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Chapter 1: Description of Region
2026 Initially Prepared Plan

Prepare for:
East Texas Regional Water Planning Group

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Chapter 1. Description of Region

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LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
AFY	acre-feet
BMPs	best management practices
cfs	cubic feet per second
CWA	Clean Water Act
ETRWPA	East Texas Regional Water Planning Area
ETRWPG	East Texas Regional Water Planning Group
ft	foot
ft/yr	foot per year
GPCPD	gallons per connection per day
GCDs	Groundwater Conservation Districts
GMAs	groundwater management areas
GPCD	gallons per capita daily
LNG	liquefied natural gas
MSA	Metropolitan Statistical Areas
MUD	Municipal Utility District
MWA	Municipal Water Authority
MWP	Major Water Provider
NRCS	National Resources Conservation Service
RWP	Regional Water Plan
RWPA	Regional Water Planning Area
RWPG	Regional Water Planning Group
SRA	Sabine River Authority
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TCF	trillion cubic feet
TPWD	Texas Parks and Wildlife Department
TTWP	Trans-Texas Water Program
TWDB	the Texas Water Development Board
USA	United States
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WMSs	Water Management Strategies
WUG	Water User Group
WWP	Wholesale Water Provider

Chapter 1. Description of Region

1 DESCRIPTION OF REGION

The East Texas Regional Water Planning Area (ETRWPA) is one of sixteen areas established by the 1997 Texas legislature Senate Bill 1 for the purpose of State water resource planning at a regional level on five-year planning cycles. The first regional water plan was adopted in 2001. Since that time, it was updated in 2006, 2011, 2016, and 2021. This plan, the 2026 Regional Water Plan (2026 Plan), is the result of the 6th cycle of regional water planning.

Pursuant to the formation of the ETRWPA, the East Texas Regional Water Planning Group (ETRWPG or RWPG), was formed and charged with the responsibility to evaluate the region's population projections, water demand projections, and existing water supplies for a 50-year planning horizon. The RWPG then identifies water shortages under drought of record conditions and recommends water management strategies. This planning is performed in accordance with regional and state water planning requirements of the Texas Water Development Board (TWDB).

This chapter provides details for the ETRWPA that are relevant to water resource planning, including: a physical description of the region, climatological details, population projections, economic activities, sources of water and water demand, and regional resources. 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 are also provided.

1.1 GENERAL INTRODUCTION

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 in Figure 1.1. The ETRWPA consists of approximately 10,329,800 acres of land and accounts for roughly six percent of total area of the State of Texas.

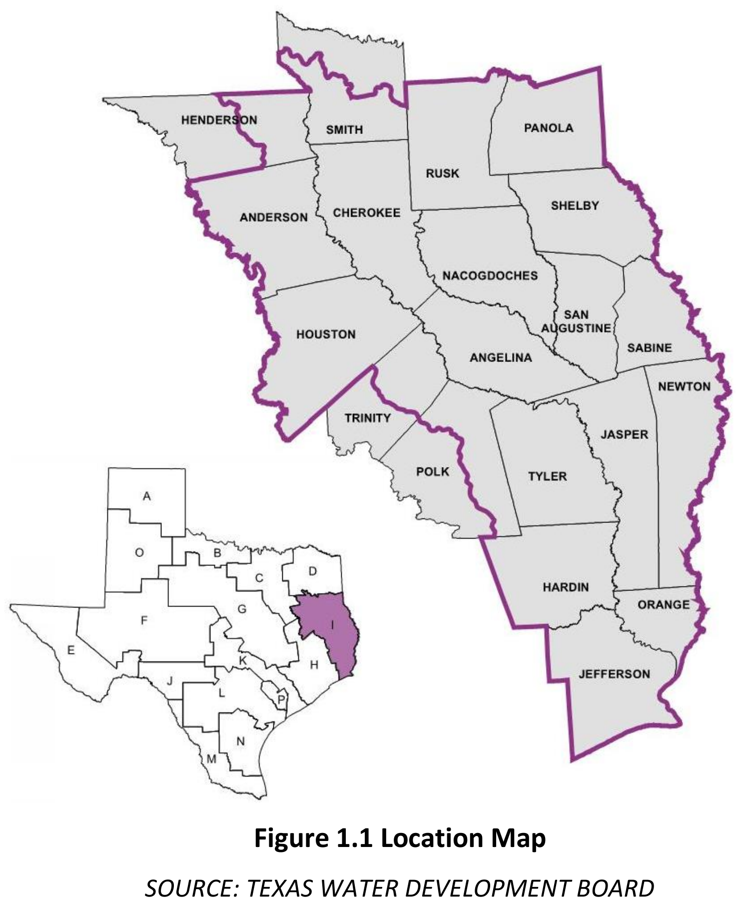

Figure 1.1 Location Map

SOURCE: TEXAS WATER DEVELOPMENT BOARD

By statute, the RWPG consists of members from at least 12 of the following statutorily required interests: public, counties, municipalities, industries, agriculture, environmental, small business, electric-generating utilities, river authorities, water districts, water utilities, and groundwater management areas. These voting, and several non-voting members, collectively represent the water supply interests of the entire region.

The City of Nacogdoches is the administrative contracting agency for the RWPG. The RWPG has retained the services of a team of water-supply consulting engineering firms to prepare the 2026 Plan including Plummer Associates, Inc. as the lead consultant, Freese & Nichols, Inc. as a subconsultant, and Advanced Groundwater Consultants as a subconsultant groundwater specialist. Table 1.1 provides a current list of the RWPG representatives involved in developing the 2026 Regional Water Plan.

Table 1.1 East Texas Regional Water Planning Group Members

Voting Members	
Category	**Name**
Agriculture	David Alders, Carrizo Creek Corporation
	Matthew Mettauer*, Mettauer Law*
Counties	Judge Chris Davis, *Cherokee County*
	Fred Jackson, Jefferson County
Electric Power	Michael Snyder, Entergy Services, LLC
Environmental	Dr. Matthew McBroom, Stephen F. Austin State University
Groundwater Management Areas	John McFarland, GMA 11
	John Martin, GMA 14
Industries	David Gorsich, Exxon Mobil Corporation
	Vacant
Municipalities	Kate Dietz, City of Tyler
	Vacant
Public	Terry D. Stelly
	Vacant
River Authorities	David Montagne, Sabine River Authority
	Monty Shank, Upper Neches River MWA
	Kelley Holcomb, Angelina-Neches River Authority
	Scott Hall, Lower Neches Valley Authority
Small Business	Christopher L. Wiesinger
	Vacant
Water Districts	Emily Whitworth
Water Utilities	Robb Starr, Lumberton MUD Vacant

Non-Voting Members	
Vacant, Texas Water Development Board	Vacant, Texas Parks & Wildlife Department
Vacant, Texas Department of Agriculture	James Alford, Trinity County
Connie Standridge, *Region C RWPG*	Vacant, Louisiana Governor's Office of Coastal Activities
Honorable Joel Hale, *Rusk County Judge*	Chang Lee, PE, *City of Dallas*
VACANT, Region H RWPG	Honorable Allison Harbison, *Shelby County Judge*
Walter Glenn, Jasper County	Vacant, U.S. Department of Agriculture
Vacant, Texas State Soil and Water Conservation Board	Vacant

Table 1.1 East Texas Regional Water Planning Group Members (Cont.)

Committees	
Executive Committee	
Chair – John Martin 1st Vice Chair – David Alders 2nd Vice Chair – John McFarland Secretary –Terry D. Stelly	Assistant Secretary- David Montagne At-Large – Matthew McBroom At-Large – Kelley Holcomb
Nominations Committee	**By-Laws Committee**
Chair – Monty Shank Member – Chris Davis Ex-Officio – Kelley Holcomb	Chair – David Alders Member - Roger Fussell
Finance Committee	**Technical Committee**
Chair – Kelley Holcomb b	Chair – Scott Hall Member – John Martin Member – Matthew McBroom

SOURCE: EAST TEXAS REGIONAL WATER PLANNING GROUP

[ETRWPG, please review and confirm the list above.]

1.1.1 Physical Description

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 at Tater Hill Mountain in Henderson County at its far northwest corner. The region is further subdivided into natural geographic areas known as the Piney Woods, the Oak Woods and Prairies, and the Coastal Prairies, described as follows.

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 as well, primarily in the valleys of rivers and creeks. Longleaf, shortleaf, and loblolly pine are native to the region and slash pine, an introduced species, is 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. 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, Anderson, and Houston counties) fall within the Oak Woods and Prairies portion of the Texas Gulf Coastal Plains. Principal trees of this area are hardwoods, including post oak, blackjack oak, and elm. Riparian areas often have pecan, walnut, and other trees with high water demands. Upland soils are sandy and sandy loam, while the bottomlands are sandy loam and clay. 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 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 that continues today. The chief concentration of this development has been from the city of Orange and the areas between the cities of Beaumont and Houston; much of the development has been in petrochemical manufacturing.

Figure 1.2 depicts the boundaries of these areas within the ETRWPA. Additional description of the region is provided later in this chapter.

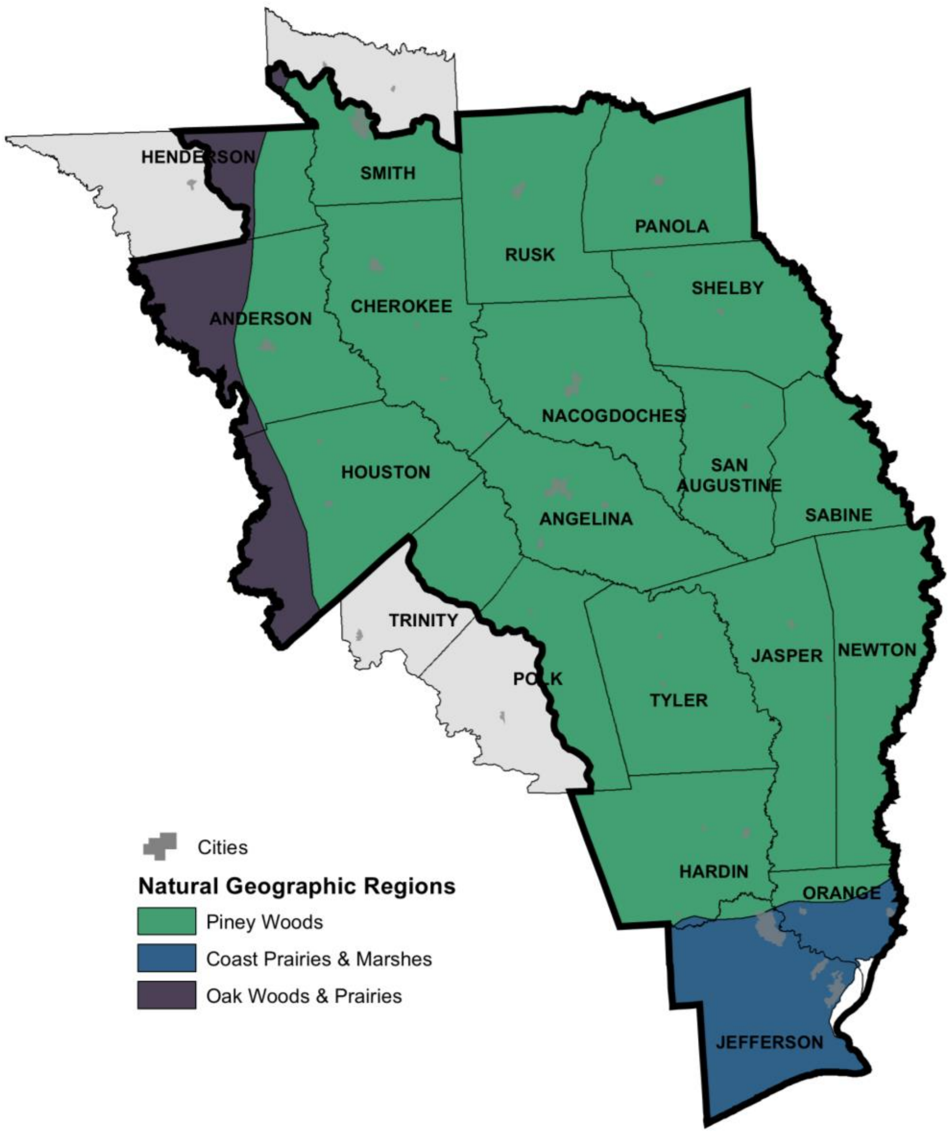

Figure 1.2 Natural Geographic Regions

SOURCE: TEXAS NATURAL RESOURCE INFORMATION SYSTEM

1.1.2 Climate

Data from National Weather Service Stations compiled by the Texas State Climatologist indicate that the mean temperatures for the entire region varied from a minimum January temperature of 35 °F in the northern portion of Region I, including Henderson, Smith, Rusk, and Panola counties, to a maximum July temperature of 95 °F in Cherokee County and western portion of the Anderson and Houston Counties.[1] Similarly, the average growing season from 1981 to 2010 was 252 days in the ETRWPA.[2]

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 51.7 inches from 1991 through 2020, with the highest average rainfall (61.4 inches) being recorded in the southwest corner of Quadrant 714 and the lowest average rainfall (40.4 inches) being recorded in Quadrant 611. From 1991 to 2020 the average annual gross reservoir evaporation (the rate of evaporation from a reservoir) ranges from approximately 47 inches in the southeast to 61 inches in the northwest.[3]

Figures 1.3 through 1.5 depict mean annual temperature, mean annual precipitation, and gross reservoir evaporation, respectively for the ETRWPA.

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[1] PRISM Climate Group. (2023). PRISM Climate Data. URL: http://www.prism.oregonstate.edu/, accessed September 2023.

[2] Texas Almanac. (2019) Texas Temperature, Freeze, Growing Season and Precipitation Records by County. URL: https://texasalmanac.com/ , accessed January 2019.

[3] Texas Water Development Board. (2023) Lake Evaporation and Precipitation. URL: https://waterdatafortexas.org/lake-evaporation-rainfall, accessed September 2023.

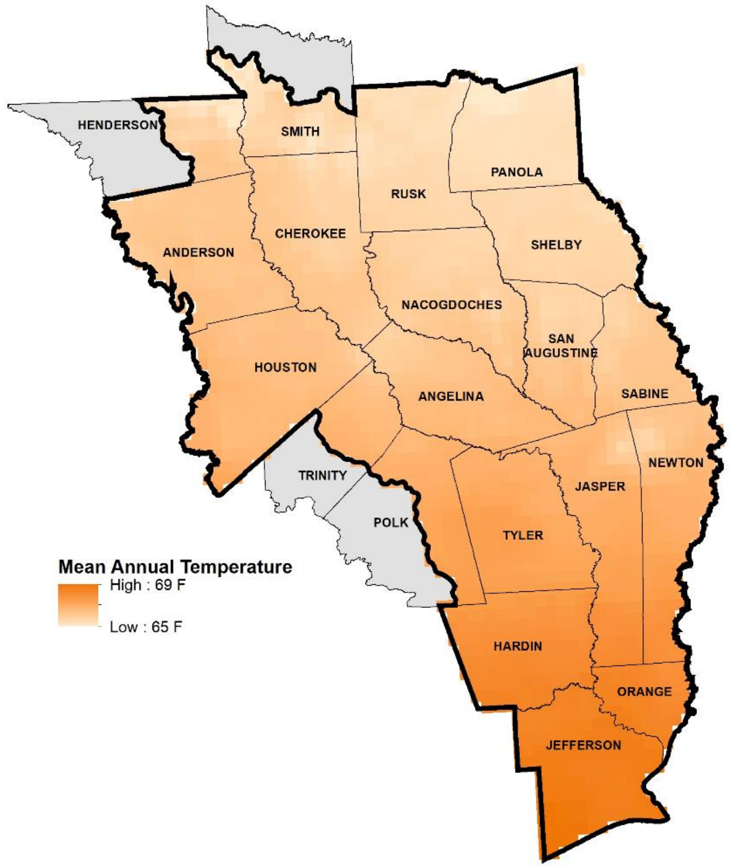

Figure 1.3 Mean Annual Temperature

SOURCE: PRISM CLIMATE GROUP

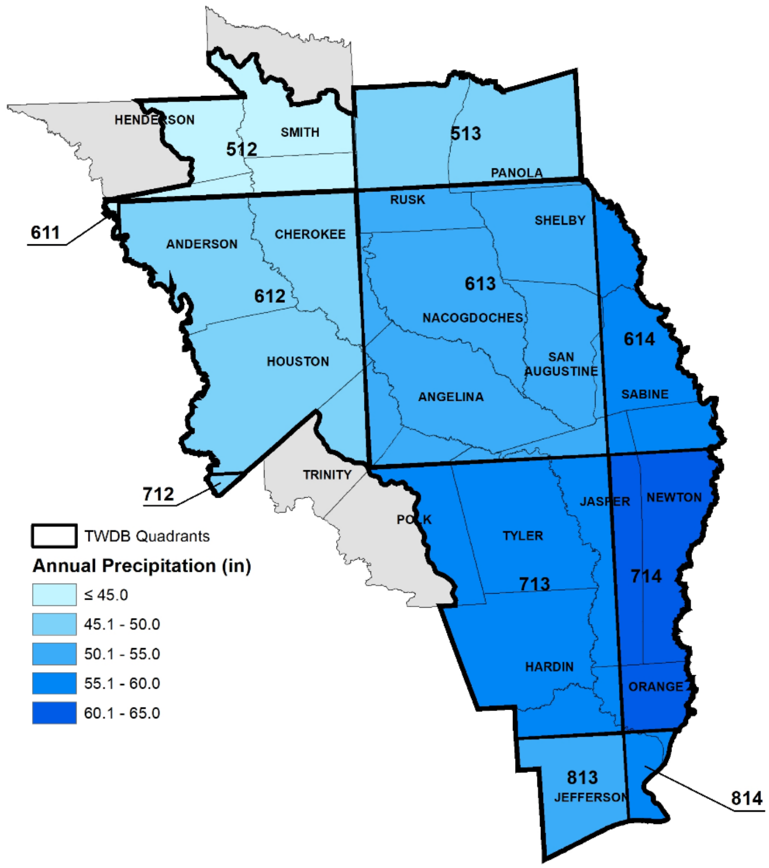

Figure 1.4 Mean Annual Precipitation

SOURCE: TEXAS WATER DEVELOPMENT BOARD

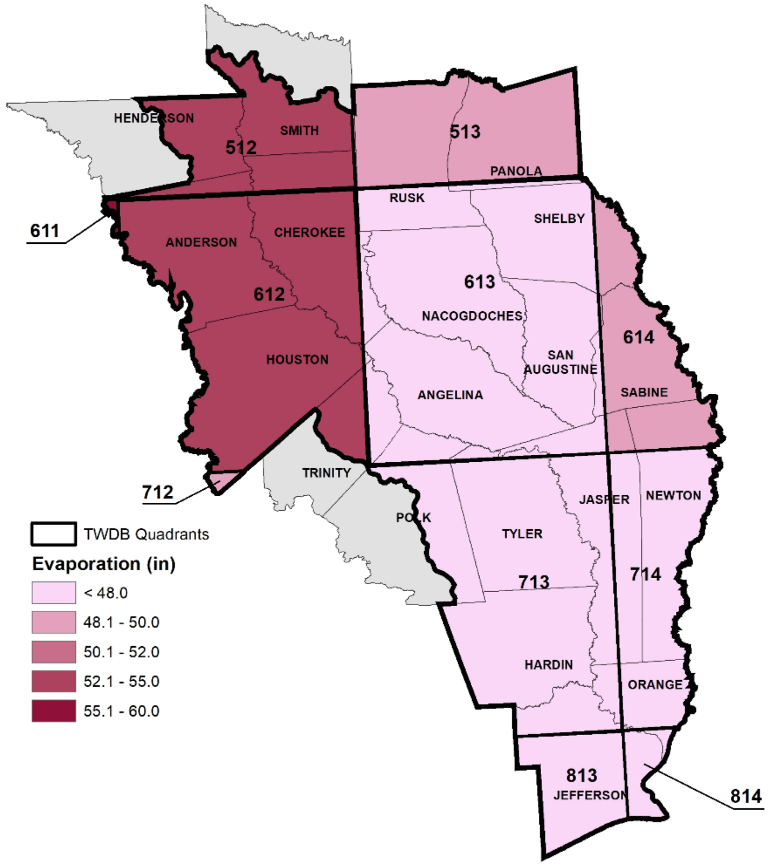

Figure 1.5 Gross Reservoir Evaporation

SOURCE: TEXAS WATER DEVELOPMENT BOARD

1.1.3 Population

The ETRWPA contains all or parts of three Metropolitan Statistical Areas (MSA) as defined by the Office of Management and Budget; an MSA is an urban area with a population of 50,000 or more.[4] The MSAs in the ETRWPA include:

- Beaumont-Port Arthur MSA (Jefferson, Orange, and Hardin counties).
- Most of the Tyler MSA (portion of Smith County in Neches basin).
- Most of the Southern Utilities Company MSA (Rusk and Gregg Counties).

