Pineywoods Groundwater Conservation District

Management Plan

Approved February 25, 2004
Amended December 11, 2008
Amended November 8, 2012
Revised and Approved October 10, 2013
Revised and Approved August 23, 2018

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PINEYWOODS GROUNDWATER CONSERVATION DISTRICT
MISSION STATEMENT

The Pineywoods Groundwater Conservation District (District) will strive for the conservation, preservation, and prevention of the waste of groundwater reservoirs over which the District has jurisdiction. The District will implement water conservation and management strategies to prevent the extreme decline of water levels for the benefit of all water users, water rights owners, the economy, or citizens, and the environment of the territory inside the District.

TIME PERIOD FOR THIS PLAN

This District Management Plan became effective February 25, 2004, following adoption by the District Board of Directors and approval by the Texas Water Development Board (TWDB) affirming the plan as administratively complete. It was re-adopted by Board Resolution on December 11, 2008 and again on November 8, 2012 and October 10, 2013. This revised and amended plan adopted on August 23, 2018, will remain in effect for a period of five (5) years as a minimum planning period, or until a revised or amended plan may be approved, whichever comes first.

STATEMENT OF GUIDING PRINCIPLES

The District recognizes that the groundwater resources of the region are of vital importance to the continued vitality of the citizens, economy, and environment within the District. The preservation of the groundwater resources can be managed and protected in the most prudent and cost-effective manner through the local regulation of production as effected by the District's well permitting and well spacing rules. This management plan is intended as a tool to direct the efforts of those individuals charged with the responsibility for the managing and execution of District activities.

GENERAL DESCRIPTION

In 2001 the Texas Legislature passed House Bill 2572, which authorized the creation of the Pineywoods Groundwater Conservation District (referred to as the "District") as a governmental agency to regulate groundwater in order to protect it from overuse and wasteful use. This was approved by the voters in a general election on November 2001. The District includes all of Angelina and Nacogdoches Counties.

The District is currently governed by a seven-member appointed Board of Directors, each serving overlapping three-year terms. The members are appointed by the county commissioners of Angelina and Nacogdoches Counties and by the city commissioners of the City of Lufkin and the City of Nacogdoches.

The District is prohibited by legislation from levying taxes. It also may not exercise the power of eminent domain. It also may not issue or sell bonds in the name of the District.

It is the goal of the District that its activities be consistent with sound business practices; that the interest of the public shall always be considered in conducting District business; that impropriety or the appearance of impropriety shall be avoided to ensure and maintain public confidence in the District; and that the Board and staff shall control and manage the affairs of the District lawfully, fairly, impartially, and in accordance with the stated purposes of the District.

The District employs a General Manager to manage the administrative affairs of the District and provides for additional staff as needed to assist in those duties. The General Manager is responsible for ensuring that the rules, regulations, policies, and procedures adopted by the Board are followed. The General Manager is held responsible by the Board and is required to provide timely reports about the administrative affairs of the District.

GROUNDWATER RESOURCES

The Desired Future Conditions for the aquifers located with the District boundaries and within Groundwater Management Area 11 (GMA-11) were established in accordance with Chapter 36.108 of the Texas Water Code at a meeting of the GMA-11 representatives on January 11, 2017.

The Carrizo-Wilcox aquifer is the primary source of groundwater within the District. The Queen City and Sparta are other minor aquifers with pumping for use within the District. Groundwater in the aquifers is under water table of unconfined conditions and the depth of the aquifer sands are highly variable within the District. Groundwater represents 87% of the water source within the District with surface water being the major remaining source. The estimated water pumping by aquifer was 75% from Carrizo-Wilcox; 20% from Queen City; 4% from Sparta; the balance from undifferentiated aquifers. Maps of the District and the aquifers are shown for reference in **Appendix A.5.**

A. THE AMOUNT OF WATER BEING USED WITHIN THE DISTRICT ON AN ANNUAL BASIS

The charts in **Appendix A.1** represent the annual water usage within the District from 2001 to 2016 and include both groundwater (GW) and surface water (SW) use. They show a total annual usage of 41,017 acre feet including 19,361 acre feet of groundwater and 21,656 acre feet of surface water in 2016.

B. PROJECTED TOTAL WATER DEMANDS

The tables in **Appendix A.1** show the projected water demand for Angelina and Nacogdoches Counties through the year 2070. This is the combined surface water and groundwater use for the District. The projections are from the 2017 State Water Plan and include agriculture, municipal and industrial use.

C. PROJECTED SURFACE WATER SUPPLIES

The charts in **Appendix A.1** show the surface water supplies for the District for 2020 and the projected surface water supplies through the year 2070. All data is from the 2017 State Water Plan.

The percentage of surface water supply not in the District is not material to the presentation of data as a whole because there is no major surface water supply in the area not in the District.

D. GROUNDWATER AVAILABILITY

Carrizo-Wilcox Aquifer

The Wilcox group and the overlaying Carrizo Formation of the Claiborne Group form a hydrologically connected system known as the Carrizo-Wilcox Aquifer. This aquifer extends from the Rio Grande in South Texas northeastward into Arkansas and Louisiana, providing all or part of the water in 60 counties in Texas. Municipal and irrigation pumpage account for about 35 and 51 percent, respectively, of pumping from the Carrizo-Wilcox Aquifer.

Queen City Aquifer

The Queen City Aquifer extends across Texas from the Frio River in South Texas northeastward into Louisiana. The aquifer provides water for domestic and livestock purposes throughout most of its extent and significant amounts for municipal and industrial supplies in Northeast Texas. The water may be acidic in much of Northeast Texas and relatively high in iron concentrations in some locations.

Sparta Aquifer

The Sparta aquifer extends in a narrow band from the Frio River in South Texas northeastward to the Louisiana border in Sabine County. The aquifer provides water for domestic and livestock purposes throughout most of its extent and water for municipal, industrial, and irrigation in much of the region. Water may contain iron concentrations in excess of drinking water standards.

Yegua-Jackson Aquifer

The Yegua-Jackson aquifer extends in a narrow band from the Rio Grande and Mexico across the State to the Sabine River and Louisiana. Although the occurrence, quality, and quantity of water from the aquifer are erratic, domestic and livestock supplies are available from shallow wells over most of its extent. Local water for municipal, industrial, and irrigation purposes is available. Yields of most wells are small, less than 50 gallons per minute, but in some areas, yields of adequately constructed

wells may range to more than 500 gallons per minute. The Yegua-Jackson aquifer consists of complex associations of sand, silt, and clay deposited during the Tertiary Period. Net freshwater sands are generally less than 200 feet deep at any location within the aquifer. Water quality varies greatly within the aquifer, and shallow occurrences of poor quality water are not uncommon. In general, however, small to moderate amounts of usable quality water can be found within shallow sands (less than 300 feet deep) over much of the Yegua-Jackson aquifer.

The modeled available groundwater is the amount of groundwater production per year, on an average basis, that will achieve a desired future condition. Total estimated recoverable storage values may include a mixture of water quality types, including fresh, brackish, and saline groundwater.

E. PROJECTED WATER NEEDS WITHIN THE DISTRICT

The water need estimates in this plan have been extracted from the 2017 State Water Plan and other GAM runs based on existing data. With normal rainfall and the advent of expected conservation practices, total water needs within the District projected to be used within the District on an annual basis from 2020 to 2070 in acre feet is shown in **Appendix A.1**.

F. PROJECTED WATER MANAGEMENT STRATEGIES

The projected water management strategies from the 2017 State Water Plan to supply the needs of the District are presented in **Appendix A.1**. These include strategies to develop and adopt methods to meet future needs in the District.

G. ANNUAL WATER BUDGET VALUES

A groundwater budget summarizes the water entering and leaving the aquifer according to a groundwater availability model. Selected components were extracted from the groundwater budget for the aquifers located within the District and were averaged over the duration of the calibrated portion of the model runs. The projected water into and out of the aquifers within the District is taken from Groundwater Availability Model Run 17-021 prepared by TWDB on December 21, 2017.

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability models for the Carrizo-Wilcox, Queen City, and Sparta aquifers were run for this analysis. The average annual water budget values for recharge, surface water outflow, inflow to the District, outflow from the District, net inter-aquifer flow (upper), and the net inter-aquifer flow (lower) for the portions of the aquifers located with the District are summarized in **Appendix A.3**.

H. MODELED AVAILABLE GROUNDWATER IN THE DISTRICT BASED ON THE DFC

As defined in Chapter 36 of the Texas Water Code, "modeled available groundwater" is the estimated amount of water that may be produced annually to achieve a Desired Future Condition (DFC).

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 conditions. 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. **Appendix A.4** shows the available groundwater based on the model run, GAM Run17-024 MAG on June 19, 2017.

MANAGEMENT OF GROUNDWATER SUPPLIES

The District will manage the supply of groundwater within the District in order to conserve the resource while seeking to maintain the economic viability of all resource user groups, public and private. In consideration of the economic and cultural activities occurring within the District, the District will identify and engage in such activities and practices that, if implemented, would result in a reduction of groundwater use. A monitor well observation network may be established and maintained in order to evaluate changing conditions of groundwater supplies (aquifer water table levels) within the District. The District will make a regular assessment of water supply and groundwater storage conditions and will report those conditions to the Board and to the public. The District will undertake as necessary, and cooperate with, investigations of the groundwater resources within the District and will make the results of investigations available to the public upon adoption by the Board.

The District will consider the water supply needs and water management strategies from Regional Water Planning Group I and other sources included in the adopted state water plan. This plan shows that the largest projected increases in water demand will be for steam-electric use and manufacturing, which are expected to require about half of the total water demand in 2070. The region as a whole appears to have enough water supplies to meet demands through 2070. In Regional Water Planning Group I, the major water supply project is the development of Lake Columbia in Cherokee County, and the District supports this effort.

The District will enforce the terms and conditions of permits and rules of the District. The District will adopt rules, and amend rules as necessary, to regulate groundwater withdrawals by means of well spacing, well permits, and production limits. The District may deny a well permit or limit groundwater withdrawals in accordance with the guidelines stated in the rules of the District and drought contingency plan. In making a determination to deny a permit or limit groundwater withdrawals, the District will consider the public benefit against individual hardship after considering all appropriate testimony.

In pursuit of the District's mission of protecting the groundwater resources, the District may require reduction of groundwater withdrawals to amounts which will not cause harm to the aquifer. To achieve this purpose, the District may, at the Board's discretion, amend or revoke any permits after notice and hearing. The determination to seek the amendment or revocation of a permit by the District will be based on aquifer conditions observed by the District. The District will enforce the terms

and conditions of permits and the rules of the District by enjoining the permit holder in a court of competent jurisdiction as provided for in Texas Water Code (TWC) 36.102.

The relevant factors to be considered in making a determination to deny a permit or limit groundwater withdrawals will include:

1) The proposed use of the water and effect of existing groundwater and surface water resources or existing permits under the rules and management plan of the District.
2) The beneficial use of the water resource to protect groundwater quality, avoid waste, and achieve water conservation.
3) The economic hardship resulting from grant or denial of a permit or the terms prescribed by the permit.
4) The application conforms to the requirements of the District and TWC Chapter 36 and is accompanied by the prescribed fees.
5) Other factors that may be specific to the application.

Drought Contingency Plan

During drought conditions within the District, all efforts will be made to see that all municipalities and public water supply companies follow their Drought Contingency Plans as they have been presented to the District. During severe drought conditions, the District staff will closely monitor the aquifer levels to ensure that adequate quantities of water are available to the District and coordinate with the Region I Water Planning Area.

