Texana Groundwater Conservation District

Management Plan

Texana Groundwater Conservation District Management Plan Adoption:	April 20, 2023
Texas Water Development Board Administrative Approval:	July 17, 2023

Table of Contents

DISTRICT MISSION

The mission of the Texana Groundwater Conservation District is to develop sound water conservation and management strategies designed to conserve, preserve, protect, and prevent waste of groundwater resources for long-term sustainability within Jackson County for the benefit of the landowners, citizens, economy, and environment of Jackson County.

The district will implement these strategies through the acquisition and dissemination of hydrogeological information, the development of programs and incentives to conserve and protect groundwater resources, and the adoption and enforcement of fair and appropriate rules governing the production and use of the groundwater resources within the Jackson County.

PURPOSE OF THE GROUNDWATER MANAGEMENT PLAN

Senate Bill 1, enacted by the 75th Texas Legislature in 1997, and Senate Bill 2, enacted by the 77th Texas Legislature in 2001, established a comprehensive statewide water resource planning process and the actions necessary for groundwater conservation districts to manage and conserve the groundwater resources of the state of Texas. These bills required all groundwater conservation districts to develop a management plan which defines the groundwater needs and groundwater supplies within each district and the goals each district has set to achieve its mission.

In addition, the 79th Texas Legislature enacted House Bill 1763 in 2005 that requires joint planning among districts that are in the same groundwater management area. These districts must jointly agree upon and establish the desired future conditions of the aquifers within their respective groundwater management areas. Through this process, the groundwater conservation districts will submit the desired future conditions to the executive administrator of the Texas Water Development Board who, in turn, will provide each district within the groundwater management area with the amount of modeled available groundwater within each district. The modeled available groundwater will be based on the desired future conditions jointly established for each aquifer within the groundwater management area.

Technical information, such as the desired future conditions within the jurisdiction of the district and the amount of modeled available groundwater from such aquifers is required by statute to be included in the management plan of the district and will guide the regulatory and management policies of the district. This management plan is intended to satisfy the requirements of Senate Bill 1, Senate Bill 2, House Bill 1763, the statutory requirements of Chapter 36 of the Texas Water Code, and the rules and requirements of the Texas Water Development Board.

DISTRICT INFORMATION

Creation

The district was created by Senate Bill 1911, 76th Legislature and codified as Chapter 8857, Special District and Local Laws Code. The citizens of Jackson County through a confirmation election held on November 6, 2001 ratified the district. The district was formed to protect, conserve, and prevent waste of the groundwater resources beneath the area of Jackson County. To manage the groundwater resources under its jurisdiction, the district is charged with the rights and responsibilities specified in its enabling legislation; the provisions of Chapter 36 of the Texas Water Code; this groundwater management plan, and the rules of the district.

Directors

The Texana Groundwater Conservation District Board of Directors consists of seven members. These directors are elected by the voters of Jackson County and serve a four-year term. The district observes the same four precincts as the Jackson County Commissioners with three at-large positions. Director terms are staggered on a two-year election interval in even numbered years.

Authority

The district has the rights and responsibilities provided in Chapter 36 of the Texas Water Code and Chapter 356 of Title 31 of the Texas Administrative Code. The district has the authority to undertake hydrogeological studies, adopt a management plan, provide for the permitting of certain water wells, and implement programs to achieve statutory requirements. The district has rule-making authority to implement its policies and procedures to manage the groundwater resources of Jackson County.

Location and Extent

The boundaries of the district are conterminous with those of Jackson County, Texas. This area encompasses approximately 857 square miles. The district is bounded by Calhoun County, Colorado County, Lavaca County, Matagorda County, Victoria County, and Wharton County.

GROUNDWATER RESOURCES OF JACKSON COUNTY

Depositions from sediment-laden rivers, currents from the Gulf of Mexico, and storm waves have influenced the geologic formations in Jackson County. The fluctuation of the coastline over geologic eons contributed to the deposition of sediments within the Jackson County as well. The geologic formations in the Jackson County according to their depositional age are summarized in Figure 1. The Gulf Coast Aquifer underlies Jackson County.

Figure 1: Geologic and Hydrogeological Units of the Gulf Coast Aquifer in Jackson County.

<table>
<tr><th colspan="2">Stratigraphic Unit</th><th>Hydrogeologic Unit</th></tr>
<tr><td colspan="2">Alluvium</td><td rowspan="6">Chicot Aquifer</td></tr>
<tr><td colspan="2">Beaumont Clay</td></tr>
<tr><td>Montgomery Formation</td><td rowspan="2">Lissie Formation</td></tr>
<tr><td>Bentley Formation</td></tr>
<tr><td colspan="2">Willis Sand</td></tr>
<tr><td colspan="2">Goliad Sand</td><td rowspan="2">Evangeline Aquifer</td></tr>
<tr><td colspan="2" rowspan="2">Fleming Formation</td></tr>
<tr><td>Burkeville Confining Unit</td></tr>
<tr><td colspan="2">Oakville Sandstone</td><td rowspan="2">Jasper Aquifer</td></tr>
<tr><td colspan="2">Catahoula Sandstone (Tuff)</td></tr>
</table>

The Gulf Coast Aquifer System is conceptualized to comprise of four distinct aquifer components: Chicot, Evangeline, Burkeville Confining Unit and the Jasper Aquifer (Baker, 1979). These aquifer components are included within the Central Gulf Coast Groundwater Availability Model developed by the Texas Water Development Board (Chowdhury and Mace, 2004).

The Chicot and the Evangeline Aquifers are utilized the most within Jackson County. The Chicot Aquifer outcrops across the entire county. The thickness of the Chicot Aquifer ranges up to approximately 1,000 feet in Jackson County. The thickness of the Evangeline Aquifer ranges from 1,000 feet to 1,600 feet in Jackson County. The Chicot and Evangeline Aquifer consist of interbedded sands, silts and clays. The sand content is higher in the Evangeline Aquifer compared to the Chicot Aquifer. The water quality in the aquifer generally deteriorates along the coast.

STATEMENT OF GUIDING PRINCIPLES

The district recognizes that the groundwater resources of Jackson County and the region are of vital importance to the many users who are dependent on these valuable resources. In addition, the district recognizes that the landowners have an ownership right in the groundwater resources associated with their properties and are the primary stewards of the groundwater resources associated with their properties. The district will work with interested parties, especially landowners, in Jackson County to conserve, preserve, protect, and prevent waste of this most valuable resource, for the benefit of the landowners, the public, the local economy, and the environment.

The groundwater management plan of the district is intended to serve as a tool to focus the thoughts and actions of those given the responsibility for the execution of the activities of the district as well as to provide information to the staff of the district, landowners, and others responsible for the execution of, or compliance with, the policies and rules of the district. The district will carry out its programs and responsibilities in implementing this groundwater management plan in a prudent and cost-effective manner. The district, with public input, will adopt and enforce rules necessary to implement this groundwater management plan.

CRITERIA FOR PLAN APPROVAL

Planning Horizon

The planning period for this plan is ten years from the date of approval by the Texas Water Development Board. This plan will be reviewed within five years as required by §36.1072(e) of the Texas Water Code. The district will consider the necessity to amend the plan and re-adopt this management plan with or without amendments as required by §36.1072(e) of the Texas Water Code.

This groundwater management plan will remain in effect until replaced by a revised management plan approved by the Texas Water Development Board.

Notice and Hearing Related to Plan Adoption - TWC §36.1071(a)

Public notices documenting that this plan was considered and adopted following appropriate public hearings are included in Appendix D.

Coordination with Regional Surface Water Management Entities - TWC §36.1071(a)

Letters transmitting this plan to the surface water management entities of the Jackson County region for coordination purposes are included in Appendix E.

Texana Groundwater Conservation District Board of Director Resolution Adopting Management Plan

A copy of the resolution approved by the Board of Directors of the Texana Groundwater Conservation District adopting this plan is included in Appendix F.

ESTIMATES OF TECHNICAL INFORMATION REQUIRED BY §36.1071 OF THE TEXAS WATER CODE AND RULE 356.52 OF TITLE 31 OF THE TEXAS ADMINISTRATIVE CODE

Estimate of Modeled Available Groundwater in the DISTRICT based on Desired Future Conditions – TWC §36.1071(e)(3)(A) and 31 TAC 356.52(a)(5)(A)

Modeled available groundwater is defined in §36.001 of the Texas Water Code as "the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a desired future condition established under Section 36.108." Desired future condition 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.” The desired future condition of an aquifer may only be determined through joint planning with other groundwater conservation districts in the same groundwater management area as specified under §36.108 of the Texas Water Code.

The district is located in Groundwater Management Area 15. The representatives of the member districts of Groundwater Management Area 15 adopted, by resolution, the desired future condition for Gulf Coast Aquifer within Groundwater Management Area 15 on October 14, 2021.

The resolution adopting the desired future condition for Groundwater Management Area 15 states the gma-specific DFC “for the counties in the groundwater management area (gma-specific DFC) shall not exceed an average drawdown of 13 feet for the Gulf Coast Aquifer System at December 2080;”

The resolution adopting the desired future condition for Groundwater Management Area 15 states the county-specific DFC for Jackson County shall not exceed “15 feet of drawdown of the Gulf Coast Aquifer System.”

The technical consultant of Groundwater Management Area 15 submitted the adopted desired future conditions and explanatory report for Groundwater Management Area 15 on December 13, 2021, to Texas Water Development Board.

The Texas Water Development Board reported the modeled available groundwater for Groundwater Management Area 15 in GAM Run 21-020 MAG which is incorporated into this management plan as Appendix C.

The modeled available groundwater, in acre-feet per year (AFY), of the Gulf Coast Aquifer within the district per Table 2 of the GAM Run 21-020 MAG specifies the following values for the district:

Year					
2020	2030	2040	2050	2060	2069
90,571	90,571	90,571	90,571	90,571	90,571

All values in acre-feet/year (AFY)

Estimate of amount of groundwater being used within the district on an annual basis – TWC §36.1071(e)(3)(B) and 31 TAC 356.52(a)(5)(B)

The district recognizes the estimate of the amount of groundwater being used within the district on an annual basis, according to information provided by the Texas Water Development Board, totals 61,064 acre-feet in year 2018. Refer to Appendix A for additional information.

Estimate of annual amount of recharge from precipitation to the groundwater resources within the district – TWC §36.1071(e)(3)(C) and 31 TAC 356.52(a)(5)(C)

The district recognizes the estimate of the amount of recharge from precipitation to the groundwater resources within the district , according to information provided by the Texas Water Development Board, totals 10,841 acre-feet. Refer to Appendix B for additional information.

Estimate for each aquifer, annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers – TWC §36.1071(e)(3)(D) and 31 TAC 356.52(a)(5)(D)

The district recognizes the estimate for each aquifer, annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers within the district , according to information provided by the Texas Water Development Board, totals 21,572 acre-feet. Refer to Appendix B for additional information.

