RUSK COUNTY GROUNDWATER CONSERVATION DISTRICT

DISTRICT MANAGEMENT PLAN

ADOPTED – AUGUST 15, 2005
AMENDED – MARCH 3, 2008
AMENDED – JULY 19, 2010
AMENDED – NOVEMBER 8, 2010
AMENDED – AUGUST 31, 2015
ADOPTED & AMENDED – NOVEMBER 12, 2018
ADOPTED & AMENDED – SEPTEMBER 11, 2023

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SECTION 1. ABOUT THE RUSK COUNTY GROUNDWATER CONSERVATION DISTRICT

1.1 District Mission

The Rusk County Groundwater Conservation District's (RCGCD) mission is to develop and implement a sound groundwater management program to protect and sustain the groundwater resources of the District.

1.2 Purpose of Management Plan

Senate Bill 1 (SB 1) enacted by the 75th Texas Legislature in 1997 requires all groundwater conservation districts to develop a management plan that defines the water needs and supplies within each district and the goals each district will use to manage the groundwater to meet the water needs of the district.

This groundwater management plan fulfills the requirements of the Texas Water Development Board (TWDB) Rules, specifically Texas Administrative Code, Chapter 356 (31 TAC §356). The plan includes the required planning elements, goals, objectives, performance standards, and tracking methods required by the TWDB.

1.3 District Creation and Background

The creation of the RCGCD was authorized in 2003 by the 78th Texas Legislature under HB 3569. The citizens of Rusk County confirmed creation of the District by an election held on June 5, 2004. This revised plan is being submitted within five years of the prior Management Plan, which was adopted on November 12, 2018, as required by Sec. 36.1072 (e) of the Texas Water Code.

The District was formed to protect the groundwater resources for the citizens of Rusk County. Beyond its enabling legislation, the District is governed primarily by the provisions of Chapter 36 of The Texas Water Code. The District has the capability and authority to undertake various studies and promote conservation; to adopt and amend, as needed, a management plan; to adopt rules; to establish a program for the registration and permitting of water wells; and to implement structural facilities and non-structural programs to achieve its statutory mandates. The District has rule-making authority to implement its policies and procedures to manage the groundwater resources.

The current members of the Board of Directors are Bobby Brown - President, Harry Hamilton - Vice President, John Langston - Treasurer, Ken Ragle, Sammy Nichols, Roy Vannoy, Jody White, Emily Whitworth and Ryan Ellis. The District General Manager is David Miley.

1.4 District Location and Extent

Rusk County is located in the Piney Woods region of East Texas. The RCGCD maintains the same boundaries as Rusk County and its jurisdiction includes all the territory located within Rusk County, which encompasses approximately 924 square miles. The County is bordered by Gregg and Harrison counties to the North, Panola and Shelby counties to the East, Nacogdoches County to the South, and Cherokee and Smith counties to the West. Henderson, which is centrally located in the County, is the County seat.

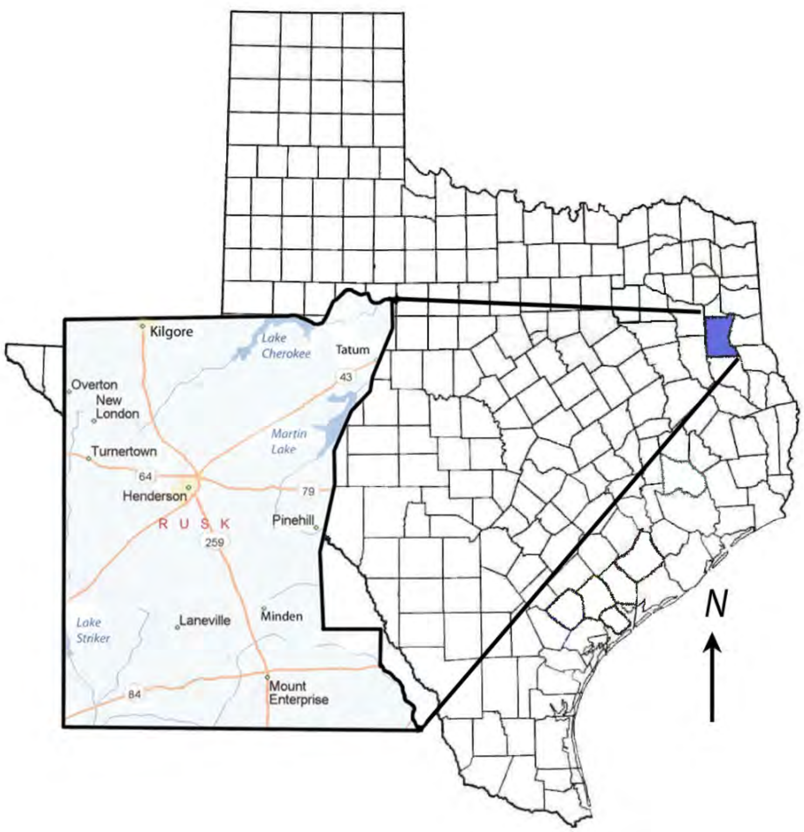

Figure 1. Rusk County Groundwater Conservation District

SECTION 2. RCGCD GEOGRAPHY AND HYDROGEOGRAPHY

2.1 District Setting and Topography

Rusk County is located within the eastern portion of the Interior Coastal Plains sub province of the Gulf Coastal Plains physiographic province (Figure 2). The sub province is comprised of alternating sequences of unconsolidated sands and clays. Erosion of the clay soils has resulted in terrain consisting of sand ridges that generally parallel the coast. In East Texas, the sub province is characterized by pine and hardwood forests and numerous permanent streams. West and northwest of Rusk County, faults associated with salt domes are characteristic of the region.

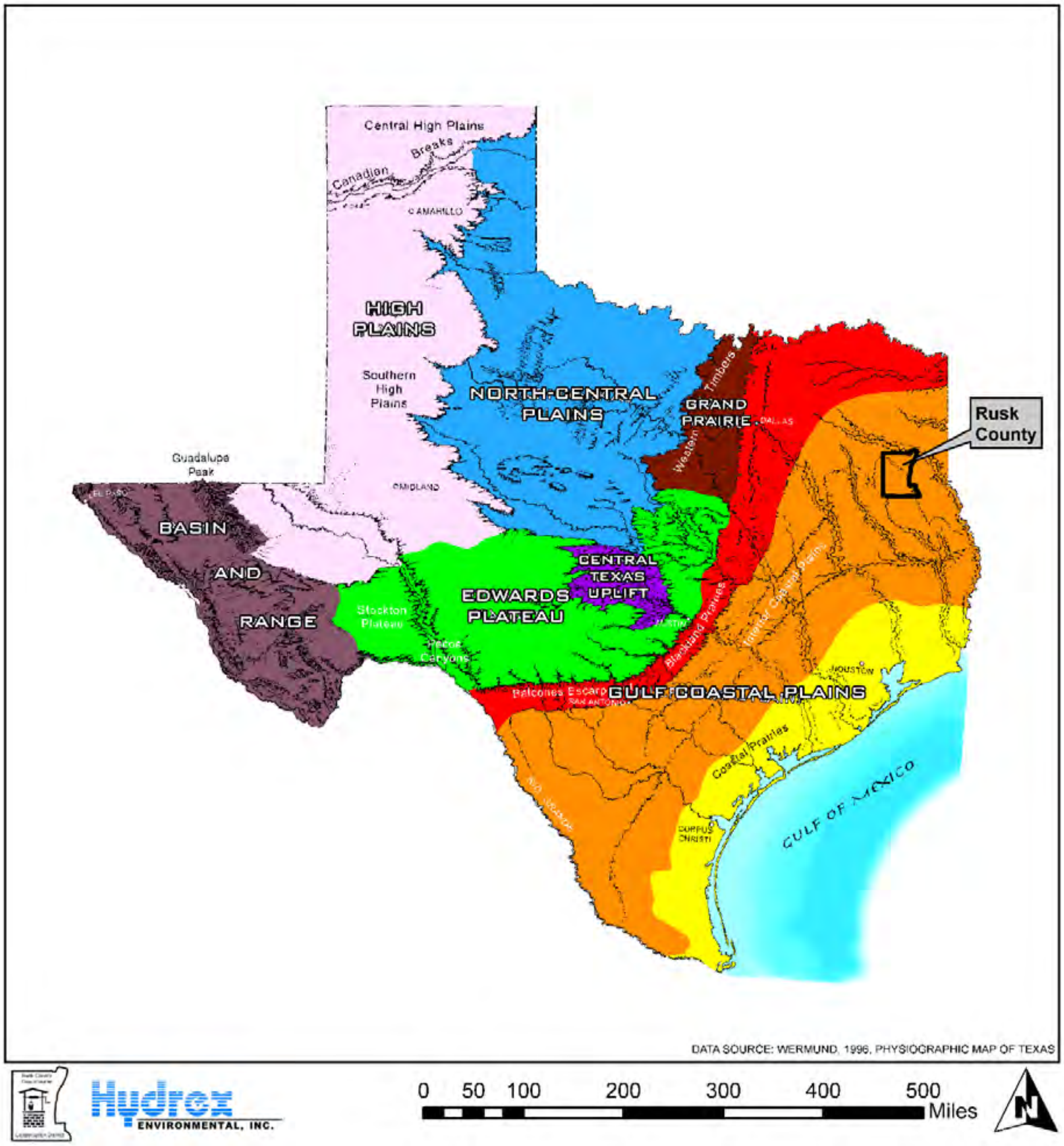

Figure 2. Physiographic Map of Texas identifying Rusk County.

Ecologically, Rusk County is situated in the South Central Plains ecoregion, which stretches across eastern Texas and into northwestern Louisiana and southwestern Arkansas (Figure 3). In eastern Texas, this ecoregion is commonly referred to as the Piney Woods. The Piney Woods region of eastern Texas is considered the western edge of the southern coniferous forest belt. Areas that were once dominated by long-leaf pine (*Pinus palustris*) savannas, are now predominantly classified more as oak-hickory-pine forest. Large areas have been converted to plantations of loblolly pine (*Pinus taeda*) and shortleaf pine (*Pinus echinata*) while some localized areas have been converted to agricultural pastureland. (Figure 3). In the northeastern portion of the county, surface mining for lignite has occurred in large areas of the Wilcox aquifer outcrop. Upon completion of mining activities, the land is reclaimed with the intent to restore pre-existing conditions, including slope and vegetation.

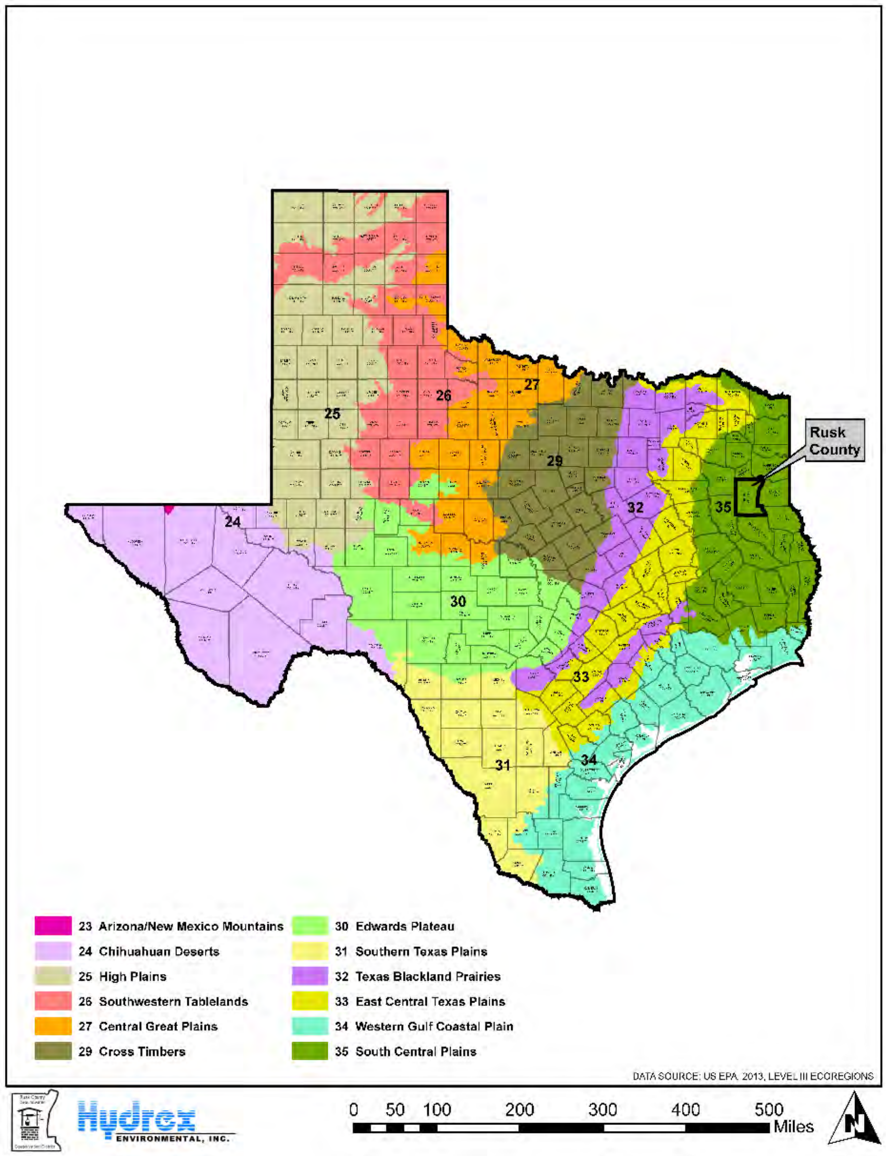

Figure 3. Ecoregions of Texas identifying Rusk County.

Topographically, Rusk County is situated atop a drainage divide that separates the Sabine River drainage basin to the northeast and the Neches River drainage basin to the southwest (Figure 4). The drainage divide generally follows a northwest-southeast trending ridge that extends through the interior of the county from just south of Overton and New London in the northwestern portion of the county to just north of Mt. Enterprise and the community of Caledonia in the southeastern portion of the county.

Higher elevations along the ridge range from 539 feet to 623 feet, relative to mean sea level (MSL). North of the ridge, topography generally slopes downward towards the Sabine River to elevations as low as 211 feet, MSL, in the northeast corner of the county. South of the ridge, topography generally slopes downward towards the Angelina River to elevations as low as 243 feet, MSL, in the southwest corner of the county. Topography along the ridge generally represents the highest elevations in the county, with the exception of areas along the Mt. Enterprise Fault System in the southern portions of the county. Higher elevations along the Mt. Enterprise Fault System range from 575 feet to 719 feet, MSL (Figure 5).

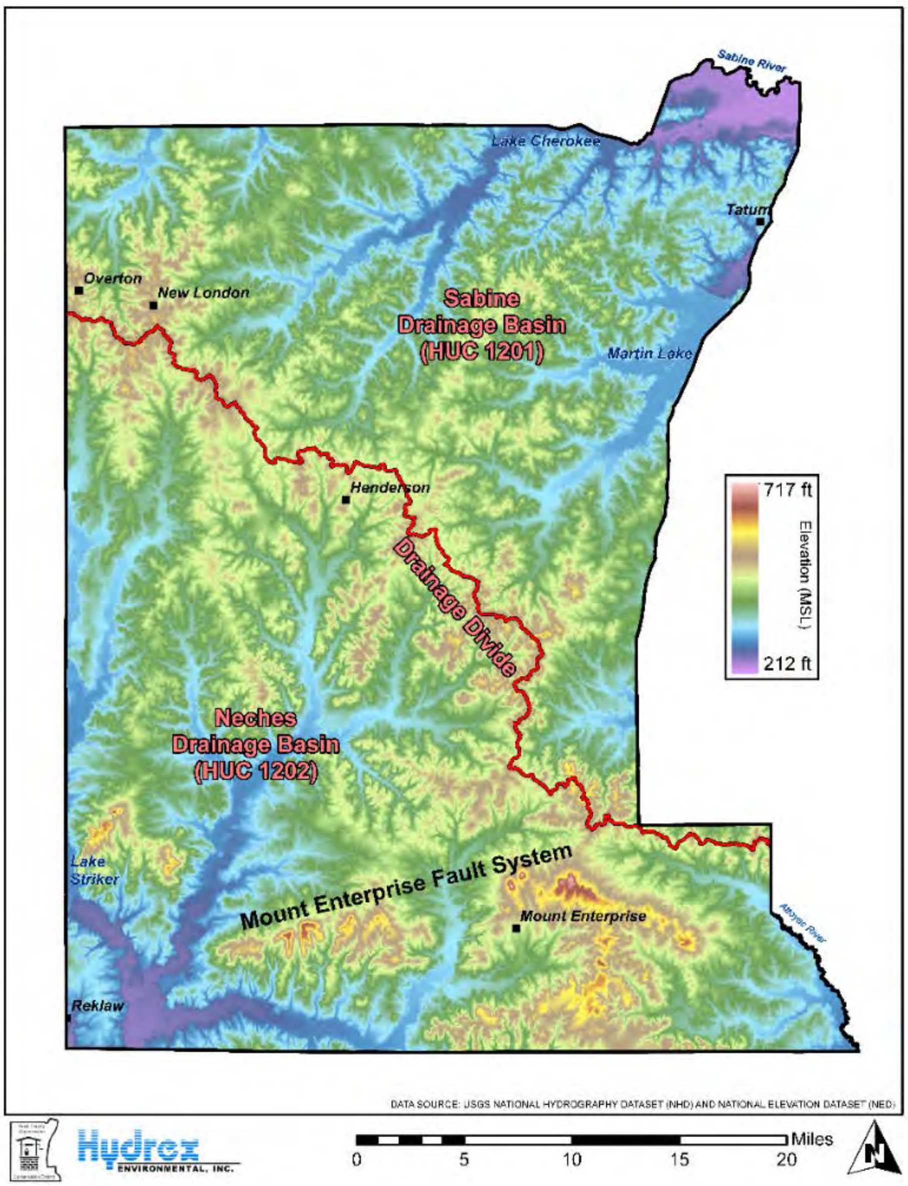

Figure 4. Topography and drainage within Rusk County.

Figure 5. USGS Topographic Map of Rusk County.

The majority of Rusk County, approximately 89 percent, is comprised of gently sloping to moderately steep rolling hills. Soil types throughout this land are predominantly well drained with moderate permeability. Approximately 11 percent of the county is located on nearly level flood plains with moderately slow permeable soils (Figure 6).

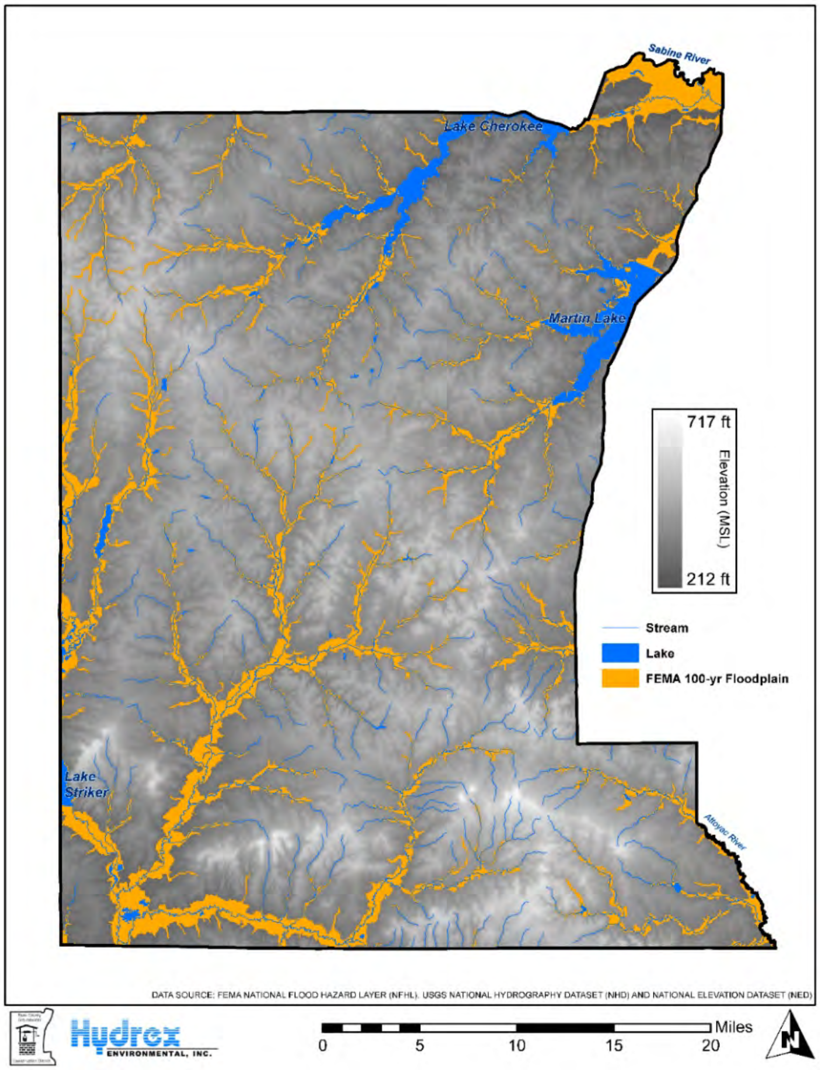

Figure 6. Digital elevation model showing FEMA 100-year floodplains within Rusk County.

2.2 Geology and Hydrogeology of Rusk County

Rusk County lies between the Sabine Uplift on the east and the East Texas Basin on the west (Figure 7). These two prominent structural features resulted from faulting that began in the Triassic Period (200 to 250 million years ago). The axis of the East Texas Basin trends north to south generally along the western boundary of Smith County. The Sabine Uplift, which centers in Panola County, Texas and northwestern Louisiana, forms the eastern boundary of the basin. The development of the two complementary structural features (basin and uplift) contributed to the setting for some of the largest petroleum reservoirs in the world: the East Texas Oil Field and the Carthage Gas Field (Figure 7).

The Mt. Enterprise Fault System trends east-west across the southern part of Rusk County (Figure 7). Movement along the fault system has been variable. Some areas show a maximum vertical displacement of over 200 feet, with beds of the Queen City Sand downdropped against the Carrizo Sand. Strata in northern and central Rusk County show a general dip away from the Sabine Uplift. In the southern part of the county, the gradient increases and becomes more variable in close proximity to the Mt. Enterprise Fault System.

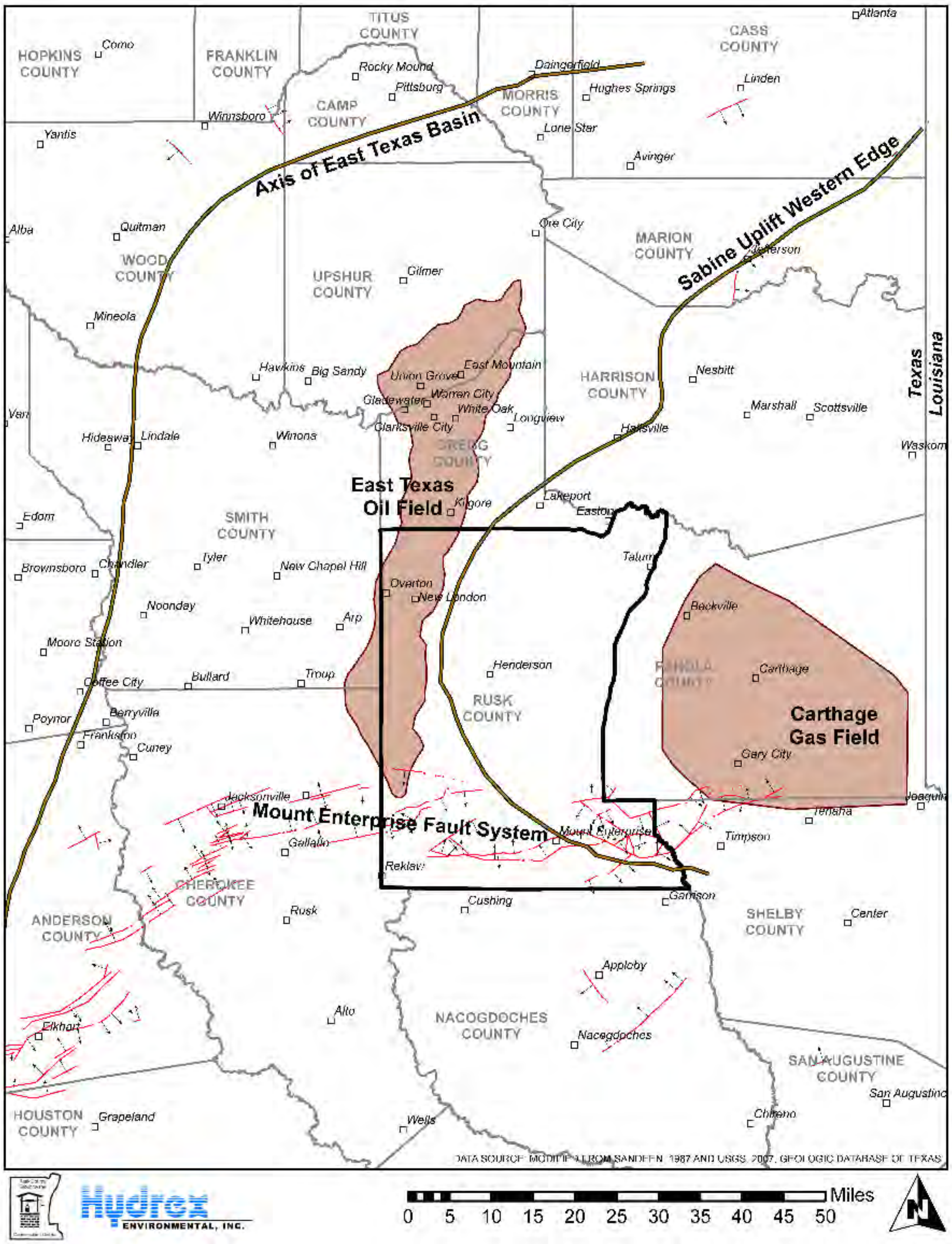

Figure 7. Structural Setting of Rusk County, Texas.