As of 2020, the combined population of the first three MSAs, with their primary population residing in Region I, accounts for approximately 30% of the total ETRWPA population, after adjusting for the regional split.

The population in the region increased approximately 3% from 2010 through 2020, to approximately 1.08 million people. Growth in the region is expected to continue at an average rate of approximately 6% per

[4] Texas Demographic Center. (2018) 2018 Texas Population Projections Data Tool. URL: http://txsdc.utsa.edu/Data/TPEPP/Projections/Tool, accessed January 2019.

decade to approximately 1.17 million by 2080. The census data from 2010 and 2020 for the region's major water user groups and their locations are provided in Figure 1.6. Additional details on population projections developed by the TWDB are provided in Chapter 2 and Appendix ES-A, Report 01.

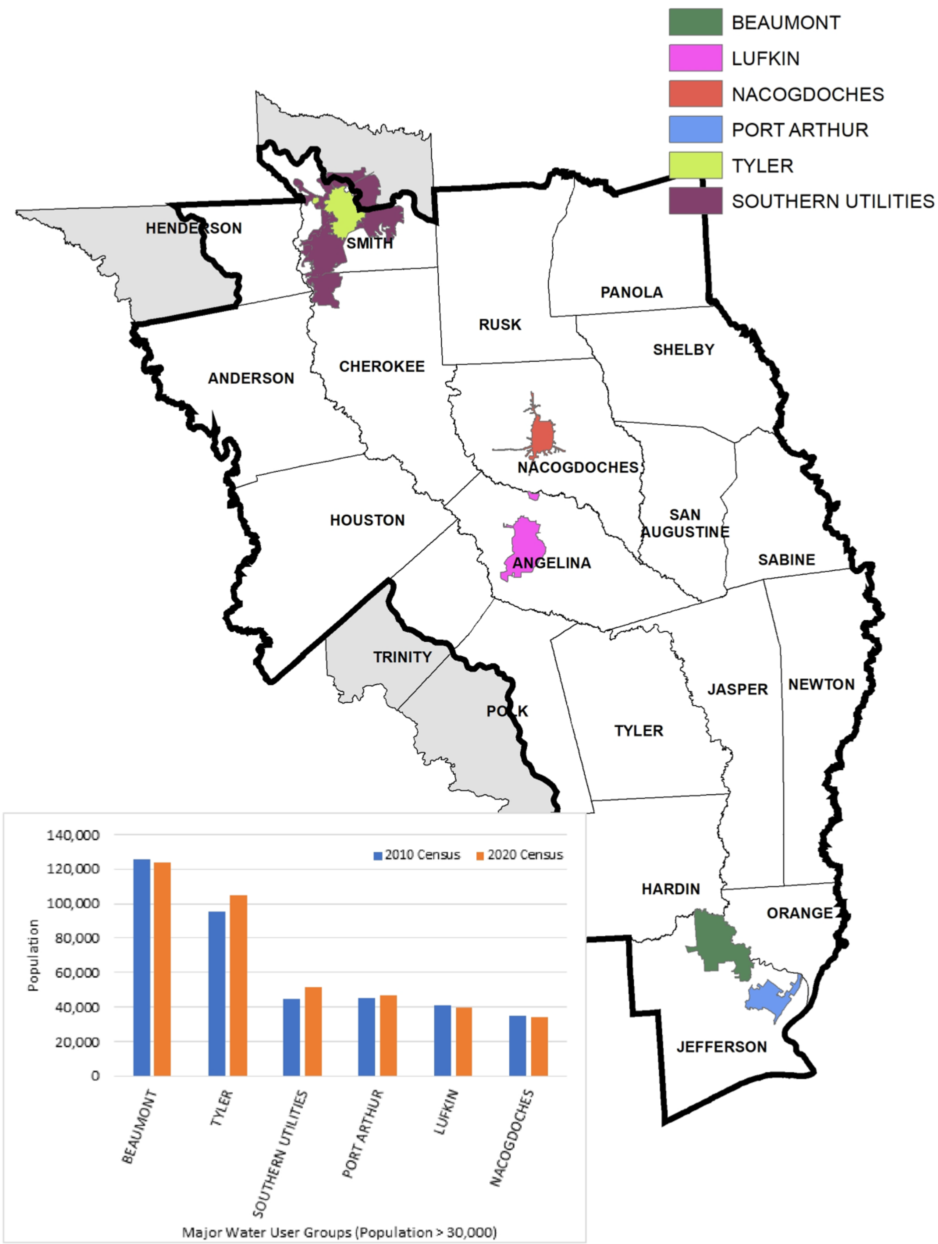

Figure 1.6 Historical Populations of Major Cities

Note: The population shown herein represents the total population of each city and is not split by regional planning area.

SOURCE: U.S. CENSUS BUREAU

1.1.4 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 in the ETRWPA are listed in Table 1.2.

Table 1.2 Economic Sectors Heavily Dependent on Water Resources

Use Category	Detail
Irrigation	Hay
	Rice
	Soybeans
	Vegetables
Livestock	Poultry
	Cattle
	Fish Hatchery
Manufacturing	Timber, Pulpwood, and Forest Fiber
	Chemical and Allied Products
	Petroleum Refining
Mining	Oil and Gas Production

SOURCE: EAST TEXAS REGIONAL WATER PLANNING GROUP

The Beaumont-Port Arthur MSA, 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 and Tyler counties.

Several seaports are located in the cities of Beaumont, Port Arthur, and Orange, plus several industrial docks, along with small amounts of shipyard activity. 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 majority of the Longview MSA is located just outside the region, north of Rusk County. It is centered in Longview in Gregg County. However, the area includes very diversified manufacturing located within the ETRWPA in Rusk County. Rusk County manufacturing includes brick manufacturing, power generation, steel fabrication, fiberglass specialties, and timber industry. Rusk County also has state correctional facilities. No major ETRWPA cities are located in this area.

The Tyler MSA, 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 ETRWPA. Local manufacturing includes air conditioning/heating equipment, cast iron pipe, tires, and meatpacking, including poultry processing. Known as the “Rose Capital,” Tyler has a thriving commercial rose industry as well. Tyler is home to Tyler Junior College and the University of Texas at Tyler, and the city is a growing hub for the health-care industry and retail in East Texas. Oil production is prevalent in the area.

Lufkin, Lumberton, and Nacogdoches, the other major cities in the ETRWPA, do not presently classify as MSAs. However, the populations in these areas are both projected to be over 40,000 in this cycle of population projections. These cities, located in adjacent counties, have many similarities including timber products industries, poultry processing, higher education, and health care service providers. Nacogdoches also has manufacturers of valves, transformers, sealing products, and motor homes. Stephen F. Austin State University is located in Nacogdoches.

Economic activity for the remainder of the region includes timber industry, including numerous timber processing mills. Natural gas and some oil productions are scattered throughout the region, and beef cattle production is prominent, being found in all counties in the region. Plant nurseries are common in the north part of the region. Poultry production and/or processing are prevalent in Anderson, Shelby, Nacogdoches, Angelina, San Augustine, Houston, Cherokee, Smith, Rusk, and Panola counties. There is diverse manufacturing in addition to timber industries. Commercial fishing is an important economic characteristic of Sabine Lake. Tourism, fishing, and hunting are important in many areas, especially on the large reservoirs in the center of the region, further to the south near Sabine Lake and the Gulf of Mexico, and in many forested areas.

Information from the Texas Workforce Commission indicates that in 2022, unemployment rates in Region I varied from 3.4% in Anderson County to 7.0% in Sabine County. The averages annual pay per job by county in Region I varies significantly, from as high as $63,901 in Jefferson County to as low as $38,591 in Tyler County. In addition, other counties with higher average annual pay per job, ranked in descending order, include Houston, Orange, and Anderson Counties, all exceeding $55,000; counties with lower average annual pay per job, ranked in descending order, include Cherokee, Henderson, Sabine, Tyler, and Newton, all below $45,000.[5]

Of the three workforce areas overlapping the region, the current average annual wages as of September 2023 were as follows:[5]

- East Texas (northern counties): $50,558
- Deep East Texas (middle counties): $38,792
- South East Texas (Beaumont-Port Arthur metropolitan area): $53,560

1.2 CURRENT WATER DEMANDS

The demand for water in the ETRWPA is expected to grow from 755,106 ac-ft per year in 2030 to 987,594 ac-ft per year in 2080. The water demands considered in the regional water planning process are 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.

Most demand in the region centers on larger cities or metropolitan areas. 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, with a substantial portion located in Jefferson County. However, large volumes of water use can occur away from large cities too, as in the case of

[5] Texas Workforce Commission. (2018), Labor Market Information. URL: https://www.twc. businesses/labor-market-information texas.gov/, accessed December 2018.

Texas Association of Counties, 2023. Texas Counties: Unemployment Rate, via link https://txcip.org/tac/census/morecountyinfo.php?MORE=1042, accessed September 2023.

Texas Association of Counties, 2023. Texas Counties: Average Annual Pay Per Job, via link https://txcip.org/tac/census/morecountyinfo.php?MORE=1047, accessed September 2023.

outlying industries and steam-electric power generating plants.

For purposes of the 2026 Plan, 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, a single industry was selected if it had 20,000 ac-ft per year or more in 2020 and represented the majority of usage in the county. As summarized in Table 1.3, there are currently three major demand centers in the ETRWPA located in Jasper, Jefferson, and Smith counties.

Table 1.3 Major Demand Centers

County	Water User Group	2020 Historical Demand (ac-ft/yr)
Jasper	Manufacturing	50,999
Jefferson	Irrigation	69,250
	Manufacturing	122,131
	Municipal	49,072
Smith	Municipal	47,629

SOURCE: TEXAS WATER DEVELOPMENT BOARD

1.3 SOURCES OF WATER

The ETRWPA primarily sources its supplies from groundwater and surface water. Springs within the region can also be an important source of water for some uses. Following is a summary of groundwater, springs, and surface water sources within the ETRWPA. Historical average pumping values for aquifers were obtained from the Historical Groundwater Pumpage Estimates report developed by the TWDB.

1.3.1 Groundwater

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 necessarily the total volume available.

The two major aquifers that underlie the region are known as the Carrizo-Wilcox and the Gulf Coast aquifers. The three minor aquifers, the Queen City, Sparta, and Yegua-Jackson aquifers, supply lesser amounts of water to the region. Figure 1.7 and Figure 1.8 show the locations of the major and minor aquifers, respectively.

The following generalized descriptions of the characteristics and quality of major and minor aquifers in the ETRWPA are based largely on the work of TWDB. Groundwater quality is affected by natural conditions as well as man-made contamination. According to the Texas Commission on Environmental Quality (TCEQ), "natural contamination probably affects the quality of more groundwater in the state than all other sources of contamination combined."[6] A more thorough discussion of groundwater availability is

[6] Texas Water Commission, Ground Water Protection Unit Staff, "Groundwater Quality of Texas - An Overview of Natural and Man-Affected Conditions," TWC Report 89-01. March 1989. URL: http://www.twdb.texas.gov/publications/reports/other_reports/doc/miscreport89-01/R89-01.pdf, accessed October 2020.

provided in Chapter 3.

Gulf Coast Aquifer. The Gulf Coast Aquifer is a major aquifer that forms an irregularly shaped belt along the Gulf of Mexico from Florida to Mexico. In Texas, this aquifer provides water to all or parts of 54 counties, including 8 counties in the ETRWPA. It extends from the Rio Grande northeastward to the borders with Louisiana . The Gulf Coast Aquifer provides the sole source of groundwater in the seven southern counties of the region.

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, Jasper, Evangeline, and Chicot layers, 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 72,789 ac-ft per year in years 2016 through 2020.

Water quality in the Gulf Coast Aquifer varies significantly, depending on location. Salt-water intrusion is a significant source 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. In areas near the coast, dissolved salts concentrations are generally in excess of 1,000 parts per million (ppm) and can exceed 10,000 ppm. In areas of the aquifer further from the coast, dissolved salts concentrations can drop to less than 500 ppm.

Heavy pumpage has caused an updip migration, or saltwater intrusion, of poor quality water into the aquifer beyond its natural limits. Salt-water conditions are a problem in Orange County in the heavily pumped areas around the City of Orange. The previously referenced TCEQ 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.

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 designations. 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. [6, 7] There is no current evidence indicating that water quality problems are directly 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 generally has good water quality except for high dissolved solids in a band along its southern boundary. Iron is a widespread problem and sulfates and chlorides are found

[7] Thorkildsen, David, Roger Quincy, "Evaluation of Water Resources of Orange and Eastern Jefferson Counties, Texas," TWDB Report 320, January 1990. URL: http://www.twdb.texas.gov/publications/reports/numbered_reports/doc/R320/R320.pdf, accessed January 2019.

in scattered locations throughout the aquifer.[6, 7]

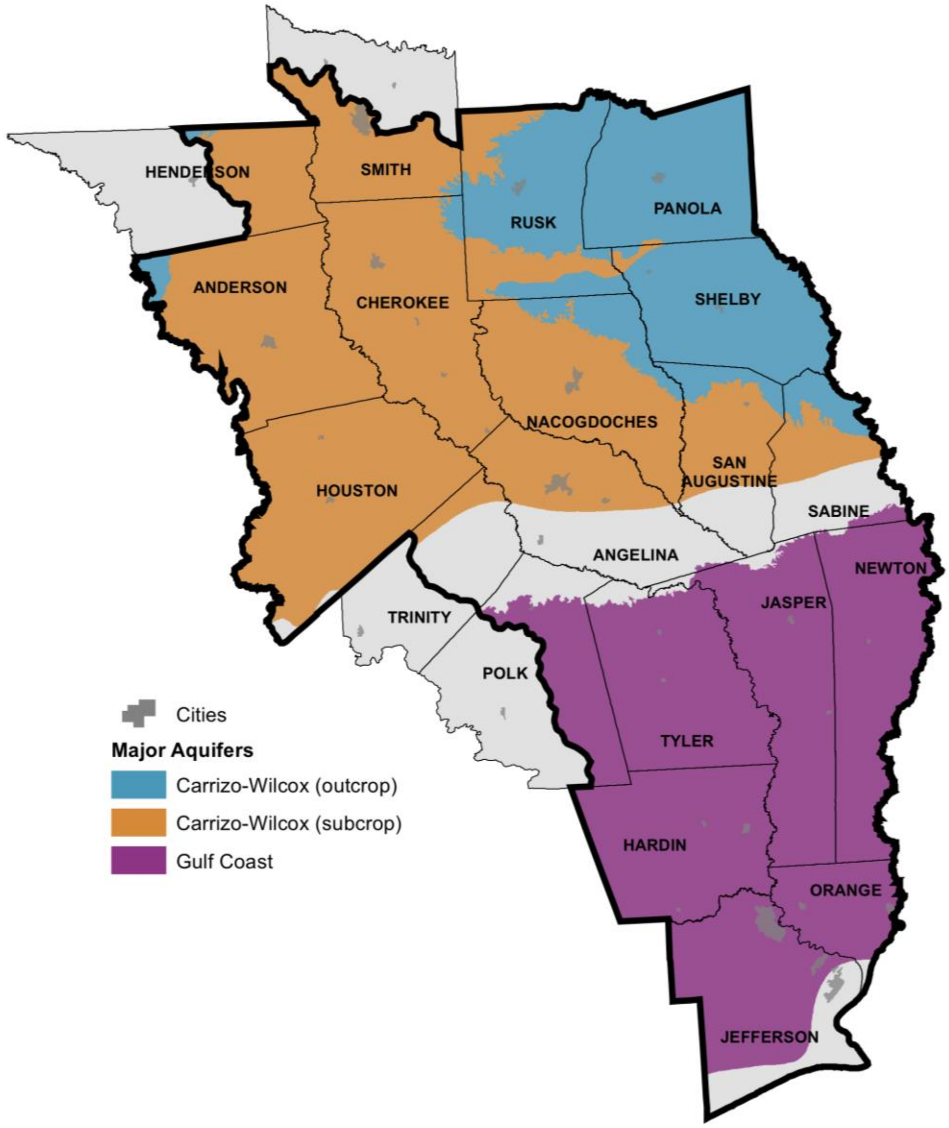

Figure 1.7 Major Aquifers

SOURCE: TEXAS WATER DEVELOPMENT BOARD

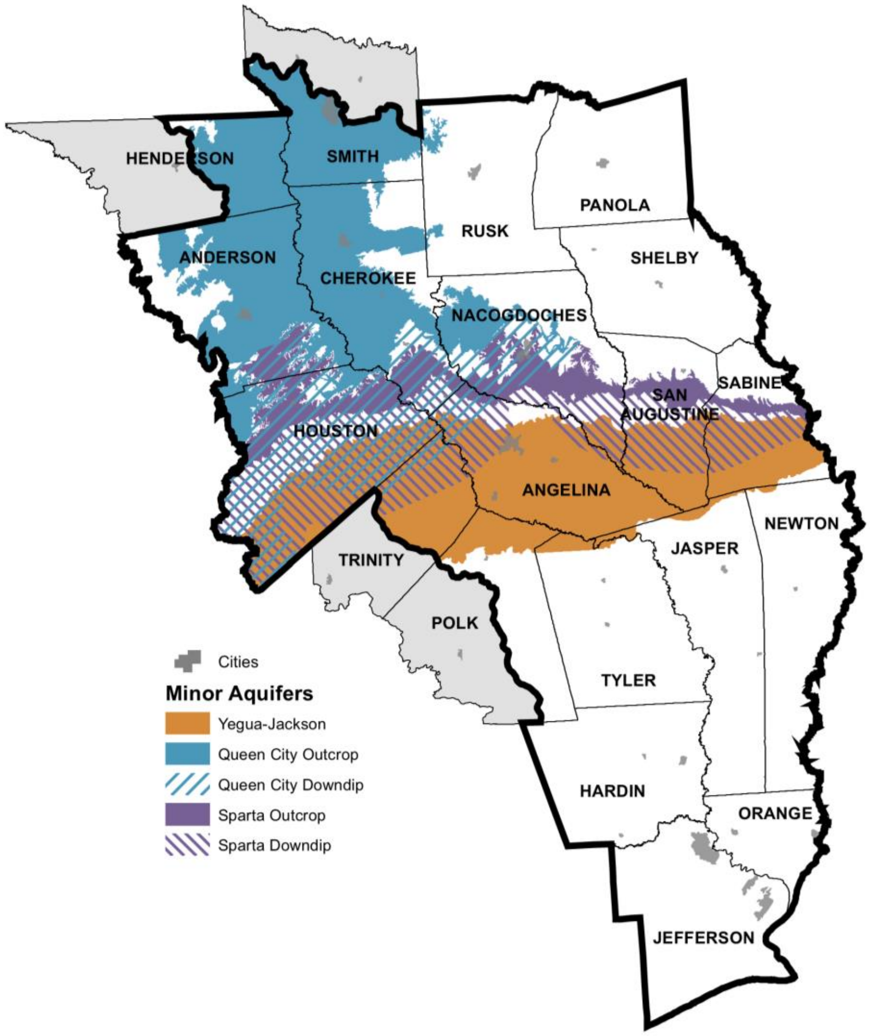

Figure 1.8 Minor Aquifers

SOURCE: TEXAS WATER DEVELOPMENT BOARD

Carrizo-Wilcox Aquifer. The Carrizo-Wilcox Aquifer is a major aquifer that 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 aquifer in the ETRWPA occurs as a major trough caused by the Sabine Uplift near the Texas-Louisiana border. It is a major source of water supply for the region.

Total groundwater pumpage from the Carrizo-Wilcox Aquifer in the region averaged 74,343 ac-ft per year based on historical pumping for years 2016 through 2020. 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 300 feet.

However, evaluation of 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 greater than 50 feet and ranges from approximately 20 feet to greater than 250 feet. Significant water-level declines have occurred in the region around Tyler and the Lufkin-Nacogdoches area.