Estimate of annual volume of flow into and out of the district within each aquifer and between aquifers in the district – TWC §36.1071(e)(3)(E) and 31 TAC 356.52(a)(5)(E)

The district recognizes the estimate of the annual volume of groundwater flowing into the district within each aquifer, according to information provided by the Texas Water Development Board, totals 38,344 acre-feet. The district recognizes the estimate of the annual volume of groundwater flowing out of the district within each aquifer, according to information provided by the Texas Water Development Board, totals 17,643 acre-feet. The estimated net annual volume of flow between each aquifer in the district is not applicable because the model assumes a no flow barrier at the base of the Gulf Coast Aquifer System. Refer to Appendix B for additional information.

Estimate of projected surface water supply in the district according to the most recently adopted state water plan – TWC §36.1071(e)(3)(F) and 31 TAC 356.52(a)(5)(F)

The district recognizes the sum of projected surface water supplies, according to information provided by the Texas Water Development Board, is 1,000 acre-feet for year 2030 and 1,000 acre-feet for year 2070.

The district recognizes the projection of existing surface water supplies, according to the 2022 State Water Plan Interactive Site published by the Texas Water Development Board, is 10,955 acre-feet for year 2030 and 10,955 acre-feet for year 2070.

Refer to Appendix A and the 2022 State Water Plan for additional information.

Estimate of projected total demand for water in the district according to the most recently adopted state water plan – TWC §36.1071(e)(3)(G) and 31 TAC 356.52(a)(5)(G)

The district recognizes the sum of projected water demands, according to information provided by the Texas Water Development Board, is 63,447 acre-feet for year 2030 and 63,502 acre-feet for year 2070.

The district recognizes the projection of water demands, according to the 2022 State Water Plan Interactive Site published by the Texas Water Development Board, is 93,277 acre-feet for year 2030 and 93,201 acre-feet for year 2070.

Refer to Appendix A and the 2022 State Water Plan for additional information.

CONSIDER THE WATER SUPPLY NEEDS AND WATER MANAGEMENT STRATEGIES INCLUDED IN THE ADOPTED STATE WATER PLAN – TWC §36.1071(e)(4)

The district recognizes that there are no water supply needs within the district, according to information provided by the Texas Water Development Board and the 2022 State Water Plan Interactive Site published by the Texas Water Development Board. Refer to Appendix A and the 2022 State Water Plan for additional information.

The district recognizes that conservation for manufacturing water management strategies for manufacturing water user groups in Jackson County are projected to supply 1,101 acre-feet of water in the district in 2030 and 1,101 acre-feet of water in the district in 2070.

The district recognizes that municipal drought management water management strategies for the Cities of Edna and Ganado are projected to supply 80 acre-feet of water in the district in 2030 and 80 acre-feet of water in the district in 2070.

Refer to Appendix A and the 2022 State Water Plan for additional information.

The district recognizes that persons possessing groundwater rights may seek authorization to produce groundwater from within Jackson County for many purposes including supplying water to activities projected by TWDB to create water supply needs and the water management strategies identified in the 2022 State Water Plan.

DETAILS ON THE DISTRICT MANAGEMENT OF GROUNDWATER

The Texas Legislature established that groundwater conservation districts are the preferred method of groundwater management in §36.0015 of the Texas Water Code. The district will manage the use of groundwater within Jackson County in order to protect, preserve, conserve, and prevent waste of the resource while seeking to maintain the economic viability of all resource user groups, public and private. The district seeks to manage the groundwater resources of Jackson County as practicably as possible as established in the plan. In consideration of the economic and cultural activities occurring within Jackson County, the district will identify and engage in such activities and practices, that if implemented may result in the reasonable and effective protection, preservation, conservation, waste prevention of groundwater in Jackson County. The district will manage groundwater resources through rules developed and implemented in accordance with Chapter 36 of the Texas Water Code and the provisions of the enabling legislation of the district .

For the purposes of this management plan, the following definitions are used:

- Protection of groundwater is the activity and practice of seeking to prevent harm or injury to a groundwater resource.
- Preservation of groundwater is the activity and practice of seeking to extend the useful longevity or life of a groundwater resource.
- Conservation of groundwater is the activity and practice of seeking to use a groundwater resource in a manner that appropriately balances the impacts associated with consuming the resource and preserving the resource for the future.
- Waste prevention of groundwater is the activity and practices seeking to prevent the use of groundwater in any manner defined as waste in §36.001 of the Texas Water Code.

The district will monitor aquifer conditions in and around Jackson County in order to monitor changing water levels and water quality of groundwater resources within Jackson County. The district will make periodic assessments of aquifer conditions and will report those conditions to the Board of Directors of the district and to the public. The district may undertake, as necessary, investigations of the groundwater resources within Jackson County and will make the results of investigations available to the public. The district will cooperate with investigations of the groundwater resources of Jackson County undertaken by other local political subdivisions or agencies of the State of Texas.

In order to better manage groundwater resources, the district may establish management zones for; and adopt different rules for:

1. Each aquifer, subdivision of an aquifer, or geologic strata located in whole or in part within Jackson County; or
2. Each geographic area overlying an aquifer or subdivision of an aquifer located in whole or in part within Jackson County.

For the purpose of managing the use of groundwater within Jackson County, the district

may define sustainable use as the use of an amount of groundwater in Jackson County as a whole or any management zone established by the district that does not exceed any of the following conditions:

1. the long-term average historical groundwater production from aquifers in Jackson County established by the district prior to the establishment of the desired future condition of aquifers in a groundwater management area in which the district is located; or
2. the desired future conditions of aquifers in Jackson County established by a groundwater management area in which the district is located; or
3. The amount of modeled available groundwater resulting from the establishment of a desired future aquifer condition by the district or a groundwater management area in which the district is located; or
4. the estimated long-term average historical amount of annual recharge of the aquifer or aquifer subdivision in which the use occurs as recognized by the district ; or
5. any other criteria established by the district as being a threshold of use beyond which further use of the aquifer or aquifer subdivision may result in a specified undesirable or injurious condition.

The district may adopt rules that protect historic use of groundwater in Jackson County to the maximum extent practical and consistent with this plan and the goals and objectives set forth herein. The district may impose more restrictive conditions on non-historic-use permits and non-historic-use permit amendments to increase use by historic users if the limitations:

1. apply to all non-historic-use permits and non-historic-use permit amendments to increase use by historic users, regardless of the type or location of use;
2. bear a reasonable relationship to the Desired Future Condition of the district ; and
3. are reasonably necessary to protect historic use.

The district may adopt rules to regulate groundwater withdrawals by means of spacing and production limits. The relevant factors to be considered in making a determination to grant or deny a permit or limit groundwater withdrawals shall include those set forth in the enabling legislation of the district , Chapter 36 of the Texas Water Code, and the rules of the district . The district may employ technical resources at its disposal, as needed, to evaluate the groundwater resources available within Jackson County and to determine the effectiveness of regulatory or conservation measures. In consideration of particular individual, localized, or district-wide conditions, including without limitation climatic conditions, the district may, by rule, allow an increase or impose a decrease in the total production in a management zone above or below the sustainable amount for a period of time considered necessary by the district in order to accomplish the purposes set forth in Chapter 36 of the Texas Water Code, or the enabling legislation of the district . The exercise of said discretion by the Board of Directors of the Texana Groundwater Conservation District shall not be construed as limiting the power of the Board of Directors of the Texana Groundwater Conservation District.

ACTIONS, PROCEDURES, PERFORMANCE AND AVOIDANCE FOR PLAN IMPLEMENTATION – TWC §36.1071(e)(2)

The district will implement the provisions of this plan and will utilize the provisions of this plan as a guide for determining the direction or priority for all activities. All operations of the district , all agreements entered into by the district , and any additional planning efforts in which the district may participate will be consistent with the provisions of this plan.

The rules of the district adopted by the Board of Directors of the Texana Groundwater Conservation District shall comply with Chapter 36 of the Texas Water Code, including §36.113 of the Texas Water Code, and the provisions of this management plan. All rules will be adhered to and enforced. The promulgation and enforcement of the rules will be based on the best technical evidence available to the district .

The rules of the district are available at the following website address: https://texanagcd.org/groundwater-policy.html.

METHODOLOGY FOR TRACKING DISTRICT PROGRESS IN ACHIEVING MANAGEMENT GOALS – 31TAC 356.52(a)(4)

The staff of the district will prepare and present an annual report to the members of the Board of Directors regarding the performance of the district in achieving management goals and objectives. The report will be presented within 180 days following the completion of each fiscal year. The district will maintain the report on file for public inspection at the office of the district upon adoption at a meeting of the Texana Groundwater Conservation Board of Directors.

GOALS, MANAGEMENT OBJECTIVES AND PERFORMANCE STANDARDS

Providing the most efficient use of groundwater – TWC §36.1071(a)(1) and 31 TAC 356.52(a)(1)(A)

Objective: Develop and maintain a program for processing permitting requests submitted to the district and tracking well registrations and permits issued by the district authorizing groundwater production during the fiscal year.

Performance Standard: The district will summarize within the annual report 1) the status of pending permitting requests and 2) the number of wells registered by the district, and 3) the volume of groundwater authorized to be produced under production permits issued by the district, as of the last day of the preceding fiscal year.

Controlling and preventing waste of groundwater – TWC §36.1071(a)(2) and 31 TAC 356.52(a)(1)(B)

Objective: Develop and maintain a program for inspecting at least twelve (12) water wells within the district during the fiscal year.

Performance Standard: The district will summarize within the annual report the number of wells inspected during the preceding fiscal year and those wells requiring corrective action.

Controlling and preventing subsidence – TWC §36.1071(a)(3) and 31 TAC 356.52(a)(1)(C)

This category of management goal is not applicable to the district at this time because no significant subsidence is occurring in Jackson County. The district will monitor geological conditions for evidence of subsidence, particularly in high groundwater production areas near the coast and take appropriate action should significant subsidence develop.

The district reviewed the technical report titled *Final Report: Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping; TWDB Contract Number 1648302062.* The report, in Section 4.2.4, characterizes all portions of Jackson County as medium or higher risk of subsidence.

Addressing conjunctive surface water management issues – TWC §36.1071(a)(4) and 31 TAC 356.52(a)(1)(D)

Objective: Participate in the regional water planning process by attending and participating in at least one (1) Lavaca Regional Water Planning Group (Region P) meeting held during the fiscal year.

Performance Standard: The district will summarize within the annual report the dates of meetings of the Lavaca Regional Water Planning Group attended by representatives of the district during the preceding fiscal year.

Addressing natural resource issues which impact the use and availability of groundwater, and which are impacted by the use of groundwater – TWC §36.1071(a)(5) and 31 TAC §356.52(a)(1)(E)

Objective: Develop and maintain a program to monitor the water quality of at least twelve (12) water wells within the district per year.

Performance Standard: The district will summarize within the annual report 1) the number of wells monitored and 2) the water quality measurements collected during the preceding fiscal year.