The geology of Rusk County, as it relates to fresh groundwater, is comprised of alternating sequences of continental, deltaic, and marine sediments that are predominantly of Eocene (33.9 to 56 million years ago) to Paleocene (56 to 66 million years ago) age (Figure 8). Continental and deltaic units, composed of quartz sand with varying amounts of silt and clay, contain the fresh groundwater in the area and form the major conduits for its movement. Marine portions of the section, consisting largely of clay or shale with lesser silt and glauconitic sandstone, form the intervening aquitards that restrict the movement of groundwater.

The deepest fresh water aquifer in Rusk County is the Carrizo-Wilcox aquifer, composed of the Wilcox Group and the immediately overlying Carrizo Sand. Excellent aquifer characteristics have made the Carrizo-Wilcox the most productive aquifer in East Texas. Recharge through its outcrop areas in Rusk County contributes significantly to the availability of Carrizo-Wilcox groundwater throughout much of the region.

The Wilcox is underlain by the Midway Group, a predominantly marine and lagoonal shale. No significant fresh groundwater is known to exist in the Midway or deeper strata; therefore, the top of the Midway marks the base of fresh groundwater in Rusk County.

The Midway Group is overlain successively by the Wilcox Group, Carrizo Sand, Reklaw Formation, Queen City Sand, Weches Formation, and Sparta Sand (Figure 9). The Reklaw and Weches have extremely poor water-bearing qualities and are insignificant as aquifers in Rusk County. Sparta and Queen City sediments are preserved on downdropped blocks of the Mt. Enterprise Fault System and on higher elevations in northern Rusk County. However, the limited areal extent of the Sparta and Queen City restricts their use as a water supply to low-yield, shallow wells.

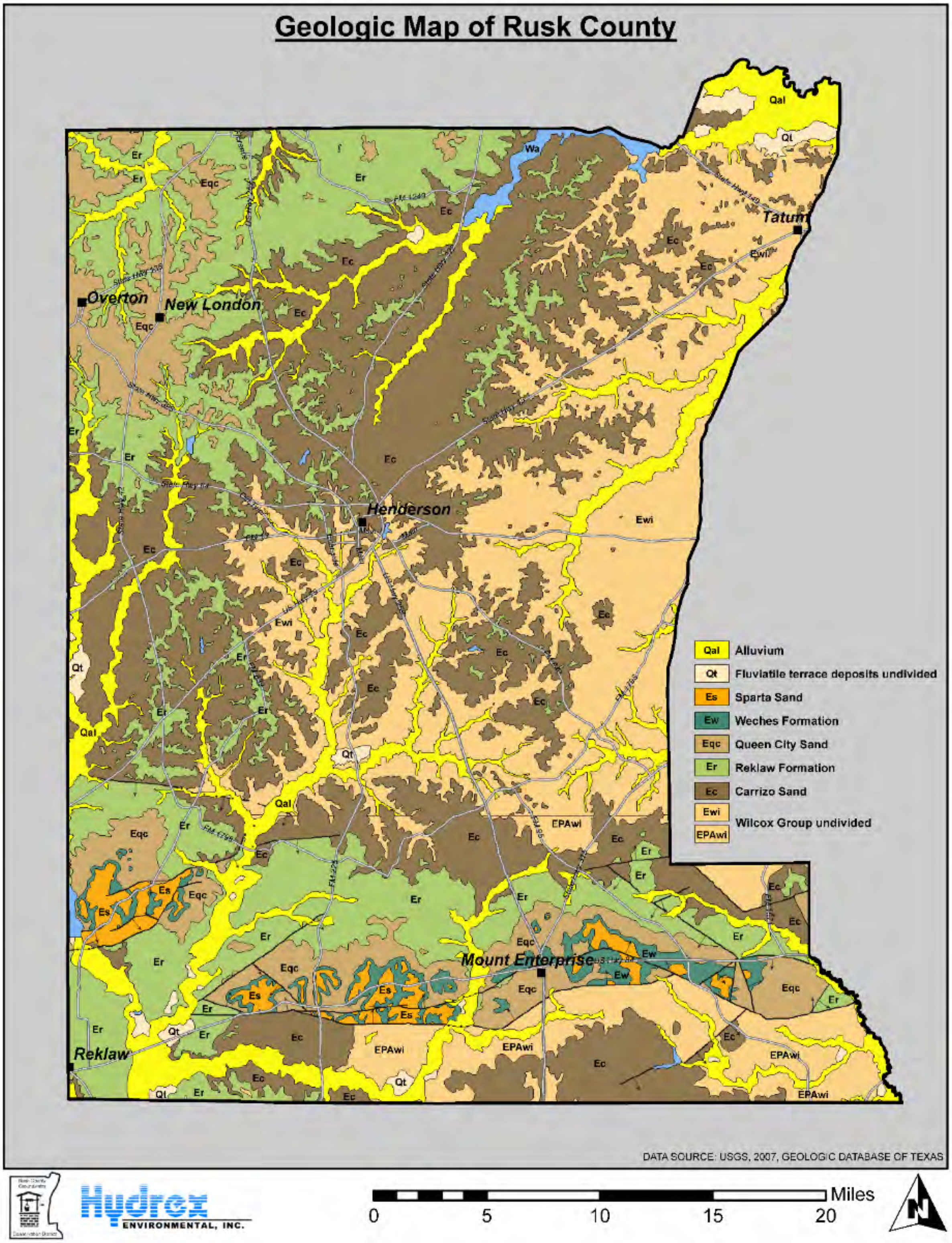

Figure 8. Geologic Map of Rusk County, Texas.

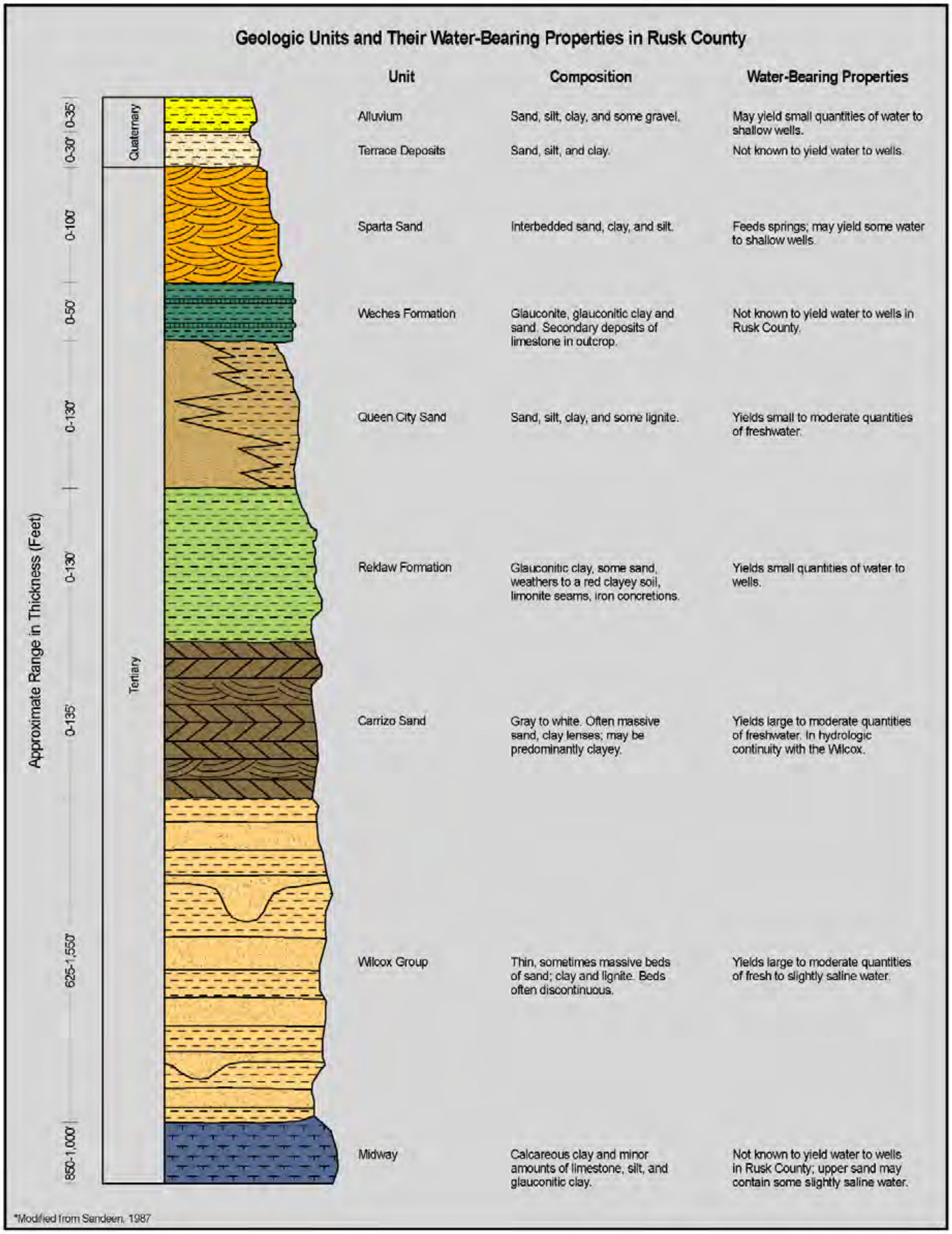

Figure 9. Geologic Units and Their Water-Bearing Properties in Rusk County, Texas.

2.3 Stratigraphy of Rusk County

The top of the Midway Group of Paleocene age marks the base of the extent of fresh groundwater in Rusk County. The Midway group is overlain successively by the Wilcox Group, Carrizo Sand, Reklaw Formation, Queen City Sand, Weches Formation, and Sparta Sand (Figure 9).

In Central Texas, the Wilcox Group of Paleocene to Eocene age, is subdivided into the Hooper, Simsboro, and Calvert Bluff formations, corresponding to deltaic, fluvial, and fluvial-deltaic facies, respectively. However, in East Texas, the Simsboro is no longer identifiable and the Wilcox Group is divided into informal lower and upper units. The lower Wilcox represents the facies equivalent of the Hooper Formation and the upper Wilcox includes both the Simsboro and the Calvert Bluff equivalent fluvial and fluvial-deltaic facies, respectively.

In East Texas and Rusk County, the Wilcox Group consists of beds of sand, silt, and clay, with locally economic amounts of lignite. These Wilcox Group sediments represent multi-facies, fluvial-deltaic systems where channels and associated sand facies form the framework for groundwater movement. The sand bodies are elongated, sinuous, and laterally discontinuous with axes generally oriented north to south consistent with the direction of sediment transport. The elongate sand bodies represent ancient fluvial systems and offer optimal locations for high yield water wells. In western Rusk County, the Wilcox reaches a maximum thickness of approximately 1500 feet. The unit thins toward the uplift and is reduced to slightly over 600 feet thick in its outcrop in the eastern portion of the county.

The Carrizo Sand is a massive, relatively homogenous sand of Eocene age consisting of medium- to fine-grain quartz sand with minor occurrences of interbedded gray clay. The Carrizo Sand is a clastic, near shore deposit with beach, dune, barrier island, and lagoonal facies represented in outcrops throughout East Texas. In Rusk County, where not thinned or entirely removed by erosion, the formation can reach a thickness of over 125 feet.

The Reklaw Formation of Eocene age is a shallow marine shelf deposit that is primarily composed of glauconitic clay and silt. In some locales, the formation commonly contains minor amounts of sand in the basal portion of the formation, near its contact with the underlying Carrizo Sand. In outcrop, the Reklaw forms a red clay soil that typically contains limonite seams and iron concretions. In Rusk County, the Reklaw Formation reaches a maximum thickness of approximately 130 feet and occurs primarily in the northern portion of the county and north of the Mt. Enterprise Fault System in the southern portion of the county.

The Queen City Sand of Eocene age was deposited by an extensive deltaic system and is primarily composed of sand, loosely cemented sandstone, and interbedded clay units with minor occurrences of lignite. In East Texas, sand facies of the Queen City Sand are thickest near the center of the East Texas Basin and generally thin eastward along the strike of the formation, pinching out in the subsurface just west of the Texas-Louisiana border. In Rusk

County, the Queen City Sand occurs in outcrop and subcrop in the northwestern portion of the county and also in the Mount Enterprise Fault System in the southern portion of the county. The formation ranges in thickness up to 130 feet.

The Weches Formation of Eocene age is a shallow marine shelf deposit that is primarily composed of glauconitic clay with only minor amounts of sand. The formation is green in unweathered sections but weathers to red when exposed. Relatively thin sections of the Weches Formation occur in the Mt. Enterprise Fault System in southern Rusk County where it attains a maximum thickness of approximately 50 feet.

The Sparta Sand of Eocene age consists of fine sand and interbedded sandy clay and silt deposited in a deltaic environment similar to the Queen City Sand. In Rusk County, the Sparta Sand only exists as laterally discontinuous units within the Mt. Enterprise Fault System where it attains maximum thicknesses of about 100 feet.

2.4 Groundwater Resources of Rusk County

The Texas Water Development Board recognizes the occurrence of one major aquifer, the Carrizo-Wilcox aquifer, and one minor aquifer, the Queen City aquifer, within Rusk County (Figures 10 and 11). Of these aquifers, the Carrizo-Wilcox aquifer is the most important and productive aquifer in Rusk County, historically supplying most of the groundwater produced within the county.

The Carrizo-Wilcox major aquifer is bound below by the marine deposits of the Midway Group and above by the Reklaw Formation. The marine deposits of the Midway Group represent a lower confining unit for the aquifer throughout its extent while the predominantly glauconitic clay sediments of the overlying Reklaw Formation represent an effective upper confining unit for the aquifer in its subcrop.

In Rusk County, much of the Carrizo-Wilcox aquifer occurs in outcrop (Figure 12). These outcrop areas serve as recharge zones for the downdip deep-lying sands of the aquifer in its subcrop. In its outcrop in the east-central portion of Rusk County, the Carrizo-Wilcox aquifer is often only represented by strata of the Wilcox Group. As the Wilcox sediments are predominantly comprised of fluvial and deltaic sands distributed among lower permeability interchannel silts and muds, the Wilcox portion of the Carrizo-Wilcox aquifer can be characterized as a multi-aquifer system. As opposed to the Carrizo aquifer, which can be characterized as a relatively homogenous, single aquifer system, the complex multi-aquifer system of the Wilcox requires an accurate description of both the arrangement of the various lithofacies (i.e. sand body distributions) and associated hydraulic properties in order for groundwater availability of the aquifer system to be properly modeled and understood.

Although considerably less important in Rusk County than the Carrizo-Wilcox aquifer, the Queen City minor aquifer is an important local source of groundwater primarily in its outcrop in the northwestern portion of Rusk County and in the Mt. Enterprise Fault System in the southwestern portion of the county (Figure 12). The Queen City aquifer's limited extent and shallow occurrence in Rusk County make it a target for primarily low-yield production. In addition, its generally poorer water quality than the Carrizo-Wilcox aquifer make it a less desirable target for production and use as a primary drinking water source in Rusk County.

Another limited source of fresh groundwater in Rusk County is the Sparta aquifer. The Sparta aquifer provides small amounts of fresh groundwater to shallow, primarily low-yield wells in its outcrop within the Mt. Enterprise Fault System in southern Rusk County. Although the Sparta aquifer is recognized as a minor aquifer in other parts of Texas, the Sparta aquifer is not considered a minor aquifer in Rusk County due to its limited areal extent and its discontinuity with other Sparta Sand sediments outside of the Mt. Enterprise Fault System and Rusk County. As a result, the Sparta aquifer in Rusk County is not considered a significant source of groundwater for purposes of regional water planning and, thus, is not considered during regional-scale groundwater availability modeling.

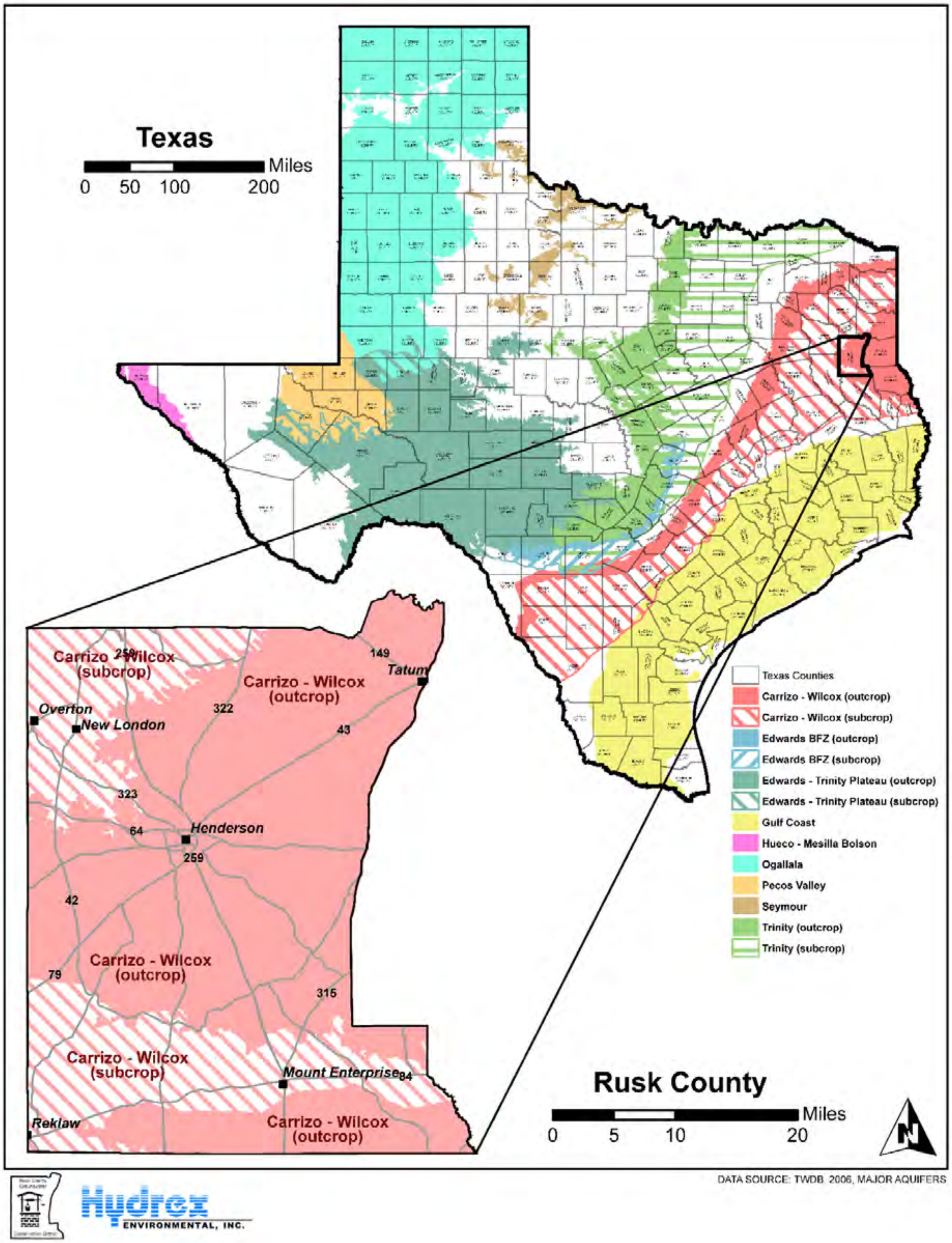

Figure 10. TWDB Major Aquifers of Texas and Rusk County.

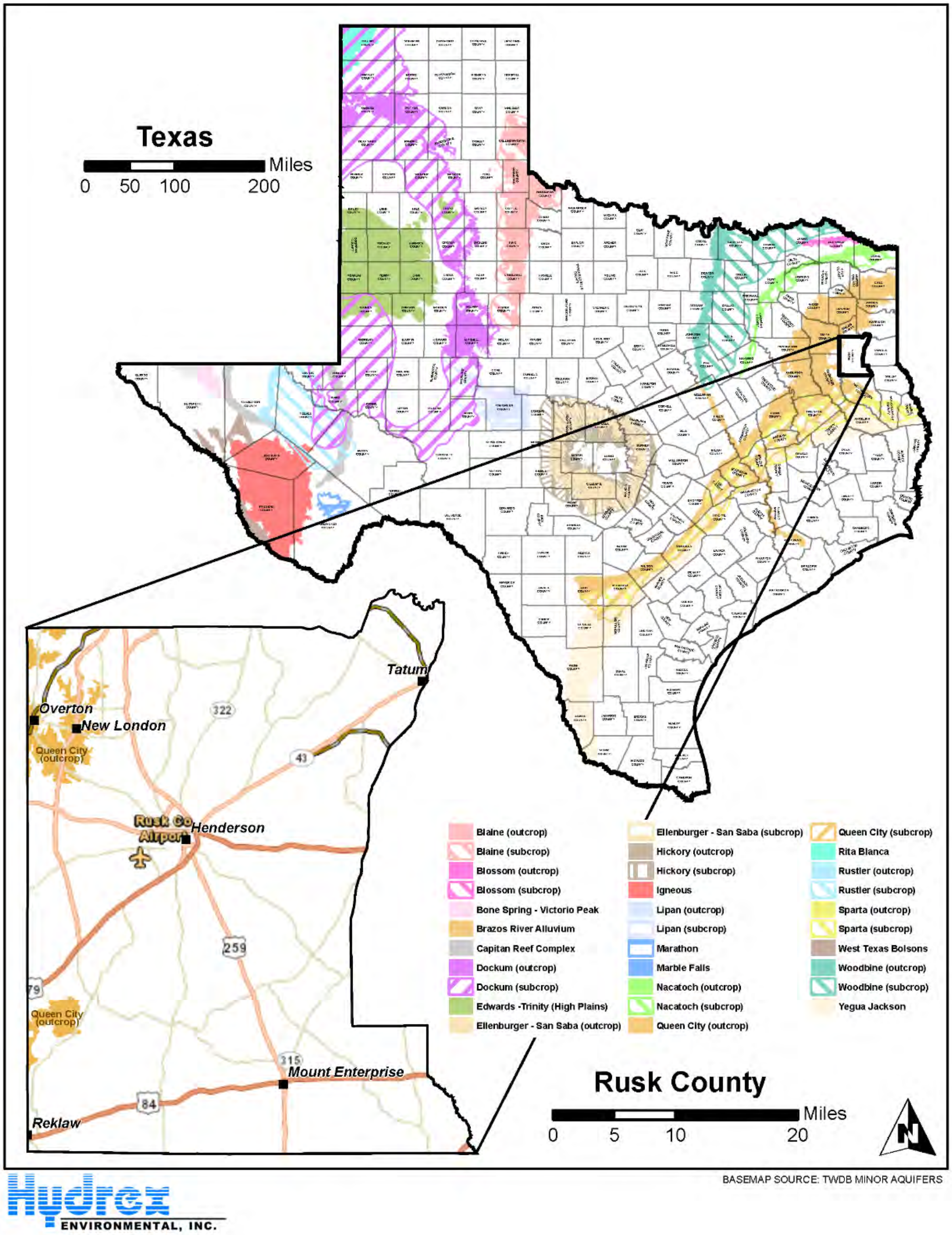

Figure 11. TWDB Minor Aquifers of Texas and Rusk County.