Large water level declines have also occurred in Smith, Anderson, and Leon counties in the confined portions of the aquifer. Generally, wells located in the northern part of the aquifer have relatively stable groundwater levels.[8]

Much of the pumpage from the Carrizo-Wilcox Aquifer 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 increased, although the wells are still being utilized.

Water quality in the Carrizo-Wilcox Aquifer is generally good. Dissolved solids concentrations are typically less than 500 ppm in outcrop areas; but can be greater than 1,000 ppm in deeper zones. In addition, groundwater in deeper zones often contains iron and manganese at concentrations that exceed the secondary drinking water standards.

Sparta Aquifer. The Sparta Aquifer is a minor aquifer that 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 in the Sparta Aquifer are generally low to moderate, although some high-capacity wells average 400 to 500 gpm. Because the more productive 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.

Total historical groundwater pumping from the Sparta Aquifer in the region averaged 1,844 ac-ft per year during 2016 through 2020. Relatively large amounts of usable quality groundwater are contained in 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.

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. Water quality can deteriorate at depths greater than 2,000 feet below ground surface. Dissolved salts concentrations in shallower zones averages around 300 ppm; and can be around 800 ppm with depth. Iron concentrations are generally high.

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

[8] Schorr, S., M. Zivic, W. R. Hutchison, S. Panday, J. Rumbaugh. "Draft Conceptual Model Report: Groundwater Availability Model for Northern Portion of the Queen City, Sparta, and Carrizo-Wilcox Aquifers." Prepared for the Texas Water Development Board, June 2018. URL: http://www.twdb.texas.gov/groundwater/models/gam/czwx_n/NorthQCSCW_ConceptualModelReport_draft_v1_full.pdf?d=10351.749999972526, accessed January 2019.

of sand, loosely cemented sandstone, and interbedded clays. Although large amounts of usable quality groundwater are contained in the Queen City Aquifer, yields are typically low. A few well yields exceed 400 gpm.

Total historical groundwater pumpage from the Queen City Aquifer in the region averaged 3,880 ac-ft per year during 2016 through 2020. Groundwater levels in most Queen City wells have remained relatively stable, with variations less than 20 feet. However, the water level in a Wood County well declined approximately 100 feet between 1980 and 2016.

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 Queen City Aquifer is generally not a problem.

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. Dissolved salts concentrations in the Queen City Aquifer are generally between 300 and 750 ppm. Dissolved iron concentrations can be high, particularly in northeastern areas of the aquifer.

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 southern 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.

Total historical groundwater pumpage from the Yegua-Jackson Aquifer in the region averaged 5,502 ac-ft per year during 2016 through 2020.

Water quality in the Yegua-Jackson Aquifer varies, with dissolved salts concentrations ranging between 50 and 1,000 ppm in most cases. Iron can be a problem, and the water from at least one location has been described as “sodium bicarbonate water.”

Groundwater Conservation Districts. 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.

Districts are required to develop five-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. More specifically, these districts are granted authority to regulate the spacing and/or production rate from water wells.

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 and Anderson counties, both in the ETRWPA, as well as Henderson County (which overlaps Regions C and the ETRWPA).

Angelina and Nacogdoches Counties. Angelina and Nacogdoches counties are covered by the Pineywoods GCD, created in 2001 and headquartered in Nacogdoches. 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 Jasper, Texas, 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 in 2005.

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, was created by the 78th legislature in 2003, confirmed by local election in 2004, and is headquartered in Henderson. The District has a groundwater management plan in place.

Houston, Jefferson, Orange, Sabine, San Augustine, Shelby, Smith, and Trinity counties are not covered by any confirmed or pending GCD.

Groundwater Management Areas. 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 and develop Desired Future Conditions.

The boundaries of the ETRWPA includes portions of 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.

The GCDs and GMAs in Region I are shown in Figure 1.9.

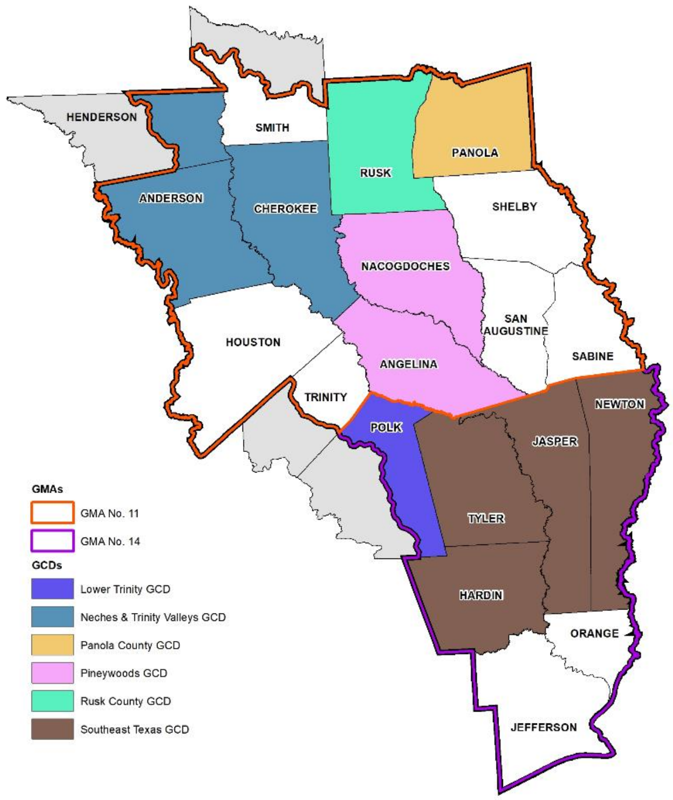

Figure 1.9 Groundwater Conservation Districts and Groundwater Management Areas

SOURCE: TEXAS WATER DEVELOPMENT BOARD

1.3.2 Springs

Over 250 springs of various sizes are documented in the ETRWPA according to the research of Gunnar M. Brune.[9] 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 7 springs that discharge between 200 and 2,000 gpm. It should be noted that Brune's research 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. Figure 1.10 shows the springs in the ETRWPA using USGS information.

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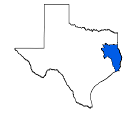
[9] Brune, Gunnar, "Springs of Texas Vol. I: Arlington, Texas," Self-Published, 1981. URL: http://eaahcp.org/?s=springs+of+texas, accessed January 2019. Brune, Gunnar, "Major and Historical Springs of Texas," Texas Water Development Board Report 189. March 1975. Texas Water Development Board State Well Records, 2005, https://www.twdb.texas.gov/publications/reports/numbered_reports/doc/R189/R189.pdf, accessed October, 2020.



Brune reported a flow of 5,700 gpm in the spring-fed Indian Creek in Jasper County, about five miles northwest of Jasper. This water was used at a Texas Parks and Wildlife Department (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), and Elkhart Creek Springs in Houston County (1,500 gpm in 1965).

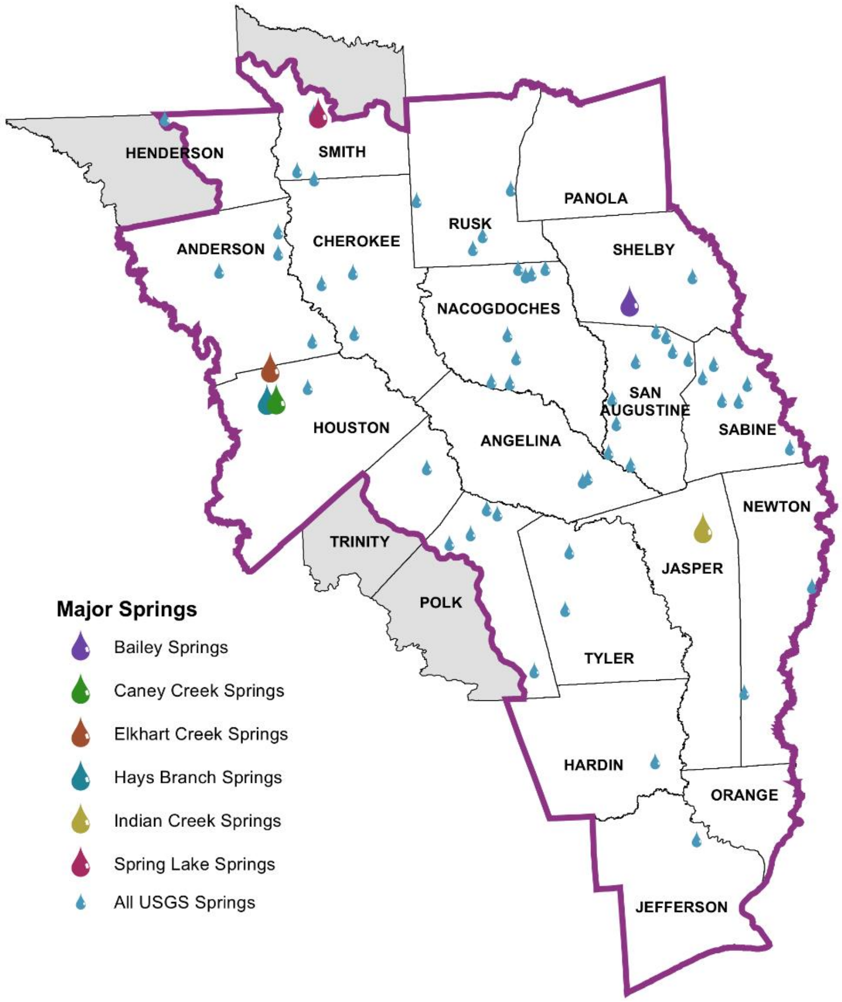


Figure 1.10 U.S. Geographical Survey Identified Springs

SOURCE: U.S. GEOGRAPHICAL SURVEY

1.3.3 Surface Water

Surface water includes water that may be obtained directly from streams, rivers, or reservoirs. Surface water sources within the ETRWPA include 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 located in 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. Approximately one square mile of the Cypress Creek Basin lies in the northeastern portion of Panola County. Figure 1.11 indicates the locations of the major river basins within the ETRWPA.

Additional descriptions of the Neches, Sabine, and Trinity River Basins follow. The current water supplies associated with each basin are described in detail in Chapter 3.

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 in Texas. 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 9,585 square miles of the basin are located within the ETRWPA. Approximately one-third of the basin area is comprised of the Angelina River Basin. Significant tributaries to the Neches River 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 five counties in the ETRWPA: Panola, Shelby, Sabine, Newton, and Orange 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. Approximately 3,930 square miles of the basin are located within the ETRWPA. The Sabine River Basin contributes approximately 4.6 million acre-feet of water to Sabine Lake annually.[10]

Neches-Trinity Basin. The coastal plain between the Neches River and Trinity River forms the Neches-Trinity Coastal Basin. The area is mostly 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 1,692 square miles. Approximately 858 square miles of the basin are located within the ETRWPA. In Jefferson County, the basin drains primarily to the Gulf Coast and to Sabine Lake.

Trinity River. The Trinity River is the longest river that flows entirely within Texas, and while a major water body in the State, only a small portion is located in the ETRWPA. The Trinity River has reaches that meet the legal definition of navigable waters, but it is not currently used for this purpose due to a cost-benefit analysis performed by the U.S. Army Corps of Engineers in the 1970s. The Trinity River basin falls almost entirely within the political boundary of the Trinity River Authority, a wholesale water provider in Regions C and H. In the ETRWPA, it forms a western boundary for Anderson and Houston counties. Approximately 1,420 square miles of the Trinity River basin are located within the ETRWPA.

[10] National Oceanic and Atmospheric Administration. (n.d.). GNOME Sabine Lake User's Guide. Retrieved from https://response.restoration.noaa.gov/sites/default/files/Gnome_SabineLake_UG.pdf

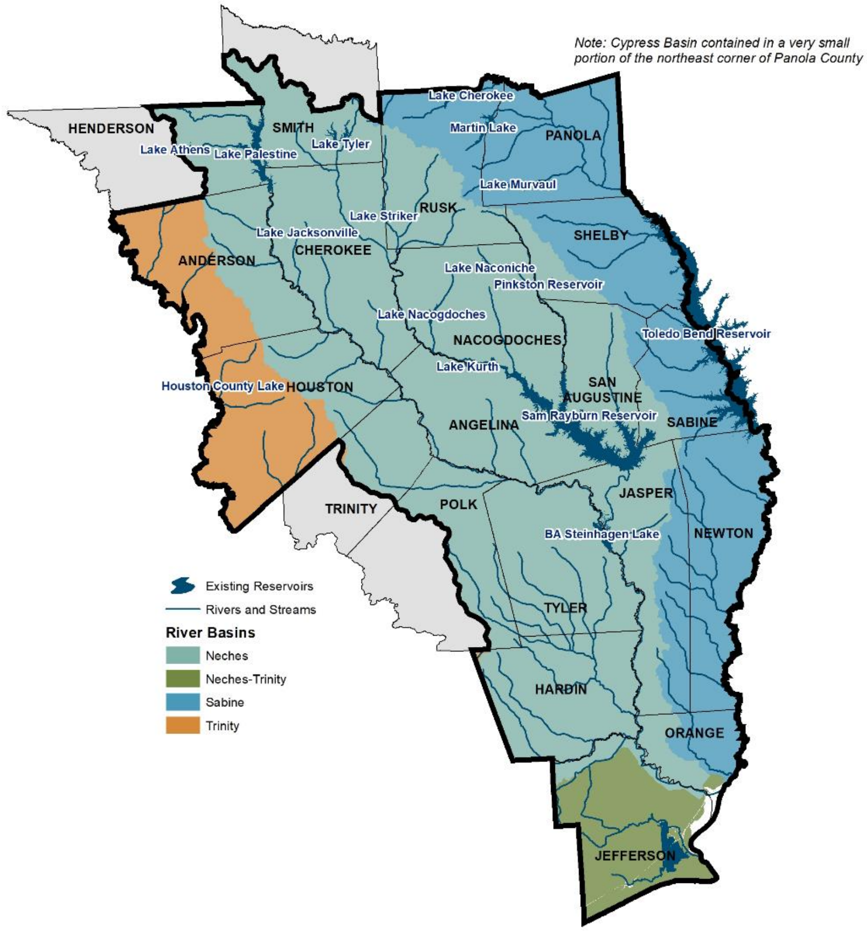


Figure 1.11 Surface Water Sources

SOURCE: TEXAS WATER DEVELOPMENT BOARD & U.S. CENSUS BUREAU

Reservoirs. In the ETRWPA, most surface water is provided by one of fourteen existing water supply reservoirs. Locations of major reservoirs in the region are shown on Figure 1.11. Details regarding these reservoirs are provided in Chapter 3.

Surface water quality in the region varies between water bodies but is generally considered to be very good for water supply purposes. Stream and lake segments with water quality impairments, as identified by the TCEQ, are discussed in Section 1.10 of this chapter. While none of the segments in the region indicate problems as drinking water sources, aquatic life uses, fish consumption, and recreational uses are sometimes not supported in the water bodies.

Fish consumption is the subject of Texas Department of State Health Services advisories in a number of segments, mostly in reservoirs as a result of mercury found in certain species of fish.[11] The mercury concentration in the water is negligible and does not present problems for recreation or water supply.[12,13]

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 for surface water generally includes sedimentation, filtration, and disinfection. Other more advanced treatment methods for surface water are uncommon in the ETRWPA.

Tidal Sources of Surface Water. Salt water intrusion can be a major concern in the tidal reaches of streams. Salt water, being denser than fresh water, tends to settle on the bottom of the channel. The horizontal and vertical extent of the salt water layer varies according to several factors including fresh water inflow and tidal influence.

In the ETRWPA, salt water has become a significant concern for Sabine Lake and the lower reaches of the Neches and Sabine Rivers, since a ship channel between the Gulf of Mexico and Sabine Lake (i.e., the Sabine-Neches Waterway) was dredged around the beginning of the twentieth century. Salt water intrusion, 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 without addition of advanced treatment to remove salts. There are still some industrial uses, including cooling, that may be available.

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.

Pollution from industrial discharges was historically a major concern in the tidal areas of the lower Neches and Sabine Rivers. However, largely due to strengthened environmental regulation and to increased environmental awareness, industries in the region have made significant improvements to the quality of their effluent discharges.

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[11] Texas Commission on Environmental Quality. (2016) 2016 Texas Integrated Report of Surface Water Quality for the Clean Water Act Sections 305(b) and 303(d). URL https://www.tceq.texas.gov/waterquality/assessment/16twqi/16txir, accessed January 2019.

[12] Texas Commission on Environmental Quality. (2020) 2020 Texas Water Quality Inventory and 303(d) List. URL: https://wayback.archive-it.org/414/20200907230611/https://www.tceq.texas.gov/assets/public/waterquality/swqm/assess/20txir/2020_303d.pdf, accessed November 2023.

[13] Angelina and Neches River Authority, "Basin Highlights Report 2021." URL: https://www.anra.org/wp-content/uploads/2022/10/2021_Upper_Neches_Basin_Highlights_Report.pdf, accessed November 2023.

1.3.4 Reuse

Reuse of effluent from wastewater treatment plants (i.e., water reuse) is another water source for the region, but the current use of reuse supplies in the ETRWPA is small as compared to groundwater and surface water supplies. The TWDB maintained a record of water supplies by county on its website, and the 2020 reuse supplies in all the Region I counites (including the portions of the counties that are split with other regions) were estimated to be 2,469 AFY. Currently, this reused water supply is only used for non-potable applications to meet portions of the municipal, manufacturing, and irrigation demand in Region I. Additional discussion of water reuse in the ETRWPA is found in Chapter 3.

1.3.5 Threats and Constraints on Water Supply

Water supplies in the ETRWPA may be threatened by conditions both within and outside of the region. Some significant potential threats and constraints are discussed following. A more detailed discussion of potential threats to water supplies may be found in Chapter 3.

Invasive Species. The introduction of invasive and/or harmful species (including zebra mussels and giant salvinia) to area lakes and surface waters poses a potential threat to water supplies throughout the state of Texas. There are currently no zebra-infested lakes in ETRWPA, but the spread of zebra mussels is a potential threat. There are several lakes in the ETRWPA that are known to have giant salvinia, which can impact water quality of the lakes. Continued monitoring and management by water suppliers in the ETRWPA will be necessary in the coming decades. In addition to zebra mussels and giant salvinia, the East Texas Pineywoods region faces threats from various invasive species like Giant Reed, Common Water Hyacinth, Japanese Honeysuckle, Japanese Climbing Fern, Kudzu, Giant salvinia, Golden Bamboo, Chinese Tallow Tree, Chinese Wisteria, Mimosa, and Chinaberry tree.

Saltwater Intrusion. The ETRWPA extends to the Texas coast along the Gulf of Mexico. Water supplies along this area work together to maintain a balance of fresh water, brackish water and seawater. Overdevelopment of groundwater along the coast and/or reduced freshwater inflows due to drought use can disrupt this balance, resulting in saltwater intrusion of the freshwater supplies. LNVA installed a saltwater barrier on the Neches River to limit saltwater intrusion upstream. In addition, the Sabine-Neches Navigation District operates saltwater barriers at the Taylor Bayou facility, which control saltwater intrusion in the Taylor and Hildebrandt Bayous of southeast Texas. These barriers help maintain the appropriate mix of saltwater and freshwater, benefiting local agriculture, including rice fields. Monitoring of both surface water and groundwater sources are needed to minimize impacts to the region's water supplies.

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 the entire basin upstream from the state line is in Texas. However, Texas does not have completely unrestricted access to the water in the basin because of allocation restrictions with Louisiana.

The Sabine River Compact, executed in 1953, provides for allotment of the water between Texas and Louisiana.[14] This agreement was not only ratified by the two state legislatures but also approved by

[14] Texas Water Code, Title 3 River Compacts, Chapter 44 Sabine River Compact, Effective June 14, 1989. URL: https://statutes.capitol.texas.gov/Docs/WA/htm/WA.44.htm, accessed October 2020.

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 cubic feet per second (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 its yield.

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.

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 is currently developing the facilities to transport and treat the water but anticipates the required construction to be complete before 2030. A long-range potential strategy to transfer water from Toledo Bend Reservoir to reservoirs located in Region C is under consideration as an alternate strategy in the 2021 RWP for Region C. There is a recommended, long-range strategy to transfer water from the Toledo Bend Reservoir to entities in Region H documented in the 2021 Region H RWP that is planned to come online in 2050. In the 2021 East Texas RWP, there is a potential strategy planned to come online in 2040 to transfer water from the Neches basin to the Trinity basin to irrigation customers in Region H and new industries as they emerge along the IH-10 corridor.