Addressing drought conditions – TWC §36.1071(a)(6) and 31 TAC 356.52(a)(1)(F)

Objective: Review drought condition information related to the district and the surrounding region of Texas collected from the following website at least four meetings of the Board of Directors during the fiscal year: https://www.waterdatafortexas.org/drought/ .

Performance Standard: The district will summarize within the annual report the number of instances drought condition information was considered by the Board of Directors during the preceding fiscal year.

Addressing conservation, recharge enhancement, rainwater harvesting, precipitation enhancement, or brush control, where appropriate and cost-effective – TWC §36.1071(a)(7) and 31 TAC 356.52(a)(1)(G)

Objective: Promote conservation, rainwater harvesting, or brush control within Jackson County at least once during the fiscal year.

Performance Standard: The district will summarize within the annual report the number of instances the district promoted conservation, rainwater harvesting, or brush control during the preceding fiscal year.

Addressing recharge enhancement and precipitation enhancement are deemed to be neither appropriate nor cost-effective activities for the district. The costs of operating a recharge enhancement or precipitation enhancement program are prohibitive and would require the district to increase taxes. Therefore, these goals are not considered applicable to the district at this time.

Addressing the desired future conditions adopted by the district under Section 36.108 – TWC §36.1071(a)(8) and 31 TAC 356.52(a)(1)(H)

Objective: Develop and maintain a program to monitor the water level of at least twelve (12) water wells within the district per year.

Performance Standard: The district will summarize within the annual report 1) the number of wells monitored and 2) the water level

measurements collected during the preceding fiscal year.

Objective: Analyze aquifer monitoring information to evaluate achievement of the desired future conditions of the district based on information available during the fiscal year.

Performance Standard: The district will summarize within the annual report 1) the aquifer monitoring information and 2) the conclusions regarding the achievement of the desired future conditions of the district during the preceding fiscal year.

List of Appendices

Appendix A. Estimated Historical Water Use and State Water Plan Data

Appendix B. Groundwater Availability Model Run provided by Texas Water Development Board - GAM RUN 20-006: TEXANA GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

Appendix C. Modeled Available Groundwater GAM Run 21-020 MAG

Appendix D. Public Notices Regarding Hearings Related to Plan Adoption

Appendix E. Letters Coordinating with Regional Surface Water Management Entities

Appendix F. Texana Groundwater Conservation District Board of Director Resolution Adopting Management Plan

Appendix G. Minutes of Texana Groundwater Conservation District Board of Director Meeting related to the public hearings for and adoption of the Management Plan

Appendix H. Texana Groundwater Conservation District Contact Information

Appendix A. Estimated Historical Water Use and State Water Plan Data

Estimated Historical Water Use And 2017 State Water Plan Datasets:

Texana Groundwater Conservation District

by Stephen Allen
Texas Water Development Board
Groundwater Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
February 22, 2021

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 Water 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 2017 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 Dr. Shirley Wade, shirley.wade@twdb.texas.gov, (512) 936-0883.

DISCLAIMER:

The data presented in this report represents the most up-to-date WUS and 2017 SWP data available as of 2/22/2021. 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 2017 SWP. District personnel must review these datasets and correct any discrepancies in order 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 2017 SWP dataset can be verified by contacting Sabrina Anderson (sabrina.anderson@twdb.texas.gov or 512-936-0886).

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 2019. TWDB staff anticipates the calculation and posting of these estimates at a later date.

JACKSON COUNTY

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2018	GW	1,422	59	0	0	59,159	424	61,064
	SW	0	480	0	0	430	229	1,139
2017	GW	1,413	66	0	0	52,934	407	54,820
	SW	0	470	0	0	891	218	1,579
2016	GW	1,316	55	0	0	55,659	536	57,566
	SW	0	464	0	0	914	289	1,667
2015	GW	1,372	62	0	0	39,041	518	40,993
	SW	0	473	0	0	488	279	1,240
2014	GW	1,637	50	0	0	71,216	506	73,409
	SW	0	474	0	0	0	273	747
2013	GW	1,748	25	0	0	97,333	482	99,588
	SW	0	431	0	0	1,492	259	2,182
2012	GW	1,947	32	0	0	48,889	534	51,402
	SW	0	458	0	0	445	288	1,191
2011	GW	2,109	28	0	0	86,894	835	89,866
	SW	0	487	0	0	442	449	1,378
2010	GW	1,713	37	43	0	42,258	793	44,844
	SW	0	432	6	0	1,500	427	2,365
2009	GW	1,852	29	43	0	45,911	681	48,516
	SW	0	431	6	0	1,699	367	2,503
2008	GW	1,746	33	42	0	35,889	670	38,380
	SW	0	451	6	0	1,334	361	2,152
2007	GW	1,626	140	0	0	33,242	757	35,765
	SW	0	461	0	0	471	409	1,341
2006	GW	1,832	167	0	0	33,396	669	36,064
	SW	0	489	0	0	0	362	851
2005	GW	1,789	166	0	0	42,893	583	45,431
	SW	0	474	0	0	0	314	788
2004	GW	1,723	122	0	0	44,599	205	46,649
	SW	0	434	0	0	621	677	1,732
2003	GW	1,793	90	0	0	33,494	210	35,587
	SW	3	494	0	0	756	689	1,942

Projected Surface Water Supplies
TWDB 2017 State Water Plan Data

JACKSON COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
P	MANUFACTURING, JACKSON	COLORADO-LAVACA	TEXANA LAKE/RESERVOIR	1,000	1,000	1,000	1,000	1,000	1,000
	Sum of Projected Surface Water Supplies (acre-feet)			**1,000**	**1,000**	**1,000**	**1,000**	**1,000**	**1,000**

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.

JACKSON COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
P	COUNTY-OTHER, JACKSON	COLORADO-LAVACA	229	226	222	220	220	221
P	COUNTY-OTHER, JACKSON	LAVACA	421	417	406	403	404	406
P	COUNTY-OTHER, JACKSON	LAVACA-GUADALUPE	50	49	48	47	48	48
P	EDNA	LAVACA	885	887	877	877	881	885
P	GANADO	LAVACA	270	270	267	266	267	268
P	IRRIGATION, JACKSON	COLORADO-LAVACA	18,061	18,061	18,061	18,061	18,061	18,061
P	IRRIGATION, JACKSON	LAVACA	36,370	36,370	36,370	36,370	36,370	36,370
P	IRRIGATION, JACKSON	LAVACA-GUADALUPE	5,370	5,370	5,370	5,370	5,370	5,370
P	LIVESTOCK, JACKSON	COLORADO-LAVACA	228	228	228	228	228	228
P	LIVESTOCK, JACKSON	LAVACA	708	708	708	708	708	708
P	LIVESTOCK, JACKSON	LAVACA-GUADALUPE	98	98	98	98	98	98
P	MANUFACTURING, JACKSON	COLORADO-LAVACA	666	686	705	721	766	815
P	MANUFACTURING, JACKSON	LAVACA	4	4	4	4	5	5
P	MINING, JACKSON	COLORADO-LAVACA	10	11	8	6	4	3
P	MINING, JACKSON	LAVACA	39	40	30	22	14	10
P	MINING, JACKSON	LAVACA-GUADALUPE	21	22	17	12	8	6
	Sum of Projected Water Demands (acre-feet)		**63,430**	**63,447**	**63,419**	**63,413**	**63,452**	**63,502**

Projected Water Supply Needs
TWDB 2017 State Water Plan Data

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

JACKSON COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
P	COUNTY-OTHER, JACKSON	COLORADO-LAVACA	0	3	7	9	9	8
P	COUNTY-OTHER, JACKSON	LAVACA	0	4	15	18	17	15
P	COUNTY-OTHER, JACKSON	LAVACA-GUADALUPE	0	1	2	3	2	2
P	EDNA	LAVACA	2	0	10	10	6	2
P	GANADO	LAVACA	0	0	3	4	3	2
P	IRRIGATION, JACKSON	COLORADO-LAVACA	0	0	0	0	0	0
P	IRRIGATION, JACKSON	LAVACA	0	0	0	0	0	0
P	IRRIGATION, JACKSON	LAVACA-GUADALUPE	0	0	0	0	0	0
P	LIVESTOCK, JACKSON	COLORADO-LAVACA	0	0	0	0	0	0
P	LIVESTOCK, JACKSON	LAVACA	0	0	0	0	0	0
P	LIVESTOCK, JACKSON	LAVACA-GUADALUPE	0	0	0	0	0	0
P	MANUFACTURING, JACKSON	COLORADO-LAVACA	334	314	295	279	234	185
P	MANUFACTURING, JACKSON	LAVACA	1	1	1	1	0	0
P	MINING, JACKSON	COLORADO-LAVACA	1	0	3	5	7	8
P	MINING, JACKSON	LAVACA	1	0	10	18	26	30
P	MINING, JACKSON	LAVACA-GUADALUPE	1	0	5	10	14	16
	Sum of Projected Water Supply Needs (acre-feet)		**0**	**0**	**0**	**0**	**0**	**0**

Projected Water Management Strategies
TWDB 2017 State Water Plan Data

JACKSON COUNTY

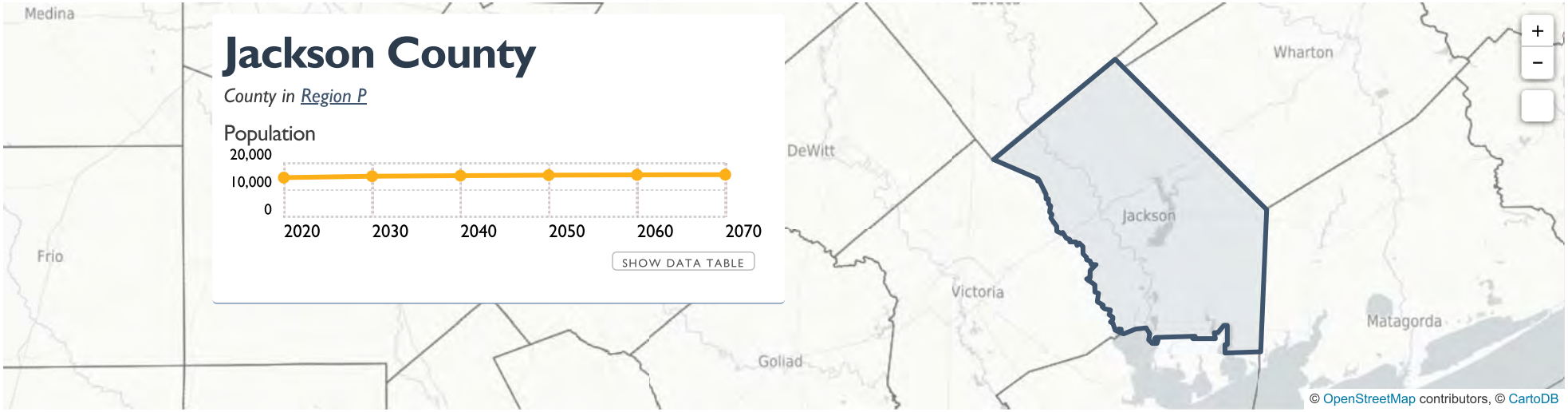
WUG, Basin (RWPG)