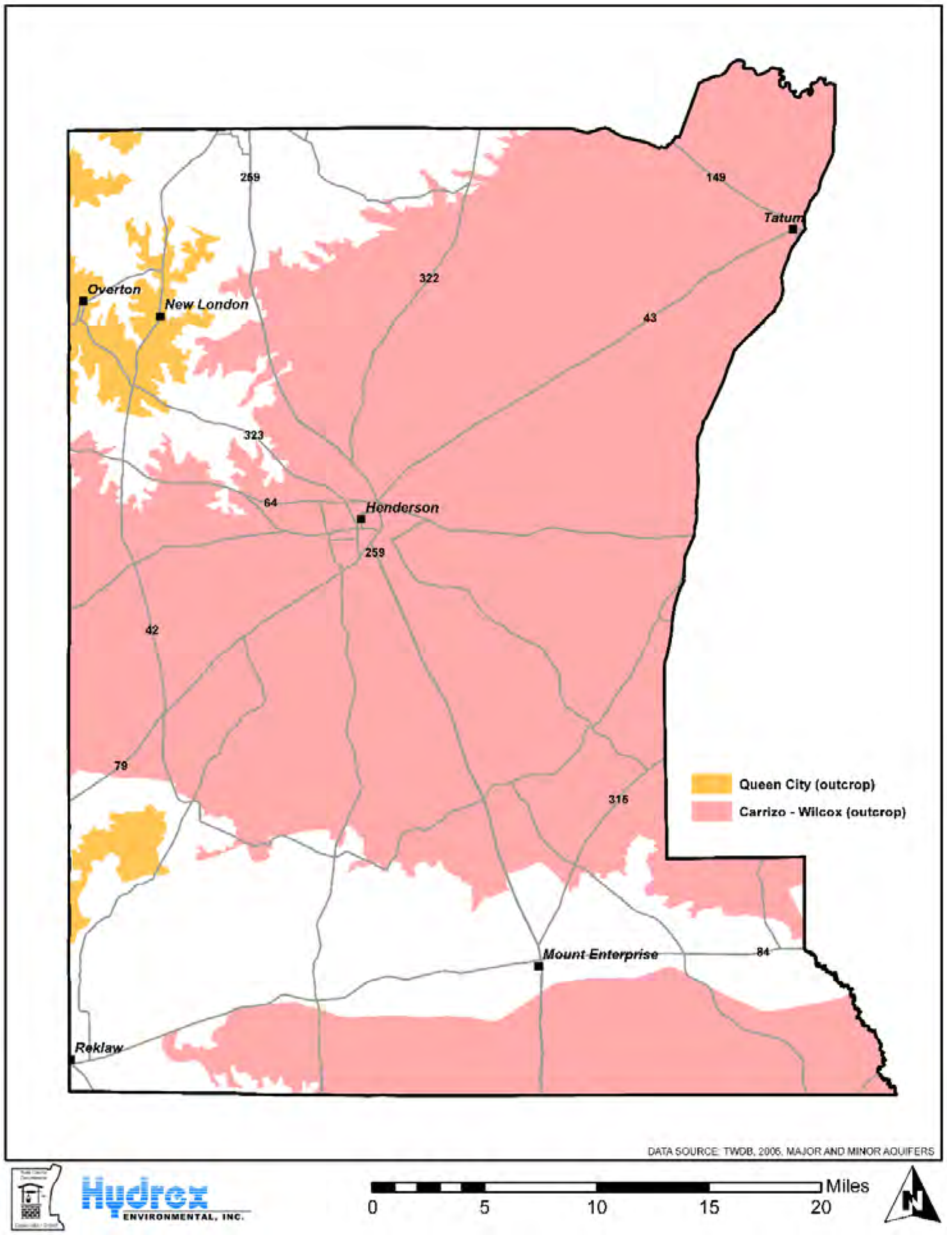

Figure 12. TWDB Major and Minor Aquifer outcrop areas in Rusk County, Texas.

Generally, groundwater movement in the different aquifers within Rusk County is from points of recharge in aquifer outcrop areas to points of discharge. In aquifer outcrops, groundwater movement is primarily downdip towards points of discharge, either along creeks, rivers, and streams or areas of significant groundwater production or withdrawal. In downdip portions of the Carrizo-Wilcox aquifer, groundwater movement is influenced by the regional dip of the Carrizo-Wilcox beds as well as cones of depression that have developed due to significant, prolonged production and/or withdrawal near the cities of Henderson and Tatum in Rusk County and Tyler in Smith County as well as the East Texas Oil Field.

SECTION 3. MODELED AVAILABLE GROUNDWATER

The 79th Texas Legislature enacted HB 1763 in 2005 that requires joint planning among districts that are in the same groundwater management area (GMA). These districts must jointly agree upon and establish the Desired Future Conditions (DFCs) of the aquifers within their respective GMAs. Through this process, the groundwater conservation districts will submit the DFC to the Executive Administrator of the Texas Water Development Board (TWDB) who, in turn, will provide each district within the GMA with the amount of Modeled Available Groundwater (MAG) within each district. The MAG will be based on the DFCs jointly established for each aquifer within the GMA.

According to the Texas Water Code Section 36.001, MAG is defined as “the amount of water that the Executive Administrator (of the TWDB) determines may be produced on an average annual basis to achieve a DFC established under §36.108.” The DFC is defined in §36.001 of the Texas Water Code as “a quantitative description, adopted in accordance with §36.108 of the Texas Water Code, of the desired condition of the groundwater resources in a management area at one or more specified future times.”

A summary of the MAG in RCGCD is summarized in Table 1, as provided by TWDB, based on the DFCs established under Texas Water Code §36.108 and initially adopted by GMA 11 in 2022. RCGCD will update the MAG in the future, once GMA 11 adopts new DFCs in 2027 and the Texas Water Development Board issues the accompanying MAG.

31 Tex. Admin. Code §356.52(a)(5)(A).

Rusk County MAG Values (acre-feet per year)										
Aquifer	County	Regional Plannin Area	River Basin	Year						
				2020	2030	2040	2050	2060	2070	2080
Carrizo-Wilcox	Rusk	I	Neches	7111	7111	7111	7111	7111	7111	7111
Carrizo-Wilcox	Rusk	I	Sabine	6907	6907	6907	6907	6907	6907	6907
			Totals	**14019**	**14019**	**14019**	**14019**	**14019**	**14019**	**14019**
Queen City	Rusk	I	Neches	39	39	39	39	39	39	39
Queen City	Rusk	I	Sabine	20	20	20	20	20	20	20
			Totals	**59**	**59**	**59**	**59**	**59**	**59**	**59**

Table 1: Groundwater Management Area 11 – MAG values for Rusk County as documented in TWDB GAM Run 21-016 MAG. See Appendix E for complete report. Units are in acre-feet per year.

SECTION 4. ANNUAL GROUNDWATER USE

To estimate the annual amount of groundwater being used in RCGCD, the RCGCD uses the TWDB Annual Water Use Survey Data, the Railroad Commission of Texas reported Mining Water Use Data, and develops its own estimates using RCGCD reported and estimated usage. The TWDB Water Use Survey Data is subject to variations in the completeness or accuracy of the data due to inconsistent reporting by some water user groups. TWDB data on estimated groundwater use is available from 2004 to 2019 and is presented in full in Appendix F. The District began documenting water use data in 2014 and has improved accuracy with each year.

Table 2 displays the amount of groundwater being used within RCGCD on an annual basis, pursuant to the TWDB Water Use Survey Groundwater from 2015-2019.

31 Tex. Admin. Code §356.52(a)(5)(B).

Rusk County Annual Groundwater Use TWDB Survey Data (acre-feet per year)							
Year	**Municipal**	**Manufacturing**	**Mining**	**Steam Electric**	**Irrigation**	**Livestock**	**Total**
2019	6,231	12	202	17	206	241	**6,909**
2018	6,947	15	464	22	173	238	**7,858**
2017	6,720	15	444	52	200	234	**7,665**
2016	6,910	12	1804	16	148	260	**9,150**
2015	7,318	13	1993	33	139	248	**9,744**

Table 2: Estimated Historical Water Use as documented in the TWDB Estimated Historical Water Use & 2022 State Water Plan Data Set. See Appendix F for complete report. Units are in acre-feet per year.

Table 3 displays the amount of groundwater being used within RCGCD on an annual basis, pursuant to reported pumpage to RCGCD for lignite mine usage from 2016-2022. The RCGCD obtains this information through Groundwater pumpage reports supplied by mining companies.

Groundwater use reported to RCGCD by mines	
year	ac-ft
2022	0
2021	0
2020	323
2019	58
2018	330
2017	231
2016	1988

Table 3: Rusk County Conservation District Use Reported in Rusk County Mines. Units are in acre-feet per year.

Table 4 displays the RCGCD-estimated water use and is considered a supplement to the TWDB estimated water use in Appendix F.

Rusk County Annual Groundwater Use RCGCD Reporting (acre-feet per year)						
Year	**Municipal**	**Oil & Gas**	**Mining**	**Steam Electric**	**Non-Exempt Livestock, Irrigation**	**Total**
2022	5,703	62.25	0	0	2,894	8,659.25
2021	5,376	5.6	0	0	2,864	8,245.6
2020	4,970	15.9	323	0	2,858	8,166.9

Table 4: Estimated Historical Water Use as documented in the TWDB Estimated Historical Water Use & 2022 State Water Plan Data Set. See Appendix F for complete report. Units are in acre-feet per year.

SECTION 5. GROUNDWATER BUDGET

5.1 Annual Amount of Recharge from Precipitation

Table 5 displays the annual amount of recharge from precipitation, if any, to the groundwater resources within the District, as provided by the TWDB.

31 Tex. Admin. Code §356.52(a)(5)(C).

Management Plan Requirement	Aquifer or Confining Unit	Results
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	19,618
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	427

Table 5: Precipitation values for Rusk County as documented in TWDB GAM Run 23-012. See Appendix D for complete report. Units are in acre-feet per year.

5.2 Annual Volume Discharges

Table 6 displays the annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers in the District, as provided by the TWDB.

31 Tex. Admin. Code §356.52(a)(5)(D).

Management Plan Requirement	Aquifer or Confining Unit	Results
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	4,079
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	390

Table 6: Discharge values for Rusk County as documented in TWDB GAM Run 23-012. See Appendix D for complete report. Units are in acre-feet per year.

5.3 Annual Volume of Flow throughout Aquifers

Table 7 and 8 displays the annual volume of flow into and out of the District within each aquifer and between aquifers in the District, if a groundwater availability model is available from the TWDB.

31 Tex. Admin. Code §356.52(a)(5)(E).

Management Plan Requirement	Aquifer or Confining Unit	Results
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	2,253
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	11,380
Estimated net annual volume of flow between each aquifer in the district	To the Carrizo-Wilcox Aquifer from the Reklaw Formation confining unit	1,741

Table 7: Aquifer flow values for Rusk County as documented in TWDB GAM Run 23-012. See Appendix D for complete report. Units are in acre-feet per year.

Management Plan Requirement	Aquifer or Confining Unit	Results
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	232
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	80
Estimated net annual volume of flow between each aquifer in the district	From the Queen City Aquifer to the Reklaw Formation confining unit	26
	From the Queen City Aquifer to the Carrizo-Wilcox Aquifer	7

Table 8: Aquifer flow values for Rusk County as documented in TWDB GAM Run 23-012. See Appendix D for complete report. Units are in acre-feet per year.

SECTION 6. PROJECTED SURFACE WATER SUPPLY IN RUSK COUNTY

6.1 Surface Water Resources of Rusk County

Rusk County is divided into two major watersheds by a northwest-southeast trending ridge that defines the boundary between the Sabine River drainage basin and the Neches River drainage basin (Figure 15). Both major watersheds are comprised of dendritic drainage systems that contain many large streams. Hydrology is provided by precipitation, surface water runoff, and groundwater discharge. Large streams throughout Rusk County are generally gaining streams, receiving an influx of water from both groundwater discharges as well as surface water run-off (Figure16). On average, Rusk County receives approximately 49.57 inches of precipitation annually.

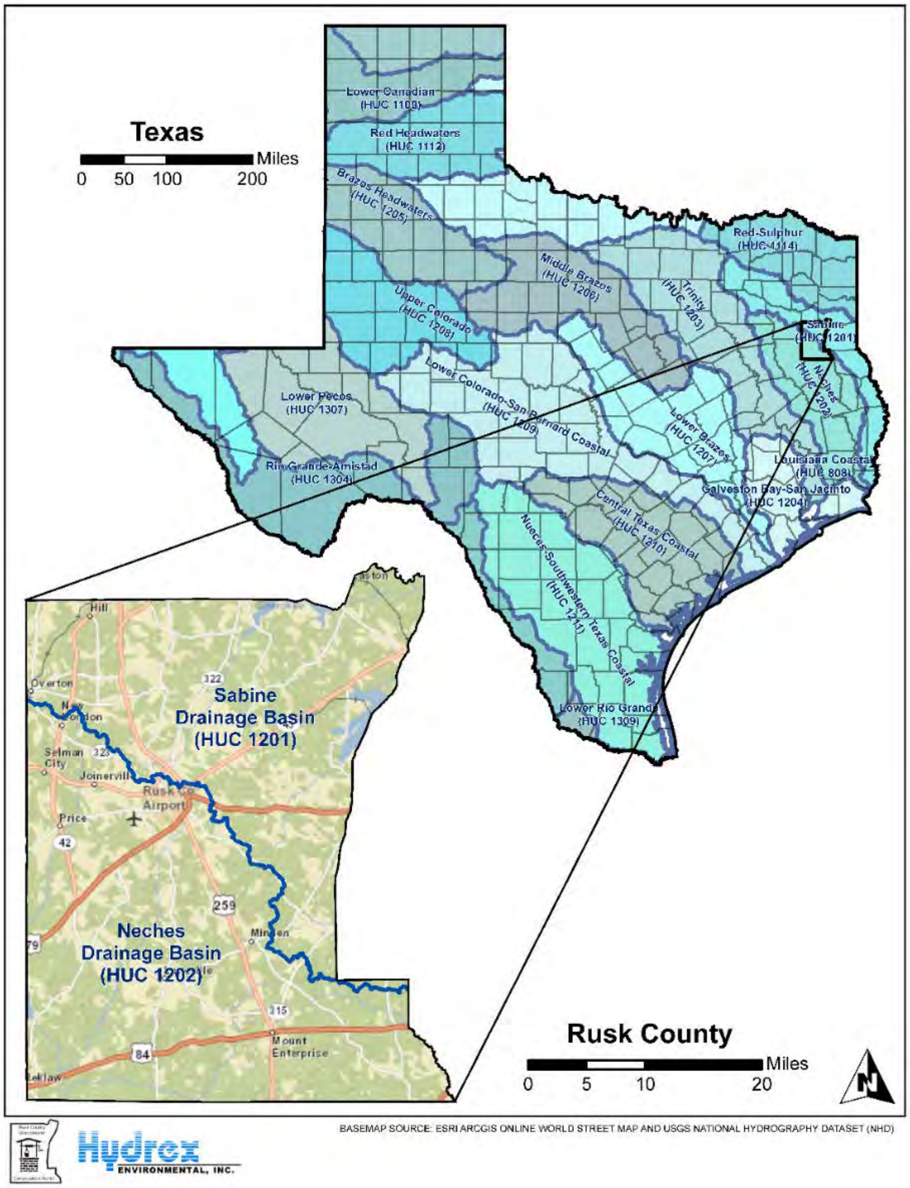

Figure 15. Major drainage basins within Texas and Rusk County.

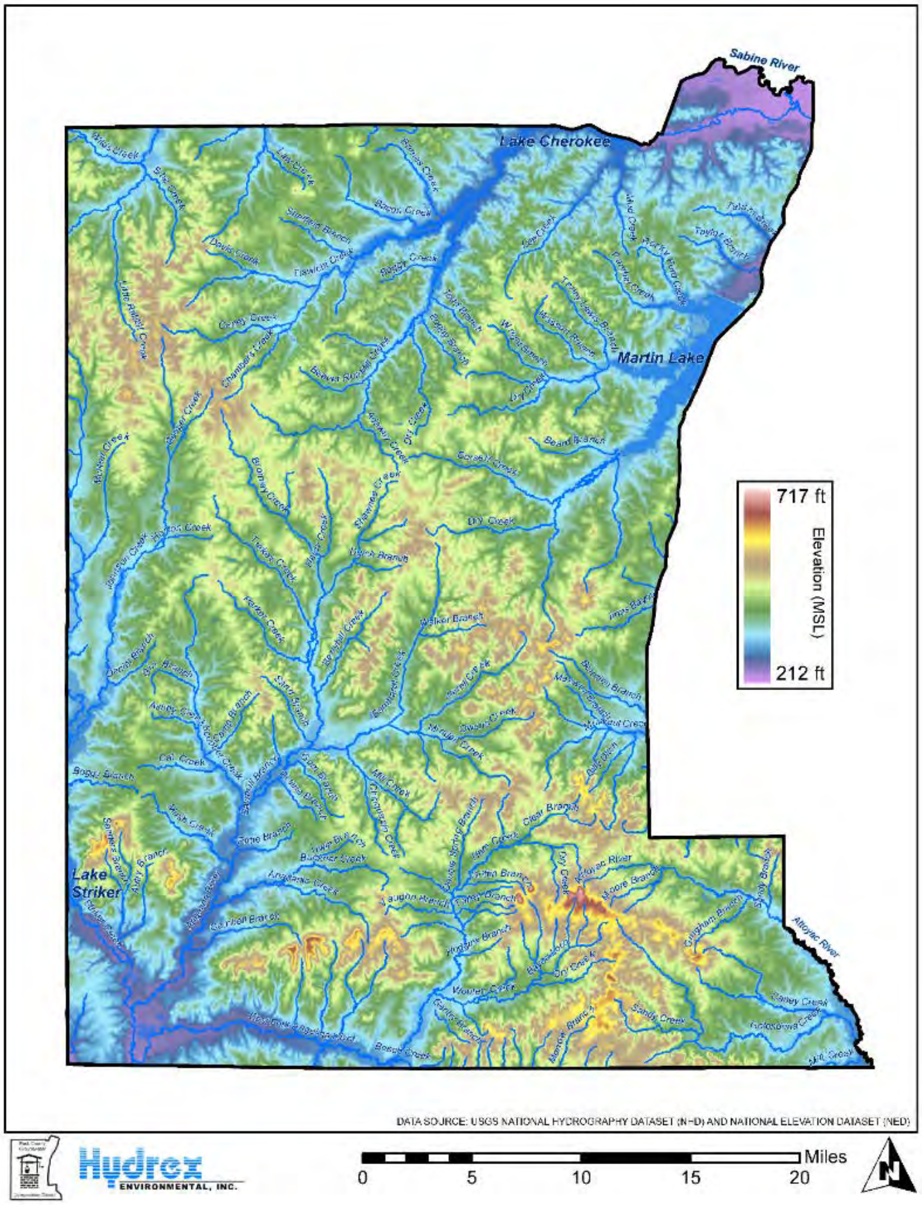

Figure 16. Topography and surface hydrology within Rusk County.

The northwestern, northeastern, and eastern portions of Rusk County lie within the Sabine River drainage basin, hydrologic unit code (HUC) 1201. Surface water in the northwestern and northeastern portions of the county, specifically in the Rabbit Creek-Sabine River (HUC 1201000206), Cherokee Bayou-Sabine River (HUC 1201000207), and Martin Creek (HUC 1201000209) sub-watersheds, generally flows in a northeasterly direction towards the Sabine River. Surface water in the eastern portions, specifically Irons Bayou (HUC 1201000210) and Murvaul Creek-Sabine River (HUC 1201000211) sub-watersheds, generally flows in an easterly direction towards the Sabine River. The Sabine River serves as the county boundary in the extreme northeastern corner of Rusk County (Figure 17).

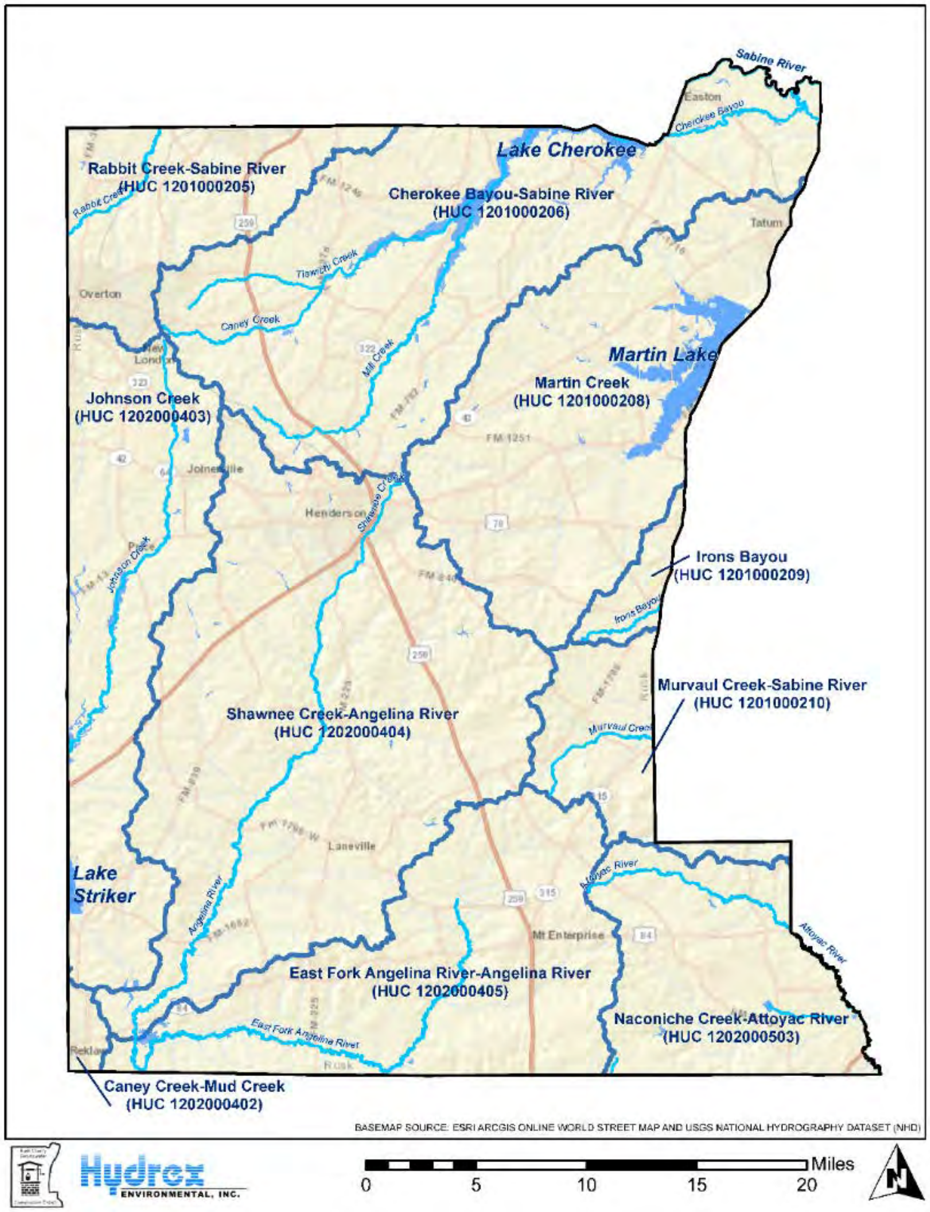

Figure 17. Sub-watersheds within Rusk County.

Lake Cherokee is located along the northern boundary of Rusk County within the Cherokee Bayou-Sabine River sub-watershed (Figure 17). Lake Cherokee, operated by Lake Cherokee Water Company, was constructed in 1948 and is currently used for municipal, industrial, and recreational purposes. The City of Longview diverts water for municipal water supply and Southwestern Power Company diverts water for cooling purposes at the Knox Lee Power Plant. At normal pool elevation of 280 feet, relative to mean sea level, Lake Cherokee yields approximately 3,497 surface acres and has a capacity of approximately 46,737 acre-feet. The drainage area above Lake Cherokee is approximately 158 square-miles. Downstream of Lake Cherokee, Cherokee Bayou converges with the Sabine River in the northeastern portion of Rusk County.

Martin Lake is located along the eastern boundary of Rusk County within the Martin Creek sub-watershed (Figure 17). Martin Lake was constructed in the 1970s for purposes of generating electricity and to serve as a cooling lake for Luminant's Martin Lake power plant. As such, the lake is not currently used as a source for municipal water supply. Martin Lake yields approximately 4,981 surface acres at normal pool elevation of 306 feet, relative to mean sea level, and has a capacity of approximately 75,116 acre-feet. The drainage area above Martin Lake is approximately 130 square-miles. Downstream of Martin Lake, Martin Creek converges with the Sabine River approximately 12.3 miles east of Rusk County.

The western, southwestern, and southeastern portions of Rusk County lie within the Neches River drainage basin, HUC 1201. Surface water in the western and southwestern portions of the county, specifically in the Johnson Creek (HUC 1202000404), Shawnee Creek-Angelina River (HUC 1202000405), East Fork Angelina River-Angelina River (HUC 1202000406), and Caney Creek-Mud Creek (HUC 1202000407) sub-watersheds, generally flows in a southwesterly direction forming the headwaters of the Angelina River (Figure 17). Surface water in the southeastern portion of the county, specifically in the Naconiche Creek-Attoyac River (HUC 1202000504) sub-watershed, generally flows in a southeasterly direction forming the headwaters of the Attoyac Bayou (Figure 17). The Attoyac Bayou converges with the Angelina River at Sam Rayburn Reservoir, approximately 40 miles south of Rusk County. Approximately 14.5 miles downstream of the Sam Rayburn Reservoir dam, the Angelina River discharges into the Neches River.

Lake Striker is located along the western boundary of Rusk County within the Johnson Creek sub-watershed (Figure 17). Lake Striker, owned by the Angelina-Nacogdoches Counties Water Control and Improvement District No. 1, was constructed in 1956 and 1957. The District provides water to Luminant Energy for industrial use at their power plant on the west side of the reservoir and also to Southern Power Company for cooling water at the biomass fired power plant near Sacul in northwestern Nacogdoches County, Texas. The City of Henderson also holds water rights in Lake Striker that may be used in the future. At normal pool elevation of 293 feet, relative to mean sea level, Lake Striker yields approximately 1,920 surface acres and has a capacity of approximately 22,865 acre-feet. The drainage area above Lake Striker is approximately 182 square-miles. Downstream of Lake Striker, Striker Creek converges with the Angelina River in the southwestern portion of Rusk County.

6.2 Projected Surface Water Supplies

Table 9 displays the projected surface water supplies within Rusk County for Water User Groups (WUGs) determined by Region Water Planning Group I.