1.4 WATER USER GROUPS AND MAJOR WATER PROVIDERS

Water User Groups. The first four rounds of regional water planning have used city populations to calculate water usage in gallons per capita daily (GPCD); however, consistent with last round of regional water planning, 31 Texas Administrative Code (TAC) §357.34 includes a new utility-based definition for WUGs as follows that uses utility service area populations to calculate GPCD:

Water User Group (WUG) – Identified user or group of users for which Water Demands and Existing Water Supplies have been identified and analyzed and plans developed to meet Water Needs. These include:

- *Privately-owned utilities that provide an average of more than 100 acre-feet per year for municipal use for all owned water systems;*
- *Water systems serving institutions or facilities owned by the state or federal government that provide more than 100 acre-feet per year for municipal use;*
- *All other Retail Public Utilities not covered in subparagraphs (A) and (B) of this paragraph that provide more than 100 acre-feet per year for municipal use;*
- *Collective Reporting Units, or groups of Retail Public Utilities that have a common association and are requested for inclusion by the RWPG;*
- *Municipal and domestic water use, referred to as County-Other, not included in subparagraphs (A) - (D) of this paragraph; and*

- *Non-municipal water use including manufacturing, irrigation, steam electric power generation, mining, and livestock watering for each county or portion of a county in an RWPA.*

WUGs in the 2026 Plan fall into one of six water use categories: Municipal; Manufacturing; Mining; Steam Electric Power; Livestock; and Irrigation. The ETRWPA has 209 municipal WUGs and 86 non-municipal WUGs. Water demands and supplies associated with each WUG are described in detail in Chapters 2 and 3, respectively.

Major Water Providers. WUGs either have direct access to water supplies or they purchase wholesale water from a Wholesale Water Provider (WWP). In this round of planning, the definition for a WWP was updated to the following:

Wholesale Water Provider (WWP) – Any person or entity, including river authorities and irrigation districts, that delivers or sells water wholesale (treated or raw) to WUGs or other WWPs or that the RWPG expects or recommends to deliver or sell water wholesale to WUGs or other WWPs during the period covered by the plan. The RWPGs shall identify the WWPs within each region to be evaluated for plan development.

In previous regional water plans, all demand and water supply data were presented in the plan summarized by WUGs and WWPs. However, in addition to the change in WWP designation outlined above, the designation of a Major Water Provider (MWP) was added to the regional water planning process intended to be a subset of WUGs and/or WWPs in the ETRWPA as identified by the RWPG to be of particular significance to the region's water supply. Throughout this plan, entities are discussed with data summarized by WUG, WWP, or MWP as required by recent rule changes.

Major Water Provider (MWP) – A water user group or a wholesale water provider of particular significance to the region's water supply as determined by the regional water planning group. This may include public or private entities that provide water for any water use category.

The RWPG discussed the designations for WWPs and MWPs in the ETRWPA and determined that all WWPs included in the 2021 Plan shall receive the designation of WWP and MWP in the 2026 Plan and include:

- Angelina and Neches River Authority
- Angelina-Nacogdoches Water Control & Improvement 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 Water Control & Improvement District No. 1
- Lower Neches Valley Authority
- Panola County Freshwater Supply District No. 1
- Sabine River Authority of Texas
- Upper Neches River Municipal Water Authority

1.5 AGRICULTURAL AND NATURAL RESOURCES

For the purposes of this discussion, the ETRWPA's agricultural resources are defined as prime farmland. Natural resources within the ETRWPA include timber, wetlands, estuaries, endangered or threatened species, ecologically significant streams, springs, and state or federal parkland and preserves. Other natural resources include oil, natural gas, sand and gravel, lignite, salt, and clay. Various major natural resources are described in the following subsections.

1.5.1 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."[15] As part of the National Resources Inventory, the NRCS has identified prime farmland throughout the country.

Figure 1.12 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 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 1.4 shows the U.S. Department of Agriculture (USDA) 2017 agriculture statistics for the counties in the ETRWPA[16] (portions of Henderson, Smith, Polk, and Trinity counties are located in other Regions). The following general statements may be made regarding the region:

- From 2012 to 2017, the total acres of farmland decreased by 6.3% while the total acres of crop land decreased by 5.9%.
- In any one year, approximately 20% of farmland is crop land.
- In any one year, approximately 63% of crop land is harvested.
- Excluding Jefferson County, approximately 3% of crop land is irrigated. In Jefferson County, approximately 18% of crop land is irrigated.
- Poultry production generates the largest agricultural product sales in Nacogdoches, Panola, San Augustine, and Shelby counties.
- Cattle and calf production generate the largest agricultural product sales in Henderson, Houston, and Smith counties.

[15] Natural Resources Conservation Service, "National Soil Survey Handbook," Updated November 2019. URL: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/ref/?cid=nrcs142p2_054242, accessed October 2020.

[16] U.S. Department of Agriculture. (2017). 2017 Census of Agriculture Highlights. URL: https://www.nass.usda.gov/Publications/AgCensus/2017/index.php, accessed April 2019. As of August 2023, USDA has not released any updated statistics.

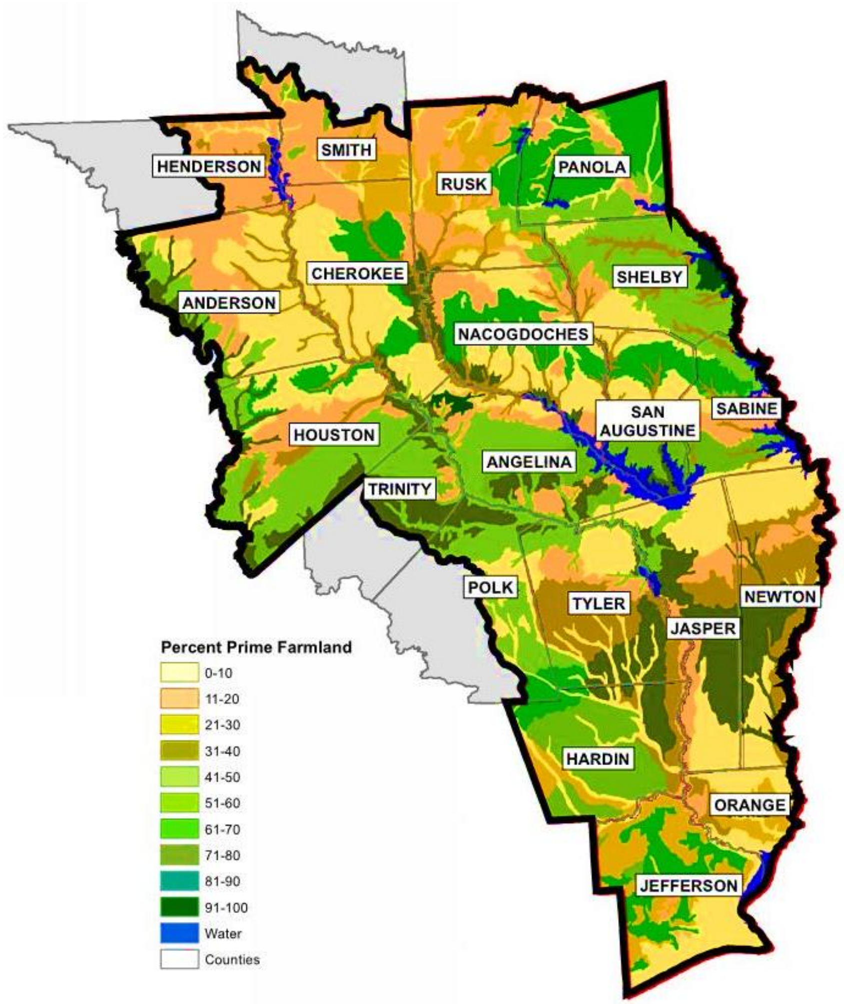

Figure 1.12 Percent Prime Farmland

SOURCE: TEXAS WATER DEVELOPMENT BOARD 2011 REGIONAL WATER PLAN

Table 1.4 U.S. Department of Agriculture 2017 Agricultural Statistics [16]

Category	Anderson	Angelina	Cherokee	Hardin	Henderson
Farms	1,754	1,028	1,587	661	1,988
Total Farmland (acres)	400,571	103,947	275,568	65,087	310,355
Crop Land (acres)	63,774	21,632	58,303	13,124	86,645
Harvested Crop Land (acres)	52,601	15,104	43,860	8,606	58,826
Irrigated Crop Land (acres)	3,089	453	978	1,081	1,614
Market Value Crops ($1,000)	15,551	2,594	66,491	2,366	11,645
Market Value Livestock ($1,000)	77,392	58,815	49,201	2,328	28,538
Total Market Value ($1,000)	92,943	61,409	115,692	4,694	40,183
Livestock and Poultry:					
Cattle and Calves Inventory	65,048	19,274	19,274	8,005	59,076
Hogs and Pigs Inventory	(D)	147	118	582	652
Sheep and Lambs Inventory	412	291	322	302	555
Layers and Pullets Inventory	3,494	2,597	2,992	3,446	6,051
Broilers and Meat-Type Chickens Sold	6,198,444	14,977,816	6,373,832	(D)	74
Crops Harvested (acres):					
Corn for Grain or Seed	2,416	0	0	5	18
Cotton	(D)	0	0	0	0
Rice	0	0	0	(D)	0
Sorghum for Grain or Seed	0	0	0	0	0
Soybeans for beans	0	0	0	(D)	(D)
Wheat for Grain	0	0	0	0	(D)
Category	**Houston**	**Jasper**	**Jefferson**	**Nacogdoches**	**Newton**
Farms	1,422	896	729	1,123	430
Total Farmland (acres)	394,543	91,437	358,934	264,750	58,793
Crop Land (acres)	70,772	13,375	137,267	29,502	5,484
Harvested Crop Land (acres)	44,044	10,743	38,047	20,450	4,105
Irrigated Crop Land (acres)	3,522	305	24,885	313	57
Market Value Crops ($1,000)	6,802	4,007	17,688	3,156	485
Market Value Livestock ($1,000)	57,716	5,132	14,629	367,586	1,102
Total Market Value ($1,000)	64,518	9,139	32,317	370,742	1,587
Livestock and Poultry:					
Cattle and Calves Inventory	68,987	14,268	37,189	34,172	4,212
Hogs and Pigs Inventory	4,762	259	511	48	177
Sheep and Lambs Inventory	1,781	372	340	198	266
Layers and Pullets Inventory	(D)	4,123	3,957	279,527	1,855
Broilers and Meat-Type Chickens Sold	7,160,115	(D)	66	84,656,731	51
Crops Harvested (acres):					
Corn for Grain or Seed	(D)	17	0	(D)	29
Cotton	(D)	0	0	0	0
Rice	0	0	20,698	0	0
Sorghum for Grain or Seed	0	0	(D)	0	0
Soybeans for beans	0	0	0	0	0
Wheat for Grain	0	0	(D)	(D)	0

Table 1.4 USDA 2017 Agricultural Statistics [16] (Cont.)

Category	Orange	Panola	Polk	Rusk	Sabine
Farms	663	978	742	1,441	200
Total Farmland (acres)	52,912	205,961	125,133	242,767	38,304
Crop Land (acres)	4,685	39,766	22,586	46,094	5,553
Harvested Crop Land (acres)	2,861	27,156	15,207	29,841	3,332
Irrigated Crop Land (acres)	342	781	281	530	56
Market Value Crops ($1,000)	1,489	4,626	2,291	5,956	450
Market Value Livestock ($1,000)	3,478	96,094	4,540	94,201	17,265
Total Market Value ($1,000)	4,967	100,720	6,831	100,157	17,715
Livestock and Poultry:					
Cattle and Calves Inventory	9,839	31,045	13,135	40,801	11,525
Hogs and Pigs Inventory	450	581	103	370	87
Sheep and Lambs Inventory	366	270	61	272	-
Layers and Pullets Inventory	8,630	1,388	1,885	25,945	359
Broilers and Meat-Type Chickens Sold	1,810	24,393,040	(D)	21,637,138	(D)
Crops Harvested (acres):					
Corn for Grain or Seed	6	(D)	14	26	(D)
Cotton	0	0	0	0	0
Rice	0	0	0	0	0
Sorghum for Grain or Seed	0	0	0	0	0
Soybeans for beans	0	(D)	0	0	0
Wheat for Grain	0	0	106	0	0

Category	San Augustine	Shelby	Smith	Trinity	Tyler
Farms	293	995	2,928	601	778
Total Farmland (acres)	61,806	179,084	271,765	98,887	91,143
Crop Land (acres)	9,196	28,551	64,308	20,051	18,847
Harvested Crop Land (acres)	7,177	20,457	49,260	13,138	13,398
Irrigated Crop Land (acres)	40	383	1,932	266	794
Market Value Crops ($1,000)	1,296	2,837	36,759	2,108	9,643
Market Value Livestock ($1,000)	55,380	464,720	16,846	6,120	5,243
Total Market Value ($1,000)	56,676	467,557	53,605	8,228	14,886
Livestock and Poultry:					
Cattle and Calves Inventory	9,853	43,354	43,874	19,464	14,052
Hogs and Pigs Inventory	153	193	559	627	351
Sheep and Lambs Inventory	39	329	1,255	27	381
Layers and Pullets Inventory	125,933	1,238,783	12,602	2,372	4,061
Broilers and Meat-Type Chickens Sold	13,552,362	103,631,416	959	(D)	295
Crops Harvested (acres):					
Corn for Grain or Seed	13	(D)	18	(D)	0
Cotton	0	0	0	0	0
Rice	0	0	0	0	0
Sorghum for Grain or Seed	0	(D)	0	0	0
Soybeans for beans	0	(D)	0	0	0
Wheat for Grain	(D)	0	(D)	0	0

Table 1.4 USDA 2017 Agricultural Statistics [16] (Cont.)

TOTALS FOR ALL COUNTIES:		SPECIAL FOR JEFFERSON COUNTY:	
Total Farmland (acres)	3,691,747	Irrigated / Total Crop Land (%)	18.13%
Crop Land (acres)	759,515		
Crop Land / Total Farmland (%)	20.57%	COUNTIES OTHER THAN JEFFERSON:	
Harvested Crop Land (acres)	478,213	Irrigated Crop Land (acres)	16,817
Harvested / Total Crop Land (%)	62.96%	Irrigated / Total Crop Land (%)	2.70%
Irrigated Crop Land (acres)	41,702	(D) – Withheld to avoid disclosing data for individual farms	
Irrigated / Total Crop Land (%)	5.49%		

1) Note: As of August 2023, USDA has not released any updated statistics.

SOURCE: U.S. DEPARTMENT OF AGRICULTURE, NATIONAL AGRICULTURAL STATISTICS SERVICE

1.5.2 Forest Products and Timberland Ecosystem Services

Some of the primary wood products produced from the timberlands in the ETRWPA include solid wood (sawtimber and chip-n-saw), engineered products (plywood, oriented strandboard, particleboard, and cross-laminated panels and timbers), fiber products (paper and fiberboard), and woody biomass (wood pellets, bioenergy, and mulch). According to the Texas A&M Forest Service, there are over 60 million acres of forestland in Texas but only about 23% of that is productive timberland. About 85% of this productive timberland is in East Texas.[17] The Texas A&M Forest Service indicates there is an estimated 11.8 million acres of timberland within the East Texas region which includes 43 counties and overlays 20 counties within Region I. This 11.8 million acres of timberland represents 53 percent of the total area in the East Texas region. [18]

In spite of rapid urbanization particularly in southeast Texas, overall forest acreage has slightly increased in the region due to conversion of marginal agricultural lands to forest over the past couple of decades. In terms of economic value, timber is the seventh most valuable agricultural commodity in Texas. In 2021, the forest industry contributed $21.4 billion to the Texas economy employing over 68,917 people with a payroll of $4.3 billion.[18] Including direct, indirect, and induced impacts, the forest sector had a total economic impact of $41.6 billion in industry output and supported more than 172,730 jobs with a payroll of $10.5 billion. The forest-based industry was one of the top 10 manufacturing sectors in the state. This resource is being sustainably managed, with overall growth rates exceeding removals since the 1980s and pine growth in particular being about 30% above removals. Compared to 2019, the 2021 Texas forest

[17] Texas A&M Forest Service. (2015) Forest Inventory and Analysis Database. URL: https://tfsweb.tamu.edu/forestinventoryandanalysis/, accessed February 2019.

[18] Texas A&M Forest Service. (2023), "Texas 2021", Texas Forest Sector Economic Impact. URL: https://texasforestinfo.tamu.edu/EconomicImpact/#/downloadreports, accessed October 2023.

sector total industry output and employment increased 13% and 3%, respectively.

Other economic and environmental benefits to the ETRWPA provided by timberlands and forests include water quality protection, fish and wildlife management, carbon sequestration, and recreational opportunities. For water quality protection, Texas has a nationally recognized forestry best management practices (BMP) program for water quality management from forest operations. These voluntary forestry water quality BMPs have about a 94% compliance rate and have been shown to be very effective in minimizing potential water quality degradation from forest management activities like clearcutting and forest regeneration.[19] About 92% of the forestland in East Texas is privately owned but numerous national and state parks and forests exist including the Angelina National Forest, Big Thicket National Preserve, Davy Crockett National Forest, and Sabine National Forest among others. These areas have an abundance of scenic pine and hardwood forests with numerous public hiking trails, paddling trails, and campgrounds. Figure 1.13 shows the ETRWPA compared to the Texas A&M Forest Service's East Texas region.

[19] Texas A&M Forest Service, "Voluntary Implementation of Forestry Best Management Practices in East Texas," December 2018. URL: https://tfsweb.tamu.edu/uploadedFiles/TFSMain/Manage_Forest_and_Land/Water_Resources_and_BMPs/Stewardship(1)/Round%2010%20BMP%20Implementation%20Report.pdf, accessed October 2020.

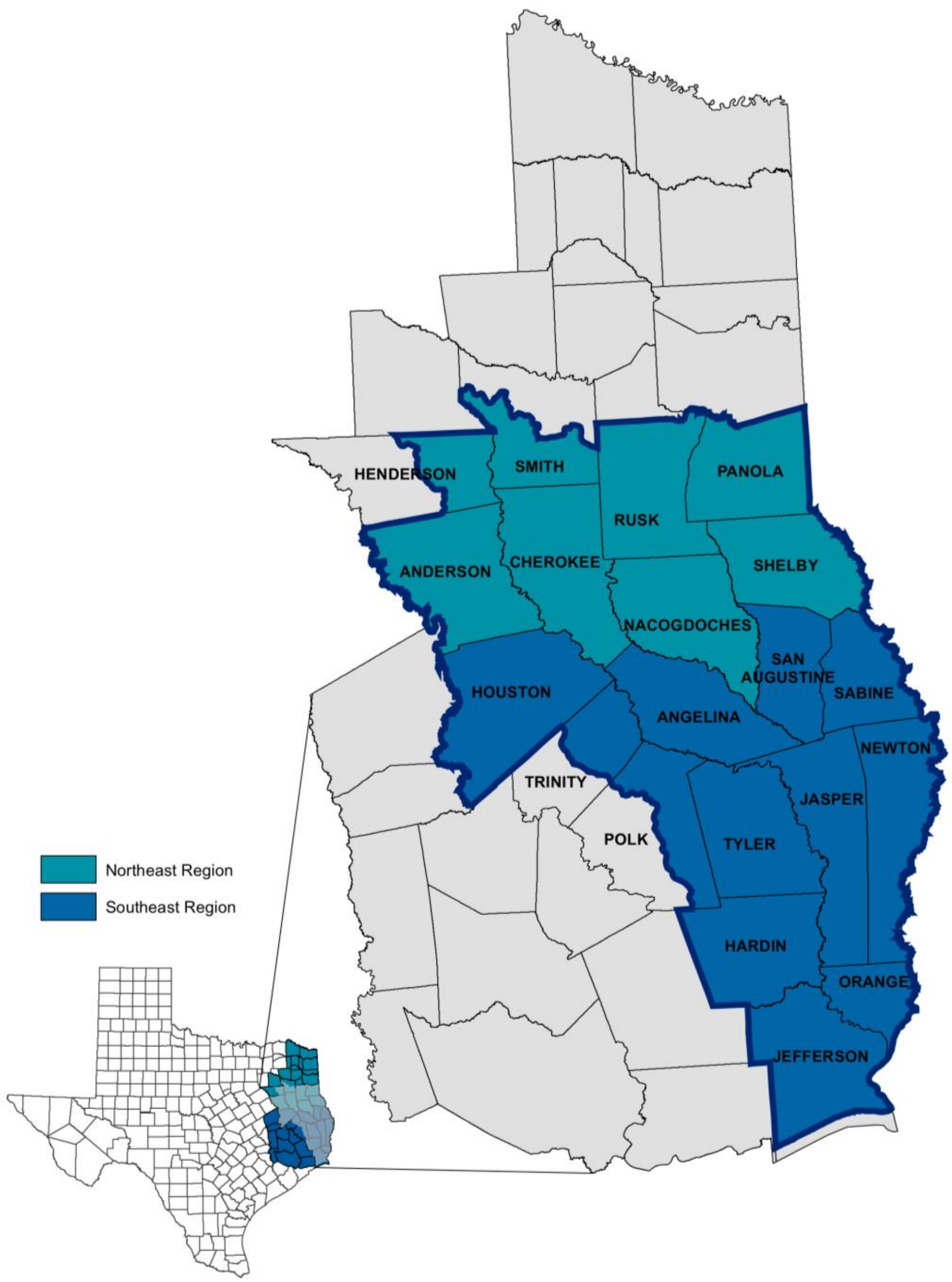

Figure 1.13 Texas A&M Forest Service Northeast and Southeast Regions

SOURCE: TEXAS A&M FOREST SERVICE, 2015

1.5.3 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.[20] 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.[20] There are significant wetland resources in the region, especially near rivers, lakes, and reservoirs.