All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
EDNA, LAVACA (P)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [JACKSON]	33	33	33	33	33	33
		33	**33**	**33**	**33**	**33**	**33**
GANADO, LAVACA (P)							
DROUGHT MANAGEMENT	DEMAND REDUCTION [JACKSON]	54	54	53	53	53	54
		54	**54**	**53**	**53**	**53**	**54**
Sum of Projected Water Management Strategies (acre-feet)		**87**	**87**	**86**	**86**	**86**	**87**

View data for | County | Select County | GO

ABOUT



Jackson County

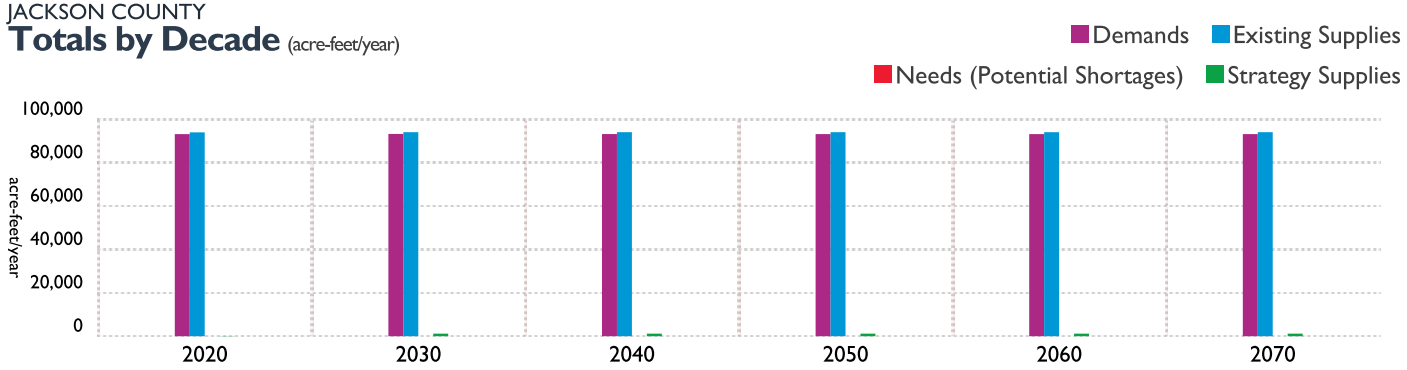
County in Region P

Population

SHOW DATA TABLE

JACKSON COUNTY

Totals by Decade (acre-feet/year)

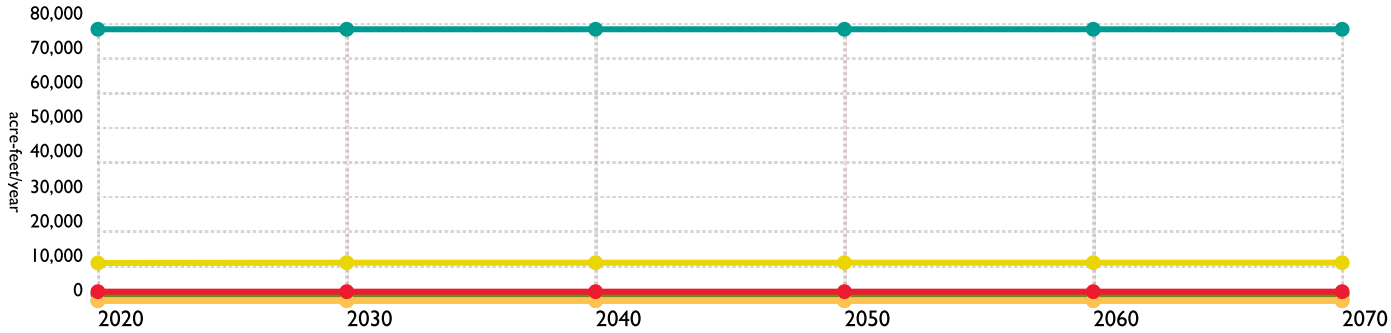


	2020	2030	2040	2050	2060	2070
Demands	93,199	93,277	93,228	93,207	93,200	93,201
Existing Supplies	94,002	94,083	94,083	94,083	94,083	94,083
Needs (Potential Shortages)	0	0	0	0	0	0
Strategy Supplies	80	1,181	1,181	1,181	1,181	1,181

View data for County | Select County

Steam Electric Power | Livestock | Mining

DEMANDS | EXISTING SUPPLIES | NEEDS (POTENTIAL SHORTAGES) | STRATEGY SUPPLIES



HIDE DATA TABLE

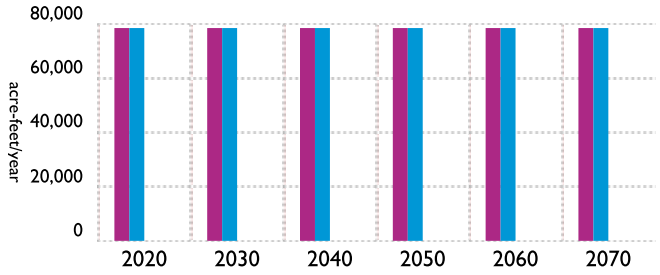
	2020	2030	2040	2050	2060	2070
Mining	73	73	73	73	73	73
Livestock	1,882	1,882	1,882	1,882	1,882	1,882
Steam Electric Power	0	0	0	0	0	0
Manufacturing	10,924	11,005	11,005	11,005	11,005	11,005
Municipal	2,625	2,625	2,625	2,625	2,625	2,625
Irrigation	78,498	78,498	78,498	78,498	78,498	78,498
Total	*94,002*	*94,083*	*94,083*	*94,083*	*94,083*	*94,083*

JACKSON COUNTY

Data by Usage Type (acre-feet/year)

Demands | Existing Supplies | Needs (Potential Shortages) | Strategy Supplies

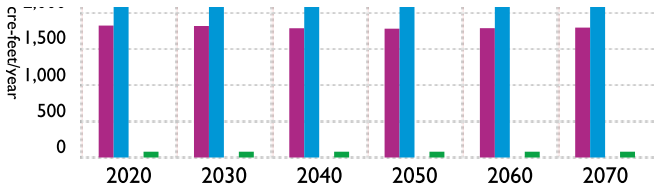
Irrigation



SHOW DATA TABLE

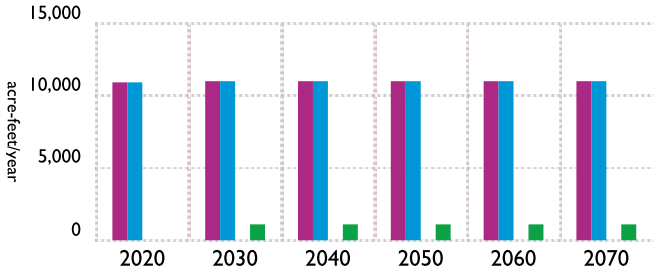
Municipal

View data for County Select County



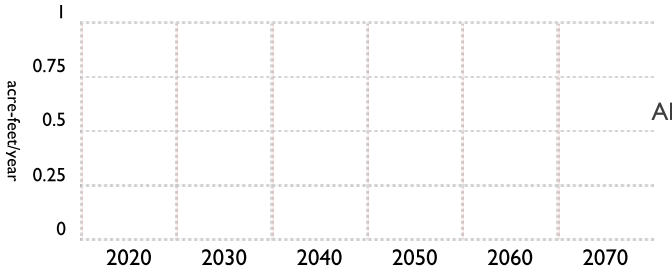
SHOW DATA TABLE

Manufacturing



SHOW DATA TABLE

Steam Electric Power

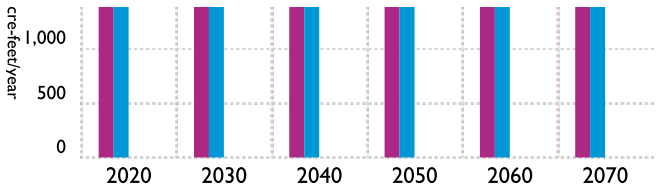


All values are zero

SHOW DATA TABLE

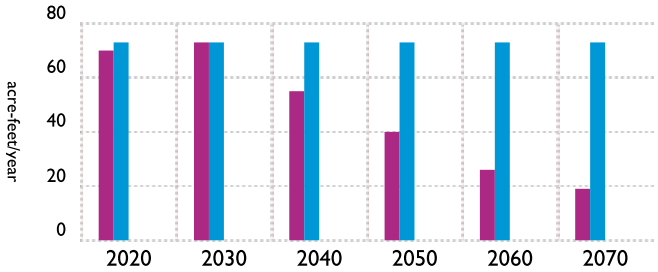
Livestock

View data for County Select County



SHOW DATA TABLE

Mining



SHOW DATA TABLE

JACKSON COUNTY
Recommended Projects Serving Area of Interest

There are no recommended projects.

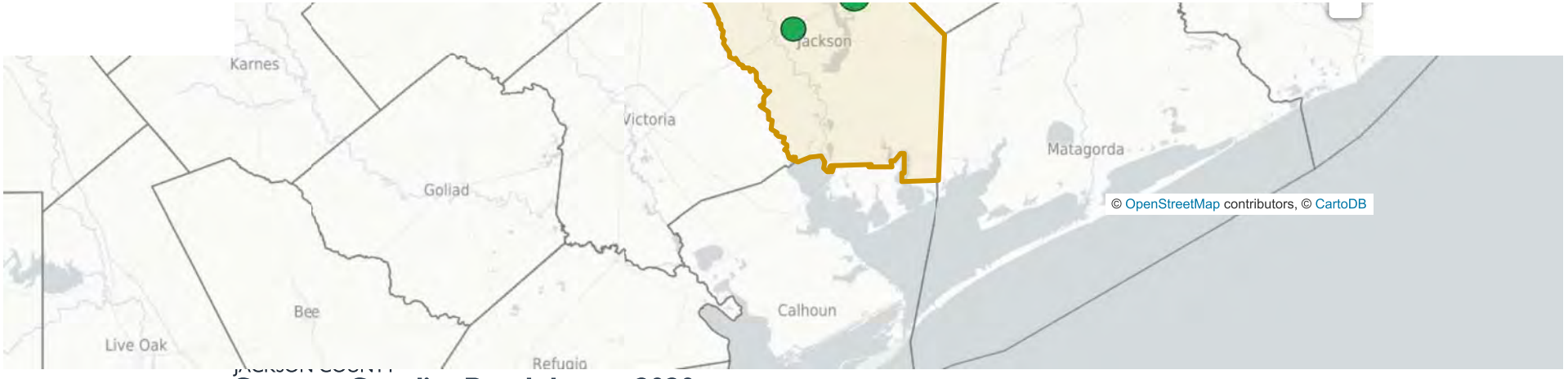
Data by Planning Decade and Theme

Decade: 2020 | 2030 | 2040 | 2050 | 2060 | 2070

Theme: POPULATION | DEMANDS | EXISTING SUPPLIES | NEEDS (POTENTIAL SHORTAGES) | STRATEGY SUPPLIES

JACKSON COUNTY
Water User Groups - 2020 - Strategy Supplies (acre-feet/year)

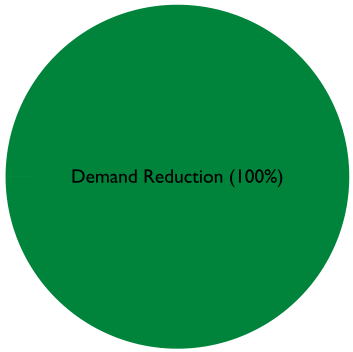
View data for County | Select County



JACKSON COUNTY

Strategy Supplies Breakdown - 2020 (acre-feet/year)

Share by Water Resource



Share by Strategy Type

Strategy Type	Amount▼
DROUGHT MANAGEMENT	100% (80)
INDUSTRIAL CONSERVATION	0% (0)

JACKSON COUNTY

Raw Data - 2020 - Strategy Supplies (acre-feet/year)

Strategy | WMS Type | Source | Region | Entity | Sub Dimension...