31 Tex. Admin. Code §356.52(a)(5)(F)

RWPG	WUG	WUG Basin	Source Name	Rusk County Surface Water Supply (acre-feet per year)					
				2020	2030	2040	2050	2060	2070
I	Cross Roads SUD	Sabine	Fork Lake/Reservoir	248	273	288	310	337	366
I	Elderville WSC	Sabine	Cherokee Lake/Reservoir	95	96	96	96	95	111
I	Elderville WSC	Sabine	Fork Lake/Reservoir	97	97	97	97	97	96
I	Henderson	Neches	Fork Lake/Reservoir	1,277	3,470	3,470	3,470	3,470	3,470
I	Henderson	Sabine	Fork Lake/Reservoir	222	603	603	603	603	603
I	Henderson	Sabine	Sabine Run-of-River	10	10	10	10	10	10
I	Irrigation, Rusk	Neches	Neches Run-of-River	80	80	80	80	80	80
I	Irrigation, Rusk	Sabine	Sabine Run-of-River	127	127	127	127	127	127
I	Kilgore	Sabine	Fork Lake/Reservoir	434	783	848	924	1,008	1,095
I	Livestock, Rusk	Neches	Neches Livestock Local Supply	452	452	452	452	452	452
I	Livestock, Rusk	Neches	Sabine Livestock Local Supply	172	172	172	172	172	172
I	Livestock, Rusk	Sabine	Neches Livestock Local Supply	356	356	356	356	356	356
I	Livestock, Rusk	Sabine	Sabine Livestock Local Supply	136	136	136	136	136	136
I	Manufacturing, Rusk	Neches	Neches Run-of-River	1	1	1	1	1	1
I	Manufacturing, Rusk	Sabine	Fork Lake/Reservoir	1	1	1	1	1	1
I	Mining, Rusk	Neches	Sabine Other Local Supply	640	640	640	640	640	640
I	Mining, Rusk	Sabine	Sabine Other Local Supply	590	590	590	590	590	590
I	Southern Utilities	Sabine	Palestine Lake/Reservoir	1	2	2	2	2	2
I	Southern Utilities	Sabine	Tyler Lake/Reservoir	2	2	2	2	2	2
I	Steam-Electric Power, Rusk	Neches	Martin Lake/Reservoir	2,479	2,479	2,479	2,479	2,479	2,479
I	Steam-Electric Power, Rusk	Neches	Toledo Bend Lake/Reservoir	1,777	1,777	1,777	1,777	1,777	1,777
I	Steam-Electric Power, Rusk	Sabine	Martin Lake/Reservoir	22,521	22,521	22,521	22,521	22,521	22,521
I	Steam-Electric Power, Rusk	Sabine	Toledo Bend Lake/Reservoir	16,145	16,145	16,145	16,145	16,145	16,145
Sum of Projected Surface Water Supplies (acre-feet)				47,863	50,813	50,893	50,991	51,101	51,232

Table 9: Projected Surface Water Supplies for Rusk County as documented in the TWDB Estimated Historical Water Use & 2022 State Water Plan Data Set. See Appendix F for complete report.

SECTION 7. PROJECTED WATER DEMANDS

The projected water demands for Rusk County through 2070 are shown in Table 10. All estimates are from the 2022 State Water Plan. As shown in table ten, the total water demand to water user groups (WUGs) in the year 2020 is 59,937 acre-feet and in year 2070 will be 65,593 acre-feet.

31 Tex. Admin. Code §356.52(a)(5)(G).

RWPG	WUG	WUG Basin	Rusk County Projected Water Demand (acre-feet per year)					
			2020	2030	2040	2050	2060	2070
I	Chalk Hill SUD	Sabine	332	352	375	404	440	478
I	County-Other, Rusk	Neches	533	568	605	654	711	771
I	County-Other, Rusk	Sabine	509	543	577	624	679	736
I	Cross Roads SUD	Sabine	259	273	288	310	337	366
I	Crystal Farms WSC	Sabine	104	111	118	127	139	151
I	Ebenezer WSC	Neches	130	141	152	165	180	196
I	Elderville WSC	Sabine	128	141	155	170	188	207
I	Gaston WSC	Neches	192	205	220	238	259	282
I	Goodsprings WSC	Neches	260	275	292	315	343	372
I	Henderson	Neches	3,187	3,491	3,795	4,140	4,516	4,911
I	Henderson	Sabine	554	607	659	719	785	853
I	Irrigation, Rusk	Neches	155	155	155	155	155	155
I	Irrigation, Rusk	Sabine	121	121	121	121	121	121
I	Jacobs WSC	Neches	10	11	11	12	13	15
I	Jacobs WSC	Sabine	273	292	314	340	370	402
I	Kilgore	Sabine	717	783	848	924	1,008	1,095
I	Livestock, Rusk	Neches	928	941	959	976	994	994
I	Livestock, Rusk	Sabine	732	742	755	769	783	783
I	Manufacturing, Rusk	Neches	30	32	32	32	32	32
I	Manufacturing, Rusk	Sabine	2	2	2	2	2	2
I	Minden Brachfield WSC	Neches	69	77	85	93	101	110
I	Minden Brachfield WSC	Sabine	31	34	38	42	46	50
I	Mining, Rusk	Neches	1,555	2,084	2,013	1,937	1,873	1,868
I	Mining, Rusk	Sabine	1,435	1,923	1,857	1,787	1,728	1,724
I	Mt Enterprise WSC	Neches	305	330	356	387	422	459
I	New London	Neches	482	529	576	629	687	747
I	New London	Sabine	388	426	464	507	553	601
I	New Prospect WSC	Sabine	91	96	101	109	118	129
I	Overton	Neches	60	65	71	77	84	91
I	Overton	Sabine	494	539	583	636	693	754
I	South Rusk County WSC	Neches	188	200	213	230	250	272
I	Southern Utilities	Sabine	72	75	80	85	92	100
I	Steam-Electric Power, Rusk	Neches	4,493	4,493	4,493	4,493	4,493	4,493
I	Steam-Electric Power, Rusk	Sabine	40,811	40,811	40,811	40,811	40,811	40,811
I	Tatum	Sabine	234	254	275	300	327	355
I	West Gregg SUD	Sabine	16	17	18	20	22	23
I	Wright City WSC	Neches	57	61	66	71	78	84
Sum of Projected Water Demands (acre-feet)			**59,937**	**61,800**	**62,533**	**63,411**	**64,433**	**65,593**

Table 10: Projected Water Demand for Rusk County as documented in the TWDB Estimated Historical Water Use & 2022 State Water Plan Data Set. See Appendix F for complete report.

The projected water supply needs for Rusk County through 2070 are shown in Table 11. All estimates are from the 2022 State Water Plan. As shown in table eleven, there are three water user groups that have projected a water supply need. These groups are mining, steam electric, and the City of Overton.

Texas Water Code §36.1071(e)(4)

RWPG	WUG	WUG Basin	Rusk County Projected Water Supply Needs (acre-feet per/year)					
			2020	2030	2040	2050	2060	2070
I	Chalk Hill SUD	Sabine	0	0	0	0	0	0
I	County-Other, Rusk	Neches	28	28	26	25	24	6
I	County-Other, Rusk	Sabine	97	98	99	100	101	103
I	Cross Roads SUD	Sabine	386	398	399	399	398	397
I	Crystal Farms WSC	Sabine	0	0	0	0	0	0
I	Ebenezer WSC	Neches	0	0	0	0	0	0
I	Elderville WSC	Sabine	64	52	38	23	4	0
I	Gaston WSC	Neches	0	0	0	0	0	0
I	Goodsprings WSC	Neches	0	0	0	0	0	0
I	Henderson	Neches	556	2,445	2,141	1,796	1,420	1,025
I	Henderson	Sabine	78	406	354	294	228	160
I	Irrigation, Rusk	Neches	140	140	140	140	140	140
I	Irrigation, Rusk	Sabine	176	176	176	176	176	176
I	Jacobs WSC	Neches	0	0	0	0	0	-1
I	Jacobs WSC	Sabine	0	0	0	0	0	-21
I	Kilgore	Sabine	68	356	356	355	352	347
I	Livestock, Rusk	Neches	0	0	-12	-29	-47	-47
I	Livestock, Rusk	Sabine	0	0	-8	-22	-36	-36
I	Manufacturing, Rusk	Neches	304	326	346	364	391	419
I	Manufacturing, Rusk	Sabine	12	13	14	14	15	17
I	Minden Brachfield WSC	Neches	1	1	1	1	1	0
I	Minden Brachfield WSC	Sabine	1	0	0	0	0	0
I	Mining, Rusk	Neches	370	-159	-88	-12	52	57
I	Mining, Rusk	Sabine	342	-146	-80	-10	49	53
I	Mt Enterprise WSC	Neches	1	0	0	1	0	1
I	New London	Neches	0	1	0	1	1	1
I	New London	Sabine	0	0	0	1	1	1
I	New Prospect WSC	Sabine	1	0	1	1	0	1
I	Overton	Neches	-7	-12	-18	-24	-31	-38
I	Overton	Sabine	-59	-110	-159	-217	-279	-346
I	South Rusk County WSC	Neches	0	0	0	0	0	0
I	Southern Utilities	Sabine	3	4	4	4	5	5
I	Steam-Electric Power, Rusk	Neches	-110	-110	-110	-110	-110	-110
I	Steam-Electric Power, Rusk	Sabine	-993	-993	-993	-993	-993	-993
I	Tatum	Sabine	124	94	67	36	9	12
I	West Gregg SUD	Sabine	6	5	4	2	0	0
I	Wright City WSC	Neches	0	0	0	0	0	-21
Sum of Projected Water Supply Needs (acre-feet)			**-1,169**	**-1,530**	**-1,468**	**-1,417**	**-1,496**	**-1,613**

Table 11: Projected Water Supply Needs for Rusk County as documented in the TWDB Estimated Historical Water Use & 2022 State Water Plan Data Set. See Appendix F for complete report.

SECTION 8. PROJECTED WATER MANAGEMENT STRATEGIES

Water management strategies are specific plans to increase water supply or maximize existing water supply to meet a specific need. The Regional Water Planning Group I has several recommendations throughout the planning area. Fourteen viable strategies were recognized for Rusk County as is displayed in Table 12. There are two water management strategies that use groundwater as a source, the Angelina-Neches River Authority has planned for wells in Rusk County to be used for manufacturing use in Cherokee and Rusk Counties.

Texas Water Code §36.1071(e)(4).

					Rusk County Projected Water Management Strategies (All values are in acre-feet)					
RWPG	WUG	Basin	Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
I	Henderson	Neches								
			ANCD-VOL-Volumetric Survey and Normal Pool Elevation Adjustment	Striker Lake/Reservoir [Reservoir]	0	0	4,771	4,770	4,771	4,771
			WUG-CONS-Municipal Conservation-Henderson	DEMAND REDUCTION [Rusk]	71	126	153	200	241	285
					71	**126**	**4,924**	**4,970**	**5,012**	**5,056**
I	Henderson	Sabine								
			ANCD-VOL-Volumetric Survey and Normal Pool Elevation Adjustment	Striker Lake/Reservoir [Reservoir]	0	0	829	830	829	829
			WUG-CONS-Municipal Conservation-Henderson	DEMAND REDUCTION [Rusk]	12	22	26	35	42	49
					12	**22**	**855**	**865**	**871**	**878**
I	Jacobs	Neches								
			RUSK-JAW-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Rusk]	0	0	0	0	0	1
					0	**0**	**0**	**0**	**0**	**1**
I	Jacobs	Sabine								
			RUSK-JAW-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Rusk]	0	0	0	0	0	21
					0	**0**	**0**	**0**	**0**	**21**
I	Kilgore	Sabine								
			Kilgore - Municipal Conservation	DEMAND REDUCTION [Rusk]	10	19	21	25	28	32
					10	**19**	**21**	**25**	**28**	**32**
I	Livestocl	Neches								
			RUSK-LTK-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Rusk]	0	0	12	29	47	47
					0	**0**	**12**	**29**	**47**	**47**
I	Livestock	Sabine								
			RUSK-LTK-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Rusk]	0	0	8	22	36	36
					0	**0**	**8**	**22**	**36**	**36**
I	Mining	Neches								
			ANRA-Run-of-River (Submitted Application)	Neches Run-of-River [Rusk]	0	159	88	12	0	0
					0	**159**	**88**	**12**	**0**	**0**
I	Mining	Sabine								
			ANRA-Run-of-River (Submitted Application)	Neches Run-of-River [Rusk]	0	146	80	10	0	0
					0	**146**	**80**	**10**	**0**	**0**
I	Mt Enterprise	Neches								
			Mt Enterprise WSC - Municipal Conservation	DEMAND REDUCTION [Rusk]	4	8	0	0	0	0
					4	**8**	**0**	**0**	**0**	**0**
I	New London	Neches								
			ANRA-COL - Lake Columbia	Columbia Lake/Reservoir [Reservoir]	0	472	474	474	473	95
			New London - Municipal Conservation	DEMAND REDUCTION [Rusk]	7	12	14	17	20	22
					7	**484**	**488**	**491**	**493**	**117**
I	New London	Sabine								
			ANRA-COL - Lake Columbia	Columbia Lake/Reservoir [Reservoir]	0	383	381	381	382	77
			New London - Municipal Conservation	DEMAND REDUCTION [Rusk]	6	10	12	13	16	18
					6	**393**	**393**	**394**	**398**	**95**
I	Overton	Neches								
			Overton - Municipal Conservation	DEMAND REDUCTION [Rusk]	1	2	2	2	2	3
			SMTH-OVN-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Rusk]	0	12	18	24	31	38
					1	**14**	**20**	**26**	**33**	**41**
I	Overton	Sabine								
			Overton - Municipal Conservation	DEMAND REDUCTION [Rusk]	7	13	15	17	20	23
			SMTH-OVN-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Rusk]	0	110	159	217	279	346
					7	**123**	**174**	**234**	**299**	**369**
I	Southern Utilities	Sabine								
			WUG-CONS-Municipal Conservation-Southern Utilities	DEMAND REDUCTION [Rusk]	5	9	11	14	17	21
					5	**9**	**11**	**14**	**17**	**21**
I	Steam-Electric	Neches								
			RUSK-SEP-Purchase From Sabine River Authority (Toledo Bend)	Sabine Run-of-River [Newton]	0	110	110	110	110	110
					0	**110**	**110**	**110**	**110**	**110**
I	Steam-Electric	Sabine								
			RUSK-SEP-Purchase From Sabine River Authority (Toledo Bend)	Sabine Run-of-River [Newton]	0	993	993	993	993	993
					0	**993**	**993**	**993**	**993**	**993**
I	Tatum	Sabine								
			Tatum - Municipal Conservation	DEMAND REDUCTION [Rusk]	3	6	7	8	9	11
					3	**6**	**7**	**8**	**9**	**11**
I	Wright City WSC	Neches								
			CHER-WCW-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Cherokee]	0	0	0	0	0	22
					0	**0**	**0**	**0**	**0**	**22**
Sum of Projected Water Management Strategies (acre-feet)					**126**	**2,612**	**8,184**	**8,203**	**8,346**	**7,850**

Table 12: Projected Water Management Strategies for Rusk County as documented in the TWDB Estimated Historical Water Use & 2022 State Water Plan Data Set. See Appendix F for complete report.

SECTION 9. MANAGEMENT OF GROUNDWATER SUPPLIES

To meet the requirements of 31 Tex. Admin. Code §356.52(a)(4), the RCGCD provides the following details on how it manages groundwater supplies in the District.

Groundwater conservation districts have statutorily been designated as the preferred method of groundwater management in Texas, through the rules developed, adopted, and promulgated by individual groundwater districts, as authorized by Chapter 36 of the Texas Water Code and the individual district's enabling act (Texas Water Code §36.0015). The RCGCD manages groundwater supplies, in part, by regulating the spacing and production of wells, to minimize drawdown of the water table or reduction of artesian pressure, to control subsidence, to prevent interference between wells, to prevent degradation of water quality, and to prevent waste (Texas Water Code § 36.116). The method of groundwater production regulation is based on hydrogeological conditions of aquifers in the District.

The RCGCD, as authorized by law, has adopted the following groundwater management strategies:

A. PUMPING RATE LIMIT

The District regulates groundwater withdrawal through permitting efforts. New non-exempt wells producing water from all RCGCD aquifers will be required to have land legally assigned to the well in an amount to be determined in relationship to the average annual production rate of the well.

B. BENEFICIAL USE

The District regulates groundwater withdrawal by setting production limits on wells based on evidence of beneficial use.

C. WELL SPACING

To minimize as far as practicable the drawdown of the water table and the reduction of artesian pressure, to control subsidence, to prevent interference between wells, to prevent degradation of water quality, and to prevent waste, the District enforces spacing requirements on all new wells in the District.

There are two types of spacing requirements, both of which apply to all new non-exempt wells in the District and water wells that require registration for production activities related to oil and gas exploration and production. The first spacing rule is the distance that the well site must be from the perimeter of the real property that is assigned to that well under Rule 8.1(b). The second spacing rule is the distance that the well site must be from all permitted non-exempt wells and all registered exempt wells.

(a) Spacing of new non-exempt wells completed in the District shall be one-half foot per gallon per minute (½ ft / gpm) of production capacity from the perimeter of the property that is legally assigned to that well.

(b) Spacing of new non-exempt wells completed in the District shall be one foot per one gallon per minute (1 ft / gpm) of production capacity from permitted or registered wells in the District.

The District's Rules are available on the District's website: http://www.rcgcd.org

SECTION 10. ACTIONS, PROCEDURES, PERFORMANCE AND AVOIDANCE FOR PLAN IMPLEMENTATION

To meet the requirements of Texas Water Code §36.107(e)(2), the District will act on the goals and directives established in this District Management Plan. The District will use the objectives and provisions of the Management Plan as a guideline in its policy implementation and decision-making. In both its daily operations and long-term planning efforts, the District will continuously strive to comply with the initiatives and standards created by the Management Plan for the District.

The District will amend rules in accordance with Chapter 36 of the Texas Water Code and rules will be followed and enforced. The District may amend the District rules as necessary to comply with changes to Chapter 36 of the Texas Water Code and to ensure the best management of the groundwater within the District. The development and enforcement of the rules of the District will be based on the best scientific and technical evidence available to the District.

The District will encourage public cooperation and coordination in the implementation of the District Management Plan. All operations and activities of the District will be performed in a manner that best encourages cooperation with the appropriate state, regional, and local water entities as well as landowners and the general public. Meetings of the District's Board of Directors will be noticed (announced) and conducted in accordance with the Texas Open Meetings Act. The District will also make available for public inspection all official documents, reports, records, and minutes of the District pursuant with the Texas Public Information Act.

SECTION 11. METHODOLOGY FOR TRACKING DISTRICT PROGRESS IN ACHIEVING MANAGEMENT GOALS

An annual report will be prepared and presented to the Board of Directors on District performance with regard to achieving management goals and objectives. The presentation of this report will occur within the first quarter of the following fiscal year. The Annual Report will be prepared in a format that will be reflective of the performance standards listed following each management objective. The District will maintain the reports on file for public inspection at the District's office upon adoption.

SECTION 12. GOALS, MANAGEMENT OBJECTIVES AND PERFORMANCE STANDARDS

The management goals, objectives, performance standards and tracking methods of the Rusk County Groundwater Conservation District in the emphasis areas defined in 31 TAC §356 as follows.

12.1. Providing the Most Efficient Use of Groundwater

12.1.A. Maintain a Well Registration Process

Objective: The District will require the registration of all groundwater wells, exempt and non-exempt, new and existing, within the boundaries of the District to be registered in accordance with the District Rules.

Performance Standard: The number of new and existing water wells registered with the District will be provided at the regular District Board meetings and in the District's Annual Report.

12.1.B. Maintain a Well Permitting Process

Objective: The District will require all new and existing non-exempt water wells within the boundaries of the District to be permitted in accordance with the District Rules.

Performance Standard: The District will process applications for operating permits of all non-exempt water wells pursuant to the permitting process of the District Rules. A summary of the number of applications for permitted use of groundwater will be provided at the regular District Board meetings and in the District's Annual Report.

12.1.C. Maintain an Electronic Database

Objective: Maintain the District's Groundwater Well Database for registrations, permits, and groundwater production volume. The database shall include information deemed necessary by the District to enable effective monitoring and regulation of groundwater in the District.

Performance Standard: The District will document all new and existing wells in the District's database. All new and existing wells documented will be included in the District's Annual Report.

Performance Standard: The District will include a summary of the estimated volume of water produced within Rusk County in the District's Annual Report.

12.2. Controlling and Preventing Waste of Groundwater

12.2.A. Disseminate Information on Waste Prevention

Objective: The District will provide information on an annual basis for the purpose of educating the public on elimination, reduction, and prevention of the waste of groundwater. The District will use at least one of the following methods to provide information to the public annually:

a. Distribute literature packets or brochures;
b. Conduct public or school presentations;
c. Sponsor an educational program or course;
d. Provide information on the District's web site;
e. Submit an article for publication with local papers;
f. Present displays at public events.

Performance Standard: A summary of the District's efforts to disseminate information on waste prevention will be included in the District's Annual Report.

12.2.B. Identify Wasteful Practices

Objective: The District will identify wasteful practices within the boundaries of the District through the following methods:

a. Track water loss for all water utilities within the District;
b. Enforce District Rule 9.2.5 requiring inspection and/or plugging of oil and gas groundwater wells.

Performance Standard: The District will include a summary of the total volume of water loss from water utilities in the District's Annual Report.

Performance Standard: The District will include the total oil and gas groundwater wells inspected and plugged each fiscal year in the District's Annual Report.

12.3. Addressing Conjunctive Surface Water Management Issues

12.3.A. Participating in the Regional Water Planning Process

Objective: The District will attend at least one East Texas Regional Water Planning Group (Region I) and the North East Texas Regional Water Planning Group (Region D) meeting each fiscal year.

Performance Standard: The District will participate in the regional planning process by attending at least one meeting of Region I and Region D meetings each fiscal year. A report will be presented at a regular board meeting of the District on conjunctive surface water issues of the appropriate Regional Water Planning Groups. Attendance of meetings for Region I and Region D will be included in the District's Annual Report.

12.4. Addressing Natural Resource Issues

12.4.A. Monitor Water Levels

Objective: The District will manage and maintain its existing water level monitoring program. The District will monitor water levels within the District boundaries at least annually and will be recorded in the District's database.

Performance Standard: A description of the number of wells measured and the monitoring results of the year will be included in the District's Annual Report.

12.4.B. Address Abandoned and Nuisance Wells

Objective: The District will encourage the plugging of abandoned and nuisance groundwater wells. The District will conduct inspections of groundwater wells within the District's boundaries to encourage proper maintenance of groundwater wells and to document abandoned and nuisance groundwater wells that pose a risk to the District's groundwater resources.

Performance Standard: A description of the number of wells inspected, the number of wells in violation, and the number of wells brought into compliance or plugged will be included in the District's Annual Report.

12.5. Addressing Drought Conditions

12.5.A. Drought Contingency Plan

Objective: The District will implement its Drought Contingency Plan if conditions meet the criteria listed in the plan. The District will evaluate its Drought Contingency Plan annually to determine if any amendments are necessary and properly respond to drought conditions locally.

Performance Standard: A summary of the evaluation of the District's Drought Contingency Plan and any revisions to the plan for proper response to drought conditions will be included in the District's Annual Report.

12.5.B. Track Drought Conditions

Objective: The District will monitor drought conditions using a suitable source such as the U.S. Drought Monitor, the Palmer Drought Severity Index Map or the Texas Water Development Board drought page. https://www.waterdatafortexas.org/drought

Performance Standard: Link's on the District's web page to the Palmer Drought Severity Index, U.S. Drought Monitor, and the TWDB's website on drought will be made available to the public.

Performance Standard: A summary of monitored drought conditions will be provided at the regular District Board meetings and in the District's Annual Report.

12.6. Addressing Conservation, Recharge Enhancement, and Rainwater Harvesting

12.6.A. Public Education to Emphasize Water Conservation

Objective: In coordination with efforts in waste prevention, the District will provide information on an annual basis to promote conservation. The District will use at least one of the following methods to provide information to the public annually:

a. Distribute literature packets or brochures;
b. Conduct public or school presentations;
c. Sponsor an educational program or course;
d. Provide information on the District's web site;
e. Submit an article for publication with local papers; and
f. Present displays at public events.

Performance Standard: A summary of the District's efforts to disseminate information on water conservation will be included in the District's Annual Report.

12.6.B. Recharge Enhancement

Objective: To continue education on the diversity of the resource, the District will continuously provide information relating to recharge enhancement on the District web site.

Performance Standard: Information that has been provided on the District web site will be included or summarized in the District's Annual Report.

12.6.C. Rainwater Harvesting

Objective: The District will promote rainwater harvesting by continuously providing information about rainwater harvesting on the District web site.

Performance Standard: Information that has been provided on the District web site will be included or summarized in the District's Annual Report.

12.7. Addressing the Desired Future Conditions of the Groundwater Resources

12.7.A. Manage and Maintain a Water Level Monitoring Program

Objective: The District will manage and maintain its existing water level monitoring program. The District will monitor water levels within the District boundaries at least annually and will be recorded in the District's database, as part of Objective 12.4.A. The District will evaluate water level trends and compare to the DFCs adopted by the District's.

Performance Standard: A description of the number of wells measured and the monitoring results of the year will be included in the District's Annual Report.

Performance Standard: An annual comparison of water level changes to the District's DFC will be evaluated and included in the District's Annual Report.

12.7.B. Monitor estimate Annual Production

Objective: The District will estimate the total annual groundwater production based on groundwater production reports, estimated exempt use, and other relevant information and compare production estimates to the Modeled Available Groundwater (MAG).

Performance Standard: An annual comparison of total recorded and estimated annual production to the District's MAG will be evaluated and included in the District's Annual Report.

12.8. Management Goals Determined Not Applicable

12.8.A. Control and Prevention of Subsidence

According to figure 4.7, TWDB subsidence risk report: Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping – TWDB Contract Number 1648302062, by LRE Water; the District not at a high risk of subsidence. The District will continue to be on the lookout for signs of subsidence.