Texas wetlands types and characteristics are summarized in Table 1.5. 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.[20] Table 1.6 shows the bottomland hardwood acreage associated with the four major rivers in the region.

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. Much of the palustrine wetland area in Jefferson County is farmed for rice growing. Figure 1.14 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. Ponds, Freshwater Lakes, Freshwater Forested/Shrub Wetlands, and Freshwater Emergent Wetlands also appear in other counties of the ETRWPA; however, only the coastal area of the ETRWPA is presented in Figure 1.14 because the wetlands in this area are more concentrated and diverse.

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,[21] particularly those dominated by emergent vegetation.

Three other kinds of wetlands cover a smaller area in the region but are ecologically significant:[21] lacustrine, riverine, and marine wetlands. See Table 1.5 above for a detailed description of these types of wetlands.

The TPWD, in a study of natural resources in Smith, Cherokee, Rusk, Nacogdoches, and Angelina counties,[22] found the most extensive wetlands in the study area were water oak-willow oak-and 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.[22] The TPWD identified specific stream segments in the region that they classify as being priority bottomland hardwood habitat.[11]

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[20] Fretwell, J. D., J. S. Williams, and P. J. Redman, "National Water Summary on Wetland Resources," United States Geological Survey 2425, 1996. URL: https://pubs.er.usgs.gov/publication/wsp2425, accessed October 2020.

[21] Moulton, D. W., T. E. Dahl, and D. M. Dall, "Texas Coastal Wetlands; Status and Trends, mid-1950s to early 1990s," U. S. Department of the Interior – Fish and Wildlife Service, Albuquerque, New Mexico, March 1997.

[22] El-Hage, A. and D .W. Moulton, "Evaluation of Selected Natural Resources in Angelina, Cherokee, Gregg, Nacogdoches, Rusk, and Smith Counties, Texas," Texas Parks and Wildlife Department, Austin, Texas, November 1998.

Table 1.5 Texas Wetland Types and Characteristics

Wetland Classifications	Definition	Vegetation / Habitat Types
Palustrine	Freshwater vegetated wetlands and intermittently or permanently flooded open-water bodies of less than 20 acres in which water is less than 6.6 feet deep, and salinity due to ocean-derived salts always is always less than 0.5 parts per thousand (ppt).	Predominantly trees; shrubs; emergent, rooted herbaceous plants; or submersed/floating plants.
Estuarine	Deep-water tidal habitats and adjacent tidal wetlands in low-wave-energy environments where the salinity of the water is greater than 0.5 ppt and is variable due to evaporation and mixing of freshwater and seawater.	Emergent plants; intertidal unvegetated mud or sand flats and bars; estuarine shrubs; subtidal open water bays (deep water habitat).
Lacustrine	Wetlands and deep-water habitats with all of the following characteristics: situated in a topographical depression or in a dammed river channel; lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30% areal coverage; total area exceeds 20 acres unless water depth at the deepest point exceeds 6.6 feet or active wave-formed or bedrock shoreline makes up all or part of the boundary; ocean-derived salinity is always less than 0.5 ppt.	Nonpersistent emergent plants, submersed plants, and floating plants.
Riverine	All freshwater wetlands and deep water habitats contained within a channel, with two exceptions: wetlands dominated by trees, shrubs, persistent, emergent mosses, or lichens, and habitats with salinity greater than 0.5 ppt.	Nonpersistent emergent plants, submersed plants, and floating plants.
Marine	Tidal wetlands that are exposed to waves and currents of the Gulf of Mexico and to water having salinity greater than 30 ppt.	Intertidal beaches, subtidal open water (deep water habitat).

SOURCE: U.S. GEOLOGICAL SURVEY[23]

[23] Cowardin, L. M., V. Carter, F. C. Golet, E. T. LaRoe. “Classification of wetlands and deepwater habitats of the United States.” U.S. Department of the Interior – Fish and Wildlife Service, Jamestown, North Dakota, December 1979.

Table 1.6 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 in ETRWPA.
Angelina River	88,000	All

SOURCE: TEXAS PARKS AND WILDLIFE DEPARTMENT

Section 404 of the Clean Water Act (CWA), administered by the U.S. Army Corps of Engineers (USACE), 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. Compensatory mitigation is required for unavoidable adverse impacts to the aquatic ecosystem that cannot reasonably be avoided or further minimized in order to replace those aquatic ecosystem functions that would be lost or impaired as a result of a USACE-authorized activity. Mitigation banking, as defined by the National Mitigation Banking Association, is the restoration, creation, enhancement, or preservation of a wetland, stream, or other habitat area undertaken expressly for the purpose of compensating for unavoidable resource losses in advance of development actions, when such compensation cannot be achieved at the development site or not be as environmentally beneficial. The USACE districts and mitigation banks located within the ETRWPA are presented in Figure 1.15. Within the boundary of Region I, mitigation banks are listed on the USACE's RIBITS site, with ten of those in the Fort Worth District and the other five in the Galveston District. The following is a table with the mitigation banks information.

Table 1.7 Mitigation Banks within Region I

Mitigation Bank	District	County	Acres
Big Woods on the Trinity	Fort Worth	Anderson	423.70
Butler Creek	Fort Worth	Smith	142.00
Flat Creek	Fort Worth	Henderson	583.00
Graham Creek - SWF	Fort Worth/Galveston	Angelina	479.60
Lost Creek Brake	Galveston	Newton	476.20
Martin Creek	Fort Worth	Rusk	183.00
Mud Creek	Fort Worth	Cherokee/Nacogdoches	959.20
Murvaul Creek	Fort Worth	Panola	584.60
Patroon Bayou	Fort Worth	Sabine	474.80
Pineywoods	Fort Worth/Galveston	Angelina/Jasper/Polk/Tyler	19,079.00
Rattlesnake	Fort Worth	Houston/Leon	517.00
Sabine Lake	Galveston	Jefferson	127.27
Scoober Creek	Fort Worth	Rusk	349.00
West Mud Creek	Fort Worth	Smith	45.44
Wet Unlimited/Bigfoot Swamp	Fort Worth	Panola	124.41

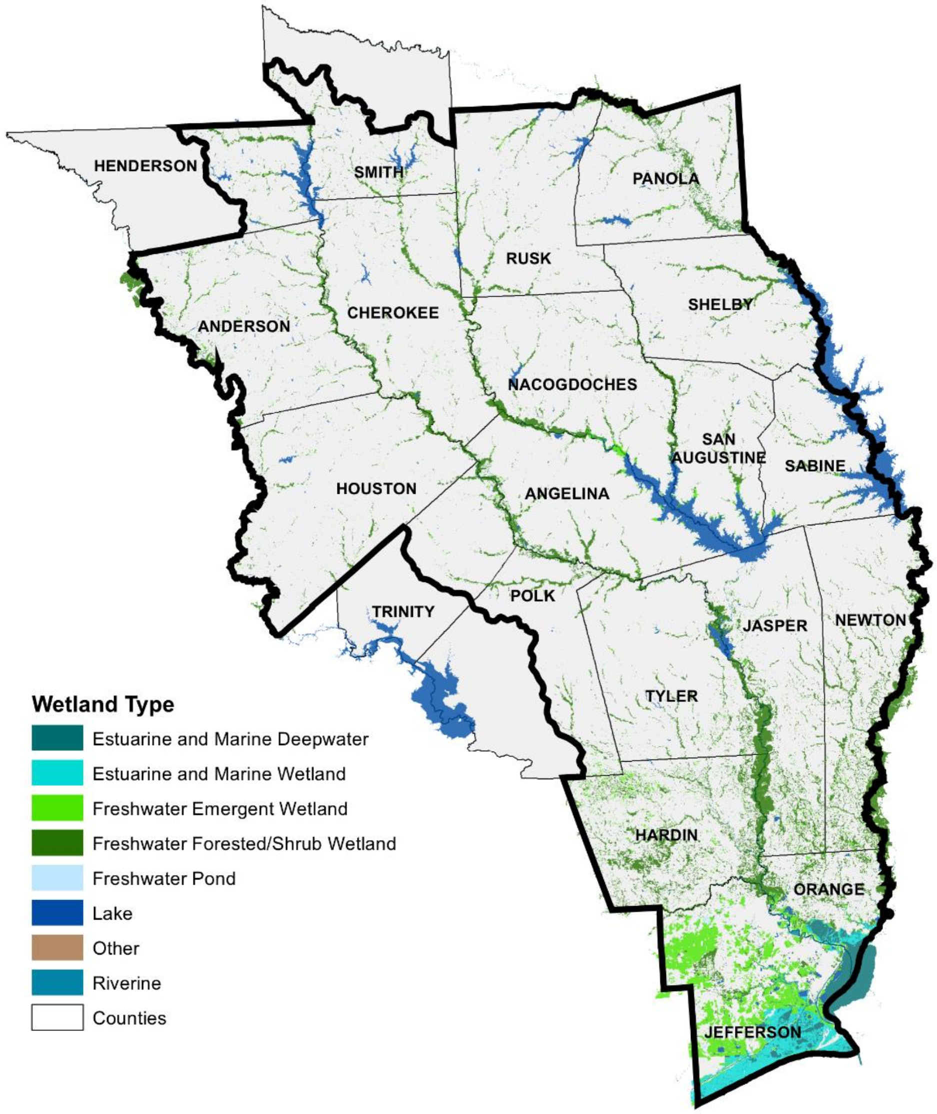

Figure 1.14 Wetland Area

SOURCE: U.S. FISH & WILDLIFE SERVICE

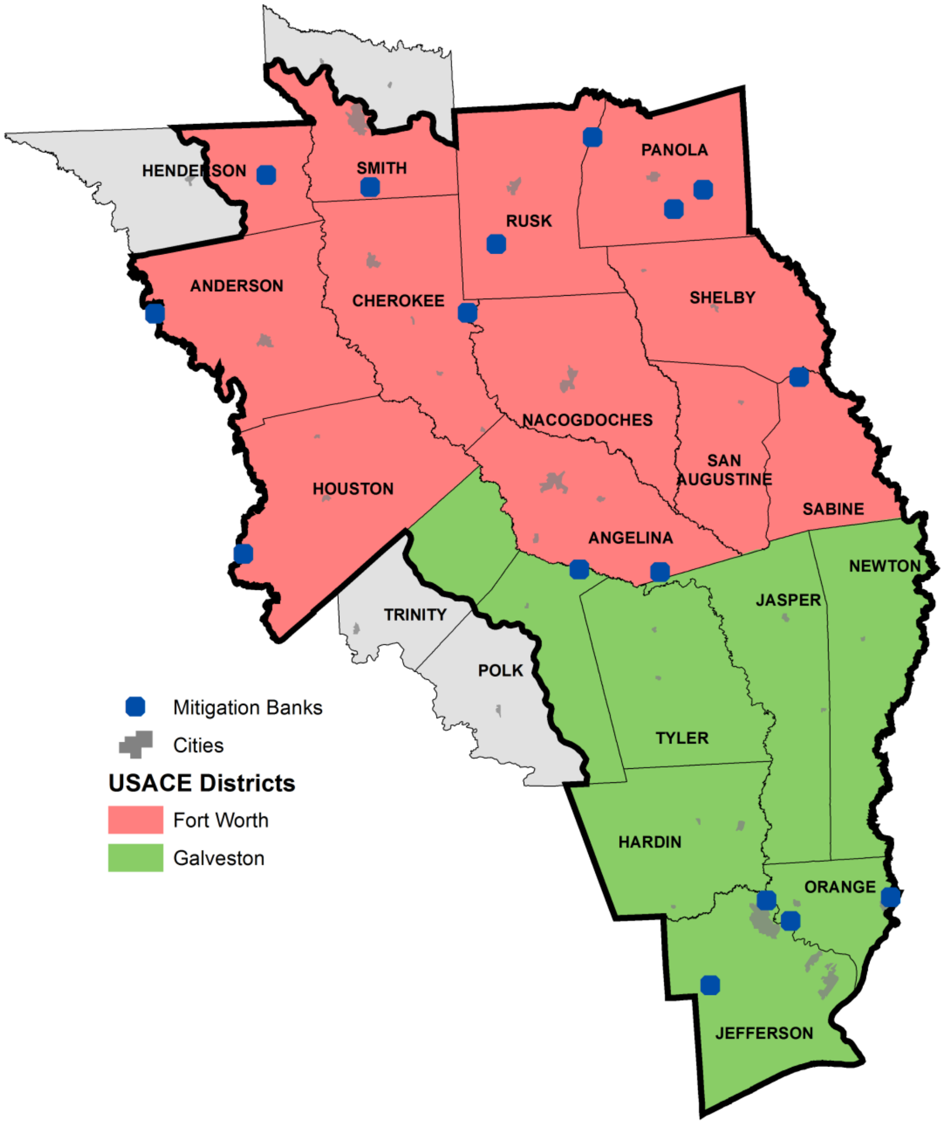

Figure 1.15 Mitigation Banks

SOURCE: U.S. ARMY CORPS OF ENGINEERS[24]

1.5.4 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

[24] USACE. Regulatory In lieu fee and Bank Information Tracking System, Mitigation Banks. URL: https://ribits.ops.usace.army.mil/ords/f?p=107:2:3198167976234::NO , accessed October 2023.

part of the Neches-Trinity Coastal Basin contribute freshwater flow to the estuary.[25] The Sabine-Neches Estuary within the ETRWPA is depicted on Figure 1.16.

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 wave action 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.

Sabine Lake is a natural water body located on the Texas-Louisiana border in southeast Texas, approximately seven miles from the Gulf of Mexico. According to SRA, the surface area for the main body of the lake is approximately 54,300 acres. The lake supports an extensive coastal wetland (i.e., salt marsh) system around much of the perimeter. The lake's small volume coupled with large freshwater inflows from the Sabine and Neches Rivers result in a turnover rate of around 50 times per year.

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.

[25] Texas Department of Water Resources, "Sabine-Neches Estuary: A Study of the Influence of Freshwater Inflows," Publication LP-116, Austin, Texas, July 1981.

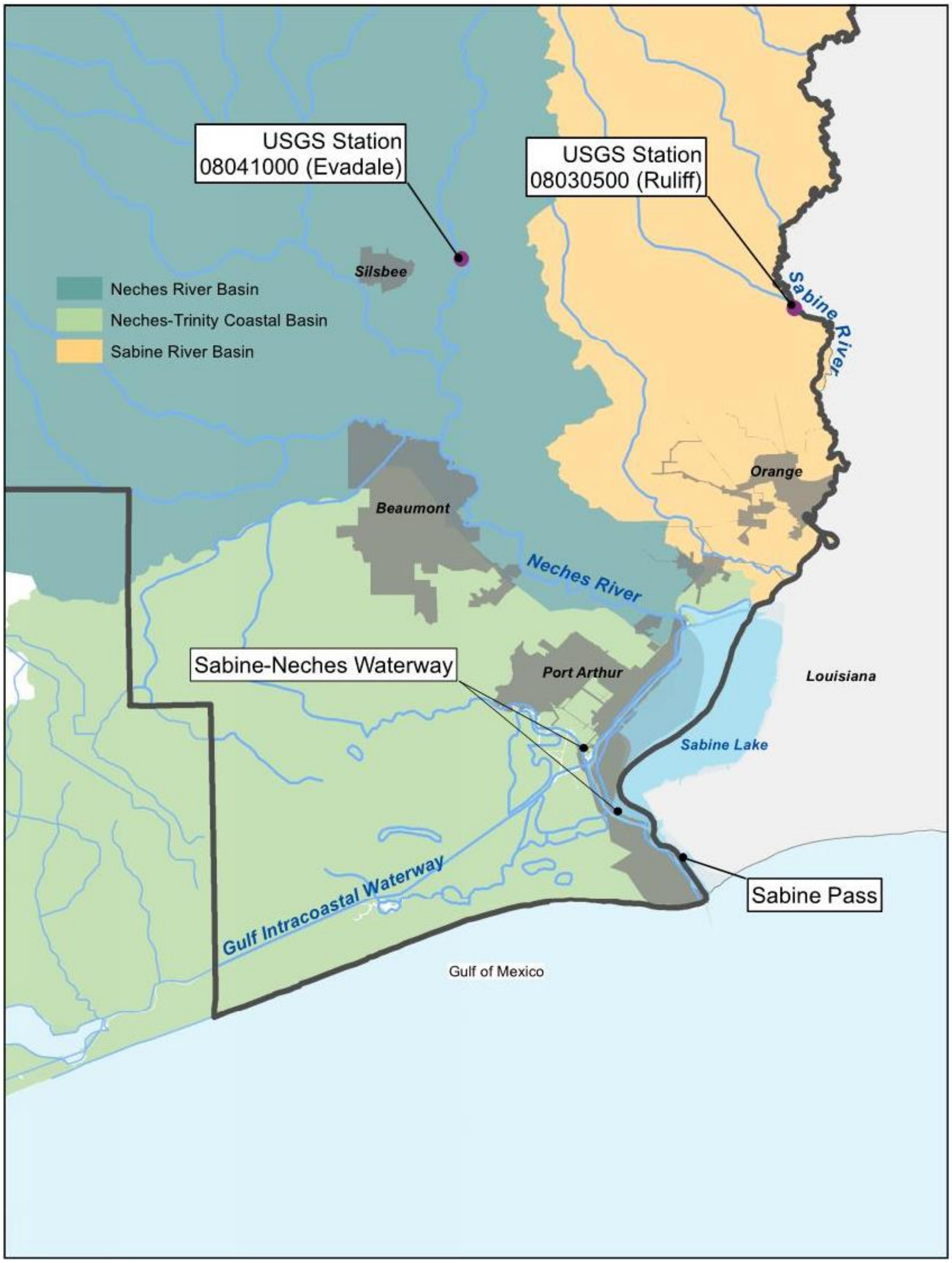

Figure 1.16 Sabine Lake Estuary and Vicinity

SOURCE: TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

The Sabine-Neches Waterway is the second-longest inland waterway on the U.S. Gulf Coast and home to two U.S. strategic seaports – the Port of Beaumont and the Port of Port Arthur. 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 to Orange, upstream on the Sabine River. The waterway is some 400 feet wide and 40 feet deep. In 2014, the U.S. House of Representatives passed the Water

Resources Reform and Development Act, H.R. 3080, authorizing 34 water projects including the widening of the Sabine-Neches Waterway. Construction on this latest deepening and widening project began in 2019 and will take almost ten years to complete. The expansion will deepen the channel to 48 feet and widen it to as much as 700 feet.

1.5.5 Rare, Threatened and Endangered Species

As of September 1st, 2023, the TPWD identified threatened and endangered species of the region (See Appendix 1-A). Included are 10 species of birds, eight mammals, eight reptiles/amphibians, six fish, seven mollusks, and seven vascular plants. These species are listed as rare, 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 Natural Diversity Database.

A USFWS IPaC review was conducted on October 3rd, 2023, and identified threatened and endangered species of the region. Included are five species of birds, three mammals, nine reptiles/amphibians, three clams, and nine plants. The IPaC also listed critical habitat or proposed critical habitat for the following species: Louisiana Pigtoe (*Pleurobema riddellii*), Louisiana Pinesnake (*Pituophis ruthveni*), Neches River Rose-mallow (*Hibiscus dasycalyx*), Texas Fawnsfoot (*Truncilla macrodon*), Texas Goldencress (*Leavenworthia texana*), and the Texas Heelsplitter (*Potamilus amphichaenus*). IPaC's are considered valid for 90 days beginning when the list was obtained, after 90 days a request for an updated list is recommended.