The District will prevent any waste of groundwater by any public or private source by promoting the most efficient use of groundwater during drought conditions whether the conditions are mild, moderate or severe.

The District shall call for the most efficient use of groundwater by all users in the District to maintain sufficient groundwater aquifer resources during periods of drought and for future resources by preventing waste and by regulation of users, if necessary, to prevent depletion of the aquifers. The District will also work closely with groundwater users and provide assistance where it is possible to control customer usage as it is outlined in their Drought Contingency Plans.

Periodically, the District will review the Texas Palmer Drought Index and the Texas Drought Preparedness Report, and monitor production figures quarterly. A summary of any drought conditions will be given to the Board of Directors in the annual report along with any recommendations and make necessary changes, as needed.

Actions, Procedures, Performance, and Avoidance Necessary to Effectuate The Management Plan

The District will implement the provisions of this plan and will utilize the provisions of the plan as a guidepost for determining the direction of priority for District activities. Operations, agreements, and planning efforts of the District will be consistent with this plan. The District will seek the cooperation of all interested parties in the implementation of this plan. The plan is for a five-year planning period; however, the Board may review the plan annually or as desired and re-adopt the plan with or without revisions at least every five years.

District Rules

The District will enforce District rules requiring the permitting of all new non-exempt wells to prevent the waste of groundwater. District rules are available upon request from the District or may be viewed at the District's website at www.pgcd.org.

Regional Water Plan

Senate Bill 1 intended for water management to be a bottom up approach. Therefore, the regional planning groups must consider this locally approved PGCD Management Plan in the development of their regional water plan to meet the intent of Senate Bill 1 and Senate Bill 1763 and, consequently, result in a regional management plan which is consistent with this local management plan, resulting in the protection of the local control of groundwater management by the local citizens.

GOALS, MANAGEMENT OBJECTIVES, PERFORMANCE STANDARDS AND METHODOLOGY TO EVALUATE PROGRESS FOR IMPLEMENTATION OF THE DISTRICT MANAGEMENT PLAN AND FUTURE BOARD REVIEW

GOAL 1.0 – PROVIDING FOR THE MOST EFFICIENT USE OF GROUNDWATER WITHIN THE DISTRICT

It is the intent of the district to provide for the most efficient use of groundwater by regulating the drilling of wells within the District and by enforcing District rules.

--Management Objective

Each year the District will require the registration of all new wells drilled within the District's jurisdiction, and the District will require a permit for drilling all non-exempt wells.

Performance Standard

At all regularly scheduled Board meetings, the General Manager reports to the Board of Directors on the number of new wells registered with the District and the number of permit applications received and approved for new wells within the District.

--Management Objective

Each year the District will provide informative speakers to schools, civic groups, social clubs, and other organizations for presentations to inform a minimum of 50 citizens on the activities and programs, the geology and hydrology of groundwater, and the principles of water conservation relating to the best management practices for the efficient use of groundwater.

Performance Standard

Report the number of citizens in attendance annually at District presentations concerning the principles of water conservation relating to the best practices for the efficient use of groundwater.

--Management Objective

Each year, on four or more occasions, the District will disseminate educational information relating to the conservation practices for the efficient use of water resources.

Performance Standard

Report the number of occasions annually that the District disseminated educational information relating to the conservation practices for the efficient use of water resources.

Methodology

Annually, the District will prepare and present a report to the Board on presentations in regards to achieving Goal 1. The report will include the number of instances each activity was engaged in during the year. The report will be maintained on file in the District office.

GOAL 2.0 - CONTROLLING AND PREVENTING WASTE OF GROUNDWATER

Management Objective

One hundred percent of complete permit applications will be reviewed by the District within 90 days to ensure all procedures are followed to control and prevent the waste of groundwater. The District will

report annually to the Board the number of permit application requests that met the District's rules and requirements for approval within 90 days of receipt of the completed application.

Performance Standard

1. Number of permits issued each year by the District for new non-exempt wells in compliance with District rules and procedures.
2. Percent of completed applications reviewed within 90 days of receipt of application.

Management Objective

The District will maintain procedures for the receipt of well permit applications. Annual reports will be made to the Board on the number and type of well permits approved. If no applications are received by the District during a reporting period, this will annually be reported to the Board.

Performance Standard

The procedures for the receipt of well permit applications will be maintained in District files. An annual report will be made by the District to the Board on the number and type of well permits approved. If no well permit applications are filed and completed during the year, this will be reported to the Board.

Methodology

Annually, the District will prepare and present a report to the Board on the number of permit applications in compliance with District rules and procedures and the percent of completed applications reported to the Board within 90 days. The report will be maintained on file in the District office.

GOAL 3.0 - CONTROLLING AND PREVENTING SUBSIDENCE

This goal is not applicable to the District.

GOAL 4.0 - ADDRESSING CONJUNCTIVE SURFACE WATER MANAGEMENT ISSUES

Management Objective

The water demands increase each year with a growing population and industrial needs. The District will work with the River Authorities in the District and with the Regional Planning Groups to assist with studies and coordinate a plan to meet the water needs of the area.

Performance Standard

Each year, the District will participate in the regional planning process by attending at least 75 percent of the Regional Water Planning Group meetings to encourage the development of surface water supplies to meet the needs of water user groups in the District.

Methodology

The District will stay informed on surface water issues by attending Region I Regional Water Planning Group meetings and obtaining reports at the GMA-11 meetings on the Region D Regional Water Planning Group activities.

GOAL 5.0 – ADDRESSING NATURAL RESOURCE ISSUES THAT IMPACT THE USE AND AVAILABILITY OF GROUNDWATER AND ARE IMPACTED BY THE USE OF GROUNDWATER

This goal is not applicable to the District.

GOAL 6.0 - ADDRESSING DROUGHT CONDITIONS

During drought conditions within the District, all efforts will be made to see that all municipalities and public water supply companies follow their drought contingency plans. During severe drought conditions that materially affect the aquifer levels, the District staff will closely monitor the aquifer levels through establishment of a District monitoring plan of static levels in selected monitoring wells or by obtaining well water levels from selected water supply companies who have such data available to ensure that adequate quantities of water are available to the District and will coordinate with Region I Water Planning Group. Additional information can be found and utilized on drought at http://waterdatafortexas.org/drought/.

Performance Standard

Periodically review the Texas Palmer Drought Index, and monitor production figures quarterly. A summary of any drought conditions will be given to the Board of Directors in the annual report, along with any recommendations and necessary changes as needed.

Methodology

When a drought occurs that requires implementing drought contingency plans by municipalities and public water supply companies, the District will prepare and present a report to the Board on the number of water users contacted and number of plans implemented with the results of water use reduction when such data is available.

GOAL 7.0 - ADDRESSING CONSERVATION, RECHARGE ENHANCEMENT, RAINWATER HARVESTING, PRECIPITATION ENHANCEMENT, OR BRUSH CONTROL

Management Objective: Conservation

Each year, on four or more occasions, the District will disseminate educational information relating to the conservation practices for the efficient use of water resources.

Performance Standard

Number of occasions, annually, the District disseminated educational information relating to the conservation practices for the efficient use of water resources.

Methodology

Annually, the District will prepare and present a report to the Board on District performance in meeting this goal. The report will include the number of instances each activity was engaged in during the year. The report will be maintained on file in the District office.

Addressing Recharge Enhancement

This goal is presently not applicable or cost effective and is, therefore, not applicable to the District at this time.

Addressing Rainwater Harvesting

This goal is presently not applicable or cost effective and is, therefore, not applicable to the District at this time.

Addressing Precipitation Enhancement

This goal is presently not applicable or cost effective and is, therefore, not applicable to the District at this time.

Addressing Brush Control

This goal is presently not applicable or cost effective and is, therefore, not applicable to the District at this time.

GOAL 8.0 - ADDRESSING THE DESIRED FUTURE CONDITIONS OF THE GROUNDWATER RESOURCES

The Desired Future Conditions of the groundwater within the District have been established in accordance with Chapter 36.108 of the Texas Water Code at a meeting of the GMA-11 representatives on January 11, 2017. The Desired Future Conditions drawdowns for Angelina and Nacogdoches counties are established as shown on **Appendix A.2.**

Management Goal

To conserve and manage groundwater resources in order to provide sufficient water resources for domestic, industrial, and public water supply use to meet the needs of the future and achieve the desired future conditions of the district.

Management Objective

The district will issue permits with annual pumping limits and will maintain a database to limit the total annual withdrawal by permit to be representative of the Modeled Available Groundwater volume without restricting industrial or domestic growth.

Performance Standard

The District will frequently monitor the total permitted allowances to determine if the permitted volume is within or representative of the Modeled Available Groundwater allowable.

Methodology

Annually, the District will prepare and present a report to the Board on District performance in meeting this goal. The report will include the total permitted water and the allowable available water based on the Modeled Available Groundwater. The report will be maintained on file in the District office.

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

Groundwater and surface water historical use estimates are currently unavailable for calendar year 2017. TWDB staff anticipates the calculation and posting of these estimates at a later date.

ANGELINA COUNTY

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2016	GW	10,404	2,088	42	261	28	100	12,923
	SW	1,434	2,138	18	0	161	901	4,652
2015	GW	10,510	2,747	19	51	0	98	13,425
	SW	129	1,039	8	0	110	878	2,164
2014	GW	9,959	3,102	0	177	0	95	13,333
	SW	574	74	0	0	92	856	1,596
2013	GW	10,649	2,897	8	0	0	98	13,652
	SW	624	297	3	0	642	886	2,452
2012	GW	10,749	3,150	27	0	274	100	14,300
	SW	37	39	11	0	729	902	1,718
2011	GW	12,666	3,161	10	0	265	109	16,211
	SW	0	77	6	0	752	985	1,820
2010	GW	11,368	3,603	15	0	238	111	15,335
	SW	0	21	8	0	902	997	1,928
2009	GW	12,218	2,934	43	0	214	47	15,456
	SW	0	17	23	0	136	425	601
2008	GW	11,984	3,384	71	0	0	49	15,488
	SW	40	1,385	38	0	95	443	2,001
2007	GW	11,540	3,723	0	0	0	42	15,305
	SW	16	2,880	0	0	482	381	3,759
2006	GW	12,410	4,425	0	0	186	40	17,061
	SW	0	2,860	0	0	48	358	3,266
2005	GW	12,183	4,358	0	0	209	39	16,789
	SW	0	2,815	0	0	100	348	3,263
2004	GW	11,448	5,765	0	0	109	199	17,521
	SW	0	965	0	0	125	298	1,388
2003	GW	11,094	13,127	0	0	25	201	24,447
	SW	0	5,198	0	0	130	301	5,629
2002	GW	11,667	11,544	0	0	9	213	23,433
	SW	0	7,937	0	0	0	320	8,257
2001	GW	11,628	12,418	0	0	9	226	24,281
	SW	0	6,365	0	0	0	339	6,704

