]*

Chapter 2

5. Water demand projections are not split out by river basins. Please present water demand projections by river basin for each county. *[31 TAC §357.7(a)(2)(A)(iv)]*

6. The plan does not include categories of water demands for wholesale water providers by river basins. Please present water demands for wholesale water providers by river basin. *[31 TAC §357.7(a)(2)(B)]*

Chapter 3

7. Page 3-10, Table 3.4: It appears that the Trinity County-Neches Basin-Irrigation water supply is mislabeled as "mining". Please revise if appropriate.

8. Page 3-17, Table 3.5: Water supply sources are not summarized by county and river basin. Please revise to summarize by county and river basin. *[31 TAC § 357.7(a)(4)(B) ; Contract Exhibit "D" Section 3.0]*

9. Page 3-28, second paragraph: A reference is made to "Appendix 3-B". The referenced appendix was not included in plan. Please include appendix or revise text.

10. Pages 3-29 and 3-30, Tables 3.9 and 3-10: Please revise tables to summarize water supplies by county and river basin. *[31 TAC § 357.7(a)(4)(B)]*

Chapter 4A

11. Page 4A-5, Table 4A.3: It appears that total county surplus and shortage (water need) volumes were calculated incorrectly by subtracting total [county-wide] supply from total [county-wide] demand. Please revise to reflect total county water needs as the sum of the individual needs of each water user group in the county; needs that are calculated based on each water user group's own demands and supplies. Please also delete region totals at bottom of table as this further mis-aggregates water needs (shortages) region-wide.

Chapter 4B

12. Please include a table with recommended and, if applicable, alternative water management strategies with project capital costs and water supply by decade. *[31 TAC §357.7(a)(7)(H); Contract Exhibit "C" Sections 4.3, 11.1]*

Chapter 4C

13. Please explain how the region considered emergency transfers of non-municipal use surface water without causing unreasonable damage to the property of the non-municipal water rights holder pursuant to Texas Water Code §11.139. *[TAC 31 §357.5(i)]*

14. P lease describe how alternative water management strategies were evaluated using environmental criteria. *[31 TAC §358.3(b)(180]*

15. Please confirm that capital costs are based on September 2008 dollars as required, or revise as appropriate. *[Contract Exhibit "C" Section 4.1.2]*

16. In instances when conservation was considered but not recommended as a water management strategy, please indicate why conservation was not recommended. *[31 TAC §357.7(a)(4)]*

Chapter 6

17. Please include a summary of information regarding water loss audits specific to Region I. *[31 TAC § 357.7 (a)(1)(M)]*

18. Page 6-3, paragraph 3: Plan does not include a model water conservation/drought contingency plan. Please include a model water conservation/drought contingency plan. *[31 TAC §357.7(c)]*

19. Page 6-8, first paragraph: Plan does not include a model drought contingency plan from an affected water user group. Please include a model drought contingency plan for an affected water user group. *[31 TAC §357.7(d)]*

20. *(Attachment B)* Comments on the online planning database (i.e. DB12) are herein being provided in spreadsheet format. These Level 1 comments are based on a direct comparison of the online planning database against the Initially Prepared Regional Water Plan document as submitted. The table only includes numbers that do not reconcile between the plan (left side of spreadsheet) and online database (right side of spreadsheet). An electronic version of this spreadsheet will be provided upon request.

21. *(Attachment C)* Based on the information provided to date by the regional water planning groups, TWDB has also attached a summary, in spreadsheet format, of apparent unmet water needs that were identified during the review of the online planning database and Initially Prepared Regional Water Plan. *[Additional TWDB comments regarding the general conformance of the online planning database (DB12) format and content to the Guidelines for Regional Water Planning Data Deliverables (Contract Exhibit D) are being provided by TWDB staff under separate cover as 'Exception Reports']*

LEVEL 2. Comments and suggestions that might be considered to clarify or enhance the plan.

Chapter 1

1. Page 1-27, Section 1.6.1: "Springs" appears to incorrectly refer to Section 1.9.8. Please consider revising reference as appropriate (i.e. to "Section 1.9.7")

2. Page 1-42, Section 1.9: Please consider including assessment of the importance of recreational uses of natural resources (fishing, boating, etc.).

Chapter 3

3. Page 3-7: A reference is made in the "Reservoirs" paragraph to a summary of "firm yields" in Table 3.2. The Table is titled "Currently Available Supplies from Permitted Reservoirs…" Please consider clarifying in Table 3.2 that it presents firm yields, if applicable.

4. Page 3-17, Table 3.5: Please consider revising two of the table headings from "Yegua" to "Yegua-Jackson" and from "Carizzo" to "Carrizo-Wilcox."

Chapter 4C

5. Page 4C-62, table: Table is referenced in the text as "4C.A". Please consider adding the missing table number "4C.A" to the table title to be consistent with other tables.

6. Appendix 4C-A: Project cost estimates are presented in two different formats (e.g. Anderson County Other, page 4C-A-3 format vs. Hardin County-Other, page 4C-A-28 format). Please consider using a consistent format for presenting "Cost Estimate" worksheets.