1.5.6 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.[26] 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 ecological significant stream segments in the ETRWPA is found in Chapter 8.

1.5.7 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.

[26] Bauer, J., R. Frye, and B. Spain, "A Natural Resource Survey for Proposed Reservoir Sites and Selected Stream Segments in Texas," Texas Parks and Wildlife Department. Austin, Texas, August 1991.

Table 1.8 Texas Parks and Wildlife Department 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 Number 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 Sandy Creek	•		•	•	•	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

SOURCE: TEXAS PARKS AND WILDLIFE DEPARTMENT

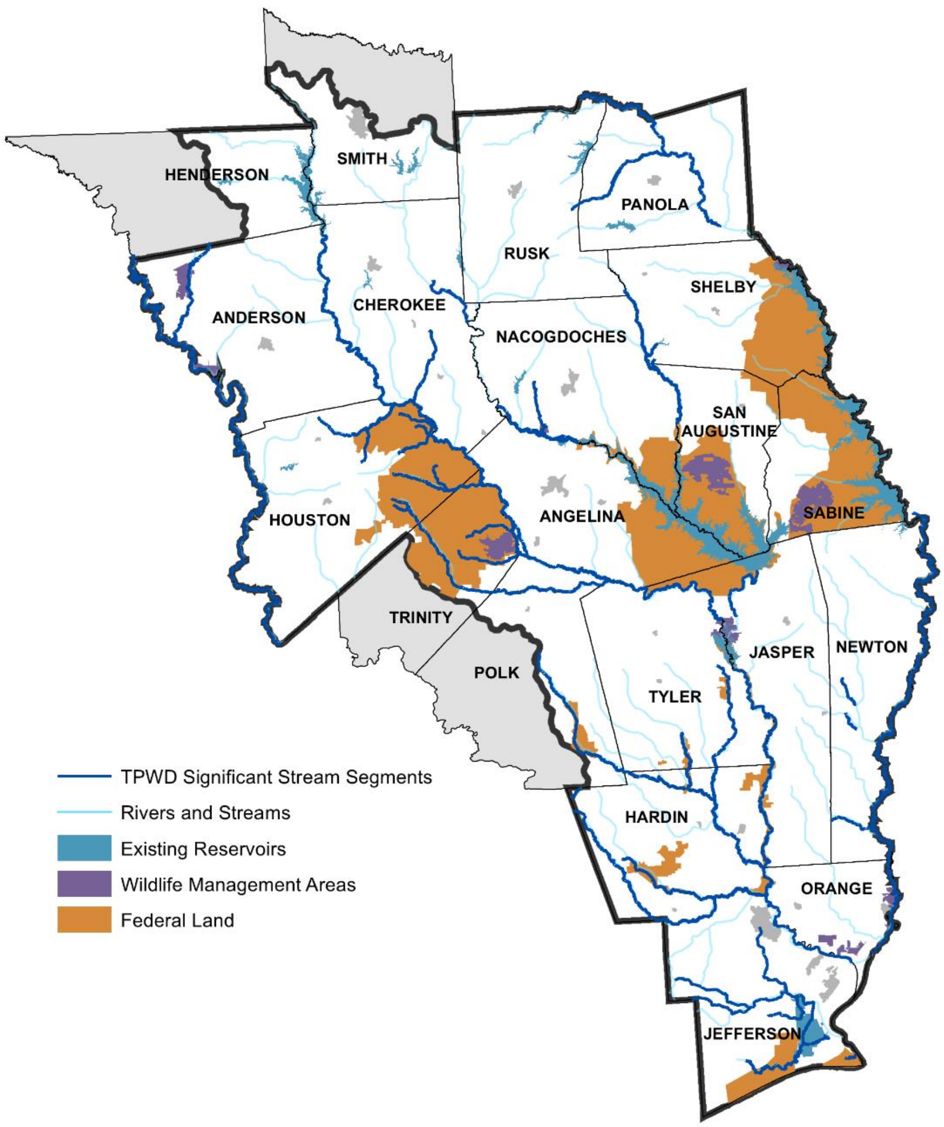

Figure 1.17 Ecologically Significant Stream Segments

SOURCE: TEXAS PARKS AND WILDLIFE DEPARTMENT

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

Owner/Operator	Name	County
Texas Parks and Wildlife Department	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
	Big Lake Bottom 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
	Angelina Neches/Dam B. Wildlife Management Area	Jasper and Tyler
	Lower Neches Wildlife Management Area	Orange
	Tony Houseman Wildlife Management Area	Orange
	J.D. Murphree Wildlife Management Area	Jefferson
	Alabama Creek Wildlife Management Area	Trinity
	Alazan Bayou Wildlife Management Area	Nacogdoches
	East Texas Conservation Center	Jasper
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	Caddo Mounds State Historical Park	Cherokee
	Mission Dolores State Historic Site	San Augustine
	Sabine Pass Battleground State Historical Site	Jefferson
U.S. Army Corps of Engineers	Sam Rayburn Reservoir	
	Town Bluff Dam, B.A. Steinhagen Lake	
U.S. Fish and Wildlife Service	Neches National Wildlife 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

SOURCE: TEXAS PARKS AND WILDLIFE DEPARTMENT, TEXAS A&M FOREST SERVICE, TEXAS HISTORICAL COMMISSION, U.S. ARMY CORPS OF ENGINEERS, U.S. FISH AND WILDLIFE SERVICE, U.S. FOREST SERVICE, AND NATIONAL PARK SERVICE

1.5.8 Archeological Resources

The east Texas area, including the ETRWPA, is rich in cultural, historical, and archeological resources. Its abundant water, timber, and other natural resources made it ideal for native American settlement. The eastern portion of Texas was explored and settled early by European cultures. The ETRWPA, from Sabine Pass to the northern extent of the region has been a significant center of Texas historical development over the past two centuries.

Texas Historical Commission maintains the Texas Historic Sites Atlas, a database containing historic county courthouses, National Register properties, historical markers, museums, sawmills, and neighborhood surveys.[27] This database contains a very large amount of data. The Texas Historical Commission does not release information on archeological sites to the general public.

The most prominent archeological site in the ETRWPA is Caddo Mounds State Historic Site, a 94-acre park in Cherokee County west of Alto. 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.[28]

An important historical route that traverses the northern portion of the ETRWPA is the El Camino Real de los Tejas. The origin of the route begins in 1690 when Spanish soldiers and priests crossed the Rio Grande and embarked towards the Neche River, establishing two missions. After years of establishing and abandoning settlements, conflicts with the native peoples of Texas and Louisiana, and dealing with French, Spanish, and Mexican governments, the route eventually reached eastern Texas and northwestern Louisiana totaling 2,500 miles. It served as a trade route between settlements as well as a way to link Mexico City with Los Adaes (east Texas).

Within the boundary of the ETRWPA lies one of the few recognized tribes in Texas, The Alabama-Coushatta Tribe. Their reservation contains 10,200 acres in the Big Thicket between the Neches and Sabine Rivers. The tribe settled in the region around 1780 after relocating from Alabama. The tribe has a long history of supporting revolutionaries, first aiding Mexicans by fighting against Spain in the Mexican War of Independence in 1813, then by guiding and providing provisions to Texas fighters while they fought again the Mexican government in the Texas War of Independence in 1836. Today the tribe has more than 1,300 individuals enrolled.

1.5.9 Mineral Resources

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

Petroleum Production. Oil and natural gas fields are significant natural resources in portions of the region. With the exception of Angelina County, producing oil wells may be found in each county in the region. A portion of the region is located within the Haynesville/Bossier Shale Formation. The Haynesville/Bossier Shale Formation is a hydrocarbon-producing geological formation capable of producing large amounts of gas. There are high densities of producing oil wells in Anderson, Hardin, and Rusk counties and high densities of natural gas wells in Nacogdoches, Panola, and Rusk, counties, with lesser densities in the other counties in the region. The Region I counties which are impacted by the

[27] Texas Historical Commission. (1999) "Texas Historic Sites Atlas." URL: http://www.thc.texas.gov/preserve/texas-historic-sites-atlas, accessed October 2020.

[28] Texas Historical Commission, "Caddo Mounds State Historic Site," URL: http://www.thc.texas.gov/historic-sites/caddo-mounds-state-historic-site, accessed October 2020.

Haynesville/Bossier Shale Formation include Angelina, Nacogdoches, Panola, Rusk, Sabine, San Augustine, and Shelby.

Figure 1.18 and Figure 1.19 depict oil and gas resources in the ETRWPA.[29]

Starting around 2008, the East Texas petroleum industry was revitalized when multi-stage hydraulic fracturing (fracking) and horizontal drilling of the Haynesville/Bossier Shale became technologically and economically feasible. According to the USGS's 2016 assessment, this natural gas field is estimated to contain in excess of 304 trillion cubic feet (TCF) of natural gas making it among the largest gas reserves in the lower 48 states.[30] This is an increase of 240 TCF over USGS's 2011 estimate of 61 TCF. An additional 4 billion barrels of oil are estimated to be in the strata associated with this formation.[30] In Region I, Angelina, Nacogdoches, Panola, Rusk, Sabine, San Augustine, and Shelby counties overlie the Haynesville/Bossier Shale. Conventional oil and gas reserves underlie the other counties in the region, with significant well densities in Nacogdoches, Anderson, Cherokee, and Rusk counties. With recent increases in pipelines, refinery capacity, and liquefied natural gas (LNG) export terminals along the Gulf Coast, demands for East Texas oil and gas are predicted to continue to increase over the coming decades.

Concerns have arisen about the large volumes of water used by the petroleum industry, especially during fracking, and the potential degradation of surface and ground water quality in Region I from oil and gas drilling and production. In terms of water use, the total volume of water used during fracking is less than 1% of the total water used in Texas.[31] Furthermore, due to the great depths separating drinking water aquifers and shales undergoing fracking and the improvements in drilling technology, it is unlikely that fracking will degrade Region I's groundwater resources. The movement of fracking fluids into drinking water aquifers has not been observed in Texas.[32] Surface spills and nonpoint stormwater discharges can result in impacts to surface waters when appropriate best management practices are not implemented.[33] However, effective stormwater and spill management practices have been shown to significantly reduce potential impacts from oil and gas development to water resources (McBroom et al., 2012).[34]

Lignite Coal Fields. Figure 1.20 shows lignite coal resources located in the region.[35] The Wilcox Group of

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[29] Texas Railroad Commission, "Texas Top Producing Fields," URL: https://www.rrc.state.tx.us/oil-gas/research-and-statistics/, accessed October 2020.

[30] Paxton, Stanley T., "Assessment of Oil and Gas Resources in the Upper Jurassic Haynesville and Bossier Formations, U.S. Gulf Coast, 2016," US Department of the Interior US Geological Survey Open-File Report 2018-1135, 2018.

[31] Nicot, J.P. and B.R. Scanlon, "Water Use for Shale-Gas Production in Texas, US," Environmental Science and Technology, 46(6):3580-6, doi: 10.1021/es204602t, 2012.

[32] The Academy of Medicine, Engineering and Science of Texas (TAMEST), "Environmental and Community Impacts of Shale Development in Texas," Austin, TX: The Academy of Medicine, Engineering and Science of Texas. doi: 10.25238/TAMESTstf.6.2017., 2017.

[33] McBroom, M. W. ed, "The Effects of Induced Hydraulic Fracturing on the Environment - Commercial Demands vs. Water, Wildlife, and Human Ecosystems," New Jersey: Apple Academic Press. ISBN: 978-1-926895-83-3, 2014.

[34] McBroom, M.W., T. Thomas and Y. Zhang, "Soil Erosion and Surface Water Quality Impacts of Natural Gas Development in East Texas, USA," Water, 4, 944-958, doi:10.3390/w4040944, 2012.

[35] Texas Center for Policy Studies, "Texas Environmental Almanac," Austin, Texas, 1995.

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.

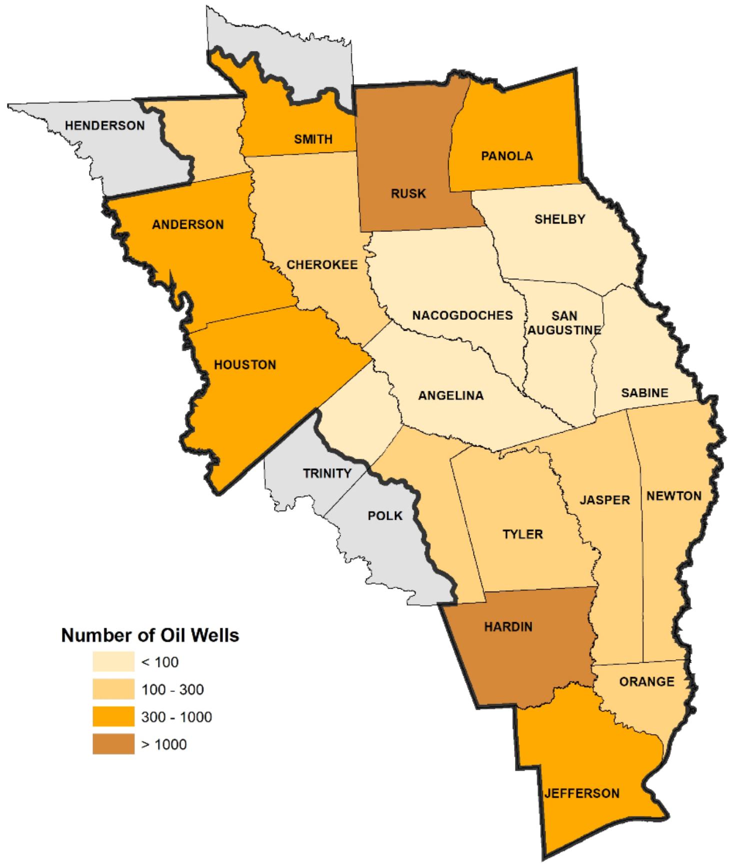

Figure 1.18 Top Producing Oil Wells

SOURCE: RAILROAD COMISSION OF TEXAS, SEPTEMBER 2023

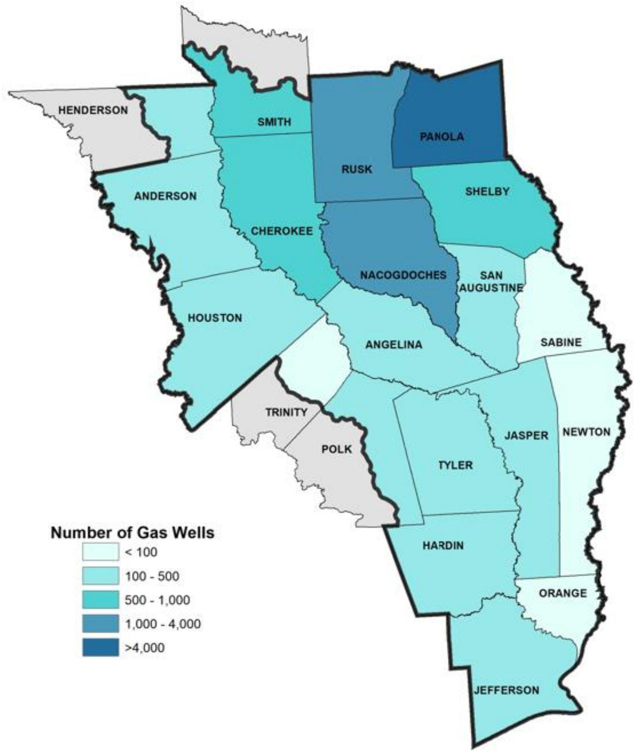

Figure 1.19 Top Producing Gas Wells

SOURCE: RAILROAD COMISSION OF TEXAS, SEPTEMBER 2023

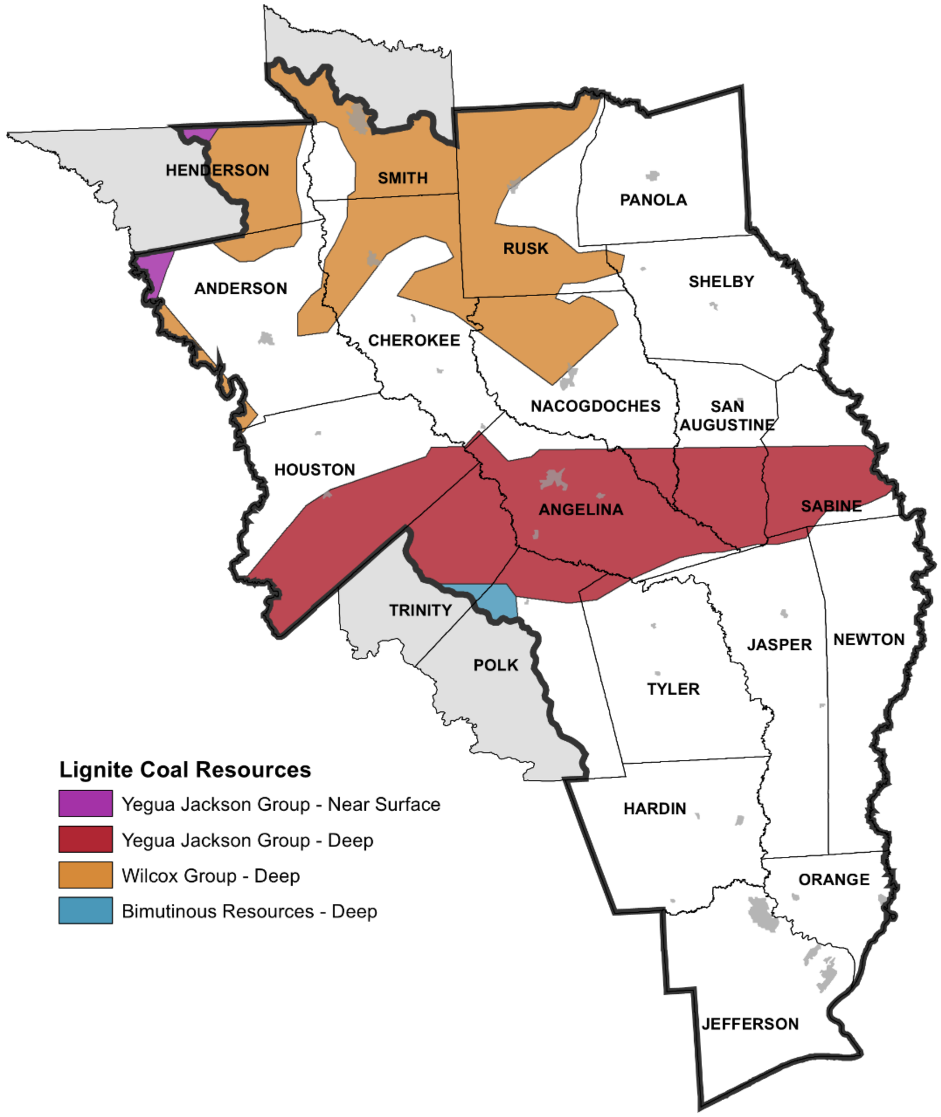

Figure 1.20 Lignite Coal Resources

SOURCE: TEXAS ALMANAC

1.6 THREATS TO WATER QUALITY

Water is a fundamental resource within the ETRWPA, essential for maintaining the health of its natural ecosystems. Inadequate water quantity and quality pose significant threats to these resources. This section outlines key challenges to water quality within the ETRWPA.

1.6.1 Surface Water Quality

The first major U.S. Law to address water pollution was the Federal Water Pollution Control Act of 1948.

This law was amended in 1972, in what became known as the Clean Water Act (CWA). The preamble of the CWA states that the objective of the Act is to "restore and maintain the chemical, physical, and biological integrity of the Nations waters." The 1972 amendments to the act included the following sweeping new changes to the approach to water pollution control:

- Established the structure for the regulation of pollutant discharges to Waters of the United States.
- Gave authority to the United States Environmental Protection Agency to implement control programs (i.e., permitting requirements) for discharges of pollutants from point sources.
- Funded construction of wastewater treatment facilities.
- Recognized the need for planning to address concerns about pollution from non-point sources.
- Established a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands.

The CWA is a cornerstone of the water planning process in the United States and central to the regional planning process.