APPENDIX A.1

NACOGDOCHES COUNTY

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2016	GW	5,178	99	48	0	102	1,011	6,438
	SW	5,095	2,517	20	248	25	9,099	17,004
2015	GW	5,396	84	71	0	106	978	6,635
	SW	5,087	2,273	30	0	2	8,805	16,197
2014	GW	5,191	87	55	0	106	949	6,388
	SW	4,432	2,254	24	0	4	8,545	15,259
2013	GW	5,587	101	0	0	0	972	6,660
	SW	4,786	2,125	0	0	250	8,752	15,913
2012	GW	5,210	200	683	0	31	958	7,082
	SW	4,400	2,265	285	0	203	8,624	15,777
2011	GW	6,194	176	825	0	298	976	8,469
	SW	5,184	2,332	395	0	136	8,787	16,834
2010	GW	5,840	186	359	0	141	990	7,516
	SW	4,638	2,285	172	0	163	8,913	16,171
2009	GW	5,772	156	352	0	226	122	6,628
	SW	4,920	2,006	169	0	149	1,099	8,343
2008	GW	6,434	140	345	0	145	119	7,183
	SW	4,464	1,996	166	0	193	1,072	7,891
2007	GW	6,145	2,028	0	0	143	112	8,428
	SW	4,628	253	0	0	4	1,007	5,892
2006	GW	6,595	2,086	0	0	248	134	9,063
	SW	4,486	310	0	0	152	1,205	6,153
2005	GW	6,859	2,030	0	0	206	120	9,215
	SW	5,215	314	0	0	184	1,082	6,795
2004	GW	6,955	2,175	0	0	281	495	9,906
	SW	5,908	100	0	0	123	743	6,874
2003	GW	5,992	2,164	0	0	395	507	9,058
	SW	4,667	85	0	0	148	761	5,661
2002	GW	6,590	1,816	0	0	187	584	9,177
	SW	5,008	67	0	0	114	876	6,065
2001	GW	6,873	1,679	0	0	419	583	9,554
	SW	5,006	91	0	0	257	875	6,229

APPENDIX A.1
Projected Surface Water Supplies
TWDB 2017 State Water Plan Data

ANGELINA COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
I	IRRIGATION, ANGELINA	NECHES	KURTH LAKE/RESERVOIR	481	481	481	481	481	481
I	LIVESTOCK, ANGELINA	NECHES	NECHES LIVESTOCK LOCAL SUPPLY	661	661	661	661	661	661
I	LUFKIN	NECHES	KURTH LAKE/RESERVOIR	2,508	2,609	2,694	2,792	2,898	3,308
I	MANUFACTURING, ANGELINA	NECHES	KURTH LAKE/RESERVOIR	1,220	1,349	1,479	1,595	1,719	1,851
I	STEAM ELECTRIC POWER, ANGELINA	NECHES	KURTH LAKE/RESERVOIR	6,721	6,721	6,721	6,721	6,721	6,721
	Sum of Projected Surface Water Supplies (acre-feet)			**11,591**	**11,821**	**12,036**	**12,250**	**12,480**	**13,022**

NACOGDOCHES COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
I	APPLEBY WSC	NECHES	NACOGDOCHES LAKE/RESERVOIR	67	67	66	66	65	65
I	COUNTY-OTHER, NACOGDOCHES	NECHES	NACOGDOCHES LAKE/RESERVOIR	48	48	48	48	48	48
I	D&M WSC	NECHES	NACOGDOCHES LAKE/RESERVOIR	186	185	183	182	181	179
I	IRRIGATION, NACOGDOCHES	NECHES	NECHES RUN-OF-RIVER	136	136	136	136	136	136
I	LIVESTOCK, NACOGDOCHES	NECHES	NECHES LIVESTOCK LOCAL SUPPLY	2,386	2,386	2,386	2,386	2,386	2,386
I	MANUFACTURING, NACOGDOCHES	NECHES	NACOGDOCHES LAKE/RESERVOIR	1,846	2,001	2,151	2,277	2,438	2,611
I	MANUFACTURING, NACOGDOCHES	NECHES	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM	10,000	10,000	10,000	10,000	10,000	10,000
I	MELROSE WSC	NECHES	NACOGDOCHES LAKE/RESERVOIR	27	26	26	26	26	26
I	MINING, NACOGDOCHES	NECHES	HOUSTON COUNTY LAKE/RESERVOIR	0	0	0	0	0	0
I	MINING, NACOGDOCHES	NECHES	NECHES OTHER LOCAL SUPPLY	494	494	494	494	494	494
I	NACOGDOCHES	NECHES	NACOGDOCHES LAKE/RESERVOIR	4,853	5,275	5,701	6,193	6,747	7,326
I	STEAM ELECTRIC POWER, NACOGDOCHES	NECHES	HOUSTON COUNTY LAKE/RESERVOIR	0	0	0	0	0	0

APPENDIX A.1
Projected Surface Water Supplies
TWDB 2017 State Water Plan Data

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
I	STEAM ELECTRIC POWER, NACOGDOCHES	NECHES	STRIKER LAKE/RESERVOIR	7,280	7,280	7,280	7,280	7,280	7,280
	Sum of Projected Surface Water Supplies (acre-feet)			**27,323**	**27,898**	**28,471**	**29,088**	**29,801**	**30,551**

APPENDIX A.1
Projected Water Demands
TWDB 2017 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.

ANGELINA COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
I	ANGELINA WSC	NECHES	251	251	255	265	275	284
I	BURKE	NECHES	156	165	172	180	186	193
I	CENTRAL WCID OF ANGELINA COUNTY	NECHES	480	495	522	547	569	589
I	COUNTY-OTHER, ANGELINA	NECHES	1,961	1,999	2,045	2,134	2,214	2,289
I	DIBOLL	NECHES	672	690	707	738	766	792
I	FOUR WAY SUD	NECHES	490	509	527	546	566	585
I	HUDSON	NECHES	388	397	406	418	433	448
I	HUDSON WSC	NECHES	407	435	459	481	500	518
I	HUNTINGTON	NECHES	231	236	241	247	257	265
I	IRRIGATION, ANGELINA	NECHES	481	481	481	481	481	481
I	LIVESTOCK, ANGELINA	NECHES	648	648	648	648	648	648
I	LUFKIN	NECHES	6,271	6,523	6,736	6,979	7,246	7,494
I	MANUFACTURING, ANGELINA	NECHES	15,249	16,858	18,487	19,934	21,478	23,142
I	MINING, ANGELINA	NECHES	486	585	410	312	237	180
I	REDLAND WSC	NECHES	201	199	208	217	225	232
I	STEAM ELECTRIC POWER, ANGELINA	NECHES	1,000	1,000	1,000	1,000	1,000	1,000
I	ZAVALLA	NECHES	79	81	82	84	87	90
	Sum of Projected Water Demands (acre-feet)		**29,451**	**31,552**	**33,386**	**35,211**	**37,168**	**39,230**

NACOGDOCHES COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
I	APPLEBY WSC	NECHES	655	718	783	858	941	1,030
I	COUNTY-OTHER, NACOGDOCHES	NECHES	1,185	1,294	1,427	1,570	1,720	1,881
I	CUSHING	NECHES	124	135	147	160	176	192
I	D&M WSC	NECHES	905	994	1,086	1,190	1,306	1,428
I	GARRISON	NECHES	225	247	269	295	324	354
I	IRRIGATION, NACOGDOCHES	NECHES	400	400	400	400	400	400
I	LILLY GROVE SUD	NECHES	429	469	511	559	613	671
I	LIVESTOCK, NACOGDOCHES	NECHES	4,364	4,557	4,781	5,040	5,337	5,779

APPENDIX A.1
Projected Water Demands
TWDB 2017 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.

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
I	MANUFACTURING, NACOGDOCHES	NECHES	2,564	2,798	3,029	3,228	3,483	3,758
I	MELROSE WSC	NECHES	504	549	595	650	713	780
I	MINING, NACOGDOCHES	NECHES	7,000	4,500	1,643	1,299	958	707
I	NACOGDOCHES	NECHES	6,742	7,376	8,027	8,781	9,638	10,545
I	STEAM ELECTRIC POWER, NACOGDOCHES	NECHES	6,911	8,079	9,504	11,241	13,358	15,874
I	SWIFT WSC	NECHES	428	465	503	550	603	660
I	WODEN WSC	NECHES	330	356	384	418	458	501
	Sum of Projected Water Demands (acre-feet)		**32,766**	**32,937**	**33,089**	**36,239**	**40,028**	**44,560**

APPENDIX A.1
Projected Water Supply Needs
TWDB 2017 State Water Plan Data

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

ANGELINA COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
I	ANGELINA WSC	NECHES	272	272	268	258	248	239
I	BURKE	NECHES	0	0	0	0	0	0
I	CENTRAL WCID OF ANGELINA COUNTY	NECHES	397	382	355	330	308	288
I	COUNTY-OTHER, ANGELINA	NECHES	397	359	313	224	144	69
I	DIBOLL	NECHES	2,042	2,024	2,007	1,976	1,948	1,922
I	FOUR WAY SUD	NECHES	726	707	689	670	650	631
I	HUDSON	NECHES	254	245	236	224	209	216
I	HUDSON WSC	NECHES	750	722	698	676	657	639
I	HUNTINGTON	NECHES	826	821	816	810	800	792
I	IRRIGATION, ANGELINA	NECHES	331	331	331	331	331	331
I	LIVESTOCK, ANGELINA	NECHES	89	89	89	89	89	89
I	LUFKIN	NECHES	0	0	0	0	0	0
I	MANUFACTURING, ANGELINA	NECHES	-10,722	-12,009	-13,313	-14,470	-15,705	-17,037
I	MINING, ANGELINA	NECHES	-473	-572	-397	-299	-224	-167
I	REDLAND WSC	NECHES	577	579	570	561	553	546
I	STEAM ELECTRIC POWER, ANGELINA	NECHES	15,802	15,802	15,802	15,802	15,802	15,802
I	ZAVALLA	NECHES	0	0	0	0	0	0
	Sum of Projected Water Supply Needs (acre-feet)		**-11,195**	**-12,581**	**-13,710**	**-14,769**	**-15,929**	**-17,204**

NACOGDOCHES COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
I	APPLEBY WSC	NECHES	285	222	157	82	0	0
I	COUNTY-OTHER, NACOGDOCHES	NECHES	0	0	0	0	0	0
I	CUSHING	NECHES	105	94	82	69	53	37
I	D&M WSC	NECHES	289	200	108	4	-112	-234
I	GARRISON	NECHES	340	318	296	270	241	211
I	IRRIGATION, NACOGDOCHES	NECHES	109	109	109	109	109	109
I	LILLY GROVE SUD	NECHES	332	292	250	202	148	90
I	LIVESTOCK, NACOGDOCHES	NECHES	-1,644	-1,837	-2,061	-2,320	-2,617	-3,059

APPENDIX A.1
Projected Water Supply Needs
TWDB 2017 State Water Plan Data

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

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
I	MANUFACTURING, NACOGDOCHES	NECHES	10,000	10,000	10,000	10,000	10,000	10,000
I	MELROSE WSC	NECHES	304	259	213	158	95	28
I	MINING, NACOGDOCHES	NECHES	-5,475	-2,975	-118	226	567	818
I	NACOGDOCHES	NECHES	0	0	0	0	0	0
I	STEAM ELECTRIC POWER, NACOGDOCHES	NECHES	369	-799	-2,224	-3,961	-6,078	-8,594
I	SWIFT WSC	NECHES	238	201	163	116	63	6
I	WODEN WSC	NECHES	440	414	386	352	312	269
	Sum of Projected Water Supply Needs (acre-feet)		**-7,119**	**-5,611**	**-4,403**	**-6,281**	**-8,807**	**-11,887**