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REGION I

		IPP document reference:		Non-matching numbers: IPP document number							Online Planning Database (DB12) number						
Region IPP	Item	Page number	Table number	non-decadal number	2010	2020	2030	2040	2050	2060	non-decadal number	2010	2020	2030	2040	2050	2060
I	Manufacturing Water Demands	ES-6			379,524	600,887	636,975	673,081	704,797	737,105		299,992	591,904	784,140	821,841	857,902	893,476
I	Mining Water Demands	ES-6			14,662	16,297						21,662	37,297				
I	Irrigation Water Demands	ES-6			222,846	223,163	223,517	223,899	224,321	224,786		151,100	151,417	151,771	152,153	152,575	153,040
I	Total Demands for Region	ES-6			875,189	1,143,278	1,201,998	1,263,584	1,329,909	1,405,971		730,911	1,083,549	1,277,417	1,340,598	1,411,268	1,490,596
I	City of Jacksonville 2010 Municipal Water Use	ES-7			7,546							3,502					
I	City of Tyler 2010 Municipal Water Use	ES-7			25,886							25,528					
I	HCWID No. 1 Demand	ES-7			612							NA					
I	Source of Supply - Groundwater	ES-8			442,270	442,270	442,270	442,270	442,270	442,270		446,044	446,044	446,044	446,044	446,044	446,044
I	Source of Supply - Surface Water Total	ES-8										3,638,252	3,634,066	3,629,882	3,625,695	3,617,323	3,621,509
I	Source of Supply - Indirect Reuse	ES-8			13,687	13,687	13,687	13,687	13,687	13,687		18,111	18,126	18,139	18,152	18,177	18,163
I	Source of Supply - Direct Reuse	ES-8			253	268	281	294	305	319		18,111	18,126	18,139	18,152	18,177	18,163
I	Source of Supply - Total	ES-8			4,435,454	4,422,273	4,409,085	4,395,898	4,382,708	4,369,516		4,102,407	4,098,236	4,094,065	4,089,891	4,081,544	4,085,716
I	Anderson Co. Shortages	ES-11			4,229	-7,509	-9,689	-12,285	-15,429	-19,219		-18	-11328	-13269	-15653	-18556	-22158
I	Angelina Co. Shortages	ES-11			-4,993	-17,313	-17,671	-22,429	-27,748	-34,118		-9383	-20806	-20557	-24836	-29598	-35451
I	Cherokee Co. Shortages	ES-11			4,790	3,374	4,595	4,393	4,065	3,532		-490	-1494	-40	-118	-233	-379
I	Hardin Co. Shortages	ES-11			-5,081	-6,418	-7,121	-7,831	-8,646	-9,435		-8955	-9931	-10540	-11148	-11790	-12317
I	Henderson Co. (P) Shortages	ES-11			676	232	-190	-607	-1,154	-1,849		-75	-297	-636	-955	-1361	-1847
I	Houston Co. Shortages	ES-11			1,988	1,512	949	346	-363	-1,178		-642	-883	-1396	-1953	-2567	-3239
I	Jasper Co. Shortages	ES-11			3,383	3,183	3,130	3,222	3,268	3,268		-374	-470	-488	-430	-403	-403
I	Jefferson Co. Shortages	ES-11			71,245	57,542	55,076	52,199	48,538	43,491		0	-13426	-15696	-18464	-21843	-25960
I	Nacogdoches Co. Shortages	ES-11			9,720	5,385	9,013	5,305	-6,827	-12,638		-5083	-7183	-1621	-3476	-12807	-15905
I	Newton Co. Shortages	ES-11			10,894	2,550	95	-2,931	-6,616	-11,097		-149	-264	-2713	-5734	-9382	-13805
I	Orange Co. Shortages	ES-11			19,080	13,507	6,860	111	-6,421	-13,977		-132	-5136	-10989	-16789	-22021	-27894
I	Panola Co. Shortages	ES-11			4,704	4,411	4,233	4,070	3,896	3,636		-96	-116	-132	-147	-161	-187
I	Polk Co. (P) Shortages	ES-11			290	-75	-374	-602	-773	-959		-208	-481	-742	-950	-1110	-1277
I	Rusk Co. Shortages	ES-11			26,110	23,165	18,405	12,725	5,594	-3,381		0	0	0	-30	-1561	-10000
I	Sabine Co. Shortages	ES-11			1,261	1,118	995	863	706	529		-40	-92	-147	-210	-283	-367
I	San Augustine Co. Shortages	ES-11			-1,422	-7,007	-107	-227	-383	-552		-1691	-7269	-360	-465	-588	-723
I	Shelby Co. Shortages	ES-11			927	-1,317	-1,206	-2,755	-4,637	-6,961		-1403	-3397	-3085	-4475	-6200	-8317
I	Smith Co. (P) Shortages	ES-11			17,874	15,669	13,708	11,742	8,161	3,165		-117	-317	-503	-807	-1138	-1627
I	Trinity Co. (P) Shortages	ES-11			194	160	156	139	116	91		0	0	0	-9	-32	-57
I	Tyler Co. Shortages	ES-11			2,249	1,922	1,729	1,696	1,725	1,720		0	-142	-239	-251	-232	-232
I	Regional Total Shortages	ES-11			168,118	94,091	82,586	47,144	-2,928	-55,932		-28856	-83032	-83153	-106900	-141866	-182145
I	Lake Naconiche reservoir availability	3-8	3.2		NA	NA	NA	NA	NA	NA		3,239	3,239	3,239	3,239	3,239	3,239
I	Jefferson Co. Neches Basin LNVA Supply	3-10	3.4		381,876	381,876	381,876	381,876	381,876	381,876		NA	NA	NA	NA	NA	NA
I	Jefferson Co. Neches-Trinity, Industrial Supply	3-10	3.4		680	680	680	680	680	680		1,160	1,160	1,160	1,160	1,160	1,160
I	Jefferson Co. Total supply	3-10	3.4		1,221,599	1,221,599	1,221,599	1,221,599	1,221,599	1,221,599		840,288	840,288	840,288	840,288	840,288	840,288
I	Angelina Co. Yegua Availability	3-17	3.5	4,860							6,472						
I	Orange Co. Gulf Coast Availability	3-17	3.5	20,000							20,001						
I	Trinity Co. Carrizo Availability	3-17	3.5	NA							2,161						
I	Angelina County, Yegua-Jackson Aquifer	3-17	3.5	4,860							6,472						
I	Trinity Co(P), Carrizo-Wilcox Aquifer	3-17	3.5	-							2,161						
I	Orange Co. Gulf Coast Aquifer	3-17	3.5	20,000							20,001						
I	N. Regional subtotal, Yegua-Jackson Aquifer	3-17	3.5	8,680							10,292						
I	N. Regional subtotal, Carrizo-Wilcox Aquifer	3-17	3.5	159,800							161,961						
I	S. Regional subtotal, Gulf Coast Aquifer	3-17	3.5	170,800							170,801						
I	Aquifer Totals, Yegua-Jackson Aquifer	3-17	3.5	9,220							10,832						
I	Aquifer Totals, Carrizo-Wilcox Aquifer	3-17	3.5	159,800							161,961						
I	Aquifer Totals, Gulf Coast	3-17	3.5	172,000							172,001						
I	Grand Total	3-17	3.5	442,270							446,044						
I	Hardin Co. Trinity Basin Livestock Supply	3-18	3.6	1							2						
I	Henderson Co. Neches Basin Livestock Supply	3-18	3.6	248							279						
I	Jefferson Co. Neches Basin Mining Supply	3-18	3.6	242							74						
I	Panola Co. Cypress Basin Livestock Supply	3-18	3.6	2							30						
I	Panola Co. Sabine Basin Livestock Supply	3-18	3.6	1,856							1,828						
I	Polk Co. Neches Basin Livestock Supply	3-18	3.6	202							122						
I	Smith Co. Neches Basin Livestock Supply	3-18	3.6	671							416						
I	Trinity Co. Neches Basin Livestock Supply	3-18	3.6	243							135						
I	Angelina Co. Neches Basin Direct Reuse	3-19	3.7	NA							1,265						
I	Hardin Co. Neches Basin Direct Reuse	3-19	3.7	NA							31						
I	Henderson Co. Neches Basin Indirect Reuse	3-19	3.7	NA							2,872						