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.[11]

Texas Clean Rivers Program was created in 1991 by the Texas Legislature to provide a network for monitoring water quality in the State's surface water bodies. The program is administered by the TCEQ; and the TCEQ partners with river authorities to improve the quality of surface water within each river basin in the State. The TCEQ and river authorities conduct water quality monitoring and assessment of streams, rivers, and lakes within their jurisdiction, and coordinate stakeholder participation in the process. The regional water authorities within the ETRWPA that have contracts with the TCEQ to participate as a Texas Clean Rivers Program partner include the Angelina Neches River Authority, Lower Neches Valley Authority, and Sabine River Authority of Texas.

1.7 THREATS TO AGRICULTURAL AND NATURAL RESOURCES

Water is essential to the ETRWPA's natural resources. A lack of water of adequate quality can present a significant threat to such resources. Some of the most significant potential threats in the ETRWPA are described below.

1.7.1 Drawdown of Aquifers

Overpumping of aquifers can pose a 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,[36] the major aquifers in the region. Groundwater conservation districts work to ensure that the risk of excessive drawdown is minimized.

[36] Texas Water Development Board, "Aquifers of Texas," Report 380, Austin, Texas, July 2011.

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.[21] 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 salt-water intrusion, where salt-water is drawn updip into the aquifer or moves vertically into fresh-water portions of the aquifer and degrades the aquifer water quality. Salt-water intrusion into the Gulf Coast Aquifer has occurred previously in central and southern Orange County[36] and Jefferson County.

1.7.2 Insufficient Instream/Environmental Flows

Flow quantities and frequencies in rivers and streams 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. Additional discussion of environmental flows is provided in Chapter 3.

1.7.3 Inundation Due to Reservoir Development

Reservoir development causes unavoidable losses to wildlife resources. In 1990, the TPWD and USFWS developed preliminary data on the acreage of land and species impacted by 44 proposed reservoirs in Texas that appeared to be the most likely to be constructed. The four projects included in this report that affect the ETRWPA include Columbia (formerly called Eastex), Rockland, Bon Wier, and Tennessee Colony reservoir projects. Table 1.10 shows the impacts of new reservoir development on the surrounding land and on protected species. For a complete list of potential reservoirs, refer to Chapter 8. [To be updated upon completion of Chapter 8.]

The USFWS has defined the following site priorities used to preserve bottomland hardwood forests and forested riparian vegetation:

- Priority 1 - excellent quality bottomlands of high value to waterfowl;
- Priority 2 - good quality bottomlands with moderate waterfowl benefits;
- Priority 3 - excellent quality bottomlands with minor waterfowl benefits because of small size, lack of management potential, or other factors;
- Priority 4 - moderate quality bottomlands with minor waterfowl benefits;
- Priority 5 - sites proposed for elimination from further study because of low quality and/or no waterfowl benefits; and Priority 6- sites recommended for future study.

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 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 quality and/or no waterfowl benefits."[37]

[37] Frye, R. G. and D. A. Curtis: Texas Water and Wildlife, "An Assessment of Direct Impacts to Wildlife Habitat from Future Water Development Projects," Texas Parks and Wildlife Department Publication PWD-BK-7108-147-5/90, Austin, Texas, May 1990.

Table 1.10 Potential Impacts of Development on Land Reservoir Area and Protected Species

Potential Impacts		Potential Reservoir Site			
		Columbia[38]	Rockland	Bon Wier	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	**10,623**	**99,500**	**35,100**	**85,100**
Endangered Species Potentially Impacted	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	•	•	•	•
	Rafinesque's big-eared bat	•	•	•	
	Reddish egret		•	•	
	Sandbank pocketbook	•	•	•	•
	Southern hickorynut	•	•	•	•
	Texas heelsplitter	•	•	•	•
	Texas horned lizard	•	•	•	•
	Texas pigtoe	•	•	•	•
	Timber rattlesnake	•	•	•	•
	White-faced ibis	•	•	•	•
	Wood stork	•	•	•	•

SOURCE: U.S. ARMY CORPS OF ENGINEERS, U.S. FISH AND WILDLIFE SERVICE, TEXAS PARKS AND WILDLIFE DEPARTMENT

[38] U.S. Army Corps of Engineers, "Lake Columbia Regional Water Supply Reservoir Project Draft Environmental Impact Statement, Vol. 1 Report," Draft Report, February 2010.

Construction of the Tennessee Colony Reservoir would inundate approximately 13,800 acres of bottomland, which comprise the Richland Creek Wildlife Management Area 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.[39] The Wildlife Management Area is located in Freestone County on the west side of the Trinity River within the boundaries of the proposed Tennessee Colony Reservoir.

The U.S. Army Corps of Engineers 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.

1.8 CONSIDERATION OF EXISTING WATER PLANNING EFFORTS

The ETRWPA published its first round of regional water planning in 2001. This plan was updated according to legislative and TWDB requirements in 2006, 2011, 2016 and again in 2021. The 2026 Plan makes up the 5th update to the regional water plan during this 6th cycle of regional water planning. 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. Coordination efforts with TWDB Regions C, D, and H (all adjacent to the ETRWPA) have occurred for consistency across plans. In addition, water plans specific to WUGs and WWPs were considered in the evaluation of WMSs included in Chapter 5B. Following is a summary of planning efforts and existing programs that have been considered and utilized by the RWPG.

1.8.1 State, Regional, and Local Water Management Planning

Water planning in the ETRWPA incorporates a combination of published plans summarizing 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 WMSs 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 WMSs 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.

[39] Alan Plummer Associates, Inc. & Water Prospecting and Resource Consulting, LLC, "An Analysis of Water Loss as Reported by Public Water."

- Interbasin transfer of water will be needed to meet future water requirements of both the southeast and central Texas areas.
- Desalination is not an appropriate economic or environmental strategy for use in the southeast area.

Beside the TTWP, the Senate Bill 1 (SB1) in 1997 introduced a regional approach to water planning. This law was a response to severe drought conditions and marked a departure from previous methods, emphasizing collaborative, area-specific strategies for water management. The creation of regional water planning groups, including Region I (ETRWPA), was a direct outcome of SB1, reflecting a shift towards more localized and effective water resource management across Texas.

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 RWPG 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. Groundwater conservation districts within the region have prepared groundwater management plans and 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 1.3.1 of Chapter 1.

1.8.2 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 (now WSP USA). 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.

1.8.3 Trinity River Basin Master Plan

This study was originally adopted by the Trinity River Authority of Texas in 1958 and has been updated various times since then, most recently in August 2023. Nearly 81% of the Trinity River Basin falls into Regions C or H while less than 8% of this basin is located within the ETRWPA.

Reservoirs are primary water sources in the Trinity River basin, with 32 identified by TWDB, providing significant economic, recreational, and water supply benefits. Groundwater, governed differently than surface water, is managed by Groundwater Conservation Districts (GCDs) to promote efficient use and prevent wastage. Reuse has steadily grown into an important component of water supplies in the Trinity basin.

The TCEQ 2020 Texas Integrated Report (assessment date range 12/1/2011 to 11/30/2018) and the Trinity River Authority Clean Rivers Program 2020 Basin Summary Report (date range 12/1/2003 to 11/30/2018) indicate that water quality in the Trinity River Basin is generally of high quality. The major issues prevalent within the basin are listings for bacteria, concerns for chlorophyll-a and nutrients, low dissolved oxygen in smaller tributaries, and fish consumption advisories.

1.8.4 Regional and State Flood Plans

In 2019, the Texas Legislature and Governor Abbott enhanced the TWDB's role in flood planning. The TWDB now manages a new state and regional flood planning process aligned with river basins. This involves 15 Regional Flood Planning Groups (RFPGs) which have submitted regional flood plans, now approved by the TWDB for integration into a statewide flood plan. A crucial aspect of this process is assessing how floodwater projects can augment water supplies, reflecting Texas's water managment approach aimed at optimizing resources and benefits in both flood management and water resource planning.

1.8.5 Consideration of Other Publicly Available Plans

The RWPG provided significant outreach to various municipal, agricultural, and manufacturing water users in the current round of planning to ensure that existing plans for water conservation, water resource planning, drought contingency, and other planning tools were appropriately considered in the 2026 Plan. Municipal WUGs and wholesale water providers were specifically queried regarding the existence of planning documents. Existing Plans have been requested of industries as well.

1.9 DROUGHT OF RECORD

In regional water planning, the availability of water supplies is determined for drought of record conditions. The drought of the 1950s is widely considered to be the drought of record, but on regional or sub-regional bases, other periods of time may have been more severe. Chapter 7 presents the current drought of record for each major reservoir in the ETRWPA and evaluates more recent droughts of record in the region. The discussion suggests that the 2010-2012 period was one of significant drought for the ETRWPA. However, more localized hydrologic information is necessary to evaluate whether accounting for a more recent drought would change the estimates of available water supplies. [To be updated upon completion of Chapter 7]

1.10 CURRENT DROUGHT PREPARATIONS

Drought contingency and water conservation 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 Chapters 7 and 5C, respectively.

1.11 WATER LOSS AND WATER AUDITS

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. Since then, the TWDB established new requirements for water audit reporting; these requirements are summarized as follows:

- Retail water suppliers with an active financial obligation with the TWDB are required to submit a water loss audit annually.
- Retail water suppliers with more than 3,300 connections are required to submit a water loss audit annually.
- All public utilities are required to submit a water loss audit once every five years.

Statewide water loss audit summaries for public utility audits submitted for 2019 through 2021 were performed. Appendix 1-B contains the 2019 through 2021 water loss audit data reported by ETRWPA utilities and a summary of the average water loss audit data by planning region. Based on data from responding utilities, the ETRWPA demonstrates an average non-revenue water of 55 gallons per connection per day (GPCPD) (the state average from 2019 to 2021 for non-revenue water is 55 GPCPD), where 47 GPCPD was attributed to real loss and 8 GPCPD to apparent loss. Apparent loss includes unauthorized consumption, meter inaccuracies, and data discrepancies.

The RWPG used the water loss audits to determine what type of water management strategy was needed for each entity with a calculated water need. In addition, conservation WMSs were recommended for the 57 entities that have a base gallon per capita per day water usage greater than the state recommended consumption rate of 140 gallons per capita day. More detail regarding these strategies and their development is provided in Chapters 5A, 5B, and 5C. [To be updated upon completion of Chapter 5]

1.12 THREATS ADDRESSED OR AFFECTED BY WATER MANAGEMENT STRATEGIES

Water management strategies (WMS) were evaluated for impacts as addressed in Chapter 5B of this Plan. The evaluation was based on a numeric evaluation from most desirable (1) to least desirable (5). The major potential impact was determined to be 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 WMSs in Chapter 5B. For discussion on drawdown on aquifers, insufficient instream/environmental flows, and inundation due to reservoir development, see Section 1.7 of this chapter. [To be updated upon completion of Chapter 5]

Appendix 1-A

Species of Special Concern in the East Texas Regional Water Planning Area

The TPWD maintains a list of species of special concern in the Texas Natural Diversity Database. Table 1-A.1 identifies rare, threatened or endangered species in the region by 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, http://tpwd.texas.gov/gis/rtest/.

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
DL, PDL	Federally Delisted/Proposed for Delisting
E, T	State Listed Endangered/Threatened
NT	Not tracked or no longer tracked by the State
Y, N	Yes, No
“blank”	Rare, but with no regulatory listing status

Taxon	SName	CName	USESA	SPROT
Amphibians	Ambystoma tigrinum	eastern tiger salamander		
Amphibians	Desmognathus conanti	spotted dusky salamander		
Amphibians	Necturus beyeri	Gulf Coast waterdog		
Amphibians	Anaxyrus woodhousii	Woodhouse's toad		
Amphibians	Pseudacris streckeri	Strecker's chorus frog		
Amphibians	Lithobates areolatus areolatus	southern crawfish frog		
Birds	Egretta rufescens	reddish egret		T
Birds	Plegadis chihi	white-faced ibis		T
Birds	Mycteria americana	wood stork		T
Birds	Elanoides forficatus	swallow-tailed kite		T
Birds	Haliaeetus leucocephalus	bald eagle		
Birds	Laterallus jamaicensis	black rail	T	T
Birds	Grus americana	whooping crane	LE	E
Birds	Charadrius melodus	piping plover	LT	T
Birds	Calidris canutus rufa	rufa red knot	LT	T
Birds	Leucophaeus pipixcan	Franklin's gull		
Birds	Rynchops niger	black skimmer		
Birds	Athene cunicularia hypugaea	western burrowing owl		
Birds	Dryobates borealis	red-cockaded woodpecker	LE	E
Birds	Anthus spragueii	Sprague's pipit		
Birds	Peucaea aestivalis	Bachman's sparrow		T
Birds	Calcarius ornatus	chestnut-collared longspur		
Fish	Polyodon spathula	paddlefish		T
Fish	Atractosteus spatula	alligator gar		
Fish	Anguilla rostrata	american eel		
Fish	Hybognathus nuchalis	Mississippi silvery minnow		
Fish	Notropis atrocaudalis	blackspot shiner		
Fish	Notropis chalybaeus	ironcolor shiner		
Fish	Notropis maculatus	taillight shiner		
Fish	Notropis potteri	chub shiner		T
Fish	Notropis sabinae	Sabine shiner		
Fish	Notropis shumardi	silverband shiner		
Fish	Cycleptus elongatus	blue sucker		T
Fish	Erimyzon claviformis	western creek chubsucker		T
Fish	Fundulus jenkinsi	saltmarsh topminnow		
Fish	Ammocrypta clara	western sand darter		
Fish	Percina shumardi	river darter		
Fish	Paralichthys lethostigma	southern flounder		
Fish	Isurus oxyrinchus	shortfin mako shark		T
Fish	Carcharhinus longimanus	oceanic whitetip shark	LT	T
Mammals	Myotis austroriparius	southeastern myotis bat		
Mammals	Perimyotis subflavus	tricolored bat		
Mammals	Eptesicus fuscus	big brown bat		
Mammals	Lasiurus borealis	eastern red bat		
Mammals	Lasiurus cinereus	hoary bat		
Mammals	Lasiurus intermedius	northern yellow bat		
Mammals	Corynorhinus rafinesquii	Rafinesque's big-eared bat		T
Mammals	Sylvilagus aquaticus	swamp rabbit		
Mammals	Microtus ochrogaster	prairie vole		

Taxon	SName	CName	USESA	SPROT
Mammals	Ondatra zibethicus	muskrat		
Mammals	Physeter macrocephalus	sperm whale	LE	E
Mammals	Balaenoptera borealis	sei whale	LE	E
Mammals	Balaenoptera musculus	blue whale	LE	E
Mammals	Balaenoptera ricei	Gulf of Mexico Bryde's whale	LE	E
Mammals	Megaptera novaeangliae	humpback whale	LE	
Mammals	Eubalaena glacialis	North Atlantic right whale	LE	E
Mammals	Ursus americanus	black bear		T
Mammals	Ursus americanus luteolus	Louisiana black bear		T
Mammals	Mustela frenata	long-tailed weasel		
Mammals	Spilogale putorius	eastern spotted skunk		
Mammals	Conepatus leuconotus	western hog-nosed skunk		
Mammals	Puma concolor	mountain lion		
Reptiles	Caretta caretta	loggerhead sea turtle	LT	T
Reptiles	Chelonia mydas	green sea turtle	LT	T
Reptiles	Lepidochelys kempii	Kemp's Ridley sea turtle	LE	E
Reptiles	Macrochelys temminckii	alligator snapping turtle		T
Reptiles	Dermochelys coriacea	leatherback sea turtle	LE	E
Reptiles	Deirochelys reticularia miaria	western chicken turtle		
Reptiles	Malaclemys terrapin littoralis	Texas diamondback terrapin		
Reptiles	Terrapene carolina	eastern box turtle		
Reptiles	Terrapene ornata	western box turtle		
Reptiles	Apalone mutica	smooth softshell		
Reptiles	Ophisaurus attenuatus	slender glass lizard		
Reptiles	Phrynosoma cornutum	Texas horned lizard		T
Reptiles	Plestiodon septentrionalis	prairie skink		
Reptiles	Cemophora coccinea	northern scarlet snake		T
Reptiles	Drymarchon melanurus erebennus	Texas indigo snake		
Reptiles	Heterodon nasicus	western hognose snake		
Reptiles	Nerodia clarkii	salt marsh snake		
Reptiles	Pituophis ruthveni	Louisiana pine snake	LT	T
Reptiles	Crotalus horridus	timber (canebrake) rattlesnake		
Reptiles	Sistrurus miliarius	pygmy rattlesnake		
Crustaceans	Procambarus nigrocinctus	blackbelted crayfish		
Crustaceans	Procambarus nechesae	Neches crayfish		
Crustaceans	Fallicambarus kountzeae	Big Thicket burrowing crayfish		
Insects	Cotalpa conclamara	No accepted common name		
Insects	Bombus pensylvanicus	American bumblebee		
Insects	Pogonomyrmex comanche	Comanche harvester ant		
Insects	Euphyes bayensis	bay skipper		
Insects	Somatochlora margarita	Texas emerald dragonfly		
Insects	Isoperla sagittata	arrowhead stripetail		
Insects	Chimarra holzenthali	Holzenthal's philopotamid caddisfly		
Insects	Cheumatopsyche morsei	Morse's net-spinning caddisfly		
Insects	Hydroptila ouachita	No accepted common name		
Insects	Neotrichia mobilensis	No accepted common name		
Insects	Phylocentropus harrisi	No accepted common name		
Mollusks	Fusconaia askewi	Texas pigtoe		T
Mollusks	Lampsilis satura	sandbank pocketbook		T

Taxon	SName	CName	USESA	SPROT
Mollusks	Obovaria arkansasensis	southern hickorynut		T
Mollusks	Pleurobema riddellii	Louisiana pigtoe	PT	T
Mollusks	Potamilus amphichaenus	Texas heelsplitter		T
Mollusks	Fusconaia chunii	Trinity pigtoe		T
Mollusks	Truncilla macrodon	Texas fawnsfoot	PT	T
Plants	Coreopsis intermedia	goldenwave tickseed		
Plants	Echinacea atrorubens	Topeka purple-coneflower		
Plants	Gaillardia aestivalis var. winkleri	white firewheel		
Plants	Hymenopappus carrizoanus	sandhill woolywhite		
Plants	Hymenoxys texana	Texas prairie dawn	LE	E
Plants	Liatris tenuis	slender gay-feather		
Plants	Prenanthes barbata	barbed rattlesnake-root		
Plants	Rudbeckia scabrifolia	bog coneflower		
Plants	Symphyotrichum puniceum var. scabricaule	rough-stem aster		
Plants	Leavenworthia texana	Texas golden gladecress	LE	E
Plants	Physaria pallida	white bladderpod	LE	E
Plants	Streptanthus maculatus ssp. maculatus	clasping twistflower		
Plants	Paronychia setacea	bristle nailwort		
Plants	Silene subciliata	scarlet catchfly		
Plants	Geocarpon minimum	earth fruit	LT	T
Plants	Amorpha laevigata	smooth indigobush		
Plants	Amorpha paniculata	panicled indigobush		
Plants	Astragalus soxmaniorum	Soxman's milkvetch		
Plants	Quercus arkansana	Arkansas oak		
Plants	Quercus boyntonii	Boynton's oak		
Plants	Bartonia paniculata ssp. texana	Texas screwstem		
Plants	Brazoria truncata var. pulcherrima	Centerville Brazos-mint		
Plants	Physostegia longisepala	long-sepaled false dragon-head		
Plants	Rhododon ciliatus	Texas sandmint		
Plants	Leitneria pilosa ssp. pilosa	corkwood		
Plants	Spigelia texana	Texas pinkroot		
Plants	Hibiscus dasycalyx	Neches River rose-mallow	LT	T
Plants	Phlox nivalis ssp. texensis	Texas trailing phlox	LE	E
Plants	Clematis carrizoensis	Carrizo Sands leather-flower		
Plants	Agrimonia incisa	incised groovebur		
Plants	Crataegus nananixonii	Nixon's dwarf hawthorn		
Plants	Crataegus viridis var. glabriuscula	Sutherland hawthorn		
Plants	Agalinis navasotensis	Navasota false foxglove		
Plants	Yucca cernua	nodding yucca		
Plants	Carex decomposita	cypress knee sedge		
Plants	Cyperus grayioides	Mohlenbrock's sedge		
Plants	Rhynchospora indianolensis	Indianola beakrush		
Plants	Rhynchospora macra	large beakrush		
Plants	Eriocaulon koernickianum	small-headed pipewort		T
Plants	Lachnocaulon digynum	tiny bog button		
Plants	Schoenolirion wrightii	Texas sunnybell		
Plants	Trillium texanum	Texas trillium		
Plants	Calopogon oklahomensis	Oklahoma grass pink		
Plants	Cypripedium kentuckiense	Southern lady's-slipper		

Taxon	SName	CName	USESA	SPROT
Plants	Platanthera integra	yellow fringeless orchid		
Plants	Platanthera chapmanii	Chapman's orchid		
Plants	Spiranthes brevilabris	Texas ladies'-tresses		
Plants	Spiranthes longilabris	giant spiral ladies'-tresses		
Plants	Spiranthes parksii	Navasota ladies'-tresses	LE	E
Plants	Triphora trianthophoros var. texensis	Texas three-birds orchid		
Plants	Xyris drummondii	Drummond's yellow-eyed grass		
Plants	Xyris chapmanii	Chapman's yellow-eyed grass		
Plants	Xyris scabrifolia	roughleaf yellow-eyed grass		

Appendix 1-B
Water Loss Audits

The TWDB established 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. Entities with active financial obligations with the TWDB are required to submit water loss data annually. This appendix provides Entity-Level Water Loss Audit Data for 2021.