12.8.B. Precipitation Enhancement

With the high amount of rainfall in the District, precipitation enhancement does not appear needed. Therefore, this goal is not applicable at this time but the District will monitor the need for the goal in the future.

12.8.C. Brush Control

A significant amount of the area of the District is heavily forested with other areas in improved pasture or cultivated land. Brush control as a goal, is not applicable at this time. The District will monitor the need for the goal in the future.

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APPENDICES

APPENDIX A

PUBLIC NOTICES FOR ADOPTION OF MANAGEMENT PLAN

RUSK COUNTY
GROUNDWATER CONSERVATION DISTRICT

P.O. BOX 97 | Henderson, TX 75653
Office (903)657-1900 | Fax (903)657-1922
www.rcgcd.org | rcgcd@suddenlinkmail.com

The Rusk County Groundwater Conservation District, in compliance with Chapter 36 of the Texas Water Code and its Rules, will receive public comment on the proposed amendment to the Rules of the District as well as proposed adoption of the Management Plan of the District at a public hearing at the District Office, located at 500 N. High St., Henderson, Texas, 75652 on Monday, September 11, 2023 at 3:00 pm. The District Board, at the conclusion of the public hearing, will discuss comments received and consider possible adoption of the proposed Rules and the Management Plan. Written comments must be submitted to the District before the date of the public hearing.
The District proposes to amend rules to comply with statutory changes and permitting and registration rules. A complete copy of the current Management Plan, current Rules of the District and proposed rule amendments and Management Plan are available at www.rcgcd.org and the District office, 500 North High Street, Henderson, Texas; 903.657.1900.

This notice is posted in accordance with the open meeting act.
Date posted: August 22, 2023

FILED FOR RECORD
Aug 22,2023 11:24A
TRUDY MCGILL, COUNTY CLERK
RUSK COUNTY, TEXAS
BY:Kathleen Andrews, DEPUTY

The Henderson News

Henderson TX

Affidavit of Publication

STATE OF TEXAS

Before me on this day, personally appeared the undersigned authority Alexander Gould, Publisher of the above listed newspapers having general circulation in Gregg and Rusk counties, who being duly sworn, deposes and says that the foregoing attached notice was published in said newspaper on the following date(s) to wit:

Newspaper The Henderson News

Date(s) August 20, 2023

Alexander Gould, Publisher

Subscribed and sword to me this 30 day of August, 20 23. To certify which witness my hand and seal of office.

Jalayna G Davis
Notary Public, Gregg County,
State of Texas
Commission expires August 21, 2026

JALAYNA G DAVIS
NOTARY PUBLIC
STATE OF TEXAS
ID # 13169015-1
My Comm. Expires 08-21-2026

The Rusk County Groundwater Conservation District, in compliance with Chapter 36 of the Texas Water Code and its Rules, will receive public comment on the proposed amendment to the Rules of the District as well as proposed adoption of the Management Plan of the District at a public hearing at the District Office, located at 500 N. High St., Henderson, Texas, 75652 on Monday, September 11, 2023 at 3:00 pm. The District Board, at the conclusion of the public hearing, will discuss comments received and consider possible adoption of the proposed Rules and the Management Plan. Written comments must be submitted to the District before the date of the public hearing.

The District proposes to amend rules to comply with statutory changes and permitting and registration rules. A complete copy of the current Management Plan, current Rules of the District and proposed rule amendments and Management Plan are available at www.rcgcd.org and the District office,
500 North High Street, Henderson, Texas; 903.657.1900.

NOTICE TO CREDITORS

Notice is hereby given that original Letters Testamentary for the Estate of Carl Barber, Deceased, were issued on May 22, 2023, in Cause No. 23-040P, pending in the County Court of Rusk County, Texas, to: Vivian A. Barber. All persons having claims against this Estate which is currently being administered are required to present them to the undersigned within the time and in the manner prescribed by law.

c/o: **J. Paul Nelson**
Attorney at Law
P. O. Box 934,
207 N. Main St.
Henderson, TX 75653

DATED the 16th day of August, 2023.

/s/ J. Paul Nelson
J. Paul Nelson
Attorney for Vivian A. Barber
State Bar No.: 14899250
P. O. Box 934,
207 N. Main St.
Henderson, TX 75653
Telephone: (903) 657-1424
Facsimile: (903) 657-6220
E-mail:bettercallipaul@gmail.com

APPENDIX B

NOTIFICATION & EVIDENCE OF COORDINATING WITH SURFACE WATER ENTITIES

David Miley

From: David Miley
Sent: Thursday, September 14, 2023 10:28 AM
To: 'kholcomb@anra.org'
Subject: Adopted RCGCD Management plan to ANRA

Dear Mr. Holcomb,

The Rusk County Groundwater Conservation District (District) adopted its most recent Management Plan September11, 2023 after public hearing by the District's Board of Directors.
In accordance with 31 TAC §356.51 and TWC §36.1071(a), the District is providing a digital copy of the Management Plan for your review. The Management Plan can also be viewed at the District's website, www.rcgcd.org located in the 'Documents' tab.
If you would like to provide any comments or have any concerns, please contact the District Office, (903)657-1900.

Sincerely,

David Miley

General Manager
Rusk County Groundwater Conservation District
500 North High St | Henderson, TX 75652
Phone (903)657-1900 | Fax (903)657-1922 | david@rcgcd.org
www.rcgcd.org **| Facebook** @rcgcd

David Miley

From: David Miley
Sent: Thursday, September 14, 2023 10:18 AM
To: Jay Abercrombie
Subject: RCGCD Management Plan to City of Henderson
Attachments: Apopted RCGCD 2023 Management Plan 9-11-23.pdf

Dear Mr. Abercrombie,

The Rusk County Groundwater Conservation District (District) adopted its most recent Management Plan September11, 2023 after public hearing by the District's Board of Directors.
In accordance with 31 TAC §356.51 and TWC §36.1071(a), the District is providing a digital copy of the Management Plan for your review. The Management Plan can also be viewed at the District's website, www.rcgcd.org located in the 'Documents' tab.
If you would like to provide any comments or have any concerns, please contact the District Office, (903)657-1900.

Sincerely,

David Miley

General Manager
Rusk County Groundwater Conservation District
500 North High St | Henderson, TX 75652
Phone (903)657-1900 | Fax (903)657-1922 | david@rcgcd.org
www.rcgcd.org **| Facebook** @rcgcd

David Miley

From: David Miley
Sent: Thursday, September 14, 2023 10:23 AM
To: ago@sratx.org
Subject: Adopted RCGCD 2023 Management Plan 9-11-2023
Attachments: Apopted RCGCD 2023 Management Plan 9-11-23.pdf

To Sabine River Authority,

The Rusk County Groundwater Conservation District (District) adopted its most recent Management Plan September11, 2023 after public hearing by the District's Board of Directors.
In accordance with 31 TAC §356.51 and TWC §36.1071(a), the District is providing a digital copy of the Management Plan for your review. The Management Plan can also be viewed at the District's website, www.rcgcd.org located in the 'Documents' tab.
If you would like to provide any comments or have any concerns, please contact the District Office, (903)657-1900.

Sincerely,

David Miley

General Manager
Rusk County Groundwater Conservation District
500 North High St | Henderson, TX 75652
Phone (903)657-1900 | Fax (903)657-1922 | david@rcgcd.org
www.rcgcd.org **| Facebook** @rcgcd

APPENDIX C

CERTIFIED COPY OF ADOPTED RESOLUTION

RUSK COUNTY

GROUNDWATER CONSERVATION DISTRICT

Certificate of Resolution

Resolution 2023-02

A RESOLUTION OF THE RUSK COUNTY GROUNDWATER CONSERVATION DISTRICT ADOPTING ITS UPDATED MANAGEMENT PLAN FOR SUBMITTAL TO THE TEXAS WATER DEVELOPMENT BOARD FOR CERTIFICATION

WHEREAS, the Rusk County Groundwater Conservation District ("District") is charged by the Texas Legislature with providing for the conservation, preservation, protection, and prevention of waste of groundwater, and of groundwater resources in Rusk County, Texas, under §36.0015, Tex. Water Code;

WHEREAS, the District is authorized to make and enforce fair and impartial rules to manage groundwater resources as scientifically necessary to conserve and protect groundwater resources in the area under §36.101, Tex. Water Code;

WHEREAS, pursuant to §§36.1071 and 36.1072, Tex. Water Code, following notice and hearing, the District developed a comprehensive management plan that addresses the required management goals, as applicable, and shall submit the updated Management Plan to the Texas Water Development Board as provided under §§36.1071, 36.1072, and 36.1073 Tex. Water Code; and

WHEREAS, the District initially submitted its Management Plan to the Texas Water Development Board in April of 2023 for pre-review and made revisions requested by the Texas Water Development Board.

NOW, THEREFORE, BE IT RESOLVED BY THE BOARD OF DIRECTORS OF THE RUSK COUNTY GROUNDWATER CONSERVATION DISTRICT THAT:

THE DISTRICT ADOPTS THE RUSK COUNTY GROUNDWATER CONSERVATION DISTRICT UPDATED MANAGEMENT PLAN AND SUBMITS IT TO THE TEXAS WATER DEVELOPMENT BOARD FOR REVIEW AND APPROVAL.

The motion passed with _7__ayes, and _0_ nayes.

PASSED AND APPROVED this the 11th day of September 2023.

RUSK COUNTY GROUNDWATER CONSERVATION DISTRICT

SIGNED AND SEALED the 11th day of September 2023

Bobby Brown, President

RUSK COUNTY Groundwater Conservation District

RUSK COUNTY

GROUNDWATER CONSERVATION DISTRICT

ATTESTED BY:

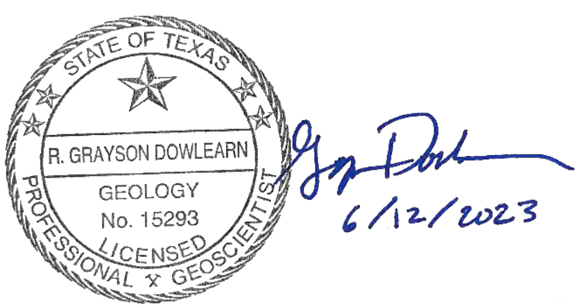
Harry Hamilton, Vice President

APPENDIX D

GAM RUN 23-012

GAM RUN 23-012: RUSK COUNTY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

Sofia Avendaño and Grayson Dowlearn, P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
512-936-6079
June 12, 2023



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GAM RUN 23-012: RUSK COUNTY GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

Sofia Avendaño and Grayson Dowlearn, P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
512-936-6079
June 12, 2023

EXECUTIVE SUMMARY:

Texas Water Code, § 36.1071(h), states that, in developing its groundwater management plan, a groundwater conservation district shall use groundwater availability modeling information provided by the Executive Administrator of the Texas Water Development Board (TWDB) in conjunction with any available site-specific information provided by the district for review and comment to the Executive Administrator.

The TWDB provides data and information to the Rusk County Groundwater Conservation District in two parts. Part 1 is the Estimated Historical Water Use/State Water Plan dataset report, which will be provided to you separately by the TWDB Groundwater Technical Assistance Department. Please direct questions about the water data report to Mr. Stephen Allen at 512-463-7317 or stephen.allen@twdb.texas.gov. Part 2 is the required groundwater availability modeling information, which includes:

1. the annual amount of recharge from precipitation, if any, to the groundwater resources within the district;

2. the annual volume of water that discharges from the aquifer to springs and any surface-water bodies, including lakes, streams, and rivers, for each aquifer within the district; and

3. the annual volume of flow into and out of the district within each aquifer and between aquifers in the district.

The groundwater management plan for the Rusk County Groundwater Conservation District should be adopted by the district on or before September 15, 2023 and submitted to the executive administrator of the TWDB on or before October 15, 2023. The current management plan for the Rusk County Groundwater Conservation District expires on December 14, 2023.

We used the groundwater availability model for the northern portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers (Panday and others, 2020) to estimate the management plan information for the Carrizo-Wilcox and Queen City aquifers within the Rusk County Groundwater Conservation District. Note that the Sparta aquifer does not appear in Rusk County.

This report replaces the results of GAM Run 19-022 (Dowlearn, 2020) and includes results from the updated groundwater availability model for the northern portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers. Additionally, the approach used for analyzing model results is reviewed during each update and may have been refined to better delineate groundwater flows. Tables 1 and 2 summarize the groundwater availability model data required by statute. Figures 1 and 3 show the area of the model from which the values in Tables 1 and 2 were extracted. Figures 2 and 4 provide a generalized diagram of the groundwater flow components provided in Tables 1 and 2. If the Rusk County Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions after reviewing the figures, please notify the TWDB Groundwater Modeling Department at your earliest convenience.

The flow components presented in this report do not represent the full groundwater budget. If additional inflow and outflow information would be helpful for planning purposes, the district may submit a request in writing to the TWDB Groundwater Modeling Department for the full groundwater budget.

METHODS:

In accordance with Texas Water Code, § 36.1071(h), the groundwater availability model mentioned above was used to estimate information for the Rusk County Groundwater Conservation District management plan. Water budgets were extracted for the historical model period (1981 through 2013) for the Carrizo-Wilcox and Queen City aquifers using ZONEBUDGET for MODFLOW 6 (Langevin and others, 2021). The average annual water budget values for recharge, surface water outflow, inflow to the district, outflow from the district, net cross-formation flow between aquifers, and net flow between aquifer and its equivalent portion located within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Carrizo-Wilcox and Queen City aquifers

- We used version 3.01 of the groundwater availability model for the northern portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers (Panday and others, 2020, and Schorr and others, 2020) to analyze the Carrizo-Wilcox and Queen City aquifers. See Panday and others (2020) and Schorr and others (2020) for assumptions and limitations of the model.
- The groundwater availability model for the northern portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers includes the following nine layers:
    - Layer 1 represents Quaternary Alluvium,
    - Layer 2 represents the Sparta Aquifer and equivalent units,
    - Layer 3 represents the Weches Formation (confining unit),
    - Layer 4 represents the Queen City Aquifer and equivalent units,
    - Layer 5 represents the Reklaw Formation (confining unit),
    - Layer 6 represents the Carrizo Formation,
    - Layer 7 represents the Upper Wilcox member,
    - Layer 8 represents the Middle Wilcox member, and
    - Layer 9 represents the Lower Wilcox member.
- Individual water budgets for the district were determined for the Queen City Aquifer (Layer 4), and the Carrizo-Wilcox Aquifer (Layers 6 through 9, collectively). The Sparta Aquifer does not exist within the district boundaries.
- Water budget terms were averaged for the period 1981 to 2013 which corresponds to stress periods 2-34
- The model was run with MODFLOW 6 (Langevin and others, 2021)

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the groundwater availability model results for the aquifers located within the Rusk County Groundwater Conservation District and averaged over the historical calibration period, as shown in Tables 1 and 2.

1. Precipitation recharge—the areally distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at land surface) within the district.

2. Surface-water outflow—the total water discharging from the aquifer (outflow) to surface-water features such as streams, reservoirs, and springs.

3. Flow into and out of district—the lateral flow within the aquifer between the district and adjacent counties.

4. Flow between aquifers—the net vertical flow between the aquifer and adjacent aquifers or confining units. This flow is controlled by the relative water levels in each aquifer and aquifer properties of each aquifer or confining unit that define the amount of leakage that occurs.

The information needed for the district's management plan is summarized in Tables 1 and 2. Figures 1 and 3 show the areas of the groundwater availability model from which the information in Tables 1 and 2 were extracted. Figures 2 and 4 provide a generalized diagram of the groundwater flow components provided in Tables 1 and 2. These diagrams only include the water budget items provided in their respective tables. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.

Table 1: Summarized information for the Carrizo-Wilcox Aquifer that is needed for the Rusk County Groundwater Conservation District groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	19,618
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers.	Carrizo-Wilcox Aquifer	4,079
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	2,253
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	11,380
Estimated net annual volume of flow between each aquifer in the district	To Carrizo-Wilcox Aquifer from the Reklaw Formation	1,741
	To Carrizo-Wilcox from Queen City Aquifer	7

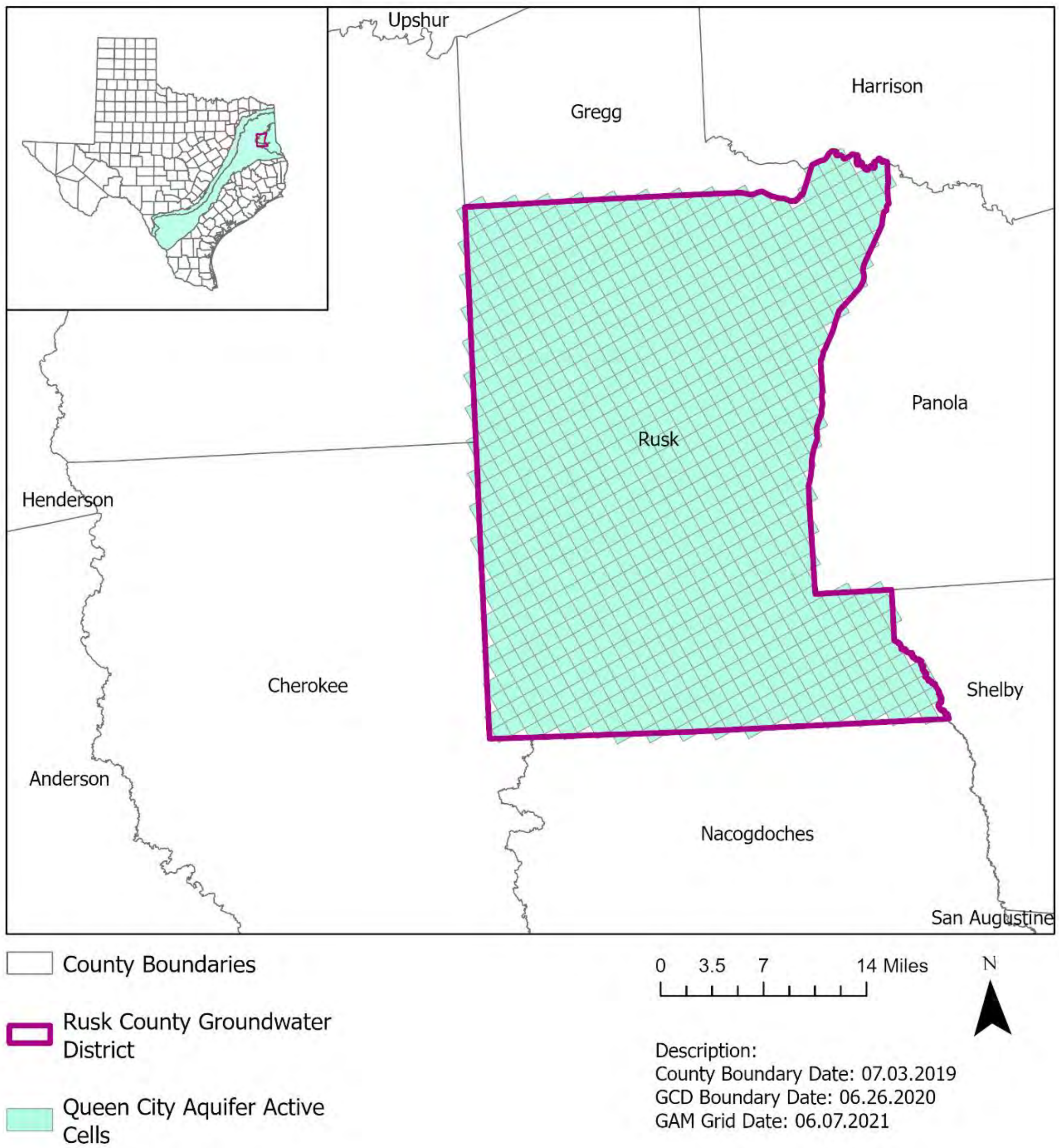
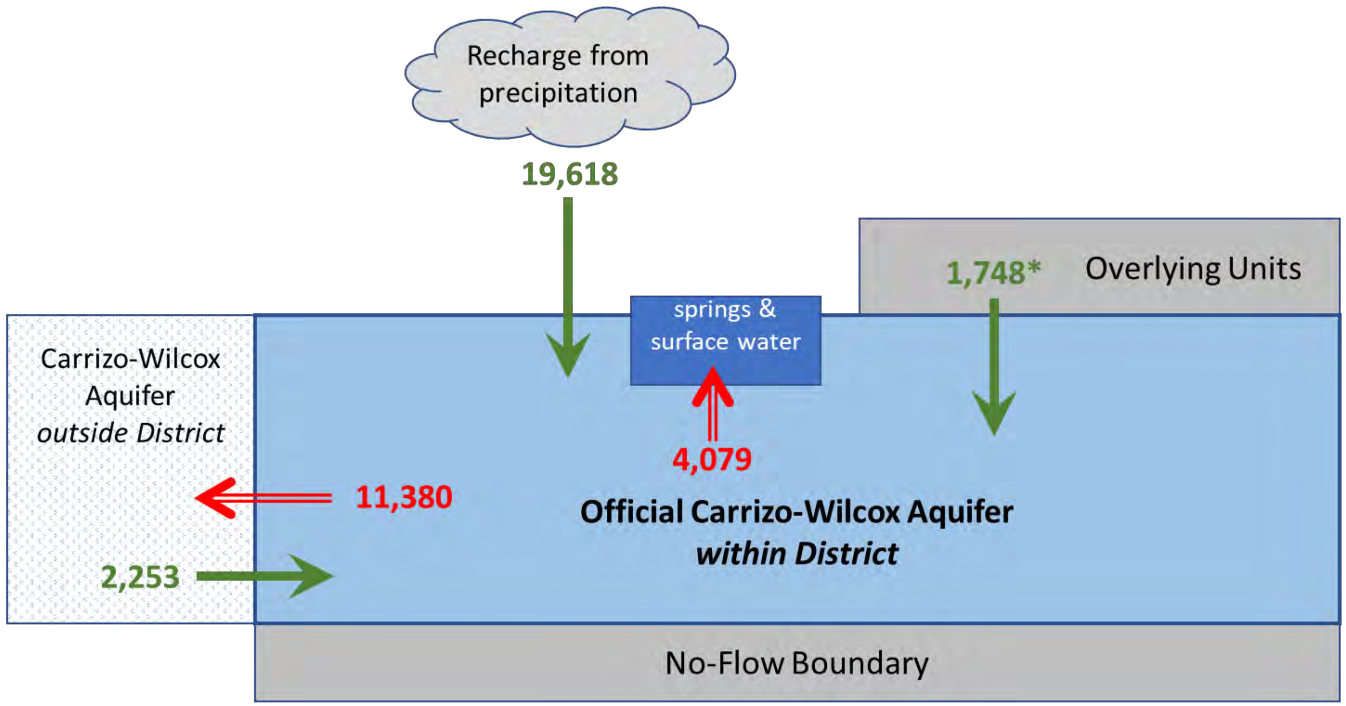


Figure 1: Area of the Northern Portion of the Carrizo-Wilcox, Queen City and Sparta Aquifers Groundwater Availability Model from which the information in Table 1 was extracted (The Carrizo-Wilcox Aquifer extent within the district boundary).



* Flow from overlying units includes net inflow of 1,741 acre-feet per year from the Reklaw formation and a net inflow of 7 acre-feet per year from the Queen City Aquifer

Caveat: This diagram only includes the water budget items provided in Table 2. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 2: Generalized diagram of the summarized budget information from Table 1, representing directions of flow for the Carrizo-Wilcox Aquifer within the Rusk County Groundwater Conservation District. Flow values are expressed in acre-feet per year.