REGION I

Region IPP	Item	IPP document reference: Page number	IPP document reference: Table number	Non-matching numbers — IPP document number: non-decadal number	2010	2020	2030	2040	2050	2060	Online Planning Database (DB12) number: non-decadal number	2010	2020	2030	2040	2050	2060
I	Jefferson Co. Neches Basin Direct Reuse	3-19	3.7	NA							3						
I	Shelby Co. Sabine Basin Direct Reuse	3-19	3.7	197							218						
I	Sabine Co. Neches Basin Direct Reuse	3-19	3.7	20							NA						
I	Anderson Co. Available Supply	3-29	3.9		17,648	17,648	17,648	17,648	17,648	17,648		17,649	17,649	17,649	17,649	17,649	17,649
I	Angelina Co. Available Supply	3-29	3.9		25,956	26,320	26,391	26,457	26,520	26,578		25,957	26,321	26,392	26,458	26,521	26,579
I	Cherokee Co. Available Supply	3-29	3.9		18,686	18,274						18,684	18,273				
I	Hardin Co. Available Supply	3-29	3.9		14,295	14,295	14,295	14,295	14,295	14,270		14,296	14,296	14,296	14,296	14,296	14,271
I	Henderson Co. Available Supply	3-29	3.9		7,367	7,246	7,128	7,020	6,911	6,811		9,509	7,890	7,705	7,538	7,365	7,205
I	Houston Co. Available Supply	3-29	3.9		10,224	10,222	10,222	10,223	10,222	10,222		10,223	10,221	10,221	10,222	10,221	10,221
I	Jasper Co. Available Supply	3-29	3.9		73,286	76,673	79,191	81,388	83,035	83,098		72,835	76,218	78,731	80,928	82,575	82,638
I	Jefferson Co. Available Supply	3-29	3.9		414,190	685,812	865,858	891,554	917,437	943,882		414,903	686,525	866,571	892,088	918,150	944,597
I	Newton Co. Available Supply	3-29	3.9		19,907	19,907	19,907	19,907	19,907	19,907		19,908	19,908	19,908	19,908	19,908	19,908
I	Orange Co. Available Supply	3-29	3.9		98,454	98,454	98,454	98,454	98,454	98,454		111,926	111,926	111,926	111,926	111,926	111,926
I	Panola Co. Available Supply	3-29	3.9		17,141	17,450	17,640	17,832	18,025	18,210		16,758	17,067	17,256	17,448	17,641	17,826
I	Rusk Co. Available Supply	3-29	3.9		60,647	60,654	60,655	60,645	60,641	60,653		60,725	60,732	60,732	60,722	60,719	60,729
I	Sabine Co. Available Supply	3-29	3.9		4,098	4,098	4,098	4,098	4,098	4,098		4,101	4,101	4,101	4,101	4,101	4,101
I	San Augustine Co. Available Supply	3-29	3.9		2,930	2,930	2,930	2,930	2,930	2,930		2,933	2,933	2,933	2,933	2,933	2,933
I	Shelby Co. Available Supply	3-29	3.9		11,431	11,443	11,457	11,470	11,482	11,495		11,430	11,445	11,458	11,471	11,482	11,496
I	Smith Co. Available Supply	3-29	3.9				58,712	58,482	58,184	57,840				58,711	58,485	58,186	57,842
I	Trinity Co. Available Supply	3-29	3.9		1,087	1,094	1,095	1,091	1,086	1,082		1,021	1,028	1,029	1,025	1,020	1,016
I	Athens MWA Supply	3-30	3.10		2,900							5,772					
I	Beaumont Supply	3-30	3.10		31,420	31,420	31,420	31,420	31,420	31,420		41,111	41,111	41,111	41,111	41,111	41,111
I	Carthage Supply	3-30	3.10		6,461	6,461	6,461	6,461	6,461	6,461		14,620	14,267	13,914	13,561	13,208	12,853
I	Houston Co. WCID 1 Supply	3-30	3.10		3500	3500	3500	3500	3500	3500		3,393	3,391	3,391	3,392	3,391	3,391
I	Lufkin Supply	3-30	3.10				11,000		11,000					11,001		11,001	
I	Motiva Enterprises Supply	3-30	3.10		NA	NA	NA	NA	NA	NA		39,825	53,467	54,046	57,125	62,705	70,783
I	Nacogdoches Supply	3-30	3.10					19,017							19,016		
I	Panola Co. FWSD-1 Supply	3-30	3.10		34,882	33,940	32,999	32,058	31,116	30,173		21,792	21,203	20,615	20,027	19,438	18,850
I	Port Arthur Supply	3-30	3.10		15,849	16,377	16,904	17,433	18,026	18,750		15,852	16,380	16,907	17,436	18,029	18,750
I	SRA Supply	3-30	3.10		1,299,942	1,297,013	1,294,085	1,291,157	1,288,228	1,285,300		1,301,815	1,298,937	1,296,054	1,293,164	1,290,254	1,287,348
I	Tyler Supply	3-30	3.10					44,696							44,997		
I	UNRMWA Supply	3-30	3.10		232,420	219,667	218,440	217,133	215,867	221,020		207,458	205,417	203,375	201,333	199,292	197,250
I	Anderson County (County-Other) Needs	4A-8	4A.5					0	0						(10)	(31)	
I	Anderson County (Mining) Needs	4A-8	4A.5		0	(19)						(18)	(22)				
I	Anderson County (Anderson County Total) Needs	4A-8	4A.5		0	(11,325)		(15,643)	(18,525)			(18)	(11,328)		(15,653)	(18,556)	
I	Angelina County (County-Other) Needs	4A-8	4A.5				(16)	(133)	(347)	(659)				(20)	(135)	(349)	(661)
I	Angelina County (Lufkin) Needs	4A-8	4A.5		(2,763)	(4,869)	(5,829)	(6,905)	(8,222)	(9,785)		(3,244)	(5,117)	(6,057)	(7,116)	(8,416)	(9,965)
I	Angelina County (Manufacturing) Needs	4A-8	4A.5		(2,509)	(10,006)	(12,523)	(15,070)	(17,365)	(19,827)		(3,117)	(10,513)	(12,983)	(15,486)	(17,739)	(20,161)
I	Angelina County (Angelina County Total) Needs	4A-8	4A.5		(8,294)	(20,051)	(19,865)	(24,207)	(29,028)	(34,935		(9,383)	(20,806)	(20,557)	(24,836)	(29,598)	(35,451)
I	Hardin County (County-Other) Needs	4A-8	4A.5		(153)							(154)					
I	Hardin County (Hardin County Total) Needs	4A-8	4A.5		(8,954)							(8,955)					
I	Henderson County (Athens) Needs	4A-8	4A.5		(21)	(36)	(56)	(77)	(107)	(147)		0	(52)	(70)	(88)	(117)	(155)
I	Henderson County (Irrigation)Needs	4A-8	4A.5		(3)	(4)	(5)	(5)	(6)	(6)		0	0	0	0	0	0
I	Henderson County (Livestock) Needs	4A-8	4A.5		(466)	(601)	(729)	(843)	(959)	(1,066)		0	(29)	(218)	(388)	(561)	(724)
I	Henderson Co.(Henderson County Total) Needs	4A-8	4A.5		(565)	(857)	(1,138)	(1,404)	(1,755)	(2,187)		(75)	(297)	(636)	(955)	(1,361)	(1,847)
I	Houston County (Irrigation) Needs	4A-8	4A.5		(382)	(667)	(986)	(1,334)	(1,720)	(2,146)		(567)	(667)	(986)	(1,334)	(1,720)	(2,146)
I	Houston County (Manufacturing) Needs	4A-8	4A.5		0	(2)	(5)	(8)	(11)	(15)		(3)	(5)	(7)	(9)	(12)	(15)
I	Houston County (Livestock) Needs	4A-8	4A.5		(34)	(210)	(402)	(609)	(834)	(1,077)		(72)	(211)	(403)	(610)	(835)	(1,078)
I	Houston County (Houston County Total) Needs	4A-8	4A.5		(416)	(879)	(1,393)	(1,951)	(2,565)	(3,238)		(642)	(883)	(1,396)	(1,953)	(2,567)	(3,239)
I	Jasper County (County-Other) Needs	4A-8	4A.5		(309)	(405)	(423)	(365)	(338)	(338		(374)	(470)	(488)	(430)	(403)	(403)
I	Jasper County (Jasper County Total) Needs	4A-8	4A.5		(309)	(405)	(423)	(365)	(338)	(338		(374)	(470)	(488)	(430)	(403)	(403)
I	Jefferson County (Mining) Needs	4A-9	4A.5						(4)							(5)	
I	Jefferson County (Jefferson County Total) Needs	4A-9	4A.5						(21,842)							(21,843)	
I	Orange County (County-Otherl) Needs	4A-9	4A.5		(88)	(2)	0	0		0		(132)	(93)	(53)	(7)		(6)
I	Orange County (Manufacturing) Needs	4A-9	4A.5			(1,914)	(7,892)	(13,852)	(19,143)	(25,094)			(5,006)	(10,855)	(16,686)	(21,863)	(27,686)
I	Orange County (Orange County Total) Needs	4A-9	4A.5		(88)	(1,953)	(7,973)	(13,948)	(19,301)	(25,296)		(132)	(5,136)	(10,989)	(16,789)	(22,021)	(27,894)
I	Panola County (Manufacturing) Needs	4A-9	4A.5						(160)							(161)	
I	Panola County (Panola County Total) Needs	4A-9	4A.5						(160)							(161)	
I	Rusk County (Mining) Needs	4A-9	4A.5					(3)	(83)	(158)					(30)	(60)	(88)
I	Rusk County (Rusk County Total) Needs	4A-9	4A.5					(3)	(1,584)	(10,070)					(30)	(1,561)	(10,000)
I	Sabine County (County-Other) Needs	4A-9	4A.5		(11)	(23)	(30)	(38)	(47)	(62)		(3)	(12)	(18)	(24)	(31)	(43)