2019 through 2021 - Summary of Reported Water Loss Audits by Utility as of 12/19/2023

This data comes from submitted water loss audits after quality control has been completed. Water loss audits with obvious data issues were removed.

GMD = gallons per mile per day; GCD = gallons per connection per day; ILI = Infrastructure Leakage Index; GPCD = gallons per capita per day

Year	Name of Utility	Real Loss GMD (<32 conn/mi)	Real Loss GCD	Apparent Loss GCD	Water Loss GCD	ILI (>= 3,000 connections)	Total GPCD	GPCD Loss	Real Loss Cost in dollars	Apparent Loss Cost in dollars
2020	Angelina WSC	260.27	8.82	5.42	14.24	0	98	5	$23,277	$30,573
2020	Appleby WSC	558.13	43.92	5.01	48.92	0	88	16	$187,746	$41,621
2019	B C Y WSC	121.19	9.64	5.79	15.43	0	39	5	$2,488	$7,578
2020	B C Y WSC		27.72	12.44	40.15	1.59	160	14	$94,272	$108,121
2020	Brushy Creek WSC		15.94	12.58	28.52	1.44	181	13	$45,199	$247,061
2020	Cardinal Meadows Improvement District	4024.72	134.56	6	140.56	0	149	46	$26,566	$2,882
2021	Cardinal Meadows Improvement District	1249.75	70.87	3.14	74.01	0	117	64	$14,985	$20,287
2020	Centerville WSC		18.02	2.85	20.87	0	67	13	$450	$890
2019	City of Beaumont Water Utility Dept	1180.41	64.89	20.33	85.23	0	147	47	$11,310	$19,280
2020	City of Beaumont Water Utility Dept		45.79	16.19	61.97	3.33	171	20	$832,219	$768,660
2019	City of Bridge City		48.44	11.02	59.46	0	116	27	$18,281	$125,591
2020	City of Bridge City	1221.54	40.81	8.27	49.09	0	104	21	$1,257	$3,185
2019	City of Brownsboro		35.82	5.48	41.3	0	93	14	$11,715	$2,910
2019	City of Carthage		34.99	0.52	35.5	0	69	12	$34,565	$2,082
2020	City of Center	1196.99	38.29	3.19	41.48	2.24	97	14	$586,110	$47,161
2021	City of Center	604.84	21.38	8.63	30.01	1.1	73	7	$63,780	$32,789
2019	City of Chandler	119	4.1	16.2	20.3	0	90	6	$827	$64,909
2020	City of Chandler		35.59	22.98	58.57	1.68	130	17	$2,593,024	$5,534,147
2020	City of China	937.67	75.62	1.9	77.52	0	181	18	$513	$129
2020	City of Corrigan		23.74	5.36	29.11	2.26	104	10	$229,167	$59,152
2020	City of Crockett		17.67	1.03	18.7	0	137	6	$19,180	$1,966
2019	City of Cushing		10.97	13.1	24.07	0	111	8	$6,279	$8,649
2020	City of Cushing		9.05	2.41	11.46	0.73	67	4	$35,370	$15,885
2019	City of Garrison		33.13	0.65	33.78	0	87	11	$17,657	$700
2020	City of Garrison		25.5	0.57	26.07	0	76	9	$7,371	$331
2021	City of Groves	1464.99	59.61	3.47	63.08	2.48	98	21	$762,300	$52,599
2019	City of Henderson	93	3.12	0.72	3.84	0	97	1	$51	$49
2020	City of Henderson		39.34	18.61	57.96	0	131	19	$11,689	$8,167
2021	City of Henderson	473.32	16.32	12.35	28.67	0	84	10	$812	$994
2019	City of Huntington	772.88	34.35	0.49	34.84	0	72	13	$147	$14
2020	City of Huntington	1564.01	66.17	0.56	66.73	0	74	22	$71,839	$2,478
2019	City of Huxley		12.83	3.03	15.86	0	123	5	$3,244	$3,380
2020	City of Huxley		28.08	1.83	29.91	0	79	10	$3,120	$897
2019	City of Jacksonville		8.85	3.29	12.13	0	199	8	$5,345	$3,428
2020	City of Jacksonville		37.87	12.11	49.97	1.45	240	21	$205,324	$202,315
2021	City of Jacksonville		16.99	18.32	35.31	0	186	17	$13,635	$20,409
2021	City of Jasper		60.46	3.64	64.1	0	104	30	$35,001	$3,163
2019	City of Kirbyville		35.06	0.45	35.51	0	60	12	$892	$47
2020	City of Kirbyville		9.34	0.46	9.79	0	61	3	$199	$40
2021	City of Kirbyville	2225.48	74.02	10.62	84.64	2.8	184	29	$454,888	$163,154
2019	City of Kountze	1165.31	42.12	0.74	42.86	0	99	14	$11,484	$825
2020	City of Kountze		20.12	0.45	20.57	0	61	7	$925	$86
2021	City of Kountze	41.55	1.35	3.25	4.6	0	50	2	$410	$7,969
2020	City of Lovelady		18.76	9.02	27.77	0	35	11	$12,990	$9,775
2019	City of Lufkin	2702.65	168.92	5.81	174.73	0	106	58	$1,533	$565
2019	City of Nacogdoches		39.41	1.07	40.48	0	87	14	$162,741	$6,586
2020	City of Nacogdoches		51.61	1.25	52.86	0	102	18	$117,494	$5,080
2021	City of Nacogdoches	865.17	40.97	0.36	41.34	0	49	14	$24,698	$896

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GMD = gallons per mile per day; GCD = gallons per connection per day; ILI = Infrastructure Leakage Index; GPCD = gallons per capita per day

Year	Name of Utility	Real Loss GMD (<32 conn/mi)	Real Loss GCD	Apparent Loss GCD	Water Loss GCD	ILI (>= 3,000 connections)	Total GPCD	GPCD Loss	Real Loss Cost in dollars	Apparent Loss Cost in dollars
2019	CITY OF NEDERLAND		33.55	3.99	37.54	0	98	13	$1,903	$1,921
2020	CITY OF NEDERLAND		59.67	1.22	60.9	0	142	38	$24,286	$995
2021	CITY OF NEDERLAND		21.56	7.31	28.87	0	152	13	$2,776	$9,408
2020	City of New Summerfield	3393.2	138.06	19.44	157.5	6.78	283	84	$35,422	$35,138
2021	City of Newton		62.57	6.16	68.73	0	79	30	$44,668	$8,366
2019	City of Nome		46.35	4.02	50.37	2.96	148	24	$245,535	$31,651
2020	City of Nome	291.57	9.29	3.56	12.85	0	64	5	$13,963	$14,254
2021	City of Nome		18.72	23.5	42.22	1.2	134	12	$1,135,653	$3,377,947
2020	City of Orange		36.69	8.68	45.37	2.57	121	18	$1,344,144	$761,894
2021	City of Orange		115.26	4.66	119.92	8.33	169	48	$570,394	$368,350
2019	City of Palestine	1871.09	80.91	14.77	95.69	0	121	48	$28,957	$5,587
2019	City of Pinehurst		7.83	18.55	26.38	0	128	18	$3,107	$45,766
2020	City of Pinehurst	336.18	16.88	12.26	29.14	0	136	13	$37,732	$38,125
2021	City of Pinehurst	81.36	4.77	5.68	10.45	0	95	5	$3,066	$5,606
2019	City of Pineland	1796.25	111.2	5.69	116.89	0	183	98	$85,232	$4,364
2020	City of Pineland		47.59	25.49	73.08	0	187	36	$57,369	$86,654
2020	City of Port Neches	437.67	69.69	25.78	95.47	0	117	34	$6,358	$19,572
2021	City of Port Neches		16.24	6.3	22.54	0.91	85	6	$9,586	$72,987
2019	City of Rusk		22.34	6.59	28.93	1.29	180	13	$84,206	$35,380
2019	City of San Augustine	18.67	2.08	3.92	6	0	98	2	$319	$4,431
2020	City of San Augustine		55.65	17.86	73.51	0	98	30	$12,972	$4,029
2021	City of San Augustine		41.35	9.84	51.19	0	82	18	$5,068	$7,373
2020	City of Tenaha		36.39	15.22	51.6	1.8	105	22	$146,190	$177,478
2021	City of Tenaha		237.91	43.09	281	0	817	216	$58,203	$10,541
2019	City of Troup	1307.37	78.44	6.52	84.96	0	107	42	$4,538	$833
2020	City of Troup	3236.91	350.57	10.66	361.23	0	313	207	$35,444	$3,772
2021	City of Troup	500.12	19.45	3.41	22.86	0	142	11	$33,953	$5,448
2019	City of Tyler		124.83	17.41	142.25	8.56	156	75	$1,171,051	$163,345
2020	City of Tyler		58.4	1.37	59.77	0	142	21	$56,384	$1,320
2021	City of Tyler		144.72	4.4	149.12	0	160	79	$101,978	$3,786
2020	City of Wells		36.65	21.03	57.68	2.67	171	22	$673,166	$503,892
2021	City of Wells		16.06	12.7	28.76	0	107	10	$1,171	$11,284
2020	City of Whitehouse		16.4	1.66	18.07	1.14	115	7	$179,636	$38,094
2019	Cypress Creek WSC		11.96	3.64	15.6	0	181	9	$5,199	$9,655
2020	Cypress Creek WSC	287.63	11.19	3.91	15.1	0	84	10	$3,675	$5,970
2019	D & M WSC	202.39	18.4	21.8	40.2	0	59	10	$615	$1,751
2020	D & M WSC		31.16	0.52	31.68	0	70	11	$32,421	$2,214
2021	D & M WSC		4.99	10.99	15.98	0	72	5	$8,582	$16,583
2019	Denning WSC	2919.28	101.57	7.31	108.88	0	103	41	$4,396	$1,007
2020	Denning WSC	73.23	27.74	0.66	28.4	0	85	9	$46,642	$1,743
2021	Emerald Bay MUD		60.96	7.07	68.02	4.62	102	18	$25,754	$195,764
2020	Evadale WCID 1		20.93	9.29	30.22	1.66	153	10	$30,435	$76,098
2021	Evadale WCID 1		97.85	7.25	105.1	7.42	150	24	$308,761	$48,141
2019	Four Pines WSC		8.84	4.57	13.41	0.86	69	4	$39,683	$32,474
2020	Four Pines WSC		2.48	0.66	3.14	0	88	1	$1,660	$790
2019	Four Way SUD		5.39	3.62	9.01	0	101	3	$10,088	$7,423
2020	Four Way SUD	999.15	35.18	44.39	79.57	0	289	9	$5,926	$7,478
2019	G-M WSC		1.29	7.4	8.69	0	206	5	$2,587	$50,304
2020	G-M WSC		38.97	6.03	44.99	0	103	15	$2,526	$2,481
2021	G-M WSC		8.54	5.63	14.17	0	114	5	$22,818	$21,216
2019	Goodsprings WSC		2.91	2.81	5.73	0	77	2	$2,002	$6,408
2020	Goodsprings WSC		12.93	9.19	22.12	0	154	8	$21,106	$23,949

Texas Water Development Board

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Year	Name of Utility	Real Loss GMD (<32 conn/mi)	Real Loss GCD	Apparent Loss GCD	Water Loss GCD	ILI (>= 3,000 connections)	Total GPCD	GPCD Loss	Real Loss Cost in dollars	Apparent Loss Cost in dollars
2021	Goodsprings WSC		86.39	5.1	91.49	0	103	31	$214,044	$12,634
2019	Gum Creek WSC		2.14	0.99	3.13	0	135	1	$1,163	$3,126
2020	Gum Creek WSC		12.23	5.97	18.2	1.04	93	6	$103,269	$35,801
2020	Hardin County WCID 1		3.08	1.65	4.73	0	169	2	$566	$3,024
2021	Hardin County WCID 1		53.36	5.95	59.3	5.2	77	19	$336,768	$76,038
2020	Hollands Quarter WSC		39.52	9.62	49.14	0	157	16	$9,279	$2,823
2019	Holmwood Angelina & Neches River Authori		11.98	9.01	20.99	0	89	4	$16,416	$15,823
2020	Holmwood Angelina & Neches River Authori		10.53	8.88	19.41	0.75	141	7	$32,924	$164,064
2021	Holmwood Angelina & Neches River Authori		48.34	9.28	57.61	0	96	10	$34,563	$6,632
2020	Hudson WSC		11.58	4.23	15.81	1.05	455	37	$13,849	$162,975
2021	Hudson WSC	283.39	46.27	5.84	52.11	0	171	17	$51,412	$7,938
2020	Jackson WSC		13.27	21.13	34.4	0	129	10	$6,330	$74,093
2019	Jasper County WCID 1	676.63	23.53	3.13	26.66	0	133	9	$3,023	$2,071
2020	Jasper County WCID 1		20.27	2.62	22.88	0	111	8	$3,195	$2,129
2021	Jasper County WCID 1	283.44	27.76	11.01	38.76	0	149	24	$23,898	$13,985
2019	Jefferson County WCID 10		265.23	36.2	301.43	0	212	103	$104,555	$60,645
2020	Jefferson County WCID 10		74.42	16.96	91.38	0	207	47	$34,471	$78,551
2021	Jefferson County WCID 10	1690.1	113.56	7.44	121.01	0	95	40	$94,383	$14,436
2020	Leagueville WSC	33.17	16.01	17.88	33.9	0	378	16	$170	$2,442
2019	Lilly Grove SUD	90.68	28.56	6.88	35.44	0	62	14	$13,239	$9,569
2021	Lilly Grove SUD	375.15	147.41	8.14	155.55	0	115	59	$54,771	$9,073
2020	Lumberton MUD	684.83	57.87	0.53	58.4	0	71	19	$950	$36
2021	Lumberton MUD	1394.5	45.8	0.32	46.12	0	43	15	$25,161	$723
2019	Mauriceville MUD	1041.77	39.67	0.54	40.21	0	73	13	$10,164	$570
2020	Mauriceville MUD		18.72	7.08	25.8	0	79	3	$13,011	$7,381
2021	Mauriceville MUD		117.28	6.76	124.04	3.81	130	41	$186,995	$288,499
2020	McClelland WSC	869.11	30.42	0.43	30.85	0	57	10	$799	$46
2020	Meeker MWD	32.77	2.77	7.36	10.13	0	71	5	$204	$3,440
2021	Meeker MWD	940.05	72.41	4.26	76.67	0	86	26	$14,823	$2,724
2020	Mt Enterprise WSC	466.83	52.23	6.28	58.52	0	116	22	$107,961	$20,350
2020	Neches WSC	673.26	34.44	18.92	53.36	0	100	18	$87,724	$70,636
2019	New WSC	422.23	32.44	4.07	36.51	0	71	12	$38,528	$4,830
2020	New WSC		69.02	12.6	81.63	0	105	27	$26,020	$57,179
2021	New WSC		141.01	16.87	157.88	0	287	51	$42,188	$10,030
2020	North Cherokee WSC		3.29	0.4	3.69	0	53	1	$70	$35
2020	North Hardin WSC		54.06	0.43	54.49	0	58	18	$17,759	$581
2020	Norwood WSC		35.96	12.8	48.77	0	113	16	$3,844	$6,077
2019	Orange County WCID 1	57.55	6.54	5.93	12.47	0	59	4	$2,059	$1,715
2020	Orange County WCID 1	501.82	129.82	9.04	138.87	0	111	46	$381,808	$34,880
2019	Orange County WCID 2		45.14	1.18	46.32	3.06	149	24	$299,907	$23,502

Texas Water Development Board

2019 through 2021 - Summary of Reported Water Loss Audits by Utility as of 12/19/2023

This data comes from submitted water loss audits after quality control has been completed. Water loss audits with obvious data issues were removed.

GMD = gallons per mile per day; GCD = gallons per connection per day; ILI = Infrastructure Leakage Index; GPCD = gallons per capita per day

Year	Name of Utility	Real Loss GMD (<32 conn/mi)	Real Loss GCD	Apparent Loss GCD	Water Loss GCD	ILI (>= 3,000 connections)	Total GPCD	GPCD Loss	Real Loss Cost in dollars	Apparent Loss Cost in dollars
2020	Orange County WCID 2	660.98	47.44	5.41	52.84	0	103	18	$185,285	$49,274
2021	Orange County WCID 2	1077.48	51.75	19.27	71.03	0	104	24	$144,846	$8,239
2019	Pleasant Springs WSC		19.58	6.76	26.34	1.05	113	10	$109,536	$43,435
2021	Pleasant Springs WSC		92.25	11.74	103.99	7.32	138	54	$544,451	$162,053
2020	Pollok-Redtown WSC		24.96	3.08	28.04	1.5	117	10	$78,524	$88,999
2021	Pollok-Redtown WSC	79.43	4.94	25.01	29.95	0	64	10	$411	$7,466
2019	Rayburn Country MUD	3412.89	134.9	0.53	135.43	0	80	63	$260,602	$1,030
2020	Rayburn Country MUD		56.85	10.57	67.42	5.43	181	33	$268,018	$148,698
2021	Rayburn Country MUD		32.14	13.93	46.07	1.69	132	14	$196,223	$952,333
2019	San Augustine Rural WSC	6761.93	225.71	12.3	238.01	0	426	130	$866,304	$52,467
2020	San Augustine Rural WSC		36.31	6.49	42.8	0	171	24	$74,550	$8,885
2021	San Augustine Rural WSC		104.83	9.2	114.03	0	125	52	$281,610	$50,062
2020	Sand Hills WSC	217.06	20.02	1.16	21.17	0	117	10	$39,614	$3,436
2020	South Newton WSC		15.84	15.96	31.79	1.44	104	9	$71,872	$229,345
2021	South Newton WSC		28.4	22.18	50.58	1.59	252	14	$150,599	$308,370
2020	South Rusk County WSC		47.84	17.04	64.88	0	178	26	$200,794	$80,482
2019	Southern Utilities		3.12	4.73	7.85	0	118	4	$24,858	$37,644
2020	Southern Utilities	364.78	12.61	6.15	18.77	0	122	7	$1,971	$2,956
2021	Southern Utilities		59.35	25.53	84.88	5.15	121	31	$537,627	$201,614
2020	Swift WSC		10.72	6.75	17.48	0.77	96	6	$29,326	$96,613
2019	Tyler County SUD	806.02	110.76	10.98	121.75	0	146	49	$196,964	$19,532
2019	Walnut Grove WSC	713.88	30.03	3.86	33.89	0	66	11	$608	$244
2020	Walnut Grove WSC	74.03	3.69	3.96	7.65	0	67	3	$7,242	$25,377
2020	Walston Springs WSC		35.43	11.42	46.86	2.12	118	15	$1,003,186	$529,267
2019	West Hardin WSC	518.06	19.43	6.21	25.64	0	141	21	$18,068	$10,877
2019	West Jacksonville WSC	326.12	23.64	4.16	27.8	0	70	9	$64,292	$13,470
2020	West Jacksonville WSC	980.5	88.03	3.66	91.69	0	79	31	$30,241	$3,192
2020	Woden WSC	122.49	70.92	2.27	73.19	0	129	28	$9,713	$493
Region I	**Average**	**974**	**47**	**8**	**55**	**2.8**	**127**	**23**	**$127,162**	**$109,747**
Statewide	**Average**	**903**	**47**	**7**	**55**	**2.7**	**119**	**21**	**$227,211**	**$102,403**