Strategy	WMS Type	Source	Region	Entity▲	2020 Strategy Supplies
CONSERVATION FOR MANUFACTURING					0

View data for County | Select County

	CONSERVATION			
		DEMAND REDUCTION		0
			P	0
			MANUFACTURING, JACKSON	0
DROUGHT MANAGEMENT - MUNICIPAL				80
	DROUGHT MANAGEMENT			80
		DEMAND REDUCTION		80
			P	80
			EDNA	33
			GANADO	47

Download Data

- Download Jackson County Population data (Comma-Separated Values)
- Download Jackson County Demands data (Comma-Separated Values)
- Download Jackson County Existing Supplies data (Comma-Separated Values)
- Download Jackson County Needs (Potential Shortages) data (Comma-Separated Values)
- Download Jackson County Strategy Supplies data (Comma-Separated Values)

EntityName	WugCounty	SourceName	WS2020	WS2030	WS2040	WS2050	WS2060	WS2070
COUNTY-OTHER, JACKSON	JACKSON	GULF COAST AQUIFER SYSTEM | JACKSON	1004	1004	1004	1004	1004	1004
EDNA	JACKSON	GULF COAST AQUIFER SYSTEM | JACKSON	1281	1281	1281	1281	1281	1281
GANADO	JACKSON	GULF COAST AQUIFER SYSTEM | JACKSON	340	340	340	340	340	340
IRRIGATION, JACKSON	JACKSON	GULF COAST AQUIFER SYSTEM | JACKSON	78498	78498	78498	78498	78498	78498
LIVESTOCK, JACKSON	JACKSON	GULF COAST AQUIFER SYSTEM | JACKSON	1882	1882	1882	1882	1882	1882
MANUFACTURING, JACKSON	JACKSON	GULF COAST AQUIFER SYSTEM | JACKSON	50	50	50	50	50	50
MINING, JACKSON	JACKSON	GULF COAST AQUIFER SYSTEM | JACKSON	73	73	73	73	73	73
MANUFACTURING, JACKSON	JACKSON	TEXANA LAKE/RESERVOIR	10874	10955	10955	10955	10955	10955

EntityName	WugCounty	WmsName	SS2020	SS2030	SS2040	SS2050	SS2060	SS2070
EDNA	JACKSON	DROUGHT MANAGEMENT - MUNICIPAL	33	33	33	33	33	33
GANADO	JACKSON	DROUGHT MANAGEMENT - MUNICIPAL	47	47	47	47	47	47
MANUFACTURING, JACKSON	JACKSON	CONSERVATION FOR MANUFACTURING	0	1101	1101	1101	1101	1101

Appendix B. Groundwater Availability Model Run provided by Texas Water Development Board - GAM RUN 20-006: TEXANA GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

GAM Run 20-006: Texana Groundwater Conservation District Management Plan

By Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Department
(512) 936-0883
November 18, 2020

Shirley C. Wade
11/18/20

This page is intentionally blank

GAM RUN 20-006: TEXANA GROUNDWATER CONSERVATION DISTRICT MANAGEMENT PLAN

By Shirley C. Wade, Ph.D, P.G.
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Department
(512) 936-0883
November 18, 2020

EXECUTIVE SUMMARY:

Texas State Water Code, Section 36.1071, Subsection (h) (Texas Water Code, 2011), 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 Texana 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 and this information includes:

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

2. for each aquifer within the district, the annual volume of water that discharges from the aquifer to springs and any surface-water bodies, including lakes, streams, and rivers; 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 Texana Groundwater Conservation District should be adopted by the district on or before March 15, 2021 and submitted to the executive administrator of the TWDB on or before April 14, 2021. The current management plan for the Texana Groundwater Conservation District expires on June 13, 2021.

We used the groundwater availability model for the central portion of the Gulf Coast Aquifer System version 1.01 (Chowdhury and others, 2004) to estimate the management plan information for the Gulf Coast Aquifer System within the Texana Groundwater Conservation District. An updated groundwater availability model for the central portion of the Gulf Coast Aquifer System is currently under development and is expected to be complete by the end of 2021. If Texana Groundwater Conservation District would like their management plan information from the updated model they can request a new GAM Run report when the model is available.

This report replaces the results of GAM Run 14-012 (Bahaya and Anaya, 2015), as the approach used for analyzing model results has been since refined to more accurately delineate flows to surface water and geographic information for the model grid has recently been updated. Table 1 summarizes the groundwater availability model data required by statute and Figure 1 shows the area of the groundwater availability model from which the values in the table was extracted. If, after review of Figure 1, the Texana Groundwater Conservation District determines that the district boundaries used in the assessment do not reflect current conditions, please notify the TWDB at your earliest convenience.

METHODS:

In accordance with the provisions of the Texas State Water Code, Section 36.1071, Subsection (h), the groundwater availability model described in the next section was used to estimate information for the Texana Groundwater Conservation District management plan. Water budgets were extracted for the Gulf Coast Aquifer System (1981-1999). We used ZONEBUDGET Version 3.01 (Harbaugh, 2009) to extract water budgets from the model results. The average annual water budget values for recharge, surface-water outflow, inflow to the district, outflow from the district, and the flow between aquifers within the district are summarized in this report.

PARAMETERS AND ASSUMPTIONS:

Gulf Coast Aquifer System

- We used version 1.01 of the groundwater availability model for the central portion of the Gulf Coast Aquifer for this analysis. See Chowdhury and others (2004) and Waterstone and others (2003) for assumptions and limitations of the groundwater availability model.
- The model for the central portion of the Gulf Coast Aquifer assumes partially penetrating wells in the Evangeline Aquifer due to a lack of data for aquifer properties in the deeper section of the aquifer located closer to the Gulf of Mexico.
- This groundwater availability model includes four layers, which generally represent the Chicot Aquifer (Layer 1), the Evangeline Aquifer (Layer 2), the Burkeville Confining Unit (Layer 3), and the Jasper Aquifer including parts of the Catahoula Formation (Layer 4).
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

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 model results for the aquifers located within the district and averaged over the historical calibration periods, as shown in Table 1.

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 Table 1. 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 GULF COAST AQUIFER SYSTEM THAT IS NEEDED FOR THE TEXANA 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	10,841
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	21,572[1]
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer System	38,344
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer System	17,643
Estimated net annual volume of flow between each aquifer in the district	Flow between the Gulf Coast Aquifer System and Underlying Units	Not Applicable[2]

1. 7,787 acre-feet per year goes to the Lavaca and Vaes Bays, while 13,785 acre-feet per year goes to springs, lakes, streams, and rivers within the Texana Groundwater Conservation District.
2. Not applicable because the model also assumes a no flow barrier at the base of the Gulf Coast Aquifer System.

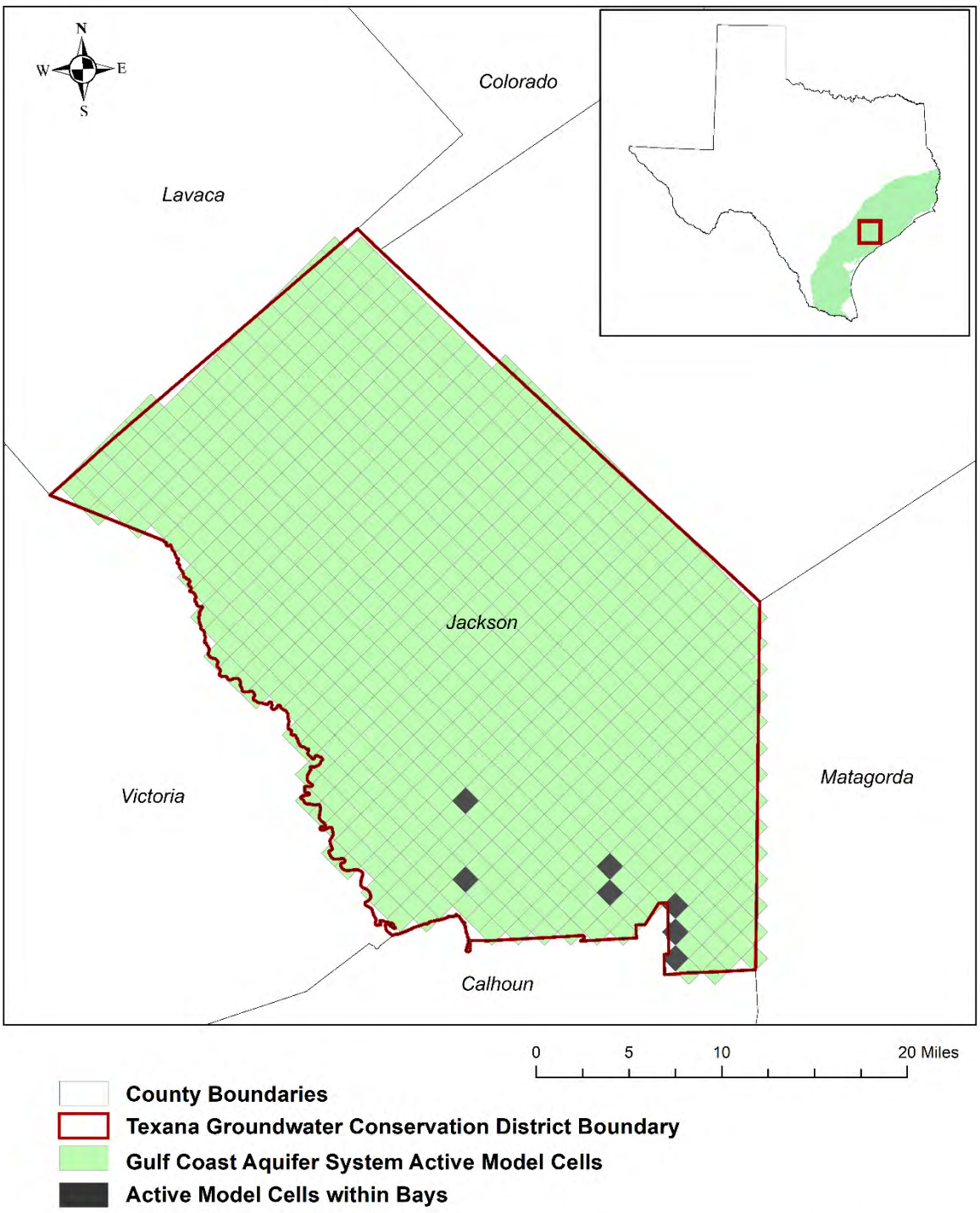


FIGURE 1: AREA OF THE GROUNDWATER AVAILABILITY MODEL FOR THE CENTRAL PORTION OF THE GULF COAST AQUIFER SYSTEM FROM WHICH THE INFORMATION IN TABLE 1 WAS EXTRACTED (THE GULF COAST AQUIFER SYSTEM EXTENT WITHIN THE DISTRICT BOUNDARY).