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		IPP document reference:		*Non-matching numbers*													
				IPP document number							Online Planning Database (DB12) number						
Region IPP	Item	Page number	Table number	non-decadal number	2010	2020	2030	2040	2050	2060	non-decadal number	2010	2020	2030	2040	2050	2060
I	Sabine County (Livestock) Needs	4A-9	4A.5		(38)	(81)	(130)	(187)	(253)	(325)		(37)	(80)	(129)	(186)	(252)	(324)
I	Sabine County (Sabine County Total) Needs	4A-9	4A.5		(49)	(104)	(160)	(225)	(300)	(387)		(40)	(92)	(147)	(210)	(283)	(367)
I	San Augustine County (Irrigation) Needs	4A-9	4A.5		(90)	(90)	(90)	(90)	(90)	(90)		(100)	(100)	(100)	(100)	(100)	(100)
I	San Augustine County (Livestock) Needs	4A-9	4A.5		(90)	(168)	(259)	(364)	(486)	(620)		(91)	(169)	(260)	(365)	(487)	(621)
I	San Augustine Co. (San Augustine Total) Needs	4A-9	4A.5		(1,680)	(7,258)	(349)	(454)	(577)	(712)		(1,691)	(7,269)	(360)	(465)	(588)	(723)
I	Shelby County (County-Other) Needs	4A-9	4A.5		0	(57)	(120)	(132)	(173)	(242)		(126)	(190)	(244)	(253)	(288)	(344)
I	Shelby County (Shelby County Total) Needs	4A-9	4A.5		(1,277)	(3,264)	(2,961)	(4,354)	(6,085)	(8,215)		(1,403)	(3,397)	(3,085)	(4,475)	(6,200)	(8,317)
I	Smith County (Lindale Rural WSC) Needs	4A-10	4A.5							(74)							(73)
I	Smith County (Manufacturing) Needs Needs	4A-10	4A.5				(5)		(183)	(294)				(6)		(182)	(295)
I	Smith County (Smith County Total) Needs	4A-10	4A.5				(502)		(1,139)					(503)		(1,138)	
I	TOTAL Regional Shortage	4A-10	4A.5		(27,775)	(79,450)	(79,756)	(103,658)	(138,785)	(179,282)		(28,856)	(83,032)	(83,153)	(106,900)	(141,866)	(182,145)
I	ANRA Needs	4A-10	4A.6		(53,869)	(53,869)	(53,869)	(53,869)	(53,869)	(53,869)		(53,870)	(53,870)	(53,870)	(53,870)	(53,870)	(53,870)
I	Athens MWA Needs	4A-10	4A.6		(2,674)	(3,190)	(3,803)	(4,499)	(5,408)	(6,533)		0	(2,154)	(2,772)	(3,473)	(4,389)	(5,530)
I	Lufkin Needs	4A-10	4A.6		(6,354)	(14,978)	(17,725)	(20,755)	(24,249)	(28,222)		(8,294)	(16,918)	(19,664)	(22,695)	(26,188)	(30,162)
I	UNRMWA Needs	4A-10	4A.6			(4,708)			(10,808)				(4,707)			(10,807)	
I	Sabine River Authority Needs	4A-10	4A.6		NA	NA	NA	NA	NA	NA		(12,648)	(13,528)	(14,415)	(15,310)	(16,220)	(17,132)
I	Lufkin, Mfg (Angelina Co.) Redistribution WMS	4B-17	4B.13			15,800	15,800	15,800	15,800	15,800			21,351	21,351	22,651	25,351	27,351
I	LNVA, Mining (San Augustine) Redistribution WMS	4B-17	4B.13		1,000	6,500						1,500	7,000				
I	SRA, Steam-Electric (Rusk) Redistribution WMS	4B-17	4B.13						1,500	1,500						1,501	10,000
I	Carthage, Mfg (Panola) Redistribution WMS	4B-17	4B.13						160							161	
I	Tyler, Mfg (Smith) Redistribution WMS	4B-17	4B.13				294	294	294	294				6	101	183	295
I	Center, C-O (Shelby Co.) Redistribution WMS	4B-17	4B.13		50	50	50	50	50	50		150	150	150	150	150	150
I	HCWCID, Mfg (Houston Co.) Redistribution WMS	4B-17	4B.13		-	2	5	8	11	15		30	30	30	30	30	30
I	HCWCID, S-E Power (Nacogdoches Co.) Redistribution WMS	4B-17	4B.13			340	340	340	340	340			5,340	5,340	5,340	13,740	13,740
I	Livestock - Sabine Co. Expand local supp. WMS	4B-20	4B.16		-	50	50	100	200			50	100	107	200	210	
I	Livestock - San Augustine Co. Expand local supp. WMS	4B-20	4B.16			-	-	-	-				50	100	200	200	
I	Anderson County-Other WMS volume	4C-2	unnumbered					-	-						100	100	
I	Anderson Co. Mining - Carrizo-Wilcox WMS volume	4C-3	unnumbered			120	120	120	120	120		18	154	154	154	154	154
I	Angelina County Manufacturing WMS volume	4C-11	unnumbered			24,351	24,351	24,351	24,351	24,351			21,351	21,351	22,651	25,351	27,351
I	New Summerfield, Water Conservation WMS volume	4C-14	unnumbered			-							10				
I	Rusk, Alternate Strategy RU-3 WMS volume	4C-15	unnumbered					212							-		
I	Hardin County Other, HAC-1A WMS volume	4C-17	unnumbered		153							154					
I	Purchase water from Athens MWA WMS volume	4C-20	unnumbered		20	30	44	60	85	117	NA	NA	NA	NA	NA	NA	NA
I	Henderson Co. - Irrigation, Lake Athens WMS volume	4C-22	unnumbered		152	158	164	169	175	181	NA	NA	NA	NA	NA	NA	NA
I	Henderson Co. - Livestock, Fish Hatchery Reuse WMS volume	4C-22	unnumbered		-	2,872	2,872	2,872	2,872	2,872		-	1,288	1,477	1,647	1,820	1,983
I	Houston Co. Mfg, Water from Houston Co WCID WMS volume	4C-23	unnumbered		-	2	5	8	11	15		30	30	30	30	30	30
I	Houston Co. Irrig., Increase Carrizo-Wilcox WMS volume	4C-24	unnumbered		383	766	1,149	1,532	1,915	2,298		766	1,149	1,149	1,639	1,915	2,298
I	Houston Co. Livestock, Increase Carrizo-Wilcox WMS volume	4C-24	unnumbered		221	221	442	663	884	1,080		111	111	221	363	542	665
I	Jefferson County, Mining, Gulf Coast Aquifer WMS volume	4C-26	unnumbered						9							5	
I	Jefferson Co. S-E Power, Neches River WMS volume	4C-27	unnumbered						25,591	25,591						25,959	25,960
I	Nacogdoches, Swift WSC, Carrizo Wilcox WMS volume	4C-29	unnumbered					350	350	350					700	700	700
I	Sabine Co., Lvstk, Expand Surface Water Supplies WMS volume	4C-45	unnumbered		-	50	50	100	200	300		50	100	107	200	210	300
I	San Augustine Co., Irrigation, Carrizo-Wilcox WMS volume	4C-46	unnumbered		90	90	90	90	90	90		100	100	100	100	100	100
I	San Augustine Co., Mining, LNVA WMS volume	4C-48	unnumbered		1,000	6,500						1,500	7,000				
I	Smith Co., Community Water Co. City of Tyler WMS volume	4C-54	unnumbered		121							105					
I	Tyler County, County-Other, Gulf Coast Aquifer WMS volume	4C-60	unnumbered			150							251				
I	ANRA, New Run-of-River Diversions WMS volume	4C-63	Table 4C.2		750						NA	NA	NA	NA	NA	NA	NA
I	ANRA Treatment Plant and Distribution System WMS volume	4C-64	Table 4C.2	5,100							-						
I	Conservation, City of Athens WMS volume	4C-67	Table 4C.2			209	344	452	589	761		47	215	357	469	611	791
I	Forest Grove w/WTP at City WMS volume	4C-67	Table 4C.2					2,240	2,240						-	-	