APPENDIX A.1
Projected Water Management Strategies
TWDB 2017 State Water Plan Data

ANGELINA COUNTY

WUG, Basin (RWPG)

All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
LUFKIN, NECHES (I)							
LUFK-RAY SAM RAYBURN INFRASTRUCTURE	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	5,043	14,949	19,372	18,137	16,805
		0	**5,043**	**14,949**	**19,372**	**18,137**	**16,805**
MANUFACTURING, ANGELINA, NECHES (I)							
ANGL-MFG CONTRACT EXPANSION	KURTH LAKE/RESERVOIR [RESERVOIR]	6,000	6,000	6,000	6,000	6,000	6,000
LUFK-RAY SAM RAYBURN INFRASTRUCTURE	SAM RAYBURN-STEINHAGEN LAKE/RESERVOIR SYSTEM [RESERVOIR]	0	6,167	7,471	8,628	9,863	11,195
		6,000	**12,167**	**13,471**	**14,628**	**15,863**	**17,195**
MINING, ANGELINA, NECHES (I)							
ANRA-RUN-OF-RIVER (SUBMITTED APPLICATION)	NECHES RUN-OF-RIVER [ANGELINA]	474	573	398	300	225	168
		474	**573**	**398**	**300**	**225**	**168**
Sum of Projected Water Management Strategies (acre-feet)		**6,474**	**17,783**	**28,818**	**34,300**	**34,225**	**34,168**

NACOGDOCHES COUNTY

WUG, Basin (RWPG)

All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
COUNTY-OTHER, NACOGDOCHES, NECHES (I)							
ANRA-COL - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR [RESERVOIR]	0	428	428	428	428	85
		0	**428**	**428**	**428**	**428**	**85**
D&M WSC, NECHES (I)							
NACW-DMW - NACOGDOCHES D&M WSC	CARRIZO-WILCOX AQUIFER [NACOGDOCHES]	0	0	0	0	112	250
		0	**0**	**0**	**0**	**112**	**250**
LIVESTOCK, NACOGDOCHES, NECHES (I)							
NACW-LTK - NACOGDOCHES LIVESTOCK	CARRIZO-WILCOX AQUIFER [NACOGDOCHES]	1,644	1,837	2,061	2,320	2,617	3,059

APPENDIX A.1

Projected Water Management Strategies

TWDB 2017 State Water Plan Data

WUG, Basin (RWPG)

All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
		1,644	**1,837**	**2,061**	**2,320**	**2,617**	**3,059**
MINING, NACOGDOCHES, NECHES (I)							
ANRA-RUN-OF-RIVER (SUBMITTED APPLICATION)	NECHES RUN-OF-RIVER [NACOGDOCHES]	5,475	2,975	118	0	0	0
		5,475	**2,975**	**118**	**0**	**0**	**0**
NACOGDOCHES, NECHES (I)							
ANRA-COL - LAKE COLUMBIA	COLUMBIA LAKE/RESERVOIR [RESERVOIR]	0	8,551	8,551	8,551	8,551	8,551
		0	**8,551**	**8,551**	**8,551**	**8,551**	**8,551**
STEAM ELECTRIC POWER, NACOGDOCHES, NECHES (I)							
HCWC PERMIT AMENDMENT	HOUSTON COUNTY LAKE/RESERVOIR [RESERVOIR]	1,000	1,000	1,000	1,000	1,000	1,000
NACW-SEP1 - NACOGDOCHES STEAM ELECTRIC POWER PURCHASE FROM ANRA	CARRIZO-WILCOX AQUIFER [NACOGDOCHES]	2,000	2,000	2,000	2,000	2,000	1,989
NACW-SEP1 - NACOGDOCHES STEAM ELECTRIC POWER PURCHASE FROM ANRA	NACOGDOCHES LAKE/RESERVOIR [RESERVOIR]	8,500	8,500	7,742	6,741	5,645	4,521
NACW-SEP2 - NEW WELLS IN CARRIZO WILCOX	CARRIZO-WILCOX AQUIFER [NACOGDOCHES]	0	0	0	0	0	2,000
		11,500	**11,500**	**10,742**	**9,741**	**8,645**	**9,510**
Sum of Projected Water Management Strategies (acre-feet)		**18,619**	**25,291**	**21,900**	**21,040**	**20,353**	**21,455**

APPENDIX A.2

GAM Run 17-024 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, and Sparta aquifers in Groundwater Management Area 11

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TABLE 1. DRAWDOWN FOR USE AS DESIRED FUTURE CONDITIONS (2000 TO 2070 IN FEET) [TABLE 5 FROM GMA 11 TECHNICAL MEMORANDUM 16-02 (DRAFT 2), DATED MARCH 25, 2016].).

County	Sparta	Queen City	Carrizo-Wilcox
Anderson	NRS	9	90
Angelina	16	NRS	48
Bowie	NP	NP	5
Camp	NP	NRS	33
Cass	NP	10	68
Cherokee	NRS	14	99
Franklin	NP	NP	14
Gregg	NP	NRS	58
Harrison	NP	1	18
Henderson	NP	5	50
Hopkins	NP	NP	3
Houston	3	6	80
Marion	NP	24	45
Morris	NP	NRS	46
Nacogdoches	5	4	29
Panola	NP	NP	3
Rains	NP	NP	1
Rusk	NP	NRS	23
Sabine	1	NP	9
San Augustine	2	NP	7
Shelby	NP	NP	1
Smith	NP	17	119
Titus	NP	NRS	11
Trinity	9	NRS	51
Upshur	NP	9	77
Van Zandt	NP	NRS	21
Wood	NP	5	89
Grand Total	4	10	56

Notes: NP = Not present
NRS = Not relevant due to size (less than 200 square miles)
Yellow Cells represent average drawdown calculations that assume negative drawdown is zero (model artifact and model limitation)
Green Cell represents the recommended DFC for Panola County as described above

TABLE 1. SUMMARIZED INFORMATION FOR THE CARRIZO-WILCOX AQUIFER FOR PINEYWOODS GROUNDWATER CONSERVATION DISTRICT'S 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	21,337
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	6,799
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	24,100
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	4,902
Estimated net annual volume of flow between each aquifer in the district	Flow to Carrizo-Wilcox Aquifer from the overlying Reklaw Confining Unit	15,938
	Flow to Carrizo-Wilcox Aquifer from brackish Carrizo-Wilcox units	7,920

TABLE 2. SUMMARIZED INFORMATION FOR THE QUEEN CITY AQUIFER FOR PINEYWOODS GROUNDWATER CONSERVATION DISTRICT'S 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	7,244
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	796
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	446
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	239
Estimated net annual volume of flow between each aquifer in the district	Flow from Queen City Aquifer into the underlying Reklaw Confining Unit	6,719
	Flow into Queen City Aquifer from the overlying Weches Confining Unit	4,709
	Flow from Queen City Aquifer into brackish Queen City units	26

TABLE 3. SUMMARIZED INFORMATION FOR THE SPARTA AQUIFER FOR PINEYWOODS GROUNDWATER CONSERVATION DISTRICT'S 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	Sparta Aquifer	16,013
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Sparta Aquifer	7,473
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	987
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	392
Estimated net annual volume of flow between each aquifer in the district	Flow into Sparta Aquifer from the overlying units	359
	Flow from Sparta Aquifer into the underlying Weches Confining Unit	7,170
	Flow from Sparta Aquifer to brackish Sparta units	205

TABLE 4. SUMMARIZED INFORMATION FOR THE YEGUA-JACKSON AQUIFER FOR PINEYWOODS GROUNDWATER CONSERVATION DISTRICT'S 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	Yegua-Jackson Aquifer	52,550
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	37,559
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	11,506
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	9,786
Estimated net annual volume of flow between each aquifer in the district	Flow to Yegua-Jackson Aquifer from the Catahoula and younger units	11

TABLE 5. SUMMARIZED INFORMATION FOR THE GULF COAST AQUIFER SYSTEM FOR PINEYWOODS GROUNDWATER CONSERVATION DISTRICT'S 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	Gulf Coast Aquifer System	18
Estimated annual volume of water that discharges from the aquifer to springs and any surface-water body including lakes, streams, and rivers	Gulf Coast Aquifer System	0
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer System	0
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer System	18
Estimated net annual volume of flow between each aquifer in the district[1]	Gulf Coast Aquifer System	NA[2]

[1] An evaluation of the general head boundary flux from the groundwater availability model for the Yegua-Jackson Aquifer suggests a flux of 72 acre-feet per year from the Jasper Aquifer to the Catahoula Formation. A part of the flow to the Catahoula confining system from the Jasper Aquifer represents flow from the Gulf Coast Aquifer System to deeper units and part represents flow within the Gulf Coast Aquifer System. It should be noted that the groundwater availability model for the Yegua-Jackson Aquifer and the groundwater availability model for the Gulf Coast Aquifer System have different assumptions.
[2] NA: Not applicable. The groundwater availability model for the Gulf Coast Aquifer System assumes a no-flow boundary condition at the base.

GAM Run 17-024 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, and Sparta aquifers in Groundwater Management Area 11

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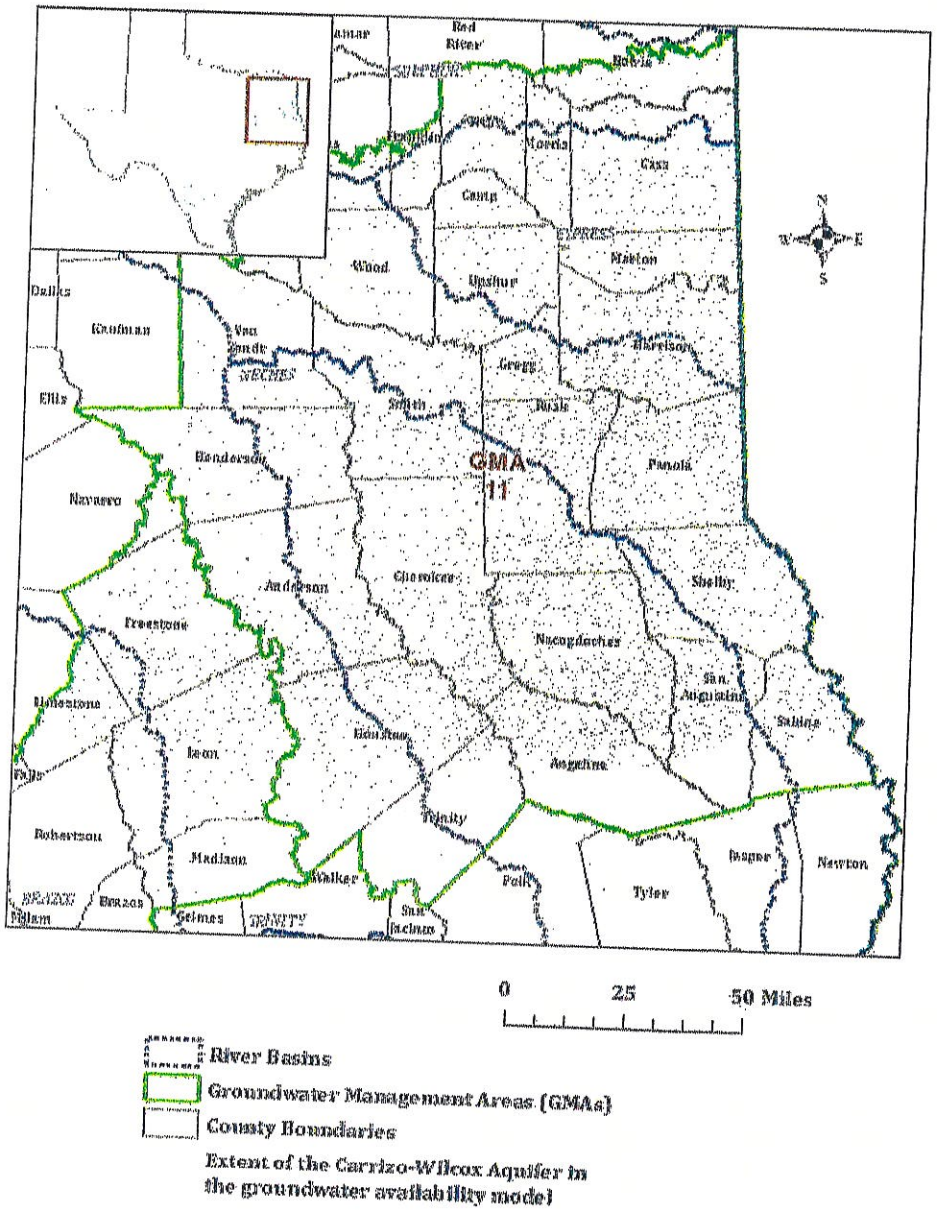