LIMITATIONS:

The groundwater models 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 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:

Chowdhury, Ali. H., Wade, S., Mace, R.E., and Ridgeway, C., 2004, Groundwater Availability Model of the Central Gulf Coast Aquifer System: Numerical Simulations through 1999- Model Report, 114 p., http://www.twdb.texas.gov/groundwater/models/gam/glfc_c/TWDB_Recalibration_Report.pdf.

Harbaugh, A. W., 2009, Zonebudget Version 3.01, A computer program for computing subregional water budgets for MODFLOW ground-water flow models, U.S. Geological Survey Groundwater Software.

Harbaugh, A. W., and McDonald, M. G., 1996, User's documentation for MODFLOW-96, an update to the U.S. Geological Survey modular finite-difference groundwater-water flow model: U.S. Geological Survey Open-File Report 96-485, 56 p.

Bataya, B. and Anaya, R., 2015, GAM Run 14-012: Texas Water Development Board, GAM Run 14-012 Report, 10 p., http://www.twdb.texas.gov/groundwater/docs/GAMruns/GR14-012.pdf

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.

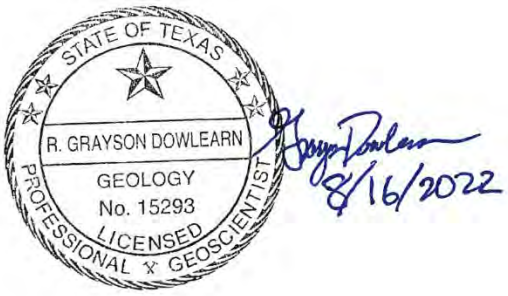
Texas Water Code, 2011, http://www.statutes.legis.state.tx.us/docs/WA/pdf/WA.36.pdf

Waterstone Environmental Hydrology and Engineering Inc. and Parsons, 2003, Groundwater availability of the Central Gulf Coast Aquifer: Numerical Simulations to 2050, Central Gulf Coast, Texas Contract report to the Texas Water Development Board, 157 p., http://www.twdb.texas.gov/groundwater/models/gam/glfc_c/Waterstone_Conceptual_Report.pdf?

Appendix C. Modeled Available Groundwater GAM Run 21-020 MAG

GAM Run 21-020 MAG: Modeled Available Groundwater for the Gulf Coast Aquifer System in Groundwater Management Area 15

Grayson Dowlearn, P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Section
512-475-1552
August 16, 2022



This page is intentionally left blank.

GAM RUN 21-020 MAG: MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 15

Grayson Dowlearn, P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Section
512-475-1552
August 16, 2022

EXECUTIVE SUMMARY:

Groundwater Management Area 15 adopted the desired future conditions listed in Table 1 for the Gulf Coast Aquifer System on October 14, 2021. The Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers were declared not relevant by Groundwater Management Area 15 for the purpose of joint planning. Groundwater Management Area 15 submitted model files as part of the Desired Future Conditions Explanatory Report for Groundwater Management Area 15 (Keester and others, 2021), which meet the desired future conditions adopted by the district representatives of Groundwater Management Area 15, to the Texas Water Development Board (TWDB) on December 13, 2021. The TWDB determined that the explanatory report and other materials submitted by the district representatives were administratively complete on April 22, 2022.

The modeled available groundwater values that meet the adopted desired future conditions for the Gulf Coast Aquifer System and its associated aquifers within Groundwater Management Area 15 are summarized by decade from 2020 to 2080 in Table 2 by groundwater conservation district and county. Figure 1 provides the groundwater conservation district and county boundaries within GMA 15. Table 3 provides modeled available groundwater values by decade from 2030 to 2080 summarized by county, regional water planning area, and river basin, for use in the regional water planning process. Figure 2 provides the county, regional water planning area, and river basin boundaries within Groundwater Management Area 15. Modeled available groundwater values fluctuate within Groundwater Management Area 15 over time, ranging from a maximum of 529,006 acre-feet per year in 2030 to a minimum of 522,307 acre-feet per year in 2040. The estimates were extracted from results of a model run using the groundwater availability model for the central portion of the Gulf Coast Aquifer System (Version 1.01; Chowdhury and others, 2004).

REQUESTOR:

Mr. Tim Andruss, Chair and Administrator of Groundwater Management Area 15.

DESCRIPTION OF REQUEST:

Mr. Tim Andruss provided the TWDB with the desired future conditions of the Gulf Coast Aquifer System on behalf of Groundwater Management Area (GMA) 15 in a letter dated December 10, 2021. Groundwater conservation district representatives in Groundwater Management Area 15 adopted desired future conditions for the Gulf Coast Aquifer System on October 14, 2021, as described in Resolution No. 2021-01 (Appendix 2 in Keester and others, 2021). The desired future conditions included in Table 1 are average water level drawdowns by county between January 2000 and December 2080 based on the predictive groundwater flow Scenario GMA15_2019_001_v1 (Keester and others, 2021). The predictive simulations were developed from the groundwater availability model for the Gulf Coast Aquifer System (Version 1.01; Chowdhury and others, 2004).

TABLE 1. DESIRED FUTURE CONDITIONS FOR EACH COUNTY WITHIN GROUNDWATER MANAGEMENT AREA 15 EXPRESSED AS AVERAGE DRAWDOWN BETWEEN JANUARY 2000 AND DECEMBER 2080 IN FEET SUBMITTED BY GROUNDWATER MANAGEMENT AREA 15. (ADAPTED FROM SUBMITTED RESOLUTION)

County	Aquifer	Desired future condition
Aransas	Gulf Coast Aquifer System	0
Bee	Gulf Coast Aquifer System	7
Calhoun	Gulf Coast Aquifer System	5
Colorado	Chicot and Evangeline	17
	Jasper	25
De Witt	Gulf Coast Aquifer System	17
Fayette	Gulf Coast Aquifer System	44
Goliad	Chicot	-4
	Evangeline	-2
	Burkeville	7
	Jasper	14
Jackson	Gulf Coast Aquifer System	15
Karnes	Gulf Coast Aquifer System	22
Lavaca	Gulf Coast Aquifer System	18
Matagorda	Chicot and Evangeline	11
Refugio	Gulf Coast Aquifer System	5
Victoria	Gulf Coast Aquifer System	5
Wharton	Chicot and Evangeline	15
Groundwater Management Area 15	Gulf Coast Aquifer System	13

After review of the explanatory report and model files, the TWDB was able to confirm that the submitted model files satisfactorily met the desired future conditions and did not require additional clarifications from Groundwater Management Area 15.

METHODS:

The TWDB ran the central portion of the Gulf Coast Aquifer System groundwater availability model (Version 1.01; Chowdhury and others, 2004) using the predictive model files submitted with the explanatory report (Keester and others, 2021) to calculate the drawdown and modeled available groundwater values for the Gulf Coast Aquifer System within Groundwater Management Area 15. The submitted predictive model files included the Scenario GMA15_2019_001_v1 (Keester and others, 2021) pumping file and the GAM Run 10-008 Addendum (Wade, 2010) model files extended to the year 2080. Drawdown was calculated for each county and model layer by first excluding model cells that went dry and model cells that fall outside of the official aquifer footprint, and then summing the drawdown (difference between the water levels from January 2000 [initial heads] to December 2080 [stress period 81]) in the remaining cells of each county and dividing by the number of model cells within that county. Drawdown values were compared to the desired future conditions and were determined to fall within the accepted tolerance for Groundwater Management Area 15.

Modeled available groundwater values were determined by extracting pumping rates by decade from the model results using ZONEBUDGET Version 3.01 (Harbaugh, 2009). Annual pumping rates by aquifer are presented from 2020 to 2080 by county and groundwater conservation district, subtotaled by groundwater conservation district, and summed for Groundwater Management Area 15 (Table 2). Annual pumping rates are also presented from 2030 to 2080 by county, river basin, and regional water planning area within Groundwater Management Area 15 for use in regional water planning (Table 3).

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:

- Version 1.01 of the groundwater availability model for the central portion of the Gulf Coast Aquifer System by Chowdhury and others (2004) was the base model for this analysis. See Chowdhury and others (2004) for assumptions and limitations of the historical calibrated model. Keester and others (2021) constructed a predictive

model simulation to extend the base model to 2080 for planning purposes. See Keester and others (2021) for assumptions of the predictive model simulation.

- The model has four layers representing the Chicot aquifer (Layer 1), the Evangeline aquifer (Layer 2), the Burkeville Confining Unit (Layer 3), and the Jasper aquifer and parts of the Catahoula Formation in direct hydrologic communication with the Jasper aquifer (Layer 4). Figures 3 to 6 show the extent of these active model layers within GMA 15.

- Pumping was not modeled in the Burkeville Confining Unit within Colorado, Matagorda, and Wharton counties and as such, this layer is excluded from the modeled available groundwater calculation in these counties.

- Pumping was not modeled in the Jasper aquifer within Matagorda and Wharton counties and as such this layer is excluded from the modeled available groundwater calculations in these counties.

- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).

- Pumping volumes are reduced to zero if a cell becomes dry during the predictive model run. For this reason, the modeled available groundwater values from the ZONEBUDGET output may not match the pumping values in the input well file.

- Drawdown averages and modeled available groundwater volumes were calculated based on the extent of the official TWDB aquifer boundary. The most recent TWDB model grid file dated June 26, 2020 (glfc_c_grid_poly062620.csv) was used to determine model cell entity assignment (county, groundwater management area, groundwater conservation district, river basin, regional water planning area).

- Drawdowns for cells that became dry during the simulation were excluded from the drawdown averages. Pumping in dry cells was excluded from the modeled available groundwater calculations.