REGION I

		IPP document reference:		Non-matching numbers													
				IPP document number							Online Planning Database (DB12) number						
Region IPP	Item	Page number	Table number	non-decadal number	2010	2020	2030	2040	2050	2060	non-decadal number	2010	2020	2030	2040	2050	2060
I	Conservation, Irrigation WMS volume	4C-74	Table 4C.2		20,000	30,000	33,000	35,000	40,000	40,000	NA	NA	NA	NA	NA	NA	NA
I	System Operation with Saltwater Barrier WMS volume	4C-74	Table 4C.2			55,500	55,500	55,500	55,500	55,500			111,000	111,000	111,000	111,000	111,000
I	Sediment reduction - Steinhagen WMS volume	4C-74	Table 4C.2						5,000	5,000	NA	NA	NA	NA	NA	NA	NA
I	Total Supplies from WMS	4C-74	Table 4C.2		20,000	113,500	116,500	118,500	286,500	286,500		16	139,023	139,026	139,029	297,033	297,037
I	Sam Rayburn Reservoir/Angelina County Regional Project WMS volume	4C-79	Table 4C.2					11,210	11,240	11,240					11,200	11,200	11,200
I	Lake Columbia WMS volume	4C-82	Table 4C.2						8,551	8,551						13,726	13,726
I	Permit Amendment WMS volume	4C-86	Table 4C.2		219,900	215,300	210,800	206,200	201,600	197,000	NA	NA	NA	NA	NA	NA	NA
I	Toldeo Bend Project WMS volume	4C-86	Table 4C.2						500,000	500,000						100,000	100,000
I	Lake Palestine WMS volume	4C-88	Table 4C.2		16,815	16,815						-	-				
I	AND-1: Increase Supply from Carrizo-Wilcox Total Capital Cost	4C-4	Table 4C.2	$ 228,730							$ 289,043						
I	ADS-1: Water from Lake Palestine Total Capital Cost	4C-5	Table 4C.2	$ 24,917,400							$ 24,917,413						
I	Increase Supply from Carrizo-Wilcox-Phase I & II Total Capital Cost	4C-9	Table 4C.2	$ 3,274,191							$ 3,274,19[illegible]						
I	Purchase water fro Provider (ANM-1 & ANM-2)Total Capital Cost	4C-11	Table 4C.2	$ 23,212,700							$ 26,176,750						
I	Houston County Irrigation, HOI-1 Total Capital Cost	4C-24	Table 4C.2	$ 3,205,560							$ 3,205,600						
I	Houston County Livestock, HOL-1: Increase Supply from Carrizo-Wilcox Total Capital Cost	4C-25	Table 4C.2	$ 2,671,300							$ 2,671,298						
I	JAC-2: Use of additional water from Gulf Coast Aquifer Total Capital Cost	4C-25	Table 4C.2	No Values							$ 393,088						
I	SW-1 Increase supply from Carrizo-Wilcox Total Capital Cost	4C-30	Table 4C.2	$ 498,171							$ 996,342						
I	Appleby WSC, APL-1 Lake Naconiche regional system Total Capital Cost	4C-31	Table 4C.2	No Values							$ 4,392,350						
I	Nacogdoches, County-Other, NaCo-1: Lake Naconiche regional system Total Capital Cost	4C-31	Table 4C.2	$ 4,392,350							$ 7,320,600						
I	Sabine County Other, SBC-1 Total Capital Cost	4C-44	Table 4C.2	$ 328,840							$ 445,304						
I	Sabine County Other, SBC-2 Total Capital Cost	4C-44	Table 4C.2	$ 809,000							$ -						
I	Sabine County Livestock SBL-2: Stock Ponds Total Capital Cost	4C-45	Table 4C.2	$ 562,700							$ 551,700						
I	San Augustine County Livestock, SAL-1 Stock Ponds Total Capital Cost	4C-47	Table 4C.2	$ 562,700							$ 413,800						
I	San Augustine County Livestock, SAL-2 & SAL-3 Total Capital Cost	4C-47	Table 4C.2	$ 568,710							$ 653,610						
I	Bullard, Strategy BU-1A: Increase supply from Carrizo-Wilcox Total Capital Cost	4C-54	Table 4C.2	$ 305,674							$ 305,767						
I	Athens MWA, Forest Grove water Total Capital Cost	4C-68	Table 4C.2	$ 16,575,556							$ 25,569,000						
I	Additiona Lake Athens/ New WTP Total Capital Cost	4C-68	Table 4C.2	$ 5,943,300							$ 12,387,000						
I	LNVA-1 to LNVA-5 Total Capital Cost	4C-75	Table 4C.2	Multiple values							NA						
I	New Groundwater Total Capital Cost	4C-80	Table 4C.2	$ 14,097,000							$ -						
I	Lake Columbia/ Purchase Water from Provider Total Capital Cost	4C-83	Table 4C.2	$ 37,282,000							$ 151,701,031						
I	Angelina Co , Other, Phase 1, New Wells in Yegua-Jackson Aquifer Total Capital Cost	4C-A-8	Appendix 4C-A	$158,947							NA						
I	Hudson, Phase 1, New Wells in Carrizo -Wilcox Total Capital Cost	4C-A-14	Appendix 4C-A	$429,568							NA						
I	Rusk Co. Mining Total Capital Cost	4C-A-50	Appendix 4C-A	$177,050							NA						
I	Rusk Co. Steam Electric Total Capital Cost	4C-A-51	Appendix 4C-A	$4,984,650							NA						
I	Nacogdoches Co. Total Capital Cost	4C-A-88	Appendix 4C-A				$363,580	$363,580	$363,580	$363,580	NA						
I	Tyler Co. Total Capital Cost	4C-A-90	Appendix 4C-A			$270,455					NA						
I	Alternate Strategy ADS-1: water from Lake Fastrill WMS volume	4C-4			21,835	21,835	21,835	21,835	21,835	21,835	NA	NA	NA	NA	NA	NA	NA

REGION I

WATER USER GROUPS WITH APPARENT UNMET NEEDS

WUG Name	WUG Region	WUG County	WUG Basin
MINING	I	CHEROKEE	NECHES
MINING	I	HARDIN	NECHES
STEAM ELECTRIC POWER	I	NACOGDOCHES	NECHES

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dallas water utilities
city of dallas

June 28, 2010

Mr. Kelley Holcomb
Chair East Texas Regional Water Planning Group
%City of Nacogdoches
P.O. Box 635030
Nacogdoches, Texas 75963-5030

Re: East Texas Regional Water Planning Area 2011 Initially Prepared Plan

Dear Mr. Holcomb:

Upon review of the *East Texas Regional Water Planning Area 2011Update of the Region Water Plan Initially Prepared Plan*, (2011 East Texas RWPA IPP), I have noticed several inconsistencies between the 2011 East Texas RWPA IPP, and the *2011 Region C Initially Prepared Water Plan* (2011 Region C IPP) with regard to Lake Fastrill and the City of Dallas. I have also included some additional detail regarding Dallas connection of Lake Palestine, and a few editorial comments. My comments are as follows:

- On page 1-38 in the discussion of Lake Palestine, the report states "The City of Dallas anticipates constructing the necessary importation facilities by 2015." The following is a more detailed description of Dallas' proposed connection to Lake Palestine for your consideration for inclusion in the East Texas RWPA IPP.

  Dallas Water Utilities (DWU) and The Tarrant Regional Water District (TRWD) are cooperating to construct the Integrated Pipeline, which will deliver water to Dallas and Tarrant Counties from Lake Palestine, as well as Cedar Creek Lake, and Richland-Chambers Reservoir. The pipeline will have a capacity of approximately 350 mgd, with 150 mgd for Dallas and 200 mgd for TRWD. Dallas' contract with the Upper Neches River Municipal Water Authority and an interbasin transfer permit allowing the use of water from Lake Palestine in the Trinity River Basin provides Dallas 114,337 acre-feet per year (102 mgd) of water from Lake Palestine. TRWD's capacity in the Integrated Pipeline will deliver about 179,000 acre-feet per year (160 mgd) from Cedar Creek Lake and Richland-Chambers Lake.