FIGURE 1. **GROUNDWATER MANAGEMENT AREA (GMA) 11 BOUNDARY, RIVER BASINS, AND COUNTIES OVERLAIN ON THE EXTENT OF THE CARRIZO-WILCOX AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS.**

APPENDIX A.4

GAM Run 17-024 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, and Sparta aquifers in Groundwater Management Area 11

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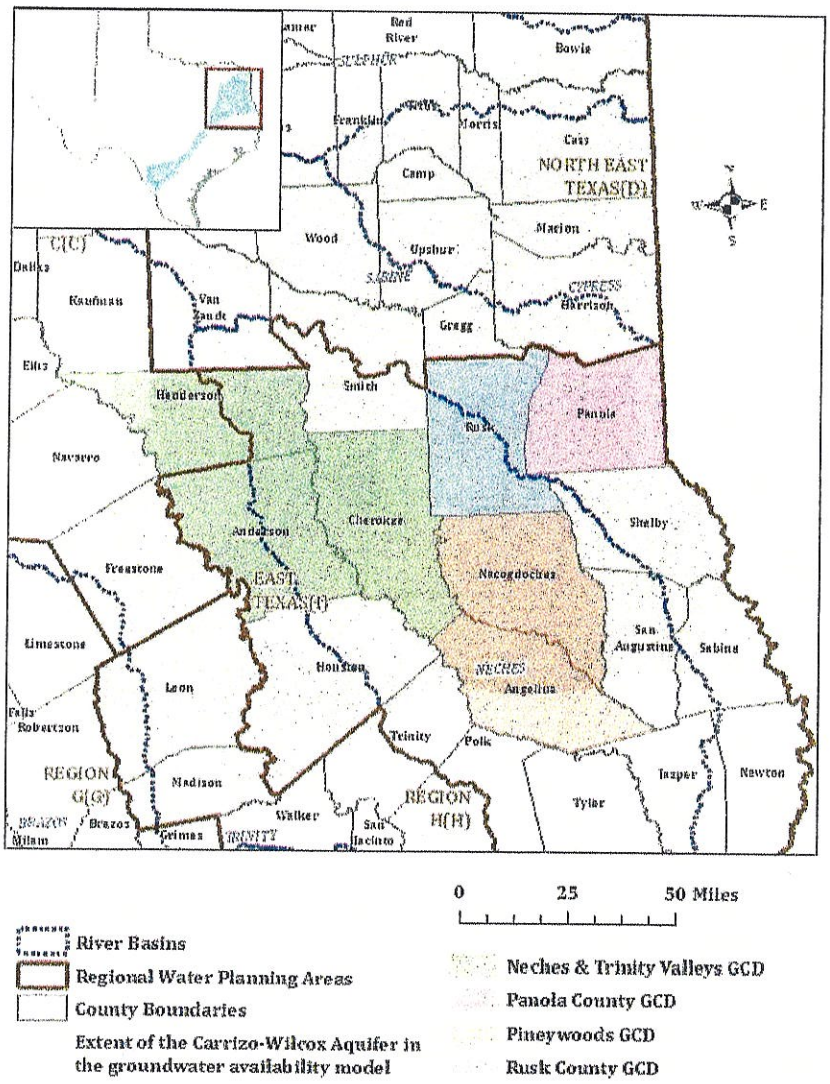

FIGURE 2. **REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE CARRIZO-WILCOX AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS.**

APPENDIX A.4

GAM Run 17-024 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, and Sparta aquifers in Groundwater Management Area 11

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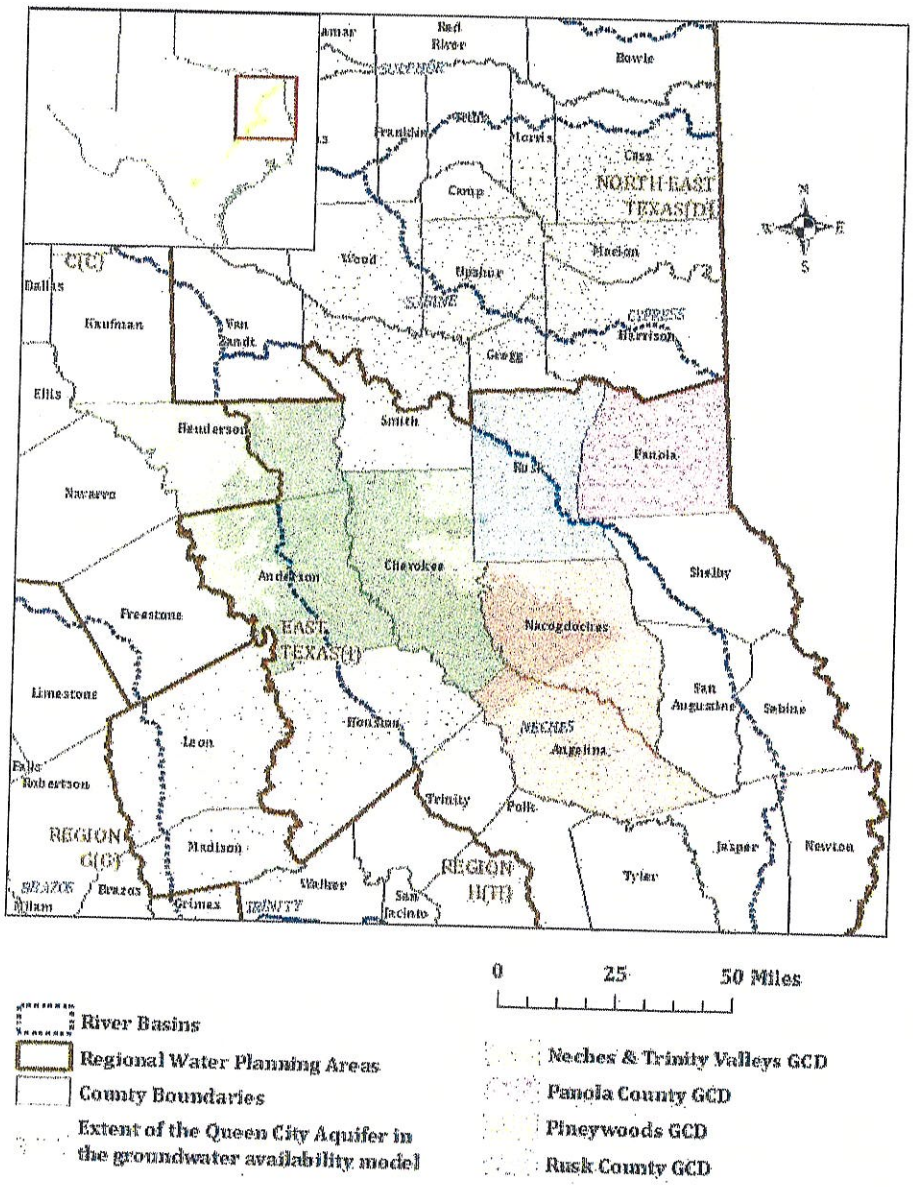

FIGURE 3. **REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE QUEEN CITY AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS.**

APPENDIX A.4

GAM Run 17-024 MAG: Modeled Available Groundwater for the Carrizo-Wilcox, Queen City, and Sparta aquifers in Groundwater Management Area 11

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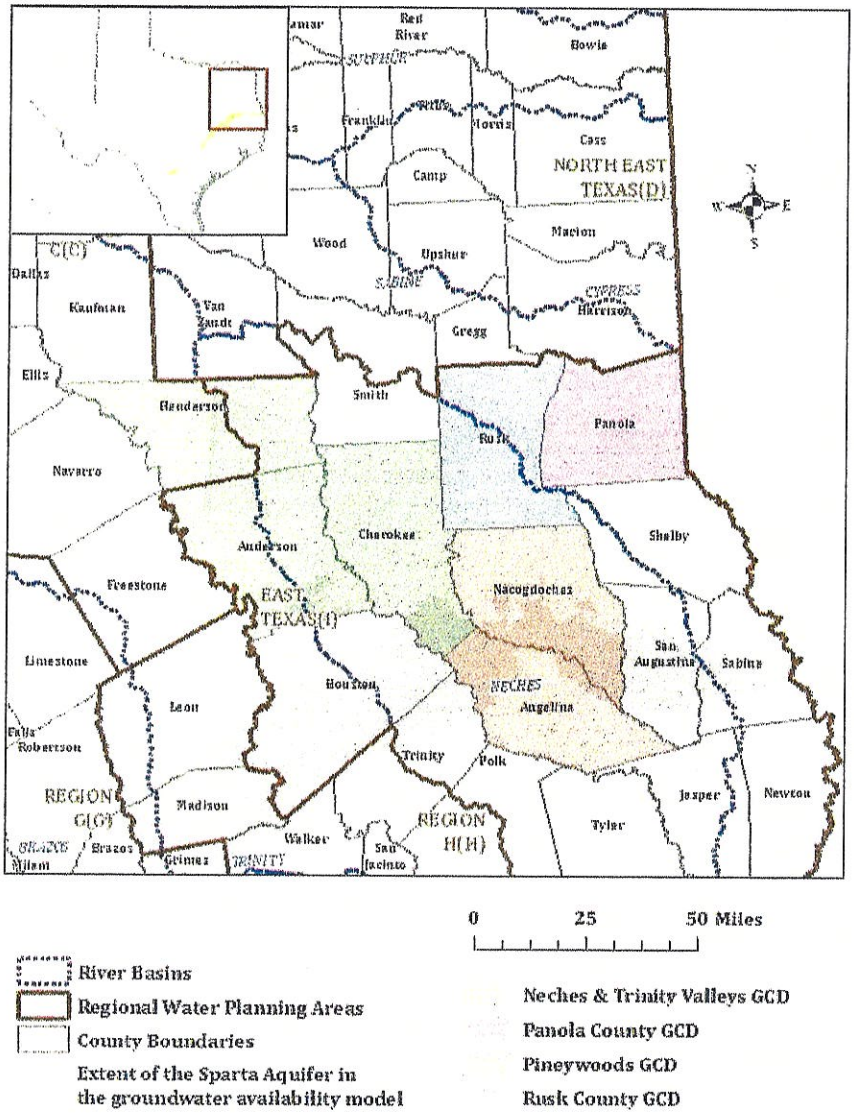


FIGURE 4. REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE SPARTA AQUIFER IN THE GROUNDWATER AVAILABILITY MODEL FOR THE NORTHERN PORTION OF THE CARRIZO-WILCOX, QUEEN CITY, AND SPARTA AQUIFERS.