- To be consistent with Groundwater Management Area 15's assumptions (see Keester and others, 2021), a tolerance of three feet was assumed when comparing desired future conditions to modeled drawdown results for all counties except Goliad County. Goliad County was given a tolerance of ±17 feet for the Chicot aquifer, ±36 feet for the Evangeline aquifer, ±14 feet for the Burkeville Confining Unit, and ±7 feet for the Jasper aquifer. Goliad County Groundwater Conservation District plans to monitor achievement of their desired future conditions within these tolerances because they rely more heavily on their extensive monitoring program rather than modeled results.

- Estimates of modeled drawdown and available groundwater from the model simulation were rounded to whole numbers.

RESULTS:

The modeled available groundwater values for the Gulf Coast Aquifer System that achieve the desired future conditions adopted by Groundwater Management Area 15 fluctuate over time, ranging from 529,006 acre-feet per year in 2030 to 522,307 acre-feet per year in 2040. The modeled available groundwater values are summarized by groundwater conservation district and county in Table 2. Table 3 summarizes the modeled available groundwater values by county, river basin, and regional water planning area for use in the regional water planning process.

The Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers were declared not relevant for the purpose of joint planning by Groundwater Management Area 15; therefore, modeled available groundwater values were not calculated for those aquifers.

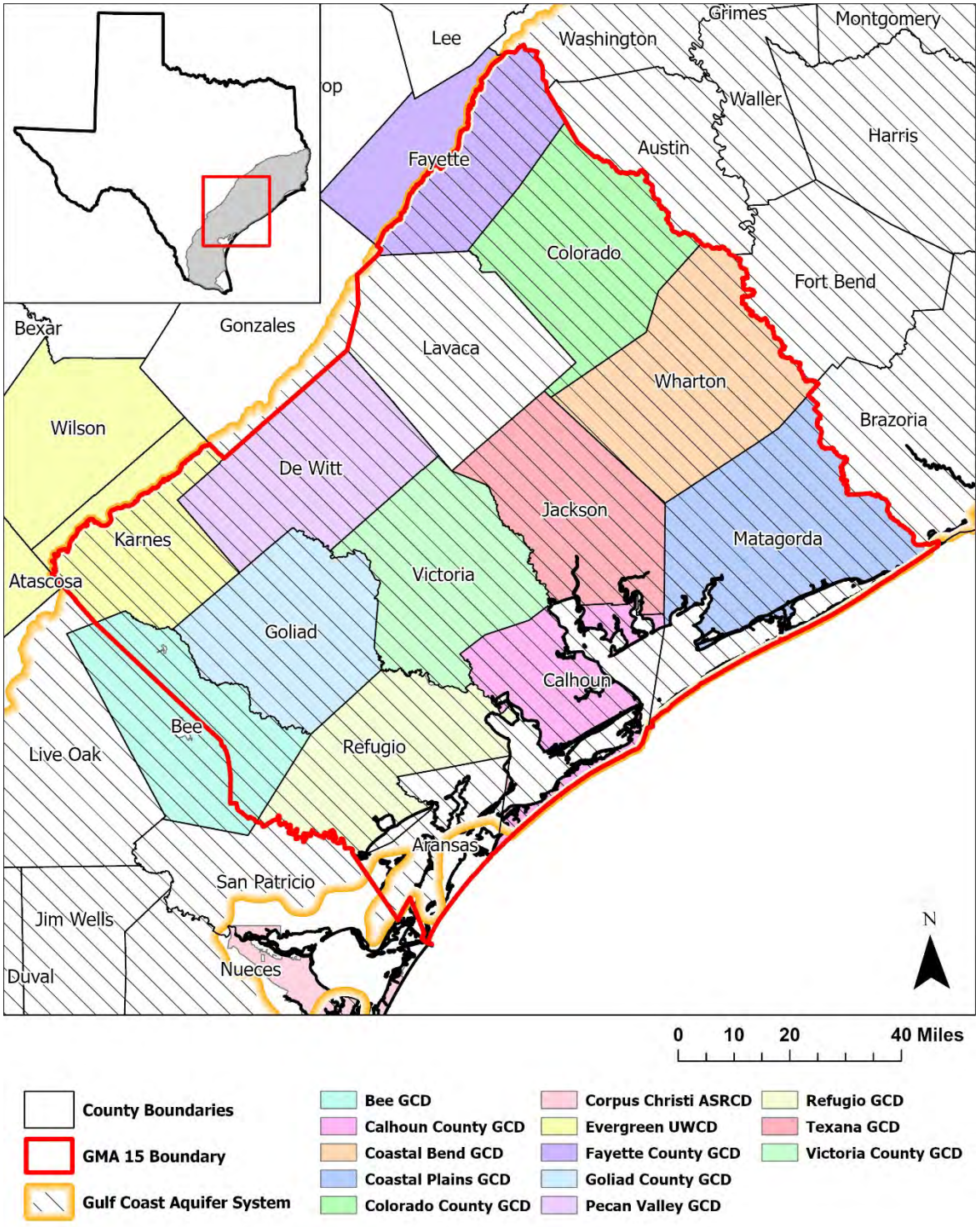


FIGURE 1. MAP SHOWING GROUNDWATER MANAGEMENT AREA (GMA) 15, GROUNDWATER CONSERVATION DISTRICTS (GCD), COUNTIES, AND THE EXTENT OF ACTIVE MODEL CELLS. (UWCD = UNDERGROUND WATER CONSERVATION DISTRICT)

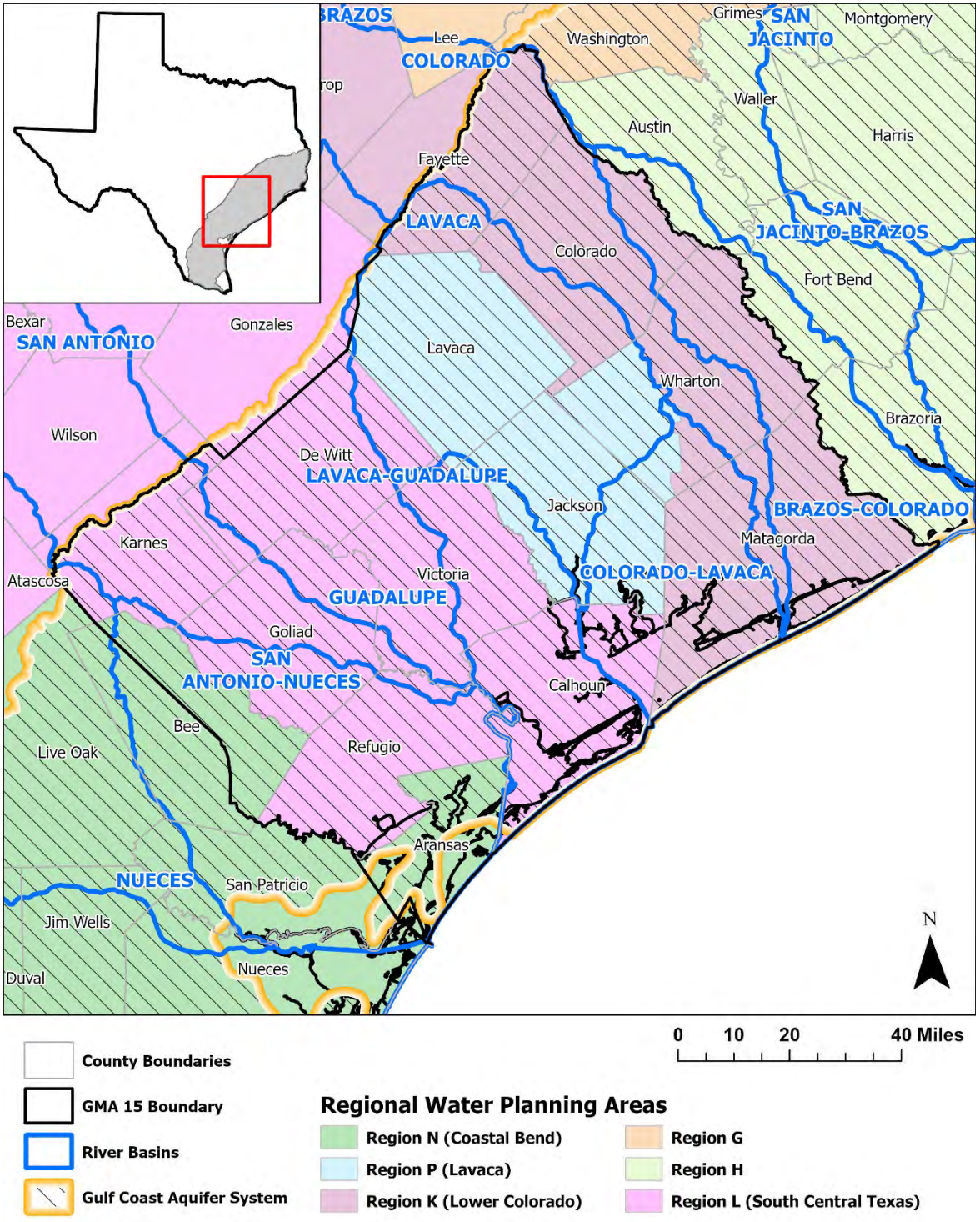


FIGURE 2. MAP SHOWING GROUNDWATER MANAGEMENT AREA (GMA) 15, REGIONAL WATER PLANNING AREAS, RIVER BASINS, COUNTIES, AND EXTENT OF ACTIVE MODEL CELLS.