- There are multiple references to Lake Fastrill as a water management strategy for the City of Dallas in the East Texas RWPA IPP. The U.S. Supreme Court's decision on February 22, 2010, not to hear the appeals of the State of Texas and Dallas, effectively supported the creation of the Neches River National Wildlife Refuge (NRNWR). This decision rendered the development of Lake Fastrill extremely unlikely. The City of Dallas is

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currently considering alternatives to Lake Fastrill inadvertently causing inconsistencies between the 2011 East Texas RWPA IPP and the 2011 Region C IPP. The following are two excerpts from the Region C IPP entitled *Lake Fastrill Replacement* and *Neches River Run-of-the-River Diversion* that describe Dallas' strategy in light of the timing of the U.S. Supreme Court's decision. I am providing these excerpts from the 2011 Region C IPP for your information and consideration in making the appropriate modifications in the 2011 East Texas RWPA IPP for consistency.

The *Lake Fastrill Replacement* excerpt below can be found in the 2011 Region C IPP in section *4E.1 Recommended Strategies for Regional Wholesale Water Providers* under "Dallas Water Utilities." This paragraph briefly describes Lake Fastrill, the U.S. Supreme Court's Decision and the alternative strategies the City of Dallas is considering to replace the 112,100 acre-feet per year that would have been provided by Lake Fastrill. Several of the alternate strategies are located in the East Texas Regional Water Planning Area while other are located in other regional water planning areas. The excerpt also includes the references identified in the excerpt.

> "**Lake Fastrill Replacement.** The Lake Fastrill Water Management Strategy would have allowed the Upper Neches River Municipal Water Authority (UNRMWA) and the City of Dallas (Dallas) to operate Lake Fastrill and Lake Palestine as a system due to its proximity to Lake Palestine resulting in increased operational flexibility, efficiencies, and associated economies of scale. Lake Fastrill was a recommended water management strategy in the approved 2006 Region C Water Plan [(9)] and the 2007 State Water Plan [(10)] and was designated by the Texas Legislature as a unique site for reservoir development. The lake was intended to meet projected water supply needs for the Dallas and water user groups in Anderson, Cherokee, Henderson, and Smith Counties in Region I. A decision of the United States Supreme Court on February 22, 2010 not to hear the appeals of the State of Texas and Dallas has effectively supported the creation of the Neches River National Wildlife Refuge (NRNWR) and rendered the development of Lake Fastrill extremely unlikely. As Dallas and the Upper Neches River Municipal Water Authority (UNRMWA) were planning on a firm water supply of at least 120 mgd (100 mgd for Dallas and 20 mgd for Region I) from the Lake Fastrill project, a new water management alternative strategy identified as the Lake Fastrill Replacement project is discussed herein.
>
> Since it is now unlikely that Lake Fastrill will ever be built, Dallas will need to find the additional 112,100 acre feet of water supply Dallas and its customer cities need from other sources. Due to the timing of the recent Supreme Court decision, the City of Dallas has not had an opportunity to reevaluate its alternative water management strategies to determine the best replacement for Dallas. The alternative strategies that are being considered by DWU as the Lake Fastrill Replacement include but are not limited to additional water conservation, Lake Texoma, Toledo Bend Reservoir, Lake O' the Pines, Lake Livingston, Ogallala groundwater in Roberts County (Region A), Marvin Nichols Reservoir, Lake

Columbia, George Parkhouse Reservoir (North), George Parkhouse Reservoir (South), Oklahoma Water and Neches River Run-of-the-River.

(9) Freese and Nichols, Inc., Alan Plummer Associates, Inc., Chiang, Patel & Yerby, Inc., and Cooksey Communications, Inc.: 2006 Region C Water Plan, prepared for the Region C Water Planning Group, Fort Worth, January 2006.

(10) Texas Water Development Board: Water for Texas 2007. [Online] Available URL: http://www.twdb.state.tx.us/wrpi/swp/swp.htm, April 2006."

The _Neches River Run-of-the-River Diversion_ excerpt below can be found in the 2011 Region C IPP in section *4D.13 Neches River Run-of-the-River Diversion*. This paragraph describes a new alternative strategy involving a run-of-the-river diversion point downstream of the proposed Lake Fastrill dam site. The *Neches River Run-of-the-River Diversion Project Preliminary Technical Information* is attached for your reference. The excerpt also includes the references identified in the excerpt.

"Neches River Run-of-the-River Diversion
Lake Fastrill was a recommended water management strategy in the approved 2006 Region C Water Plan [12] and the 2007 State Water Plan [14] and was designated by the Texas Legislature as a unique site for reservoir development. The lake was intended to meet projected water supply needs for the Dallas and water user groups in Anderson, Cherokee, Henderson, and Smith Counties in Region I. A decision of the United States Supreme Court on February 22, 2010 not to hear the appeals of the State of Texas and Dallas has effectively supported the creation of the Neches River National Wildlife Refuge (NRNWR) and rendered the development of Lake Fastrill extremely unlikely.

The Neches Run-of-the-River Diversion strategy is one potential alternative to Lake Fastrill. It would involve run-of-the-river diversions from the Neches River in Anderson and Cherokee Counties downstream of Lake Palestine and the Neches River National Wildlife Refuge and upstream of the Weches Dam site. The run-of-the-river diversions would be subject to senior water rights and environmental flow restrictions and would not be available at all times. Hence, the run-of-the-river project would include one or more "off-channel" storage reservoirs located on tributaries of the Neches River in Anderson and Cherokee Counties which would be refilled during periods when water is available for diversion from the Neches River. Based on an off-channel storage capacity of about 540,000 acre-foot firm water supplies of approximately 134,500 acre-foot per year would be available from the off-channel reservoirs to meet Dallas and Region I needs. A firm supply of 112,100 acre-feet per year would be delivered from off-channel storage to the proposed pump station at Lake Palestine and then on to Dallas and firm supplies of 22,400 acre-feet per year from the off-channel storage for Region I [13].

(12) Freese and Nichols, Inc., Alan Plummer Associates, Inc., Chiang, Patel & Yerby, Inc., and Cooksey Communications, Inc.: 2006 Region C Water Plan, prepared for the Region C Water Planning Group, Fort Worth, January 2006.

(13)HDR, Inc.: "Neches River Run-of-the-River Diversions Project Preliminary Technical Information for 2011 Region C Regional Water Plan," Austin, March 2010.

(14)Texas Water Development Board: *Water for Texas 2007*. [Online] Available URL: http://www.twdb.state.tx.us/wrpi/swp/swp.htm, April 2006."

- Lake Fastrill was identified as a "Unique Reservoir Site" in *Water for Texas 2007*, the State water plan, and designated a "Unique Reservoir Site" in Senate Bill 3 of the 80th Legislature which was signed into law by Governor Perry on June 16, 2007. As such Lake Fastrill should remain in the 2011 East Texas RWPA IPP as a Unique Reservoir Site" in the event conditions change and it becomes favorable to proceed with Lake Fastrill. Due to the Supreme Court decision, discussed above, Dallas has identified alternatives to Lake Fastrill, also discussed above, but is not proposing that Lake Fastrill be removed from the 2011 East Texas RWPA IPP, but rather modify references to Dallas and its strategies for meeting the 112,100 acre-feet per year demand from the East Texas Regional Water Planning Area.

- Table 4.B.18 - Demands by Lake Fastrill. The demands identified for Dallas were left blank. The demand supplied by Lake Fastrill would have been 112,100 ac-ft per year (100 MGD). Even though this demand may not be met by Lake Fastrill it is currently anticipated the demand will be met through the Upper Neches River Municipal Water Authority.

- On Page 4C-90 in the "Demands" section of the table "Demand (Potential Future)" shows "112,000" ac-ft per year beginning in 2040, in the text above the table there is a discussion of Dallas obtaining "112,100" ac-ft per year. These numbers should be consistent (112,100 ac-ft per year) if referring to the same water.