Table 2: Summarized information for the Queen City Aquifer that is needed for the Rusk County Groundwater Conservation District groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	427
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	390
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	232
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	80
Estimated net annual volume of flow between each aquifer in the district	From the Queen City Aquifer to the Reklaw Formation	26
	To Queen City Aquifer from the equivalent Queen City Aquifer units	167
	From Queen City Aquifer to the Carrizo-Wilcox Aquifer	7

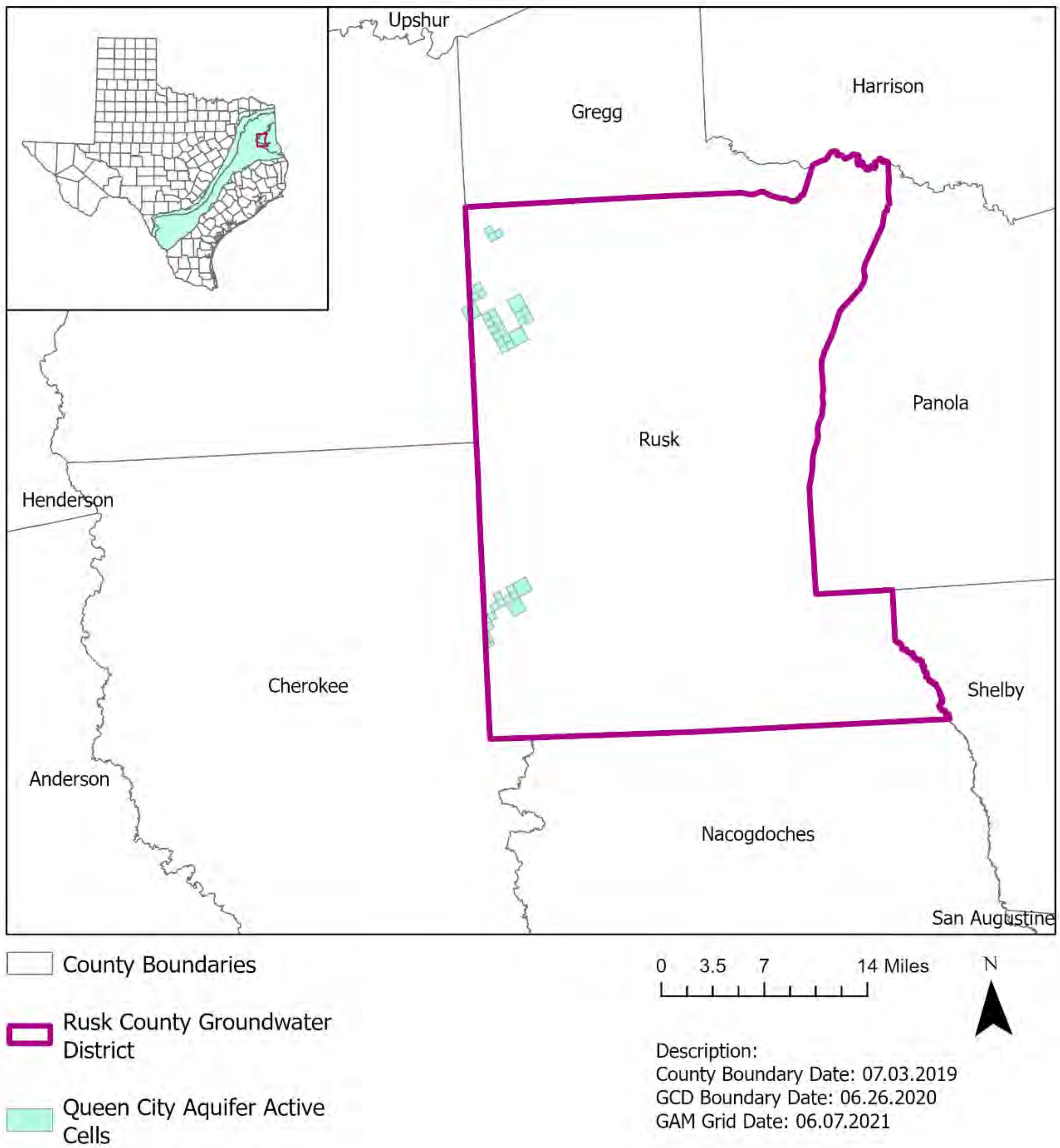
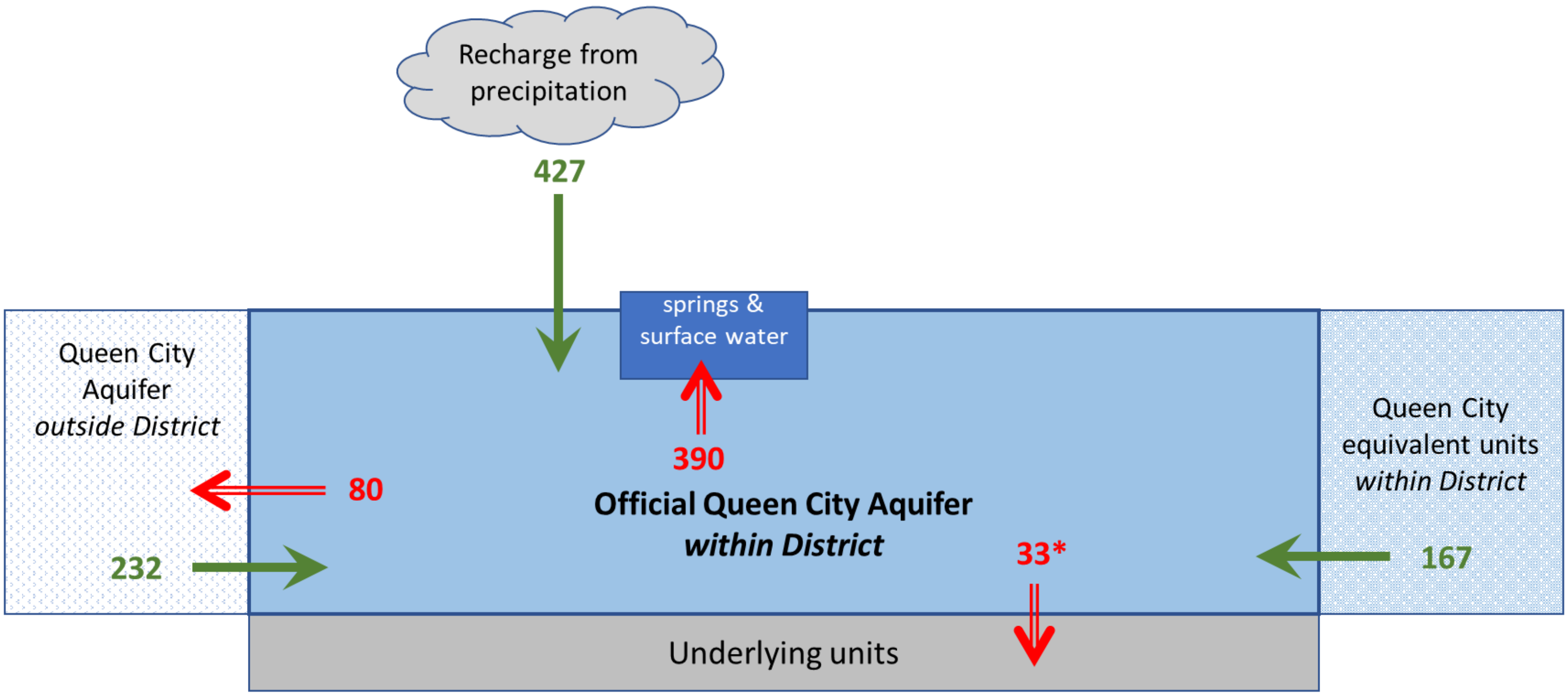


Figure 3: Area of the northern portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers groundwater availability model from which the information in Table 2 was extracted (the Queen City Aquifer extent within the district boundary).



* Flow to underlying units includes net outflow of 26 acre-feet per year to the Reklaw formation and a net outflow of 7 acre-feet per year to the Carrizo-Wilcox Aquifer

Caveat: This diagram only includes the water budget items provided in Table 2. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 4: Generalized diagram of the summarized budget information from Table 2, representing directions of flow for the Queen City Aquifer within the Rusk County Groundwater Conservation District. Flow values are expressed in acre-feet per year.

LIMITATIONS:

The groundwater models used in completing this analysis are the best available scientific tools that can be used to meet the stated objectives. To the extent that this analysis will be used for planning purposes and/or regulatory purposes related to pumping in the past and into the future, it is important to recognize the assumptions and limitations associated with the use of the results. In reviewing the use of models in environmental regulatory decision making, the National Research Council (2007) noted:

> *"Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."*

A key aspect of using the groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historical pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and interaction with streams are specific to particular historic time periods.

Because the application of the groundwater models was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations related to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and overall conditions of the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

REFERENCES:

Dowlearn, G., 2020, GAM Run 19-022: Rusk County Groundwater Conservation District Management Plan, Texas Water Development Board, GAM Run 19-022 Report, 12 p., https://www.twdb.texas.gov/groundwater/docs/GAMruns/GR19-022.pdf

Langevin, C.D., Hughes, J.D., Banta, E.R., Provost, A.M., Niswonger, R.G., and Panday, Sorab, 2021, ZONEBUDGET for MODFLOW 6, 14 p., https://doi.org/10.5066/F76Q1VQV

National Research Council, 2007, Models in Environmental Regulatory Decision Making Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p., http://www.nap.edu/catalog.php?record_id=11972

Panday, S., Rumbaugh, J., Hutchison, W. R., and Schorr, S., 2020, Numerical Model Report: Groundwater Availability Model for the Northern Portion of the Queen City, Sparta and Carrizo-Wilcox Aquifers, by GSI Environmental Inc., 201 p., https://www.twdb.texas.gov/groundwater/models/gam/czwx_n/2020_12_08_Numerical_Model_Report_Accessible.pdf?d=7079

Schorr, S., Zivic, M., Hutchison, W. R., Panday, S., and Rumbaugh, J., 2020, Conceptual Model Report: Groundwater Availability Model for Northern Portion of the Queen City, Sparta and Carrizo-Wilcox Aquifers, by Montgomery and Associates, 240 p., https://www.twdb.texas.gov/groundwater/models/gam/czwx_n/North_QCSCW_GAM_Conceptual_Model_Report_FullRpt_Appendices.pdf?d=7079

Texas Water Code § 36.1071

APPENDIX E

GAM RUN 21-016 MAG

GAM RUN 21-016 MAG:
MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS IN GROUNDWATER MANAGEMENT AREA 11

Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
(512) 936-0883
February 17, 2022

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GAM RUN 21-016 MAG: MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS IN GROUNDWATER MANAGEMENT AREA 11

Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
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Groundwater Modeling Department
(512) 936-0883
February 17, 2022

EXECUTIVE SUMMARY:

The modeled available groundwater for Groundwater Management Area 11 for the Carrizo-Wilcox, Queen City, and Sparta aquifers is summarized by decade for the groundwater conservation districts (Tables 2 through 4 respectively) and for use in the regional water planning process (Tables 5 through 7 respectively). The modeled available groundwater estimates for the Carrizo-Wilcox Aquifer are approximately 251,220 acre-feet per year for each decade from 2020 through 2080. The modeled available groundwater estimates for the Queen City Aquifer are approximately 130,850 acre-feet per year for each decade from 2020 through 2080 (Table 3). The modeled available groundwater estimates for the Sparta Aquifer are approximately 3,260 acre-feet per year for each decade from 2020 to 2080 (Table 4). The estimates were extracted from results of a model run using the groundwater availability model for the northern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers (Version 3.01). The model run files, which meet the desired future conditions adopted by district representatives of Groundwater Management Area 11, were submitted to the Texas Water Development Board (TWDB) on August 26, 2021, as part of the Desired Future Conditions Explanatory Report for Groundwater Management Area 11. The explanatory report and other materials submitted to the Texas Water Development Board (TWDB) were determined to be administratively complete on October 29, 2021.

REQUESTOR:

Ms. Teresa Griffin, coordinator of Groundwater Management Area 11.

DESCRIPTION OF REQUEST:

In an email dated August 26, 2021, Dr. William R. Hutchison, on behalf of Groundwater Management Area 11, provided the TWDB with the desired future conditions of the Carrizo-Wilcox, Queen City, and Sparta aquifers adopted by the groundwater conservation districts in Groundwater Management Area 11. The desired future conditions for the Carrizo-Wilcox, Queen City, and Sparta aquifers are listed in Table 1 of the Resolution to Adopt Desired Future Conditions for Aquifers in Groundwater Management Area 11, adopted August 11, 2021, by the groundwater conservation districts within Groundwater Management Area 11. The desired future conditions (Table 1) are county-aquifer average water level drawdowns from 2013 to 2080 and are based on modeling Scenario 33 documented in Technical Memorandum 21-01 (Hutchison, 2021).

TABLE 1. DESIRED FUTURE CONDITIONS FOR EACH COUNTY-AQUIFER UNIT IN GROUNDWATER MANAGEMENT AREA 11 EXPRESSED AS AVERAGE DRAWDOWN FROM 2013 TO 2080 IN FEET.[1]

County	Sparta	Queen City	Carrizo-Wilcox
Anderson	30	44	155
Angelina	6	28	67
Bowie	NP[2]	NP	12
Camp	NP	11	85
Cass	66	34	79
Cherokee	7	31	176
Franklin	NP	NP	102
Gregg	NP	49	109
Harrison	NP	41	26
Henderson	NP	33	106
Hopkins	NP	NP	61
Houston	3	12	86
Marion	123	32	32
Morris	NP	39	78
Nacogdoches	7	22	73
Panola	NP	NP	21
Rains	NP	NP	17

[1] Based on table 1 from Resolution to Adopt Desired Future Conditions for Aquifers in Groundwater Management Area 11 dated August 11, 2021.
[2] NP: Aquifer not present in the county.

County	Sparta	Queen City	Carrizo-Wilcox
Red River	NP	NP	NR[3]
Rusk	26	17	86
Sabine	1	3	9
San Augustine	2	7	22
Shelby	18	12	17
Smith	121	132	265
Titus	NP[4]	9	66
Trinity	5	18	56
Upshur	10	30	149
Van Zandt	NP	73	55
Wood	9	16	122

[3] Carrizo-Wilcox considered non-relevant in Red River County.
[4] NP: Aquifer not present in the county.

TWDB staff reviewed the model files associated with the desired future conditions and received clarification on procedures and assumptions from the Groundwater Management Area 11 Technical Coordinator in an email on September 9, 2021. The Technical Coordinator confirmed that the Carrizo-Wilcox Aquifer should be considered non-relevant in Red River County, drawdown averages and modeled available groundwater values should be based on the model extent rather than the official aquifer extent, average drawdowns were not area-weighted, and a two-feet tolerance should be used when comparing model calculated drawdown with the desired future condition. Clarification also confirmed that no model cells converted to dry in the simulation.

METHODS:

The groundwater availability model for the northern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers Version 3.01 (Figures 1 through 4) was run using the model files submitted with the explanatory report (Hutchison, 2021). Model-calculated drawdowns were extracted for the year 2080. Drawdown averages were calculated for each county by aquifer. The calculated drawdown averages were compared with the desired future conditions to verify that the pumping scenario expressed in the model files achieved the desired future conditions within an acceptable tolerance of two feet based on a September 9, 2021 clarification from the Groundwater Management Area 11 Technical Coordinator. The modeled available groundwater values were determined by extracting pumping rates by decade from the model results using ZONEBUDGET for MODFLOW 6 Version 1.01 (U.S. Geological Survey, 2021). Annual pumping rates by aquifer are presented by county and groundwater conservation district, subtotaled by groundwater conservation district, and then summed for Groundwater Management Area 11 (Tables 2 through 4). Annual pumping rates by aquifer are also presented by county, river basin, and regional water planning area within Groundwater Management Area 11 (Tables 5 through 7).

Modeled Available Groundwater and Permitting

As defined in Chapter 36 of the Texas Water Code (2011), "modeled available groundwater" is the estimated average amount of water that may be produced annually to achieve a desired future condition. Groundwater conservation districts are required to consider modeled available groundwater, along with several other factors, when issuing permits in order to manage groundwater production to achieve the desired future condition(s). The other factors districts must consider include annual precipitation and production patterns, the estimated amount of pumping exempt from permitting, existing permits, and a reasonable estimate of actual groundwater production under existing permits.

PARAMETERS AND ASSUMPTIONS:

The parameters and assumptions for the modeled available groundwater estimates are described below:

- We used Version 3.01 of the groundwater availability model for the northern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers. See Panday and others (2021) for assumptions and limitations of the groundwater availability model for the northern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.
- This groundwater availability model includes nine layers, which represent quaternary alluvium adjacent to rivers and streams, the Sparta Aquifer (Layer 2), the Weches Confining Unit (Layer 3), the Queen City Aquifer (Layer 4), the Reklaw Confining Unit (Layer 5), the Carrizo (Layer 6), the Upper Wilcox (Layer 7), the Middle Wilcox (Layer 8), and the Lower Wilcox (Layer 9). Layers represent equivalent geologic units outside of the official aquifer extents.
- The model was run with MODFLOW 6 (Langevin and others, 2017).
- Drawdown averages and modeled available groundwater values were based on the extent of the model area (Figures 1 through 4).
- County average drawdowns were calculated as the sum of drawdowns for all model cells divided by the number of cells, without an area weighting correction.
- Based on a clarification from the Groundwater Management Area 11 Technical Coordinator, a tolerance of two feet was assumed when comparing desired future conditions (Table 1, average drawdown values per county) to model drawdown results.
- Estimates of modeled available groundwater from the model simulation were rounded to whole numbers.
- The Carrizo-Wilcox Aquifer in Red River County was assumed non-relevant for joint planning purposes.

RESULTS:

The modeled available groundwater estimates for the Carrizo-Wilcox Aquifer are approximately 251,220 acre-feet per year for each decade from 2020 through 2080. The modeled available groundwater estimates for the Queen City Aquifer are approximately 130,850 acre-feet per year for each decade from 2020 through 2080 (Table 3). The modeled available groundwater estimates for the Sparta Aquifer are approximately 3,260 acre-feet per year for each decade from 2020 to 2080 (Table 4). The modeled available groundwater is summarized by groundwater conservation district and county for the

Carrizo-Wilcox, Queen City, and Sparta aquifers (Tables 2, 3, and 4 respectively). The modeled available groundwater has also been summarized by county, river basin, and regional water planning area for use in the regional water planning process for the Carrizo-Wilcox, Queen City, and Sparta aquifers (Tables 5, 6, and 7 respectively). Small differences of values between table summaries are due to rounding.

The Gulf Coast, Nacatoch, Trinity, and Yegua-Jackson aquifers and the Carrizo-Wilcox Aquifer in Red River County were declared non-relevant for the purpose of adopting desired future conditions by the Groundwater Management Area 11 Districts; therefore, modeled available groundwater values were not calculated for those aquifers.

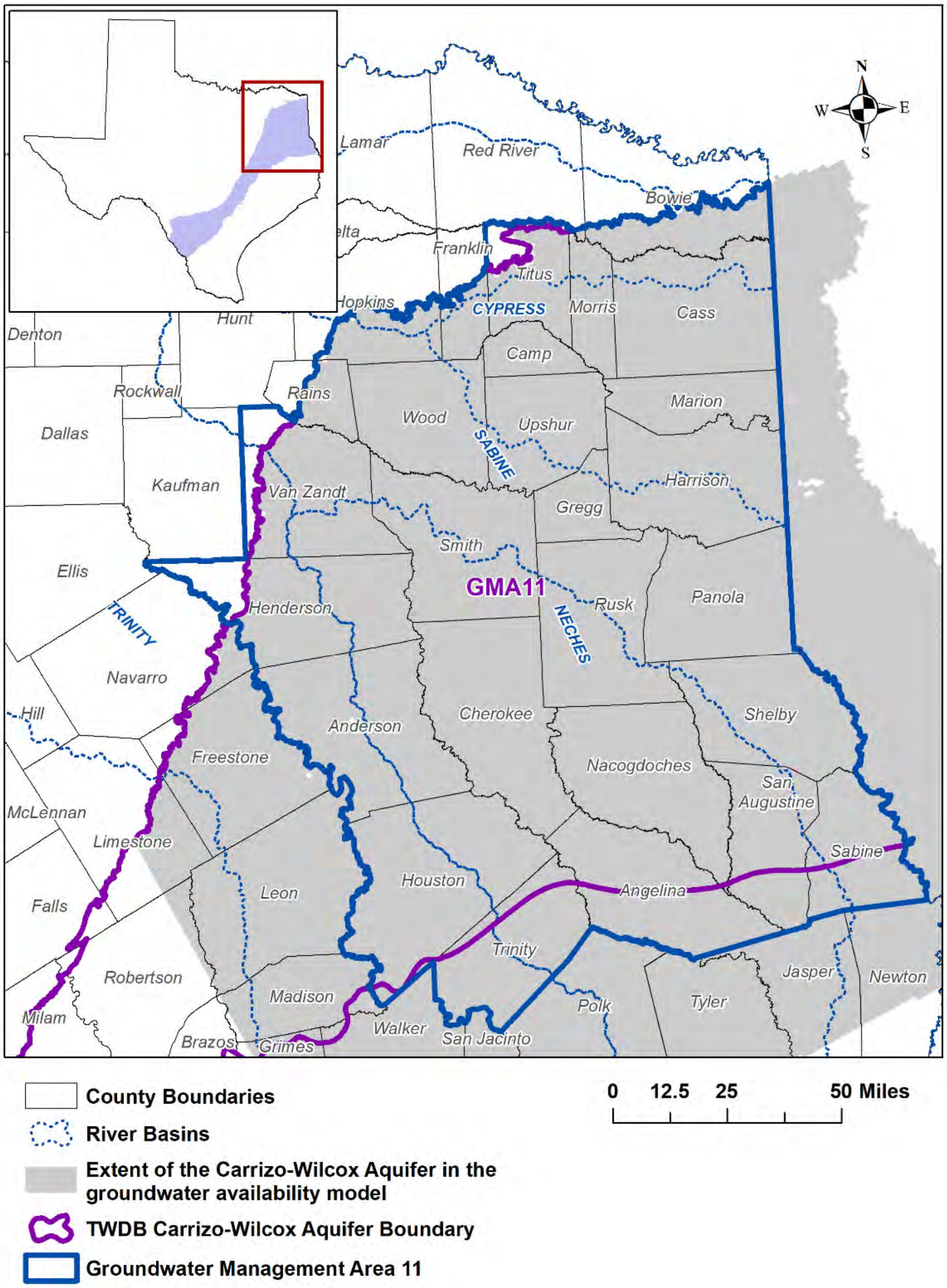

FIGURE 1. GROUNDWATER MANAGEMENT AREA (GMA) 11 BOUNDARY, RIVER BASINS, AND COUNTIES OVERLAIN ON THE EXTENT OF THE CARRIZO-WILCOX AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS.

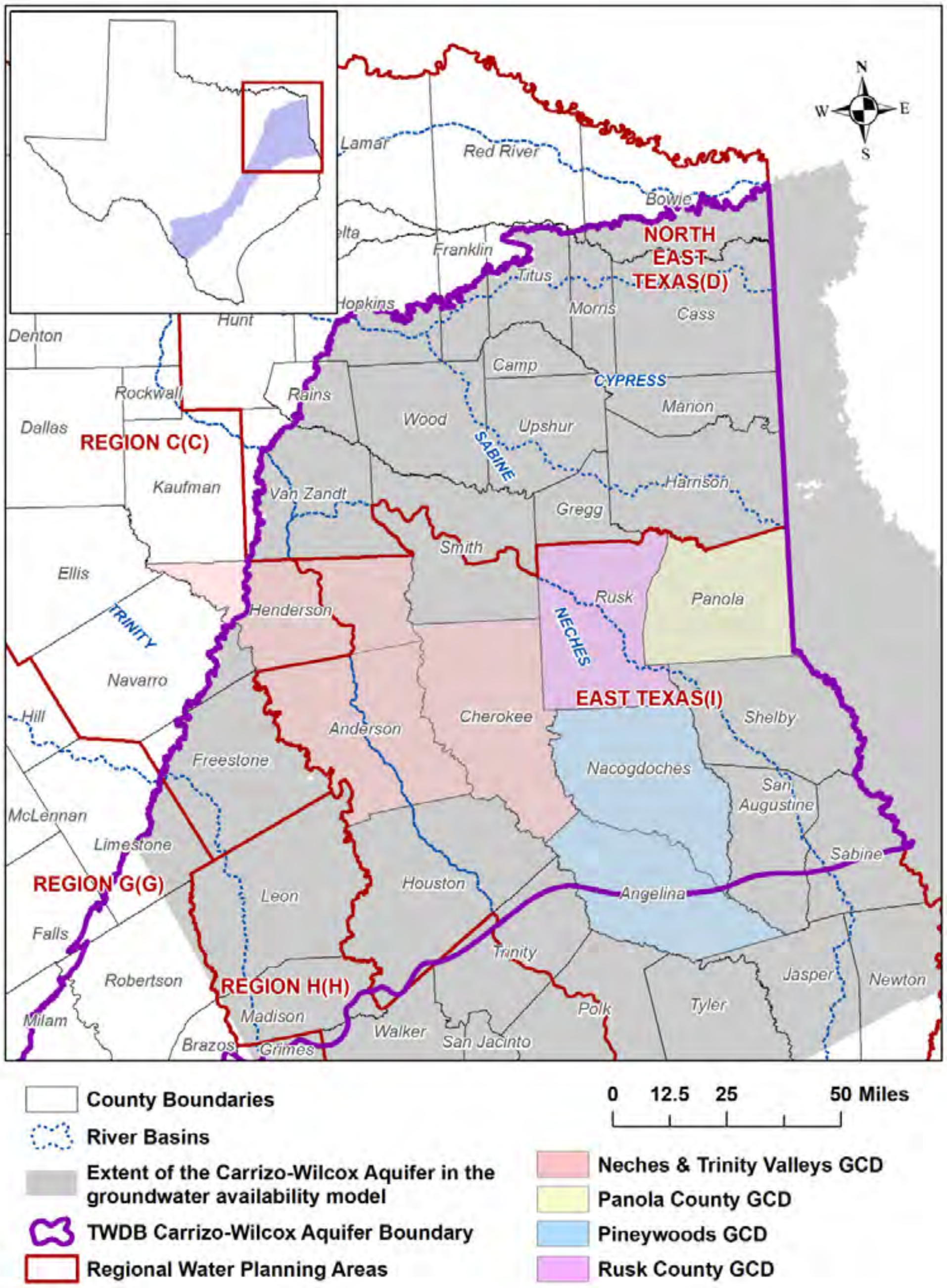

FIGURE 2. REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE CARRIZO-WILCOX AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS.