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 2010 AND 2070. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2010	2020	2030	2040	2050	2060	2070
Neches & Trinity Valleys GCD	Anderson	Carrizo-Wilcox	29,088	29,088	29,088	29,088	29,088	29,088	29,088
Neches & Trinity Valleys GCD	Cherokee	Carrizo-Wilcox	20,933	20,933	20,933	20,933	20,933	20,933	20,470
Neches & Trinity Valleys GCD	Henderson	Carrizo-Wilcox	13,866	13,866	13,866	13,866	13,768	13,614	13,585
Neches & Trinity Valleys GCD Total		**Carrizo-Wilcox**	**63,886**	**63,886**	**63,886**	**63,886**	**63,789**	**63,634**	**63,143**
Panola County GCD	Panola	**Carrizo-Wilcox**	**8,376**	**8,376**	**8,218**	**8,218**	**8,218**	**8,068**	**8,068**
Pineywoods GCD	Angelina	Carrizo-Wilcox	27,591	27,591	27,591	27,591	27,591	27,591	27,591
Pineywoods GCD	Nacogdoches	Carrizo-Wilcox	24,181	24,181	24,181	24,181	24,181	24,181	24,181
Pineywoods GCD Total		**Carrizo-Wilcox**	**51,773**	**51,773**	**51,773**	**51,773**	**51,773**	**51,773**	**51,773**
Rusk County GCD Total	Rusk	**Carrizo-Wilcox**	**20,847**	**20,837**	**20,837**	**20,837**	**20,818**	**20,818**	**20,818**
Total (GCDs)		**Carrizo-Wilcox**	**144,882**	**144,872**	**144,714**	**144,714**	**144,598**	**144,293**	**143,801**
No District-County	Bowie	Carrizo-Wilcox	10,845	9,872	9,558	9,278	9,278	8,999	8,999
No District-County	Camp	Carrizo-Wilcox	4,050	4,050	4,050	4,050	4,050	4,050	4,050
No District-County	Cass	Carrizo-Wilcox	18,078	18,023	17,925	17,863	17,786	17,702	17,626
No District-County	Franklin	Carrizo-Wilcox	9,786	9,786	9,786	9,786	9,786	9,786	9,786
No District-County	Gregg	Carrizo-Wilcox	8,041	8,041	8,041	8,041	8,041	8,041	8,041
No District-County	Harrison	Carrizo-Wilcox	11,165	11,035	10,961	10,921	10,873	10,853	10,827
No District-County	Hopkins	Carrizo-Wilcox	6,392	6,392	6,392	6,392	6,392	6,392	6,392
No District-County	Houston	Carrizo-Wilcox	26,294	26,294	26,294	26,294	26,294	26,294	26,294
No District-County	Marion	Carrizo-Wilcox	2,729	2,726	2,726	2,726	2,726	2,726	2,726

Groundwater Conservation District	County	Aquifer	2010	2020	2030	2040	2050	2060	2070
No District-County	Morris	Carrizo-Wilcox	2,627	2,569	2,569	2,569	2,569	2,569	2,569
No District-County	Rains	Carrizo-Wilcox	1,922	1,839	1,839	1,839	1,802	1,802	1,745
No District-County	Red River	Carrizo-Wilcox	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
No District-County	Sabine	Carrizo-Wilcox	3,606	3,606	3,606	3,606	3,606	3,606	3,606
No District-County	San Augustine	Carrizo-Wilcox	1,439	1,439	1,439	1,439	1,439	1,439	1,439
No District-County	Shelby	Carrizo-Wilcox	11,210	10,894	10,441	10,305	9,723	9,287	9,100
No District-County	Smith	Carrizo-Wilcox	35,951	35,951	35,925	35,925	35,925	35,912	35,889
No District-County	Titus	Carrizo-Wilcox	10,354	10,052	9,902	9,672	9,624	9,573	9,472
No District-County	Trinity	Carrizo-Wilcox	368	368	368	368	368	368	368
No District-County	Upshur	Carrizo-Wilcox	7,132	7,132	7,132	7,132	7,132	7,132	7,132
No District-County	Van Zandt	Carrizo-Wilcox	10,330	10,330	10,330	10,157	10,098	10,098	9,971
No District-County	Wood	Carrizo-Wilcox	21,544	21,457	21,413	21,338	21,316	21,292	21,237
No District-County Total		**Carrizo-Wilcox**	**203,863**	**201,856**	**200,696**	**199,700**	**198,827**	**197,920**	**197,268**
Total for GMA 11		**Carrizo-Wilcox**	**348,745**	**346,728**	**345,410**	**344,414**	**343,424**	**342,213**	**341,069**

[1]A desired future condition was not specified for the Carrizo-Wilcox Aquifer in Red River County; however, other counties with fewer than 200 square miles of aquifer were noted as not relevant due to size (NRS) in the desired future condition statement. Areas which are not relevant due to size are listed with a NULL value for modeled available groundwater.

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 2010 AND 2070. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2010	2020	2030	2040	2050	2060	2070
Neches & Trinity Valleys GCD	Anderson	Queen City	19,101	19,101	19,101	19,101	19,101	19,101	19,101
Neches & Trinity Valleys GCD	Cherokee	Queen City	23,211	23,211	23,211	23,211	23,211	23,039	22,866
Neches & Trinity Valleys GCD	Henderson	Queen City	15,412	15,412	15,412	15,412	15,412	15,412	15,412
Neches & Trinity Valleys GCD Total		**Queen City**	**57,725**	**57,725**	**57,725**	**57,725**	**57,725**	**57,552**	**57,380**
Pineywoods GCD	Angelina	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Pineywoods GCD	Nacogdoches	Queen City	2,985	2,985	2,985	2,985	2,985	2,985	2,985
Pineywoods GCD Total		**Queen City**	**2,985**	**2,985**	**2,985**	**2,985**	**2,985**	**2,985**	**2,985**
Rusk County GCD Total	**Rusk**	**Queen City**	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Total (GCDs)		**Queen City**	**60,710**	**60,710**	**60,710**	**60,710**	**60,710**	**60,537**	**60,365**
No District-County	Camp	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
No District-County	Cass	Queen City	38,509	38,509	38,509	38,509	38,509	38,509	38,509
No District-County	Gregg	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
No District-County	Harrison	Queen City	10,071	10,071	10,071	10,071	10,071	10,071	10,071
No District-County	Houston	Queen City	2,301	2,301	2,301	2,301	2,301	2,301	2,301
No District-County	Marion	Queen City	15,407	15,407	15,407	15,407	15,407	15,338	15,271
No District-County	Morris	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
No District-County	Smith	Queen City	59,034	59,034	59,034	59,034	58,904	58,709	58,578
No District-County	Titus	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
No District-County	Trinity	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
No District-County	Upshur	Queen City	27,391	27,391	27,391	27,197	27,197	27,197	27,145

Groundwater Conservation District	County	Aquifer	2010	2020	2030	2040	2050	2060	2070
No District-County	Van Zandt	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
No District-County	Wood	Queen City	10,046	10,046	10,046	10,046	10,046	10,046	10,046
No District-County Total		**Queen City**	**162,759**	**162,759**	**162,759**	**162,566**	**162,435**	**162,172**	**161,922**
Total for GMA 11		**Queen City**	**223,469**	**223,469**	**223,469**	**223,275**	**223,145**	**222,709**	**222,287**

[1]Counties with fewer than 200 square miles of aquifer were noted as not relevant due to size (NRS) in the desired future condition statement. Areas which are not relevant due to size are listed with a NULL value for modeled available groundwater. For additional information in pumping in the model run see Table 6 from Technical Memorandum 16-02 (Hutchison, 2016).

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 2010 AND 2070. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2010	2020	2030	2040	2050	2060	2070
Neches & Trinity Valleys GCD	Anderson	Sparta	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Neches & Trinity Valleys GCD	Cherokee	Sparta	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Neches & Trinity Valleys GCD Total		**Sparta**	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Pineywoods GCD	Angelina	Sparta	371	371	371	371	371	371	371
Pineywoods GCD	Nacogdoches	Sparta	365	365	365	365	365	365	365
Pineywoods GCD Total		**Sparta**	**737**	**737**	**737**	**737**	**737**	**737**	**737**
Total (GCDs)		**Sparta**	**737**	**737**	**737**	**737**	**737**	**737**	**737**
No District-County	Houston	Sparta	1,454	1,454	1,454	1,454	1,454	1,454	1,454
No District-County	Sabine	Sparta	197	197	197	197	197	197	197
No District-County	San Augustine	Sparta	166	166	166	166	166	166	166
No District-County	Trinity	Sparta	182	182	182	182	182	182	182
No District-County Total		**Sparta**	**1,999**	**1,999**	**1,999**	**1,999**	**1,999**	**1,999**	**1,999**
Total for GMA 11		**Sparta**	**2,736**	**2,736**	**2,736**	**2,736**	**2,736**	**2,736**	**2,736**

[1]Counties with fewer than 200 square miles of aquifer were noted as not relevant due to size (NRS) in the desired future condition statement. Areas which are not relevant due to size are listed with a NULL value for modeled available groundwater. For additional information in pumping in the model run see Table 6 from Technical Memorandum 16-02 (Hutchison, 2016).

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
Anderson	I	Neches	Carrizo-Wilcox	23,335	23,335	23,335	23,335	23,335	23,335
Anderson	I	Trinity	Carrizo-Wilcox	5,753	5,753	5,753	5,753	5,753	5,753
Angelina	I	Neches	Carrizo-Wilcox	27,591	27,591	27,591	27,591	27,591	27,591
Bowie	D	Sulphur	Carrizo-Wilcox	9,872	9,558	9,278	9,278	8,999	8,999
Camp	D	Cypress	Carrizo-Wilcox	4,050	4,050	4,050	4,050	4,050	4,050
Cass	D	Cypress	Carrizo-Wilcox	15,159	15,132	15,132	15,119	15,106	15,094
Cass	D	Sulphur	Carrizo-Wilcox	2,864	2,794	2,731	2,667	2,596	2,532
Cherokee	I	Neches	Carrizo-Wilcox	20,933	20,933	20,933	20,933	20,933	20,470
Franklin	D	Cypress	Carrizo-Wilcox	7,765	7,765	7,765	7,765	7,765	7,765
Franklin	D	Sulphur	Carrizo-Wilcox	2,021	2,021	2,021	2,021	2,021	2,021
Gregg	D	Cypress	Carrizo-Wilcox	862	862	862	862	862	862
Gregg	D	Sabine	Carrizo-Wilcox	7,179	7,179	7,179	7,179	7,179	7,179
Harrison	D	Cypress	Carrizo-Wilcox	6,183	6,109	6,070	6,036	6,016	5,990
Harrison	D	Sabine	Carrizo-Wilcox	4,851	4,851	4,851	4,837	4,837	4,837
Henderson	C	Trinity	Carrizo-Wilcox	7,829	7,829	7,829	7,732	7,577	7,548
Henderson	I	Neches	Carrizo-Wilcox	6,036	6,036	6,036	6,036	6,036	6,036
Hopkins	D	Cypress	Carrizo-Wilcox	313	313	313	313	313	313
Hopkins	D	Sabine	Carrizo-Wilcox	2,842	2,842	2,842	2,842	2,842	2,842
Hopkins	D	Sulphur	Carrizo-Wilcox	3,237	3,237	3,237	3,237	3,237	3,237
Houston	I	Neches	Carrizo-Wilcox	22,488	22,488	22,488	22,488	22,488	22,488
Houston	I	Trinity	Carrizo-Wilcox	3,806	3,806	3,806	3,806	3,806	3,806
Marion	D	Cypress	Carrizo-Wilcox	2,726	2,726	2,726	2,726	2,726	2,726
Morris	D	Cypress	Carrizo-Wilcox	2,166	2,166	2,166	2,166	2,166	2,166
Morris	D	Sulphur	Carrizo-Wilcox	402	402	402	402	402	402
Nacogdoches	I	Neches	Carrizo-Wilcox	24,181	24,181	24,181	24,181	24,181	24,181
Panola	I	Cypress	Carrizo-Wilcox	6	6	6	6	6	6