- In section <u>1.16.4 Special Study No. 4: Lake Murvaul Study</u> there is a discussion of an impending contract between Dallas and Luminent Energy. The section states "Luminant Energy has exercised its contract option with the City of Dallas and can now transfer 13,000 acre-feet per year from Lake Fork to the station at Martin Lake."

  Luminant is currently in the process of exercising its option with Dallas. Luminant's proposed contract is based on a maximum of 12,000 ac-ft/year. It is anticipated that Dallas' City Council will consider the Luminant Contract in August or September 2010.

- The Tables and Figures in Section 4C of the report are not identified with names or numbers making references to the figures and tables difficult.

If you have any questions or need additional information, please call Denis Qualls, the Interim Planning Division Manager for the City's Water Utilities Department at (214) 670-3843.

Sincerely,

For Jo M. (Jody) Puckett, P.E.
Director, Water Utilities Department

JMP:dwq
Enclosures

cc: Monty Shank, Upper Neches River Municipal Water Authority
Jim Parks, P.E., Region C Water Planning Group
Rex Hunt, P.E., Alan Plummer and Associates, Inc.
Tom Gooch, P.E., Freese & Nichols, Inc.

Neches River Run-of-the-River Diversions Project Preliminary Technical Information for 2011 Region C Regional Water Plan

HDR Engineering, Inc.
March 9, 2010

Description

Lake Fastrill was a recommended water management strategy in the approved 2006 Region C Water Plan and 2007 State Water Plan and was intended to meet projected water supply needs for the City of Dallas (Dallas) and water user groups in Anderson, Cherokee, Henderson, and Smith Counties in Region I. A decision of the United States Supreme Court on February 22, 2010 not to hear the appeals of the State of Texas and Dallas has effectively supported the creation of the Neches River National Wildlife Refuge (NRNWR) and rendered the development of Lake Fastrill extremely unlikely. As Dallas and the Upper Neches River Municipal Water Authority (UNRMWA) were planning on a firm water supply of at least 120 mgd (100 mgd for Dallas and 20 mgd for Region I) from the Lake Fastrill project, a new water management strategy identified as the Neches River Run-of-the-River Diversions project is discussed herein.

The proposed Neches River Run-of-the-River Diversions project would involve run-of-the-river diversions from the Neches River in Anderson and Cherokee Counties downstream of Lake Palestine and the NRNWR and upstream of the Weches Dam site. Subject to senior water rights and environmental flow restrictions, however, such run-of-the-river diversions would not be available at all times. Hence, the Neches River Run-of-the-River Diversions project includes one or more "off-channel" storage reservoirs located on tributaries of the Neches River in Anderson and Cherokee Counties which would be refilled during periods when water is available for diversion from the Neches River. Based on off-channel storage capacity of about 540,000 acft, firm water supplies of 120 mgd (~134,500 acft/yr) would be available from the off-channel reservoirs to meet Dallas and Region I needs. For regional water planning purposes, it is assumed that a firm supply of 100 mgd (~112,100 acft/yr) would be delivered from off-channel storage to the proposed pump station site at Lake Palestine and then on to the Dallas Eastside Water Treatment Plant (WTP). Firm Region I supplies of 20 mgd (~22,400 acft/yr) from the Neches River Run-of-the-River Diversions project are assumed to be available at one of the proposed off-channel reservoirs.

Available Yield

Water available for run-of-the-river diversion from the Neches River at the Fastrill Dam site downstream of State Highway 294 was calculated subject to senior water rights and Consensus Criteria for Environmental Flow Needs (CCEFN) using the Neches River Basin Water Availability Model (Neches WAM) and a daily operations model in MS Excel generally as described in the Fastrill Reservoir Preliminary Yield & Feasibility Study.[1] A maximum

[1] HDR Engineering, Inc., "Fastrill Reservoir Preliminary Yield & Feasibility Study," Upper Neches River Municipal Water Authority, Dallas Water Utilities, September 2006.

diversion rate of 4,455 cfs from the Neches River to off-channel storage and off-channel storage capacity of about 540,000 acft were assumed for the purposes of this preliminary technical evaluation. Off-channel reservoir operations were simulated using composite elevation-area-capacity relationships assuming no impoundment of local runoff, net evaporation rates associated with Lake Fastrill, and uniform diversion of the firm yield.

Preliminary Estimate of Project Cost

A preliminary estimate of cost for the Neches River Run-of-the-River Diversions project based on standard procedures and unit prices developed by HDR Engineering, Inc. and Freese & Nichols, Inc. for use in regional water planning studies pursuant to Texas Water Development Board and Region C guidance is summarized in Table 1. Project facilities include: a) an intake and pump station on the Neches River; b) high capacity pipelines for transmission of Neches River diversions into off-channel storage; c) dams and off-channel reservoirs; d) intake(s), pump station(s), collector pipeline(s), and a transmission pipeline for delivery of water from off-channel storage to the Lake Palestine pump station site; and e) a transmission pipeline from Lake Palestine to the Dallas Eastside WTP. Total cost for the Neches River Run-of-the-River Diversions project is estimated to be $1.981 billion. Annual debt service with all facilities financed over 30 years at 6 percent interest totals $143.9 million. Annual costs for operations and maintenance, including power, are estimated at $49.4 million. Hence, the total annual cost for the project subject to full debt service is $193.3 million. Dividing this total annual cost by the estimated firm yield of 134,500 acft/yr results in an annual unit cost of $1,437/acft or $4.41/kgal. These preliminary cost estimates may be refined by optimization of project size and associated firm yield and through use of site-specific information compiled in future feasibility studies.

Table Q-55
Cost of Neches River Run-of-the-River Diversions Project for Dallas Water Utilities

Probable Owner:	DWU		
Quantity:	134,500	AF/Y	20% Retained for Local Use (~20 MGD)
Quantity for DWU:	112,100	AF/Y	

CONSTRUCTION COSTS	**Size**	**Quantity**	**Unit**	**Unit Price**	**Cost**
Dam and Reservoir					
Dams and Reservoirs Construction		1	LS	$193,450,000	$193,450,000
Engineering and Contingencies (35%)					$67,708,000
Land Acquisition and Mitigation		1	LS	$65,969,000	$65,969,000
Total Dams and Reservoirs					**$327,127,000**
Transmission Systems					
Intake and Pump Station at River	235808 HP	1	LS	$308,292,000	$308,292,000
Diversion Pipelines to DWU OCRs (Rural)	144 in	148,000	LF	$1,903	$281,644,000
Diversion Pipeline to Local OCR (Rural)	114 in	17,400	LF	$1,183	$20,584,000
Intake and Pump Station at DWU OCRs	10370 in	1	LS	$26,452,000	$26,452,000
Booster Pump Stations from DWU OCRs	Varies	3	LS	$17,105,000	$51,315,000
Transmission Pipeline from DWU OCRs (Rural)	72 in	536,838	LF	$530	$284,524,000
Transmission Pipeline from DWU OCRs (Urban)	72 in	156,546	LF	$714	$111,774,000
ROW Easements					$7,588,000
					$1,092,173,000
Engineering and Contingencies (30% for pipelines, 35% for other)					$344,678,000
Permitting & Mitigation - Conveyance System					$4,095,000
Construction					**$1,768,073,000**
Interest During Construction (36 months)					**$212,205,000**
TOTAL CAPITAL COST					**$1,980,278,000**
ANNUAL COSTS					
Debt Service (6% for 30 years)					$143,865,000
Electricity ($0.09 per kWh)					$30,021,000
Operation & Maintenance					$19,415,000
Total Annual Costs					**$193,301,000**
UNIT COSTS (Until Amortized)					
Per Acre-Foot					$1,437
Per 1,000 Gallons					$4.41
UNIT COSTS (After Amortization)					
Per Acre-Foot					$368
Per 1,000 Gallons					$1.13

Cost estimates provided by HDR, Inc.