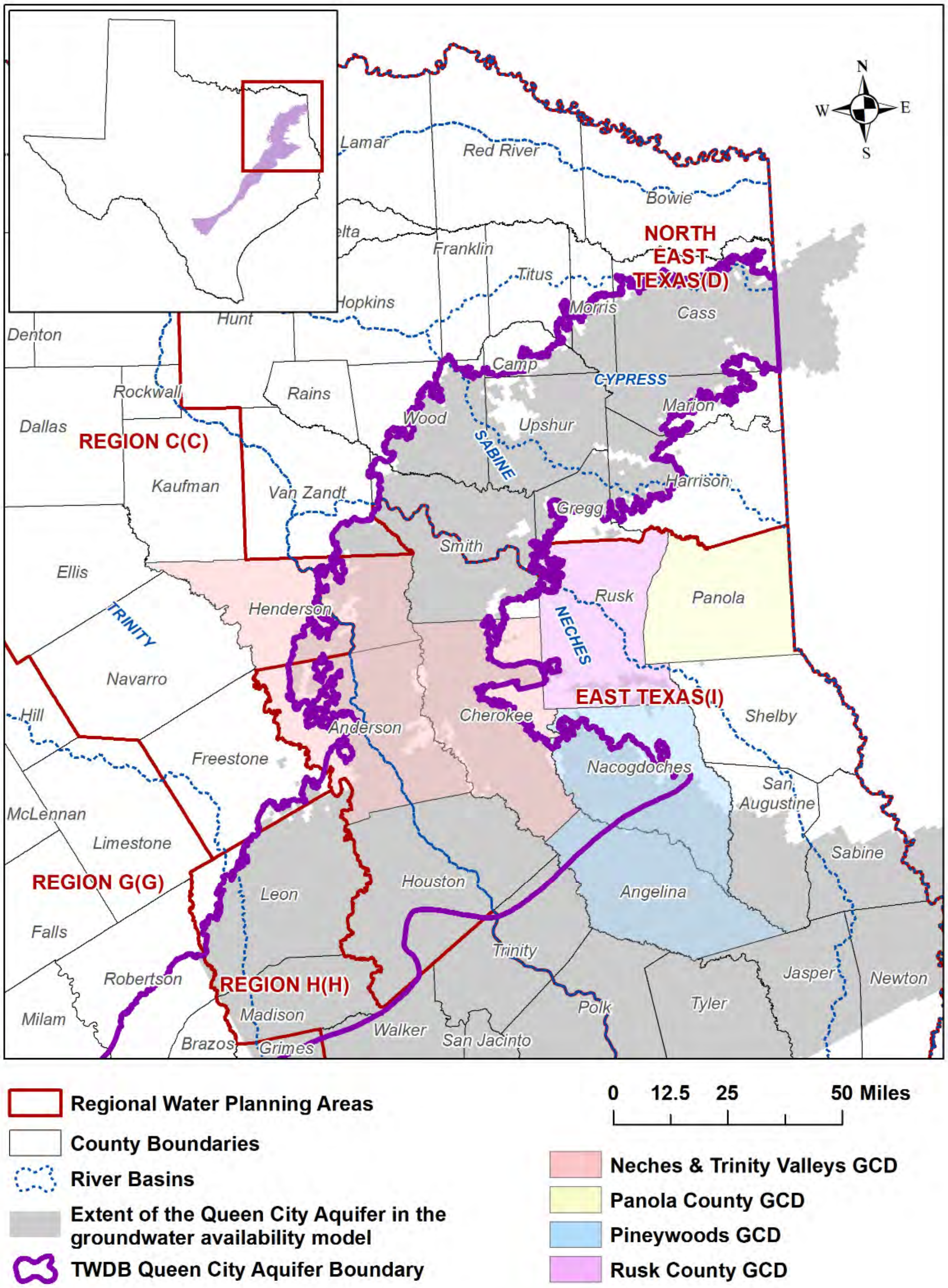

FIGURE 3. REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE QUEEN CITY AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS.

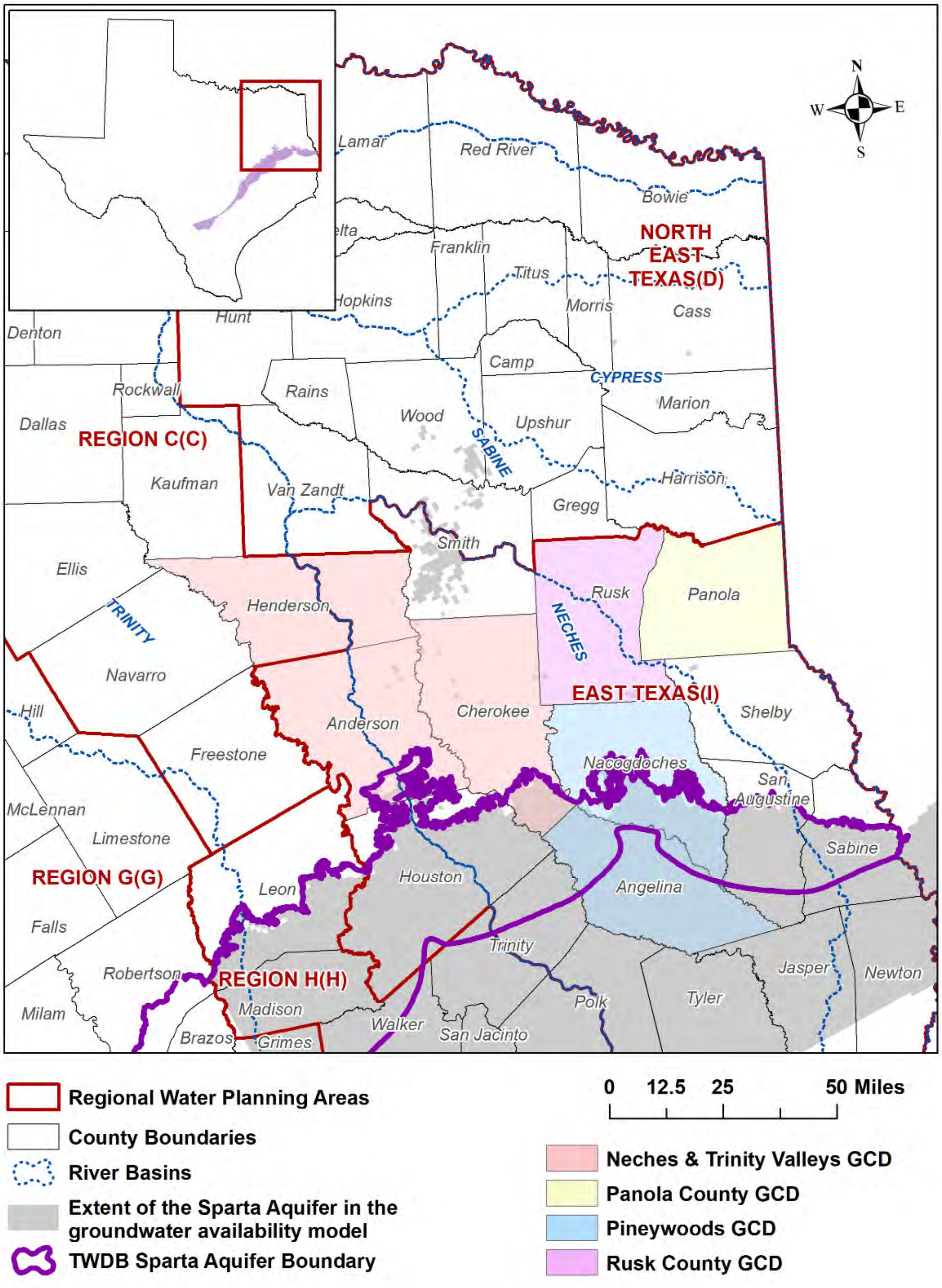

FIGURE 4. **REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE SPARTA AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS.**

TABLE 2. MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX AQUIFER IN GROUNDWATER MANAGEMENT AREA 11 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Neches & Trinity Valleys GCD	Anderson	Carrizo-Wilcox	27,024	27,024	27,024	27,024	27,024	27,024	27,024
Neches & Trinity Valleys GCD	Cherokee	Carrizo-Wilcox	15,241	15,241	15,241	15,241	15,241	15,241	15,241
Neches & Trinity Valleys GCD	Henderson	Carrizo-Wilcox	7,222	7,222	7,222	7,222	7,222	7,222	7,222
Neches & Trinity Valleys GCD Total		**Carrizo-Wilcox**	**49,488**	**49,488**	**49,488**	**49,488**	**49,488**	**49,488**	**49,488**
Panola County GCD	Panola	**Carrizo-Wilcox**	**4,999**	**4,999**	**4,999**	**4,999**	**4,999**	**4,999**	**4,999**
Pineywoods GCD	Angelina	Carrizo-Wilcox	27,611	27,611	27,611	27,611	27,611	27,611	27,611
Pineywoods GCD	Nacogdoches	Carrizo-Wilcox	20,859	20,859	20,859	20,859	20,859	20,859	20,859
Pineywoods GCD Total		**Carrizo-Wilcox**	**48,470**	**48,470**	**48,470**	**48,470**	**48,470**	**48,470**	**48,470**
Rusk County GCD Total	Rusk	**Carrizo-Wilcox**	**14,019**	**14,019**	**14,019**	**14,019**	**14,019**	**14,019**	**14,019**
Total (GCDs)		**Carrizo-Wilcox**	**116,975**	**116,975**	**116,975**	**116,975**	**116,975**	**116,975**	**116,975**
No District-County	Bowie	Carrizo-Wilcox	9,645	9,645	9,645	9,645	9,645	9,645	9,645
No District-County	Camp	Carrizo-Wilcox	3,862	3,862	3,862	3,862	3,862	3,862	3,862
No District-County	Cass	Carrizo-Wilcox	13,642	13,642	13,642	13,642	13,642	13,642	13,642
No District-County	Franklin	Carrizo-Wilcox	5,732	5,732	5,732	5,732	5,732	5,732	5,732
No District-County	Gregg	Carrizo-Wilcox	6,072	6,072	6,072	6,072	6,072	6,072	6,072
No District-County	Harrison	Carrizo-Wilcox	9,096	9,096	9,096	9,096	9,096	9,096	9,096
No District-County	Hopkins	Carrizo-Wilcox	4,753	4,753	4,753	4,752	4,752	4,752	4,752
No District-County	Houston	Carrizo-Wilcox	2,356	2,356	2,356	2,356	2,356	2,356	2,356
No District-County	Marion	Carrizo-Wilcox	1,966	1,966	1,966	1,966	1,966	1,966	1,966

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
No District-County	Morris	Carrizo-Wilcox	2,570	2,570	2,570	2,570	2,570	2,570	2,570
No District-County	Rains	Carrizo-Wilcox	1,411	1,411	1,411	1,411	1,411	1,411	1,411
No District-County	Red River	Carrizo-Wilcox	NR[1]	NR[1]	NR[1]	NR[1]	NR[1]	NR[1]	NR[1]
No District-County	Sabine	Carrizo-Wilcox	1,388	1,388	1,388	1,388	1,388	1,388	1,388
No District-County	San Augustine	Carrizo-Wilcox	587	587	587	587	587	587	587
No District-County	Shelby	Carrizo-Wilcox	6,319	6,319	6,319	6,319	6,319	6,319	6,319
No District-County	Smith	Carrizo-Wilcox	25,547	25,547	25,547	25,547	25,547	25,547	25,547
No District-County	Titus	Carrizo-Wilcox	7,536	7,536	7,536	7,536	7,536	7,536	7,536
No District-County	Trinity	Carrizo-Wilcox	267	267	267	267	267	267	267
No District-County	Upshur	Carrizo-Wilcox	6,658	6,658	6,658	6,658	6,658	6,658	6,658
No District-County	Van Zandt	Carrizo-Wilcox	6,932	6,932	6,932	6,932	6,932	6,932	6,932
No District-County	Wood	Carrizo-Wilcox	17,902	17,902	17,902	17,902	17,902	17,902	17,902
No District-County Total		**Carrizo-Wilcox**	**134,241**	**134,241**	**134,241**	**134,241**	**134,241**	**134,241**	**134,240**
Total for GMA 11		**Carrizo-Wilcox**	**251,217**	**251,217**	**251,217**	**251,216**	**251,216**	**251,216**	**251,215**

[1]A desired future condition was not specified for the Carrizo-Wilcox Aquifer in Red River County and was declared as not relevant (NR) in a clarification.

TABLE 3. MODELED AVAILABLE GROUNDWATER FOR THE QUEEN CITY AQUIFER IN GROUNDWATER MANAGEMENT AREA 11 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Neches & Trinity Valleys GCD	Anderson	Queen City	16,591	16,591	16,591	16,591	16,591	16,591	16,591
Neches & Trinity Valleys GCD	Cherokee	Queen City	8,812	8,812	8,812	8,812	8,812	8,812	8,812
Neches & Trinity Valleys GCD	Henderson	Queen City	10,671	10,671	10,671	10,670	10,670	10,670	10,670
Neches & Trinity Valleys GCD Total		**Queen City**	36,073	36,073	36,073	36,073	36,073	36,073	36,073
Pineywoods GCD	Angelina	Queen City	1,095	1,095	1,095	1,095	1,095	1,095	1,095
Pineywoods GCD	Nacogdoches	Queen City	2,946	2,946	2,946	2,946	2,946	2,946	2,946
Pineywoods GCD Total		**Queen City**	**4,041**	**4,041**	**4,041**	**4,041**	**4,041**	**4,041**	**4,041**
Rusk County GCD Total	**Rusk**	**Queen City**	**59**	**59**	**59**	**59**	**59**	**59**	**59**
Total (GCDs)		**Queen City**	**40,173**	**40,173**	**40,173**	**40,173**	**40,173**	**40,173**	**40,172**
No District-County	Camp	Queen City	1,594	1,594	1,594	1,594	1,594	1,594	1,594
No District-County	Cass	Queen City	16,479	16,479	16,479	16,479	16,479	16,479	16,479
No District-County	Gregg	Queen City	2,511	2,511	2,511	2,511	2,511	2,511	2,511
No District-County	Harrison	Queen City	3,537	3,537	3,537	3,537	3,537	3,537	3,537
No District-County	Houston	Queen City	2,295	2,295	2,295	2,295	2,295	2,295	2,295
No District-County	Marion	Queen City	7,389	7,389	7,389	7,389	7,389	7,389	7,389
No District-County	Morris	Queen City	3,278	3,278	3,278	3,278	3,278	3,278	3,278
No District-County	Sabine	Queen City	0[5]	0	0	0	0	0	0

[5] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
No District-County	San Augustine	Queen City	0[6]	0	0	0	0	0	0
No District-County	Shelby	Queen City	0	0	0	0	0	0	0
No District-County	Smith	Queen City	32,578	32,578	32,578	32,578	32,578	32,578	32,578
No District-County	Titus	Queen City	0	0	0	0	0	0	0
No District-County	Trinity	Queen City	0	0	0	0	0	0	0
No District-County	Upshur	Queen City	12,165	12,165	12,165	12,165	12,165	12,165	12,164
No District-County	Van Zandt	Queen City	2,343	2,343	2,343	2,343	2,343	2,343	2,343
No District-County	Wood	Queen City	6,510	6,510	6,510	6,510	6,510	6,510	6,510
No District-County Total		**Queen City**	**90,681**	**90,681**	**90,680**	**90,680**	**90,680**	**90,680**	**90,679**
Total for GMA 11		**Queen City**	**130,854**	**130,854**	**130,853**	**130,853**	**130,853**	**130,852**	**130,852**

[6] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE 4. MODELED AVAILABLE GROUNDWATER FOR THE SPARTA AQUIFER IN GROUNDWATER MANAGEMENT AREA 11 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Neches & Trinity Valleys GCD	Anderson	Sparta	307	307	307	307	307	307	307
Neches & Trinity Valleys GCD	Cherokee	Sparta	352	352	352	352	352	352	352
Neches & Trinity Valleys GCD Total		**Sparta**	**658**	**658**	**658**	**658**	**658**	**658**	**658**
Pineywoods GCD	Angelina	Sparta	390	390	390	390	390	390	390
Pineywoods GCD	Nacogdoches	Sparta	362	362	362	362	362	362	362
Pineywoods GCD Total		**Sparta**	**752**	**752**	**752**	**752**	**752**	**752**	**752**
Total (GCDs)		**Sparta**	**1,410**	**1,410**	**1,410**	**1,410**	**1,410**	**1,410**	**1,410**
No District-County	Cass	Sparta	0[7]	0	0	0	0	0	0
No District-County	Houston	Sparta	1,482	1,482	1,482	1,482	1,482	1,482	1,482
No District-County	Marion	Sparta	0	0	0	0	0	0	0
No District-County	Sabine	Sparta	49	49	49	49	49	49	49
No District-County	San Augustine	Sparta	166	166	166	166	166	166	166
No District-County	Shelby	Sparta	0	0	0	0	0	0	0
No District-County	Smith	Sparta	0	0	0	0	0	0	0
No District-County	Trinity	Sparta	152	152	152	152	152	152	152
No District-County	Upshur	Sparta	0	0	0	0	0	0	0
No District-County	Wood	Sparta	0	0	0	0	0	0	0
No District-County Total		**Sparta**	**1,848**	**1,848**	**1,848**	**1,848**	**1,848**	**1,848**	**1,848**
Total for GMA 11		**Sparta**	**3,259**	**3,259**	**3,259**	**3,259**	**3,259**	**3,259**	**3,259**

[7] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE 5. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE CARRIZO-WILCOX AQUIFER IN GROUNDWATER MANAGEMENT AREA 11. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

County	RWPA	River Basin	Aquifer	2020	2030	2040	2050	2060	2070	2080
Anderson	I	Neches	Carrizo-Wilcox	21,958	21,958	21,958	21,958	21,958	21,958	21,958
Anderson	I	Trinity	Carrizo-Wilcox	5,066	5,066	5,066	5,066	5,066	5,066	5,066
Angelina	I	Neches	Carrizo-Wilcox	27,611	27,611	27,611	27,611	27,611	27,611	27,611
Bowie	D	Sulphur	Carrizo-Wilcox	9,645	9,645	9,645	9,645	9,645	9,645	9,645
Camp	D	Cypress	Carrizo-Wilcox	3,862	3,862	3,862	3,862	3,862	3,862	3,862
Cass	D	Cypress	Carrizo-Wilcox	12,865	12,865	12,865	12,865	12,865	12,865	12,865
Cass	D	Sulphur	Carrizo-Wilcox	777	777	777	777	777	777	777
Cherokee	I	Neches	Carrizo-Wilcox	15,241	15,241	15,241	15,241	15,241	15,241	15,241
Franklin	D	Cypress	Carrizo-Wilcox	5,334	5,334	5,334	5,334	5,334	5,334	5,334
Franklin	D	Sulphur	Carrizo-Wilcox	398	398	398	398	398	398	398
Gregg	D	Cypress	Carrizo-Wilcox	726	726	726	726	726	726	726
Gregg	D	Sabine	Carrizo-Wilcox	5,346	5,346	5,346	5,346	5,346	5,346	5,346
Harrison	D	Cypress	Carrizo-Wilcox	4,636	4,636	4,636	4,636	4,636	4,636	4,636
Harrison	D	Sabine	Carrizo-Wilcox	4,460	4,460	4,460	4,460	4,460	4,460	4,460
Henderson	C	Trinity	Carrizo-Wilcox	3,226	3,226	3,226	3,226	3,226	3,226	3,226
Henderson	I	Neches	Carrizo-Wilcox	3,996	3,996	3,996	3,996	3,996	3,996	3,996
Hopkins	D	Cypress	Carrizo-Wilcox	309	309	309	309	309	309	309
Hopkins	D	Sabine	Carrizo-Wilcox	2,426	2,426	2,426	2,426	2,426	2,426	2,426
Hopkins	D	Sulphur	Carrizo-Wilcox	2,017	2,017	2,017	2,017	2,017	2,017	2,017
Houston	I	Neches	Carrizo-Wilcox	1,721	1,721	1,721	1,721	1,721	1,721	1,721
Houston	I	Trinity	Carrizo-Wilcox	634	634	634	634	634	634	634
Marion	D	Cypress	Carrizo-Wilcox	1,966	1,966	1,966	1,966	1,966	1,966	1,966
Morris	D	Cypress	Carrizo-Wilcox	2,156	2,156	2,156	2,156	2,156	2,156	2,156
Morris	D	Sulphur	Carrizo-Wilcox	415	415	415	415	415	415	415
Nacogdoches	I	Neches	Carrizo-Wilcox	20,859	20,859	20,859	20,859	20,859	20,859	20,859

		River								
Panola	I	Cypress	Carrizo-Wilcox	0[8]	0	0	0	0	0	0
Panola	I	Sabine	Carrizo-Wilcox	4,999	4,999	4,999	4,999	4,999	4,999	4,999
Rains	D	Sabine	Carrizo-Wilcox	1,411	1,411	1,411	1,411	1,411	1,411	1,411
Red River	D	Sulphur	Carrizo-Wilcox	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Rusk	I	Neches	Carrizo-Wilcox	7,111	7,111	7,111	7,111	7,111	7,111	7,111
Rusk	I	Sabine	Carrizo-Wilcox	6,907	6,907	6,907	6,907	6,907	6,907	6,907
Sabine	I	Neches	Carrizo-Wilcox	356	356	356	356	356	356	356
Sabine	I	Sabine	Carrizo-Wilcox	1,032	1,032	1,032	1,032	1,032	1,032	1,032
San Augustine	I	Neches	Carrizo-Wilcox	303	303	303	303	303	303	303
San Augustine	I	Sabine	Carrizo-Wilcox	284	284	284	284	284	284	284
Shelby	I	Neches	Carrizo-Wilcox	2,621	2,621	2,621	2,621	2,621	2,621	2,621
Shelby	I	Sabine	Carrizo-Wilcox	3,698	3,698	3,698	3,698	3,698	3,698	3,698
Smith	D	Sabine	Carrizo-Wilcox	7,939	7,939	7,939	7,939	7,939	7,939	7,939
Smith	I	Neches	Carrizo-Wilcox	17,607	17,607	17,607	17,607	17,607	17,607	17,607
Titus	D	Cypress	Carrizo-Wilcox	5,594	5,594	5,594	5,594	5,594	5,594	5,594
Titus	D	Sulphur	Carrizo-Wilcox	1,942	1,942	1,942	1,942	1,942	1,942	1,942
Trinity	H	Trinity	Carrizo-Wilcox	1	1	1	1	1	1	1
Trinity	I	Neches	Carrizo-Wilcox	266	266	266	266	266	266	266
Upshur	D	Cypress	Carrizo-Wilcox	5,107	5,107	5,107	5,107	5,107	5,107	5,107
Upshur	D	Sabine	Carrizo-Wilcox	1,550	1,550	1,550	1,550	1,550	1,550	1,550
Van Zandt	D	Neches	Carrizo-Wilcox	2,616	2,616	2,616	2,616	2,616	2,616	2,616
Van Zandt	D	Sabine	Carrizo-Wilcox	3,286	3,286	3,286	3,286	3,286	3,286	3,286
Van Zandt	D	Trinity	Carrizo-Wilcox	1,030	1,030	1,030	1,030	1,030	1,030	1,030
Wood	D	Cypress	Carrizo-Wilcox	925	925	925	925	925	925	925
Wood	D	Sabine	Carrizo-Wilcox	16,977	16,977	16,977	16,977	16,977	16,977	16,977
GMA 11 Total			**Carrizo-Wilcox**	251,217	251,217	251,217	251,216	251,216	251,216	251,215

[8] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE 6. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE QUEEN CITY AQUIFER IN GROUNDWATER MANAGEMENT AREA 11. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

County	RWPA	River Basin	Aquifer	2020	2030	2040	2050	2060	2070	2080
Anderson	I	Neches	Queen City	11,489	11,489	11,489	11,488	11,488	11,488	11,488
Anderson	I	Trinity	Queen City	5,102	5,102	5,102	5,102	5,102	5,102	5,102
Angelina	I	Neches	Queen City	1,095	1,095	1,095	1,095	1,095	1,095	1,095
Camp	D	Cypress	Queen City	1,594	1,594	1,594	1,594	1,594	1,594	1,594
Cass	D	Cypress	Queen City	15,855	15,855	15,855	15,855	15,855	15,855	15,855
Cass	D	Sulphur	Queen City	624	624	624	624	624	624	624
Cherokee	I	Neches	Queen City	8,812	8,812	8,812	8,812	8,812	8,812	8,812
Gregg	D	Cypress	Queen City	456	456	456	456	456	456	456
Gregg	D	Sabine	Queen City	2,056	2,056	2,056	2,056	2,056	2,056	2,055
Harrison	D	Cypress	Queen City	2,976	2,976	2,976	2,976	2,976	2,976	2,976
Harrison	D	Sabine	Queen City	561	561	561	561	561	561	561
Henderson	C	Trinity	Queen City	154	154	154	154	154	154	154
Henderson	I	Neches	Queen City	10,516	10,516	10,516	10,516	10,516	10,516	10,516
Houston	I	Neches	Queen City	2,080	2,080	2,080	2,080	2,080	2,080	2,080
Houston	I	Trinity	Queen City	216	216	216	216	216	216	216
Marion	D	Cypress	Queen City	7,389	7,389	7,389	7,389	7,389	7,389	7,389
Morris	D	Cypress	Queen City	3,278	3,278	3,278	3,278	3,278	3,278	3,278
Nacogdoches	I	Neches	Queen City	2,946	2,946	2,946	2,946	2,946	2,946	2,946
Rusk	I	Neches	Queen City	39	39	39	39	39	39	39
Rusk	I	Sabine	Queen City	20	20	20	20	20	20	20
Sabine	I	Neches	Queen City	0[9]	0	0	0	0	0	0
Sabine	I	Sabine	Queen City	0	0	0	0	0	0	0
San Augustine	I	Neches	Queen City	0	0	0	0	0	0	0
Shelby	I	Sabine	Queen City	0	0	0	0	0	0	0