County	RWPA	River Basin	Aquifer	2020	2030	2040	2050	2060	2070
Panola	I	Sabine	Carrizo-Wilcox	8,370	8,212	8,212	8,212	8,062	8,062
Rains	D	Sabine	Carrizo-Wilcox	1,839	1,839	1,839	1,802	1,802	1,745
Red River	D	Sulphur	Carrizo-Wilcox	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Rusk	I	Neches	Carrizo-Wilcox	11,769	11,769	11,769	11,750	11,750	11,750
Rusk	I	Sabine	Carrizo-Wilcox	9,068	9,068	9,068	9,068	9,068	9,068
Sabine	I	Neches	Carrizo-Wilcox	356	356	356	356	356	356
Sabine	I	Sabine	Carrizo-Wilcox	3,249	3,249	3,249	3,249	3,249	3,249
San Augustine	I	Neches	Carrizo-Wilcox	1,149	1,149	1,149	1,149	1,149	1,149
San Augustine	I	Sabine	Carrizo-Wilcox	290	290	290	290	290	290
Shelby	I	Neches	Carrizo-Wilcox	2,577	2,288	2,151	2,018	2,018	2,018
Shelby	I	Sabine	Carrizo-Wilcox	8,317	8,154	8,154	7,705	7,269	7,081
Smith	D	Sabine	Carrizo-Wilcox	13,246	13,220	13,220	13,220	13,206	13,196
Smith	I	Neches	Carrizo-Wilcox	22,705	22,705	22,705	22,705	22,705	22,693
Titus	D	Cypress	Carrizo-Wilcox	7,215	7,064	6,834	6,786	6,735	6,634
Titus	D	Sulphur	Carrizo-Wilcox	2,838	2,838	2,838	2,838	2,838	2,838
Trinity	H	Trinity	Carrizo-Wilcox	99	99	99	99	99	99
Trinity	I	Neches	Carrizo-Wilcox	269	269	269	269	269	269
Upshur	D	Cypress	Carrizo-Wilcox	5,442	5,442	5,442	5,442	5,442	5,442
Upshur	D	Sabine	Carrizo-Wilcox	1,689	1,689	1,689	1,689	1,689	1,689
Van Zandt	D	Neches	Carrizo-Wilcox	4,317	4,317	4,317	4,317	4,317	4,317
Van Zandt	D	Sabine	Carrizo-Wilcox	4,629	4,629	4,456	4,397	4,397	4,270
Van Zandt	D	Trinity	Carrizo-Wilcox	1,384	1,384	1,384	1,384	1,384	1,384
Wood	D	Cypress	Carrizo-Wilcox	2,053	2,053	2,053	2,053	2,053	2,053
Wood	D	Sabine	Carrizo-Wilcox	19,404	19,360	19,285	19,263	19,239	19,184
GMA 11 Total			**Carrizo-Wilcox**	**346,728**	**345,410**	**344,414**	**343,424**	**342,213**	**341,069**

[1] A desired future condition was not specified for the Carrizo-Wilcox Aquifer in Red River County; however, other counties with fewer than 200 square miles of aquifer were noted as not relevant due to size (NRS) in the desired future condition statement. Areas which are not relevant due to size are listed with a NULL value for modeled available groundwater.

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
Anderson	I	Neches	Queen City	11,828	11,828	11,828	11,828	11,828	11,828
Anderson	I	Trinity	Queen City	7,274	7,274	7,274	7,274	7,274	7,274
Angelina	I	Neches	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Camp	D	Cypress	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Cass	D	Cypress	Queen City	35,499	35,499	35,499	35,499	35,499	35,499
Cass	D	Sulphur	Queen City	3,010	3,010	3,010	3,010	3,010	3,010
Cherokee	I	Neches	Queen City	23,211	23,211	23,211	23,211	23,039	22,866
Gregg	D	Cypress	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Gregg	D	Sabine	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Harrison	D	Cypress	Queen City	7,762	7,762	7,762	7,762	7,762	7,762
Harrison	D	Sabine	Queen City	2,310	2,310	2,310	2,310	2,310	2,310
Henderson	C	Trinity	Queen City	3,345	3,345	3,345	3,345	3,345	3,345
Henderson	I	Neches	Queen City	12,067	12,067	12,067	12,067	12,067	12,067
Houston	I	Neches	Queen City	2,043	2,043	2,043	2,043	2,043	2,043
Houston	I	Trinity	Queen City	258	258	258	258	258	258
Marion	D	Cypress	Queen City	15,407	15,407	15,407	15,407	15,338	15,271
Morris	D	Cypress	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Nacogdoches	I	Neches	Queen City	2,985	2,985	2,985	2,985	2,985	2,985
Rusk	I	Neches	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Rusk	I	Sabine	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Smith	D	Sabine	Queen City	28,343	28,343	28,343	28,213	28,018	27,887
Smith	I	Neches	Queen City	30,692	30,692	30,692	30,692	30,692	30,692
Titus	D	Cypress	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Trinity	H	Trinity	Queen City	0	0	0	0	0	0
Trinity	I	Neches	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]

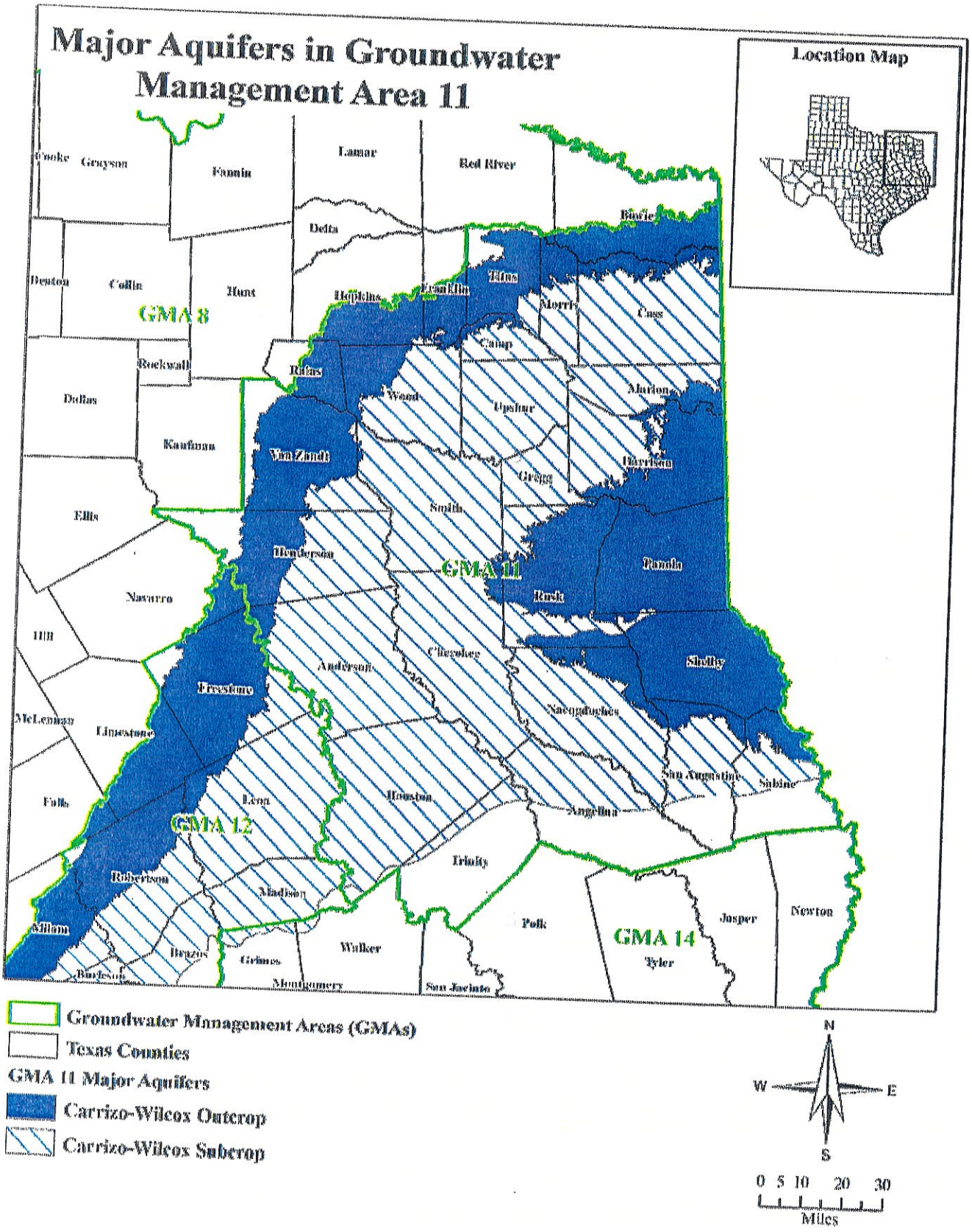
County	RWPA	River Basin	Aquifer	2020	2030	2040	2050	2060	2070
Upshur	D	Cypress	Queen City	19,642	19,642	19,448	19,448	19,448	19,396
Upshur	D	Sabine	Queen City	7,749	7,749	7,749	7,749	7,749	7,749
Van Zandt	D	Neches	Queen City	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Wood	D	Cypress	Queen City	986	986	986	986	986	986
Wood	D	Sabine	Queen City	9,060	9,060	9,060	9,060	9,060	9,060
GMA 11 Total			**Queen City**	**223,469**	**223,469**	**223,276**	**223,145**	**222,709**	**222,287**