Appendix 10-D

Water Management Strategies Source Exceptions and Responses

The TWDB provided comments to the ETRWPG regarding the online planning database (DB12) based on a direct comparison of the DB12 against the 2011 IPP. Data which did not reconcile between the plan and the online database were provided to the ETRWPG. This appendix includes responses to TWDB comments regarding the DB12.

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WMS SOURCE EXCEPTIONS

Response

Exception Description: The sum of the WMS Source does not equal the sum of the strategy supplies for all of the WUGs and WWPs attached to this source. Please verify that this is correct.

	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	Response
1.	742	H	LNVA TO WUG CONTRACT	OTHER INFRASTRUCTURE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	H07-WUGC11	Region H strategy
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	
1.	629	I	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	060A0	

	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	Response
2.	443	I	NEW WELLS - CARRIZO WILCOX AQUIFER	OTHER INFRASTRUCTURE	NEW SURFACE WATER OR NEW GROUNDWATER SOURCE	I03.1CW	
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	
1.	1466	I	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	00310	Correct. Supplies shown on WWP.
2.	1483	I	CARRIZO-WILCOX AQUIFER	NACOGDOCHES	NECHES	17410	Correct. Supplies shown on WWP.

	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	Response
3.	440	I	PURCHASE WATER FROM PROVIDER (1)	NO INFRASTRUCTURE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	I02.1PUR	
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	
1.	565	I	CENTER LAKE/RESERVOIR	RESERVOIR	SABINE	05260	Correct. Supplies shown on WWP.
2.	643	I	HOUSTON COUNTY LAKE/RESERVOIR	RESERVOIR	TRINITY	08280	Correct. Supplies shown on WWP.
3.	567	I	MURVAUL LAKE/RESERVOIR	RESERVOIR	SABINE	05160	Correct. Supplies shown on WWP.
4.	541	I	SABINE RIVER RUN-OF-RIVER	NEWTON	SABINE	3460504662	Correct. Supplies shown on WWP.
5.	566	I	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	05170	Correct. Supplies shown on WWP.

	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	Response
4.	441	I	PURCHASE WATER FROM PROVIDER (2)	PIPELINE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	I02.2PUR	
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	
1.	1466	I	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	00310	Correct. Supplies shown on WWP.
2.	628	I	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	06180	Correct. Supplies shown on WWP.
3.	626	I	KURTH LAKE/RESERVOIR	RESERVOIR	NECHES	06290	Correct. Supplies shown on WWP.
4.	629	I	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	060A0	Correct. Supplies shown on WWP.
5.	566	I	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	05170	Correct. Supplies shown on WWP.

	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	Response
5.	442	I	PURCHASE WATER FROM PROVIDER (3)	PIPELINE AND WATER TREATMENT PLANT	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	I02.3PUR	
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	
1.	622	I	PALESTINE LAKE/RESERVOIR	RESERVOIR	NECHES	06020	Correct. Supplies shown on WWP.

Location on Interface: WMS SOURCE Module

WMS SOURCE EXCEPTIONS

Response

Exception Description: The sum of the WMS Source does not equal the sum of the costs for all of the WUGs and WWPs attached to this source. Please verify that this is correct.

	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	Response
1.	443	I	NEW WELLS - CARRIZO WILCOX AQUIFER	OTHER INFRASTRUCTURE	NEW SURFACE WATER OR NEW GROUNDWATER SOURCE	I03.1CW	
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	
1.	1466	I	CARRIZO-WILCOX AQUIFER	ANGELINA	NECHES	00310	Correct. Costs are shown for WWP.
	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	
2.	440	I	PURCHASE WATER FROM PROVIDER (1)	NO INFRASTRUCTURE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	I02.1PUR	
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	
1.	566	I	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	05170	Alternative strategy set to No. Correct.
	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	
3.	441	I	PURCHASE WATER FROM PROVIDER (2)	PIPELINE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	I02.2PUR	
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	
1.	566	I	TOLEDO BEND LAKE/RESERVOIR	RESERVOIR	SABINE	05170	Alternative strategy set to No. Correct.
	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	
4.	442	I	PURCHASE WATER FROM PROVIDER (3)	PIPELINE AND WATER TREATMENT PLANT	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	I02.3PUR	
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	
1.	628	I	COLUMBIA LAKE/RESERVOIR	RESERVOIR	NECHES	06180	Corrected Nacogdoches WWP. All costs are shown on WWP.

Location on Interface: WMS SOURCE Module

WMS SOURCE EXCEPTIONS

Response

Exception Description: The WMS Source Sum is greater than zero for strategies and/or costs. However, the Include in State Water Plan flag is set to No. Please verify that this is correct.

#	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	Response
1.	428	C	PURCHASE FROM WATER PROVIDER (2)	NO INFRASTRUCTURE	REUSE	C50.2	
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	Region C strategy
1.	4406	I	INDIRECT REUSE	HENDERSON	NECHES	3506107	
	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	
2.	429	C	PURCHASE FROM WATER PROVIDER (3)	NO INFRASTRUCTURE	NEW SURFACE WATER OR NEW GROUNDWATER SOURCE	C50.3	
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	Region C strategy
1.	4162	I	FASTRILL LAKE/RESERVOIR	RESERVOIR	NECHES	06090	
	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	
3.	443	I	NEW WELLS - CARRIZO WILCOX AQUIFER	OTHER INFRASTRUCTURE	NEW SURFACE WATER OR NEW GROUNDWATER SOURCE	I03.1CW	
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	
1.	1472	I	CARRIZO-WILCOX AQUIFER	HENDERSON	NECHES	10710	Corrected in DB12
	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	
4.	890	I	SEDIMENT REDUCTION	NO INFRASTRUCTURE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	I21	Corrected in DB12
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	
1.	629	I	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	RESERVOIR	NECHES	060A0	
	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	
5.	889	I	WHOLESALE CUSTOMER CONSERVATION	NO INFRASTRUCTURE	CONSERVATION	I01ACON	Corrected in DB12
	DBSOID	SOURCE RWPG	SOURCE NAME	SOURCE COUNTY	SOURCE BASIN	SOURCE ID	
1.	582	I	NECHES RIVER RUN-OF-RIVER PINE ISLAND BAYOU	JASPER	NECHES	3460604411B	

Location on Interface: WMS SOURCE Module

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WMS PROJECT EXCEPTIONS

Response

Exception Description: The following WMS Projects are a combination of Recommended, Considered and Alternative. Please verify that this is correct.

	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	Response
1.	443	I	NEW WELLS - CARRIZO WILCOX AQUIFER	OTHER INFRASTRUCTURE	NEW SURFACE WATER OR NEW GROUNDWATER SOURCE	I03.1CW	Correct
2.	440	I	PURCHASE WATER FROM PROVIDER (1)	NO INFRASTRUCTURE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	I02.1PUR	Correct
3.	441	I	PURCHASE WATER FROM PROVIDER (2)	PIPELINE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	I02.2PUR	Correct. Changed to alternate.
4.	442	I	PURCHASE WATER FROM PROVIDER (3)	PIPELINE AND WATER TREATMENT PLANT	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	I02.3PUR	Correct

Location on Interface: WMS Module

Exception Description: The WMS Project Sum is greater than zero for strategies and/or costs. However, the Include in State Water Plan flag is set to No. Please verify that this is correct.

	DBPROJECTID	PROJECT RWPG	PROJECT NAME	PROJECT INFRASTRUCTURE	PROJECT TYPE	WMS PROJECT ID	Response
1.	890	I	SEDIMENT REDUCTION	NO INFRASTRUCTURE	EXISTING SOURCE OR EXPANDED USE OF AN EXISTING SOURCE (SURFACE WATER OR GROUNDWATER)	I21	Changed to include in SWP
2.	889	I	WHOLESALE CUSTOMER CONSERVATION	NO INFRASTRUCTURE	CONSERVATION	I01ACON	Changed to include in SWP

Location on Interface: WMS Module