[9] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

County	RWPA	River Basin	Aquifer	2020	2030	2040	2050	2060	2070	2080
Smith	D	Sabine	Queen City	12,457	12,457	12,457	12,457	12,457	12,457	12,457
Smith	I	Neches	Queen City	20,121	20,121	20,121	20,121	20,121	20,121	20,121
Titus	D	Cypress	Queen City	0[10]	0	0	0	0	0	0
Trinity	H	Trinity	Queen City	0	0	0	0	0	0	0
Trinity	I	Neches	Queen City	0	0	0	0	0	0	0
Upshur	D	Cypress	Queen City	6,216	6,215	6,215	6,215	6,215	6,215	6,215
Upshur	D	Sabine	Queen City	5,949	5,949	5,949	5,949	5,949	5,949	5,949
Van Zandt	D	Neches	Queen City	2,343	2,343	2,343	2,343	2,343	2,343	2,343
Wood	D	Cypress	Queen City	779	779	779	779	779	779	779
Wood	D	Sabine	Queen City	5,731	5,731	5,731	5,731	5,731	5,731	5,731
GMA 11 Total			**Queen City**	**130,854**	**130,854**	**130,853**	**130,853**	**130,853**	**130,852**	**130,852**

[10] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

TABLE 7. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE SPARTA AQUIFER IN GROUNDWATER MANAGEMENT AREA 11. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

County	RWPA	River Basin	Aquifer	2020	2030	2040	2050	2060	2070	2080
Anderson	I	Neches	Sparta Aquifer	109	109	109	109	109	109	109
Anderson	I	Trinity	Sparta Aquifer	198	198	198	198	198	198	198
Angelina	I	Neches	Sparta Aquifer	390	390	390	390	390	390	390
Cass	D	Cypress	Sparta Aquifer	0[11]	0	0	0	0	0	0
Cherokee	I	Neches	Sparta Aquifer	352	352	352	352	352	352	352
Houston	I	Neches	Sparta Aquifer	505	505	505	505	505	505	505
Houston	I	Trinity	Sparta Aquifer	977	977	977	977	977	977	977
Marion	D	Cypress	Sparta Aquifer	0	0	0	0	0	0	0
Nacogdoches	I	Neches	Sparta Aquifer	362	362	362	362	362	362	362
Rusk	I	Neches	Sparta Aquifer	0	0	0	0	0	0	0
Sabine	I	Neches	Sparta Aquifer	36	36	36	36	36	36	36
Sabine	I	Sabine	Sparta Aquifer	13	13	13	13	13	13	13
San Augustine	I	Neches	Sparta Aquifer	163	163	163	163	163	163	163
San Augustine	I	Sabine	Sparta Aquifer	3	3	3	3	3	3	3
Shelby	I	Sabine	Sparta Aquifer	0	0	0	0	0	0	0
Smith	D	Sabine	Sparta Aquifer	0	0	0	0	0	0	0
Smith	I	Neches	Sparta Aquifer	0	0	0	0	0	0	0
Trinity	H	Trinity	Sparta Aquifer	0	0	0	0	0	0	0
Trinity	I	Neches	Sparta Aquifer	152	152	152	152	152	152	152
Upshur	D	Sabine	Sparta Aquifer	0	0	0	0	0	0	0
Wood	D	Sabine	Sparta Aquifer	0	0	0	0	0	0	0
GMA 11 Total			**Sparta Aquifer**	**3,259**	**3,259**	**3,259**	**3,259**	**3,259**	**3,259**	**3,259**

[11] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

LIMITATIONS:

The groundwater model used in completing this analysis is the best available scientific tool that can be used to meet the stated objectives. To the extent that this analysis will be used for planning purposes and/or regulatory purposes related to pumping in the past and into the future, it is important to recognize the assumptions and limitations associated with the use of the results. In reviewing the use of models in environmental regulatory decision making, the National Research Council (2007) noted:

> "Models will always be constrained by computational limitations, assumptions, and knowledge gaps. They can best be viewed as tools to help inform decisions rather than as machines to generate truth or make decisions. Scientific advances will never make it possible to build a perfect model that accounts for every aspect of reality or to prove that a given model is correct in all respects for a particular regulatory application. These characteristics make evaluation of a regulatory model more complex than solely a comparison of measurement data with model results."

A key aspect of using the groundwater model to evaluate historic groundwater flow conditions includes the assumptions about the location in the aquifer where historic pumping was placed. Understanding the amount and location of historic pumping is as important as evaluating the volume of groundwater flow into and out of the district, between aquifers within the district (as applicable), interactions with surface water (as applicable), recharge to the aquifer system (as applicable), and other metrics that describe the impacts of that pumping. In addition, assumptions regarding precipitation, recharge, and streamflow are specific to a particular historic time period.

Because the application of the groundwater model was designed to address regional scale questions, the results are most effective on a regional scale. The TWDB makes no warranties or representations relating to the actual conditions of any aquifer at a particular location or at a particular time.

It is important for groundwater conservation districts to monitor groundwater pumping and groundwater levels in the aquifer. Because of the limitations of the groundwater model and the assumptions in this analysis, it is important that the groundwater conservation districts work with the TWDB to refine this analysis in the future given the reality of how the aquifer responds to the actual amount and location of pumping now and in the future. Historic precipitation patterns also need to be placed in context as future climatic conditions, such as dry and wet year precipitation patterns, may differ and affect groundwater flow conditions.

REFERENCES:

Hutchison, W.R., 2021, GMA 11 Technical Memorandum 21-01, Adjusted Pumping Simulations for Joint Planning with Updated Groundwater Availability Model for the Sparta, Queen City, and Carrizo-Wilcox Aquifers, 31p.

Langevin, C.D., Hughes, J.D., Banta, E.R., Niswonger, R.G., Panday, Sorab, and Provost, A.M., 2017, Documentation for the MODFLOW 6 Groundwater Flow (GWF) Model: U.S. Geological Survey Techniques and Methods, book 6, chap. A55, 197 p., accessed August 4, 2017, at https://doi.org/10.3133/tm6A55

National Research Council, 2007, Models in Environmental Regulatory Decision Making Committee on Models in the Regulatory Decision Process, National Academies Press, Washington D.C., 287 p., http://www.nap.edu/catalog.php?record_id=11972.

Panday, S., Rumbaugh, J., Hutchison, W.R., and Schorr, S., 2020, Numerical Model Report: Groundwater Availability Model for the Northern Portion of the Queen City, Sparta, and Carrizo-Wilcox Aquifers. Final Report prepared for Texas Water Development Board, Contact Number #1648302063, 198p.

Texas Water Code, 2011, http://www.statutes.legis.state.tx.us/docs/WA/pdf/WA.36.pdf.

U.S. Geological Survey, 2021, Zonebudget for MODFLOW 6, U.S. Geological Survey Groundwater Software.

APPENDIX F

ESTIMATED HISTORICAL WATER USE & 2022 STATE WATER PLAN DATASETS

Estimated Historical Groundwater Use And 2022 State Water Plan Datasets:

Rusk County Groundwater Conservation District

Texas Water Development Board
Groundwater Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
January 27, 2023

GROUNDWATER MANAGEMENT PLAN DATA:

This package of water data reports (part 1 of a 2-part package of information) is being provided to groundwater conservation districts to help them meet the requirements for approval of their five-year groundwater management plan. Each report in the package addresses a specific numbered requirement in the Texas Water Development Board's groundwater management plan checklist. The checklist can be viewed and downloaded from this web address:

http://www.twdb.texas.gov/groundwater/docs/GCD/GMPChecklist0113.pdf

The five reports included in this part are:

1. Estimated Historical Groundwater Use (checklist item 2)

   from the TWDB Historical Water Use Survey (WUS)

2. Projected Surface Water Supplies (checklist item 6)
3. Projected Water Demands (checklist item 7)
4. Projected Water Supply Needs (checklist item 8)
5. Projected Water Management Strategies (checklist item 9)

   from the 2022 Texas State Water Plan (SWP)

Part 2 of the 2-part package is the groundwater availability model (GAM) report for the District (checklist items 3 through 5). The District should have received, or will receive, this report from the Groundwater Availability Modeling Section. Questions about the GAM can be directed to Grayson Dowlearn, grayson.dowlearn@twdb.texas.gov, (512) 475-1552.

DISCLAIMER:

The data presented in this report represents the most up to date WUS and 2022 SWP data available as of 1/27/2023. Although it does not happen frequently, either of these datasets are subject to change pending the availability of more accurate WUS data or an amendment to the 2022 SWP. District personnel must review these datasets and correct any discrepancies to ensure approval of their groundwater management plan.

The WUS dataset can be verified at this web address:

http://www.twdb.texas.gov/waterplanning/waterusesurvey/estimates/

The 2022 SWP dataset can be verified by contacting Sabrina Anderson (sabrina.anderson@twdb.texas.gov or 512-936-0886).

The values presented in the data tables of this report are county-based. In cases where groundwater conservation districts cover only a portion of one or more counties the data values are modified with an apportioning multiplier to create new values that more accurately represent conditions within district boundaries. The multiplier used in the following formula is a land area ratio: (data value * (land area of district in county / land area of county)). For two of the four SWP tables (Projected Surface Water Supplies and Projected Water Demands) only the county-wide water user group (WUG) data values (county other, manufacturing, steam electric power, irrigation, mining and livestock) are modified using the multiplier. WUG values for municipalities, water supply corporations, and utility districts are not apportioned; instead, their full values are retained when they are located within the district and eliminated when they are located outside (we ask each district to identify these entity locations).

The remaining SWP tables (Projected Water Supply Needs and Projected Water Management Strategies) are not modified because district-specific values are not statutorily required. Each district needs only “consider” the county values in these tables.

In the WUS table every category of water use (including municipal) is apportioned. Staff determined that breaking down the annual municipal values into individual WUGs was too complex.

TWDB recognizes that the apportioning formula used is not ideal but it is the best available process with respect to time and staffing constraints. If a district believes it has data that is more accurate it can add those data to the plan with an explanation of how the data were derived. Apportioning percentages that the TWDB used are listed above each applicable table.

For additional questions regarding this data, please contact Stephen Allen (stephen.allen@twdb.texas.gov or 512-463-7317).

Estimated Historical Water Use
TWDB Historical Water Use Survey (WUS) Data

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2020. TWDB staff anticipates the calculation and posting of these estimates at a later date.

RUSK COUNTY *100% (multiplier)* All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2019	GW	6,231	12	202	17	206	241	6,909
	SW	1,271	0	62	16,369	0	966	18,668
2018	GW	6,947	15	464	22	173	238	7,859
	SW	1,317	1	168	19,384	0	955	21,825
2017	GW	6,720	15	444	52	200	234	7,665
	SW	910	0	168	19,325	0	936	21,339
2016	GW	6,910	12	1,804	16	148	260	9,150
	SW	924	0	313	16,294	0	1,038	18,569
2015	GW	7,318	13	1,993	33	139	248	9,744
	SW	1,182	1	540	13,828	0	995	16,546
2014	GW	6,217	17	454	49	166	325	7,228
	SW	643	1	415	17,130	0	1,302	19,491
2013	GW	7,405	13	577	0	358	321	8,674
	SW	1,248	0	640	28,292	0	1,288	31,468
2012	GW	7,885	15	277	2,377	123	308	10,985
	SW	1,399	0	544	38,434	150	1,232	41,759
2011	GW	8,954	26	262	1,023	308	351	10,924
	SW	1,688	1	788	32,947	0	1,405	36,829
2010	GW	7,517	31	1,058	358	0	353	9,317
	SW	1,525	1	1,258	21,129	0	1,415	25,328
2009	GW	6,719	219	1,059	183	0	194	8,374
	SW	1,639	386	655	21,535	0	776	24,991
2008	GW	7,071	177	1,233	147	29	209	8,866
	SW	1,705	1	763	25,771	0	838	29,078
2007	GW	6,778	172	0	356	25	216	7,547
	SW	1,675	9	0	24,366	0	866	26,916
2006	GW	6,973	293	0	287	100	202	7,855
	SW	1,379	55	0	24,872	0	806	27,112
2005	GW	6,751	233	3	0	92	231	7,310
	SW	1,231	407	0	17,008	0	924	19,570
2004	GW	7,180	192	6	113	92	221	7,804
	SW	464	24	0	6,982	0	872	8,342

Projected Surface Water Supplies
TWDB 2022 State Water Plan Data

RUSK COUNTY *100% (multiplier)* All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
I	Cross Roads SUD	Sabine	Fork Lake/Reservoir	248	273	288	310	337	366
I	Elderville WSC	Sabine	Cherokee Lake/Reservoir	95	96	96	96	95	111
I	Elderville WSC	Sabine	Fork Lake/Reservoir	97	97	97	97	97	96
I	Henderson	Neches	Fork Lake/Reservoir	1,277	3,470	3,470	3,470	3,470	3,470
I	Henderson	Sabine	Fork Lake/Reservoir	222	603	603	603	603	603
I	Henderson	Sabine	Sabine Run-of-River	10	10	10	10	10	10
I	Irrigation, Rusk	Neches	Neches Run-of-River	80	80	80	80	80	80
I	Irrigation, Rusk	Sabine	Sabine Run-of-River	127	127	127	127	127	127
I	Kilgore	Sabine	Fork Lake/Reservoir	434	783	848	924	1,008	1,095
I	Livestock, Rusk	Neches	Neches Livestock Local Supply	452	452	452	452	452	452
I	Livestock, Rusk	Neches	Sabine Livestock Local Supply	172	172	172	172	172	172
I	Livestock, Rusk	Sabine	Neches Livestock Local Supply	356	356	356	356	356	356
I	Livestock, Rusk	Sabine	Sabine Livestock Local Supply	136	136	136	136	136	136
I	Manufacturing, Rusk	Neches	Neches Run-of-River	1	1	1	1	1	1
I	Manufacturing, Rusk	Sabine	Fork Lake/Reservoir	1	1	1	1	1	1
I	Mining, Rusk	Neches	Sabine Other Local Supply	640	640	640	640	640	640
I	Mining, Rusk	Sabine	Sabine Other Local Supply	590	590	590	590	590	590
I	Southern Utilities	Sabine	Palestine Lake/Reservoir	1	2	2	2	2	2
I	Southern Utilities	Sabine	Tyler Lake/Reservoir	2	2	2	2	2	2
I	Steam-Electric Power, Rusk	Neches	Martin Lake/Reservoir	2,479	2,479	2,479	2,479	2,479	2,479
I	Steam-Electric Power, Rusk	Neches	Toledo Bend Lake/Reservoir	1,777	1,777	1,777	1,777	1,777	1,777
I	Steam-Electric Power, Rusk	Sabine	Martin Lake/Reservoir	22,521	22,521	22,521	22,521	22,521	22,521
I	Steam-Electric Power, Rusk	Sabine	Toledo Bend Lake/Reservoir	16,145	16,145	16,145	16,145	16,145	16,145
	Sum of Projected Surface Water Supplies (acre-feet)			**47,863**	**50,813**	**50,893**	**50,991**	**51,101**	**51,232**

Projected Water Demands
TWDB 2022 State Water Plan Data

Please note that the demand numbers presented here include the plumbing code savings found in the Regional and State Water Plans.

RUSK COUNTY *100% (multiplier)* All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
I	Chalk Hill SUD	Sabine	332	352	375	404	440	478
I	County-Other, Rusk	Neches	533	568	605	654	711	771
I	County-Other, Rusk	Sabine	509	543	577	624	679	736
I	Cross Roads SUD	Sabine	259	273	288	310	337	366
I	Crystal Farms WSC	Sabine	104	111	118	127	139	151
I	Ebenezer WSC	Neches	130	141	152	165	180	196
I	Elderville WSC	Sabine	128	141	155	170	188	207
I	Gaston WSC	Neches	192	205	220	238	259	282
I	Goodsprings WSC	Neches	260	275	292	315	343	372
I	Henderson	Neches	3,187	3,491	3,795	4,140	4,516	4,911
I	Henderson	Sabine	554	607	659	719	785	853
I	Irrigation, Rusk	Neches	155	155	155	155	155	155
I	Irrigation, Rusk	Sabine	121	121	121	121	121	121
I	Jacobs WSC	Neches	10	11	11	12	13	15
I	Jacobs WSC	Sabine	273	292	314	340	370	402
I	Kilgore	Sabine	717	783	848	924	1,008	1,095
I	Livestock, Rusk	Neches	928	941	959	976	994	994
I	Livestock, Rusk	Sabine	732	742	755	769	783	783
I	Manufacturing, Rusk	Neches	30	32	32	32	32	32
I	Manufacturing, Rusk	Sabine	2	2	2	2	2	2
I	Minden Brachfield WSC	Neches	69	77	85	93	101	110
I	Minden Brachfield WSC	Sabine	31	34	38	42	46	50
I	Mining, Rusk	Neches	1,555	2,084	2,013	1,937	1,873	1,868
I	Mining, Rusk	Sabine	1,435	1,923	1,857	1,787	1,728	1,724
I	Mt Enterprise WSC	Neches	305	330	356	387	422	459
I	New London	Neches	482	529	576	629	687	747
I	New London	Sabine	388	426	464	507	553	601
I	New Prospect WSC	Sabine	91	96	101	109	118	129
I	Overton	Neches	60	65	71	77	84	91
I	Overton	Sabine	494	539	583	636	693	754
I	South Rusk County WSC	Neches	188	200	213	230	250	272
I	Southern Utilities	Sabine	72	75	80	85	92	100
I	Steam-Electric Power, Rusk	Neches	4,493	4,493	4,493	4,493	4,493	4,493
I	Steam-Electric Power, Rusk	Sabine	40,811	40,811	40,811	40,811	40,811	40,811
I	Tatum	Sabine	234	254	275	300	327	355

I	West Gregg SUD	Sabine	16	17	18	20	22	23
I	Wright City WSC	Neches	57	61	66	71	78	84
	Sum of Projected Water Demands (acre-feet)		**59,937**	**61,800**	**62,533**	**63,411**	**64,433**	**65,593**

Projected Water Supply Needs
TWDB 2022 State Water Plan Data

Negative values (in red) reflect a projected water supply need, positive values a surplus.

RUSK COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
I	Chalk Hill SUD	Sabine	0	0	0	0	0	0
I	County-Other, Rusk	Neches	28	28	26	25	24	6
I	County-Other, Rusk	Sabine	97	98	99	100	101	103
I	Cross Roads SUD	Sabine	386	398	399	399	398	397
I	Crystal Farms WSC	Sabine	0	0	0	0	0	0
I	Ebenezer WSC	Neches	0	0	0	0	0	0
I	Elderville WSC	Sabine	64	52	38	23	4	0
I	Gaston WSC	Neches	0	0	0	0	0	0
I	Goodsprings WSC	Neches	0	0	0	0	0	0
I	Henderson	Neches	556	2,445	2,141	1,796	1,420	1,025
I	Henderson	Sabine	78	406	354	294	228	160
I	Irrigation, Rusk	Neches	140	140	140	140	140	140
I	Irrigation, Rusk	Sabine	176	176	176	176	176	176
I	Jacobs WSC	Neches	0	0	0	0	0	-1
I	Jacobs WSC	Sabine	0	0	0	0	0	-21
I	Kilgore	Sabine	68	356	356	355	352	347
I	Livestock, Rusk	Neches	0	0	-12	-29	-47	-47
I	Livestock, Rusk	Sabine	0	0	-8	-22	-36	-36
I	Manufacturing, Rusk	Neches	304	326	346	364	391	419
I	Manufacturing, Rusk	Sabine	12	13	14	14	15	17
I	Minden Brachfield WSC	Neches	1	1	1	1	1	0
I	Minden Brachfield WSC	Sabine	1	0	0	0	0	0
I	Mining, Rusk	Neches	370	-159	-88	-12	52	57
I	Mining, Rusk	Sabine	342	-146	-80	-10	49	53
I	Mt Enterprise WSC	Neches	1	0	0	1	0	1
I	New London	Neches	0	1	0	1	1	1
I	New London	Sabine	0	0	0	1	1	1
I	New Prospect WSC	Sabine	1	0	1	1	0	1
I	Overton	Neches	-7	-12	-18	-24	-31	-38
I	Overton	Sabine	-59	-110	-159	-217	-279	-346
I	South Rusk County WSC	Neches	0	0	0	0	0	0
I	Southern Utilities	Sabine	3	4	4	4	5	5
I	Steam-Electric Power, Rusk	Neches	-110	-110	-110	-110	-110	-110
I	Steam-Electric Power, Rusk	Sabine	-993	-993	-993	-993	-993	-993
I	Tatum	Sabine	124	94	67	36	9	12

I	West Gregg SUD	Sabine	6	5	4	2	0	0
I	Wright City WSC	Neches	0	0	0	0	0	-21
	Sum of Projected Water Supply Needs (acre-feet)		**-1,169**	**-1,530**	**-1,468**	**-1,417**	**-1,496**	**-1,613**

Projected Water Management Strategies
TWDB 2022 State Water Plan Data

RUSK COUNTY

WUG, Basin (RWPG)

All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
Henderson, Neches (I)							
ANCD-VOL-Volumetric Survey and Normal Pool Elevation Adjustment	Striker Lake/Reservoir [Reservoir]	0	0	4,771	4,770	4,771	4,771
WUG-CONS-Municipal Conservation-Henderson	DEMAND REDUCTION [Rusk]	71	126	153	200	241	285
		71	**126**	**4,924**	**4,970**	**5,012**	**5,056**
Henderson, Sabine (I)							
ANCD-VOL-Volumetric Survey and Normal Pool Elevation Adjustment	Striker Lake/Reservoir [Reservoir]	0	0	829	830	829	829
WUG-CONS-Municipal Conservation-Henderson	DEMAND REDUCTION [Rusk]	12	22	26	35	42	49
		12	**22**	**855**	**865**	**871**	**878**
Jacobs WSC, Neches (I)							
RUSK-JAW-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Rusk]	0	0	0	0	0	1
		0	**0**	**0**	**0**	**0**	**1**
Jacobs WSC, Sabine (I)							
RUSK-JAW-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Rusk]	0	0	0	0	0	21
		0	**0**	**0**	**0**	**0**	**21**
Kilgore, Sabine (I)							
Kilgore - Municipal Conservation	DEMAND REDUCTION [Rusk]	10	19	21	25	28	32
		10	**19**	**21**	**25**	**28**	**32**
Livestock, Rusk, Neches (I)							
RUSK-LTK-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Rusk]	0	0	12	29	47	47
		0	**0**	**12**	**29**	**47**	**47**
Livestock, Rusk, Sabine (I)							
RUSK-LTK-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Rusk]	0	0	8	22	36	36
		0	**0**	**8**	**22**	**36**	**36**
Mining, Rusk, Neches (I)							
ANRA-Run-of-River (Submitted Application)	Neches Run-of-River [Rusk]	0	159	88	12	0	0
		0	**159**	**88**	**12**	**0**	**0**
Mining, Rusk, Sabine (I)							
ANRA-Run-of-River (Submitted Application)	Neches Run-of-River [Rusk]	0	146	80	10	0	0

		0	146	80	10	0	0
Mt Enterprise WSC, Neches (I)							
Mt Enterprise WSC - Municipal Conservation	DEMAND REDUCTION [Rusk]	4	8	0	0	0	0
		4	**8**	**0**	**0**	**0**	**0**
New London, Neches (I)							
ANRA-COL - Lake Columbia	Columbia Lake/Reservoir [Reservoir]	0	472	474	474	473	95
New London - Municipal Conservation	DEMAND REDUCTION [Rusk]	7	12	14	17	20	22
		7	**484**	**488**	**491**	**493**	**117**
New London, Sabine (I)							
ANRA-COL - Lake Columbia	Columbia Lake/Reservoir [Reservoir]	0	383	381	381	382	77
New London - Municipal Conservation	DEMAND REDUCTION [Rusk]	6	10	12	13	16	18
		6	**393**	**393**	**394**	**398**	**95**
Overton, Neches (I)							
Overton - Municipal Conservation	DEMAND REDUCTION [Rusk]	1	2	2	2	2	3
SMTH-OVN-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Rusk]	0	12	18	24	31	38
		1	**14**	**20**	**26**	**33**	**41**
Overton, Sabine (I)							
Overton - Municipal Conservation	DEMAND REDUCTION [Rusk]	7	13	15	17	20	23
SMTH-OVN-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Rusk]	0	110	159	217	279	346
		7	**123**	**174**	**234**	**299**	**369**
Southern Utilities, Sabine (I)							
WUG-CONS-Municipal Conservation-Southern Utilities	DEMAND REDUCTION [Rusk]	5	9	11	14	17	21
		5	**9**	**11**	**14**	**17**	**21**
Steam-Electric Power, Rusk, Neches (I)							
RUSK-SEP-Purchase From Sabine River Authority (Toledo Bend)	Sabine Run-of-River [Newton]	0	110	110	110	110	110
		0	**110**	**110**	**110**	**110**	**110**
Steam-Electric Power, Rusk, Sabine (I)							
RUSK-SEP-Purchase From Sabine River Authority (Toledo Bend)	Sabine Run-of-River [Newton]	0	993	993	993	993	993
		0	**993**	**993**	**993**	**993**	**993**
Tatum, Sabine (I)							
Tatum - Municipal Conservation	DEMAND REDUCTION [Rusk]	3	6	7	8	9	11
		3	**6**	**7**	**8**	**9**	**11**
Wright City WSC, Neches (I)							
CHER-WCW-New Wells in Carrizo-Wilcox Aquifer	Carrizo-Wilcox Aquifer [Cherokee]	0	0	0	0	0	22
		0	**0**	**0**	**0**	**0**	**22**
Sum of Projected Water Management Strategies (acre-feet)		**126**	**2,612**	**8,184**	**8,203**	**8,346**	**7,850**