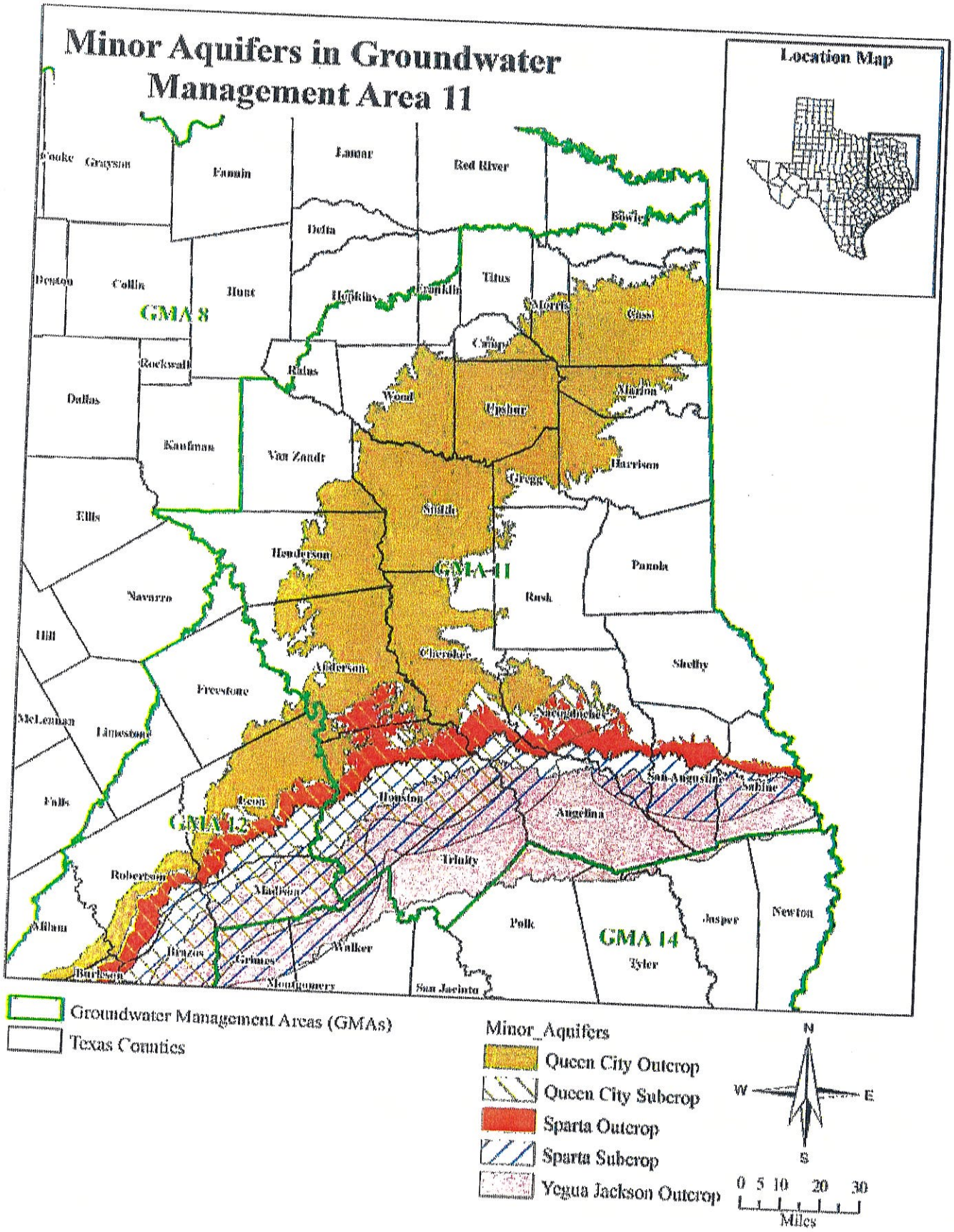
[1]Counties with fewer than 200 square miles of aquifer were noted as not relevant due to size (NRS) in the desired future condition statement. Areas which are not relevant due to size are listed with a NULL value for modeled available groundwater. For additional information in pumping in the model run see Table 6 from Technical Memorandum 16-02 (Hutchison, 2016).

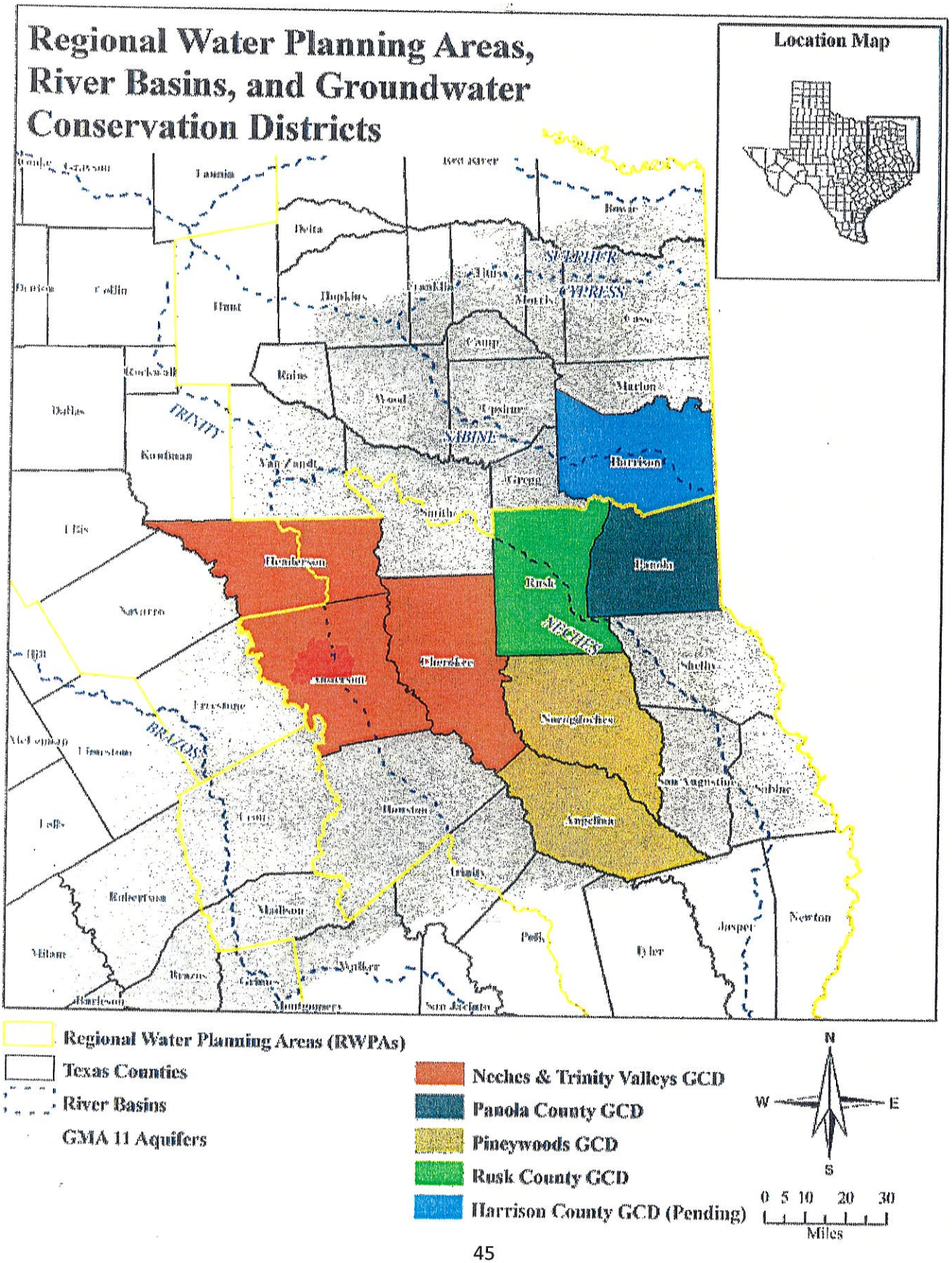
TABLE 7. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE SPARTA AQUIFER IN GROUNDWATER MANAGEMENT AREA 11. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

County	RWPA	River Basin	Aquifer	2020	2030	2040	2050	2060	2070
Anderson	I	Neches	Sparta Aquifer	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Anderson	I	Trinity	Sparta Aquifer	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Angelina	I	Neches	Sparta Aquifer	371	371	371	371	371	371
Cherokee	I	Neches	Sparta Aquifer	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]	NULL[1]
Houston	I	Neches	Sparta Aquifer	477	477	477	477	477	477
Houston	I	Trinity	Sparta Aquifer	977	977	977	977	977	977
Nacogdoches	I	Neches	Sparta Aquifer	365	365	365	365	365	365
Sabine	I	Neches	Sparta Aquifer	37	37	37	37	37	37
Sabine	I	Sabine	Sparta Aquifer	160	160	160	160	160	160
San Augustine	I	Neches	Sparta Aquifer	163	163	163	163	163	163
San Augustine	I	Sabine	Sparta Aquifer	3	3	3	3	3	3
Trinity	H	Trinity	Sparta Aquifer	29	29	29	29	29	29
Trinity	I	Neches	Sparta Aquifer	154	154	154	154	154	154
GMA 11 Total			**Sparta Aquifer**	**2,736**	**2,736**	**2,736**	**2,736**	**2,736**	**2,736**

[1] Counties with fewer than 200 square miles of aquifer were noted as not relevant due to size (NRS) in the desired future condition statement. Areas which are not relevant due to size are listed with a NULL value for modeled available groundwater. For additional information in pumping in the model run see Table 6 from Technical Memorandum 16-02 (Hutchison, 2016).


Major Aquifers in Groundwater Management Area 11
Location Map
GMA 8
GMA 11
GMA 12
GMA 14
Cooke
Grayson
Fannin
Lamar
Red River
Delta
Bowie
Denton
Collin
Hunt
Hopkins
Franklin
Titus
Morris
Cass
Camp
Rockwall
Rains
Wood
Upshur
Marion
Dallas
Kaufman
Van Zandt
Harrison
Gregg
Smith
Ellis
Henderson
Panola
Navarro
Rusk
Hill
Anderson
Cherokee
Shelby
Freestone
Nacogdoches
McLennan
Limestone
San Augustine
Sabine
Leon
Houston
Angelina
Falls
Robertson
Trinity
Madison
Polk
Jasper
Newton
Milam
Walker
Tyler
Brazos
Grimes
Burleson
Montgomery
San Jacinto
Groundwater Management Areas (GMAs)
Texas Counties
GMA 11 Major Aquifers
Carrizo-Wilcox Outcrop
Carrizo-Wilcox Subcrop
N
W
E
S
0 5 10 20 30
Miles


Minor Aquifers in Groundwater Management Area 11
Location Map
GMA 8
GMA 11
GMA 12
GMA 14
Cooke
Grayson
Fannin
Lamar
Red River
Bowie
Delta
Hopkins
Franklin
Titus
Morris
Cass
Camp
Marion
Harrison
Gregg
Panola
Rusk
Shelby
Sabine
San Augustine
Angelina
Nacogdoches
Cherokee
Anderson
Houston
Trinity
Polk
Tyler
Jasper
Newton
Walker
Montgomery
San Jacinto
Grimes
Madison
Leon
Freestone
Limestone
McLennan
Falls
Robertson
Milam
Burleson
Brazos
Navarro
Ellis
Henderson
Smith
Van Zandt
Kaufman
Rockwall
Dallas
Collin
Denton
Hunt
Rains
Wood
Upshur
Groundwater Management Areas (GMAs)
Texas Counties
Minor_Aquifers
Queen City Outcrop
Queen City Subcrop
Sparta Outcrop
Sparta Subcrop
Yegua Jackson Outcrop
N
W
E
S
0 5 10 20 30
Miles


Regional Water Planning Areas, River Basins, and Groundwater Conservation Districts
Location Map
SABINE
NECHES
TRINITY
BRAZOS
Henderson
Cherokee
Anderson
Rusk
Panola
Harrison
Nacogdoches
Angelina
Shelby
Regional Water Planning Areas (RWPAs)
Texas Counties
River Basins
GMA 11 Aquifers
Neches & Trinity Valleys GCD
Panola County GCD
Pineywoods GCD
Rusk County GCD
Harrison County GCD (Pending)
N
W
E
S
0 5 10 20 30
Miles