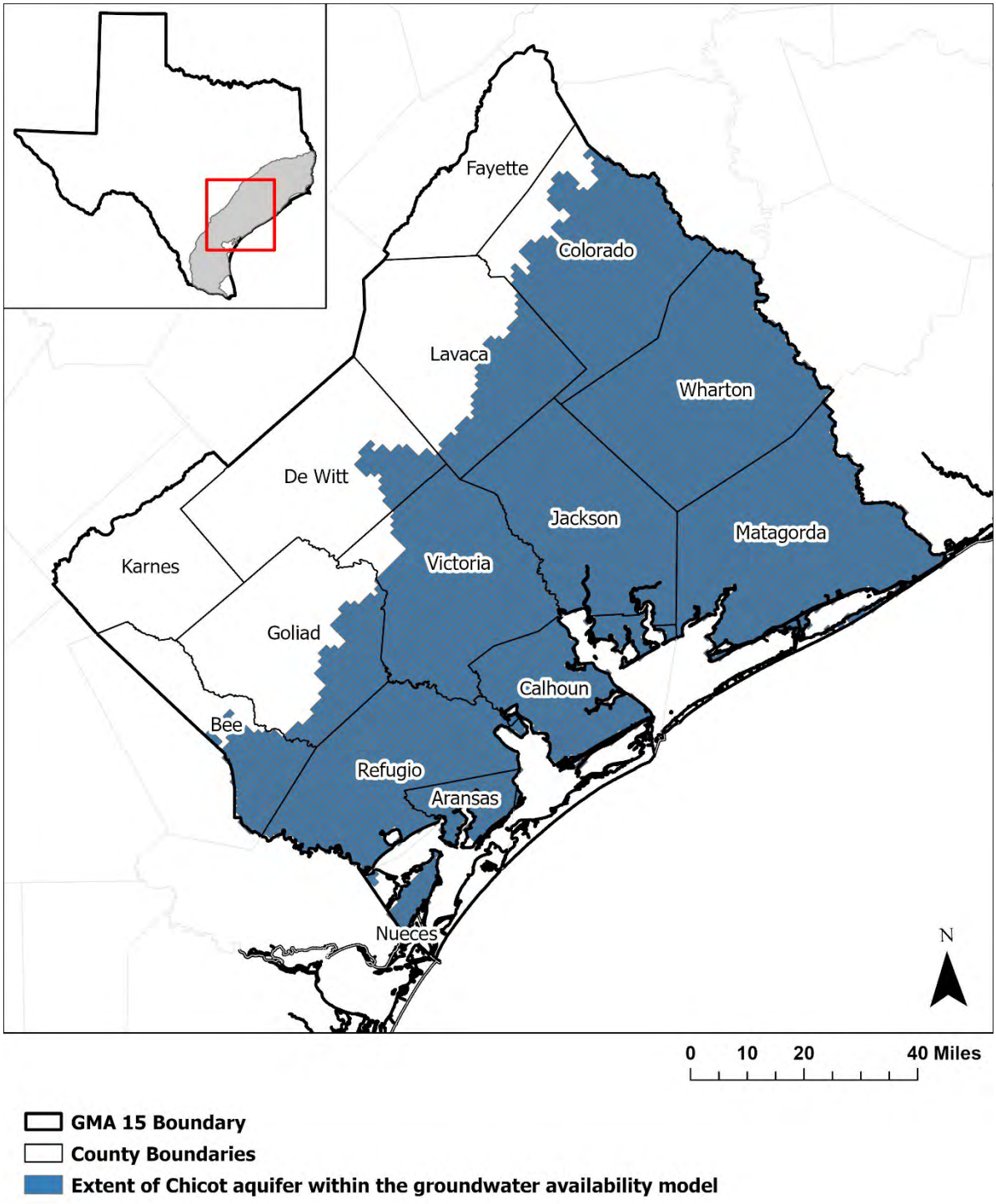


FIGURE 3. MAP SHOWING THE ACTIVE MODEL CELLS WITHIN GROUNDWATER MANAGEMENT AREA (GMA) 15 REPRESENTING THE CHICOT AQUIFER IN LAYER 1 OF THE CENTRAL GULF COAST AQUIFER SYSTEM GROUNDWATER AVAILABILITY MODEL.

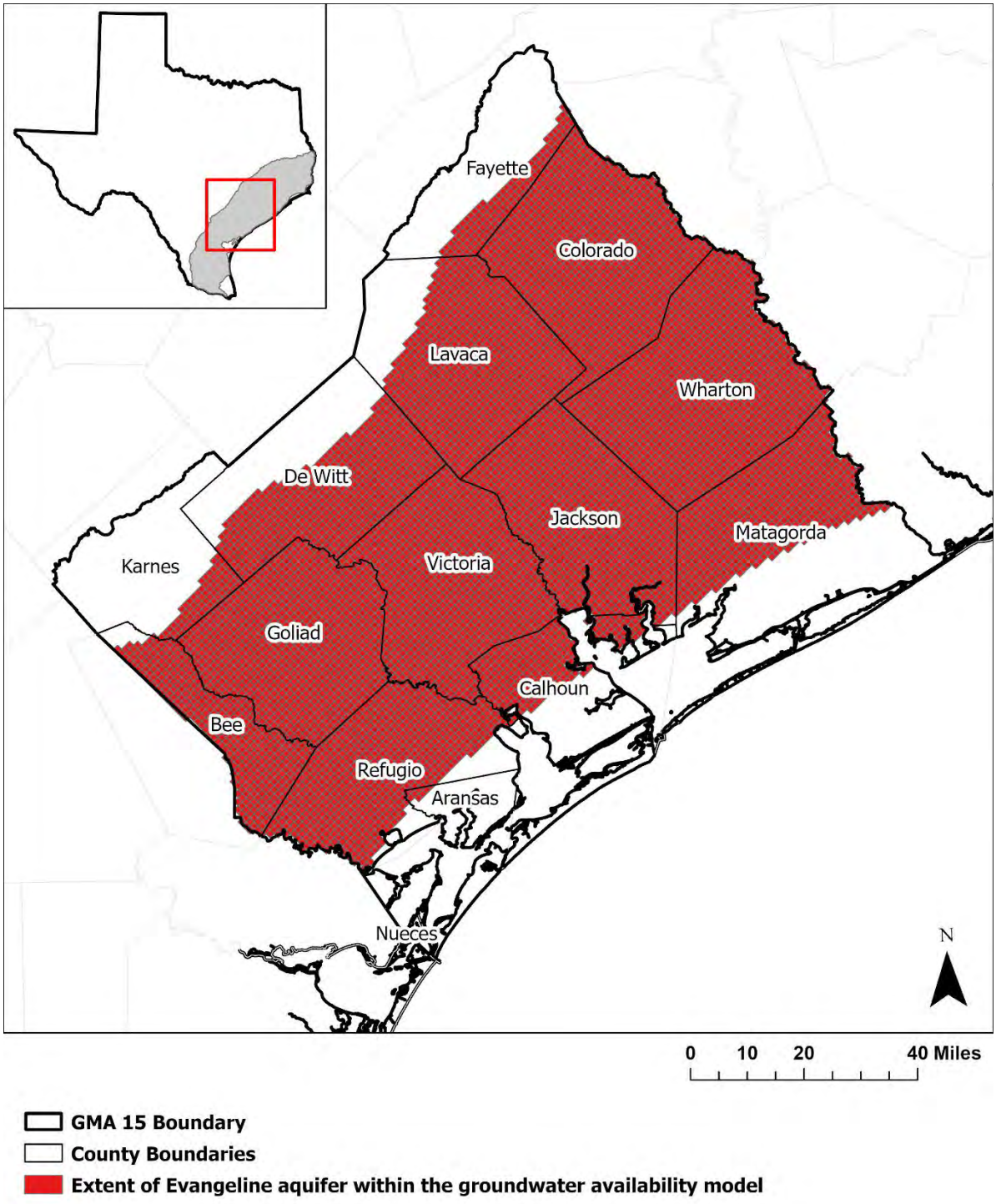


FIGURE 4. MAP SHOWING THE ACTIVE MODEL CELLS WITHIN GROUNDWATER MANAGEMENT AREA (GMA) 15 REPRESENTING THE EVANGELINE AQUIFER IN LAYER 2 OF THE CENTRAL GULF COAST AQUIFER SYSTEM GROUNDWATER AVAILABILITY MODEL.

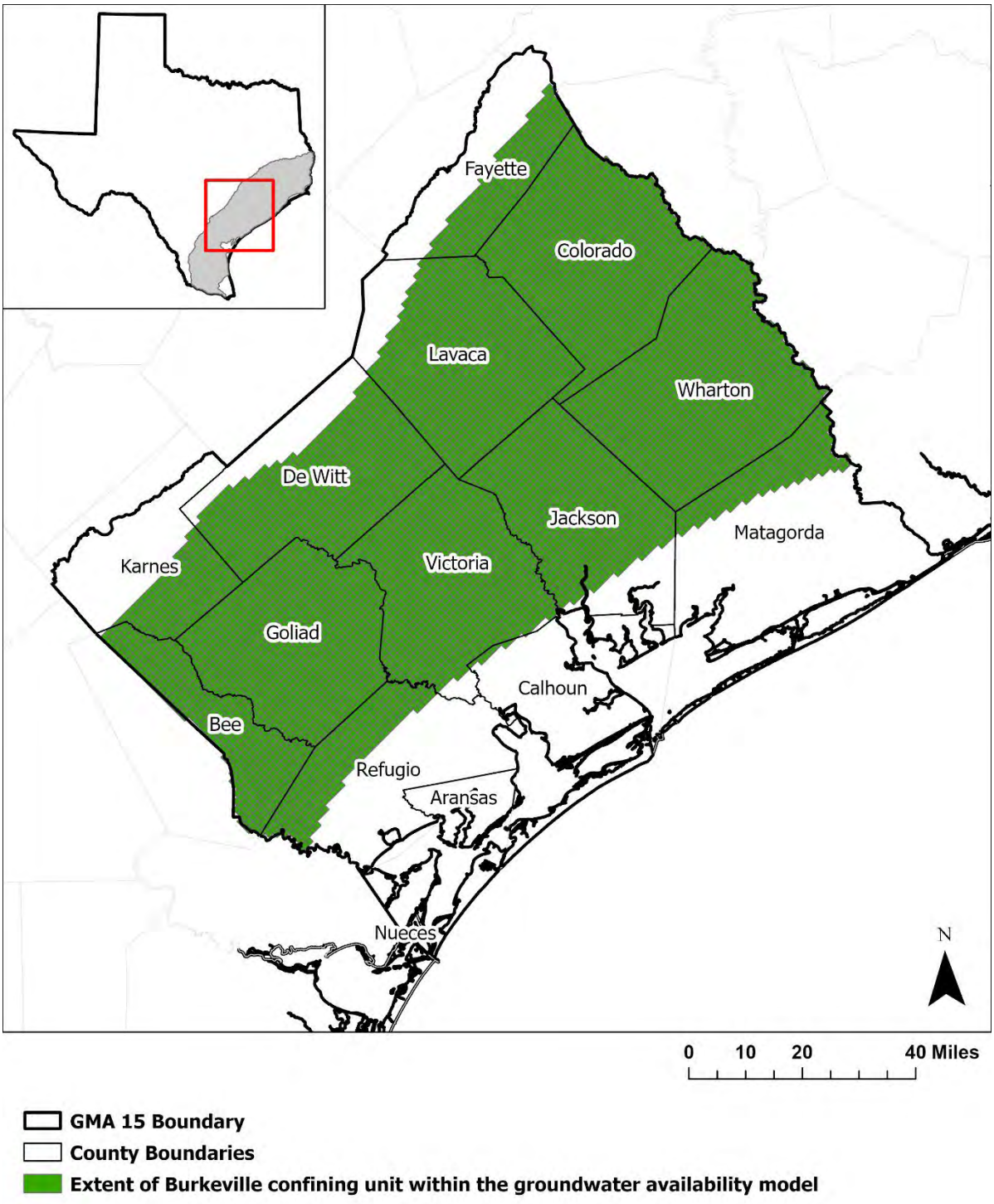


FIGURE 5. MAP SHOWING THE ACTIVE MODEL CELLS WITHIN GROUNDWATER MANAGEMENT AREA (GMA) 15 REPRESENTING THE BURKEVILLE CONFINING UNIT IN LAYER 3 OF THE CENTRAL GULF COAST AQUIFER SYSTEM GROUNDWATER AVAILABILITY MODEL.

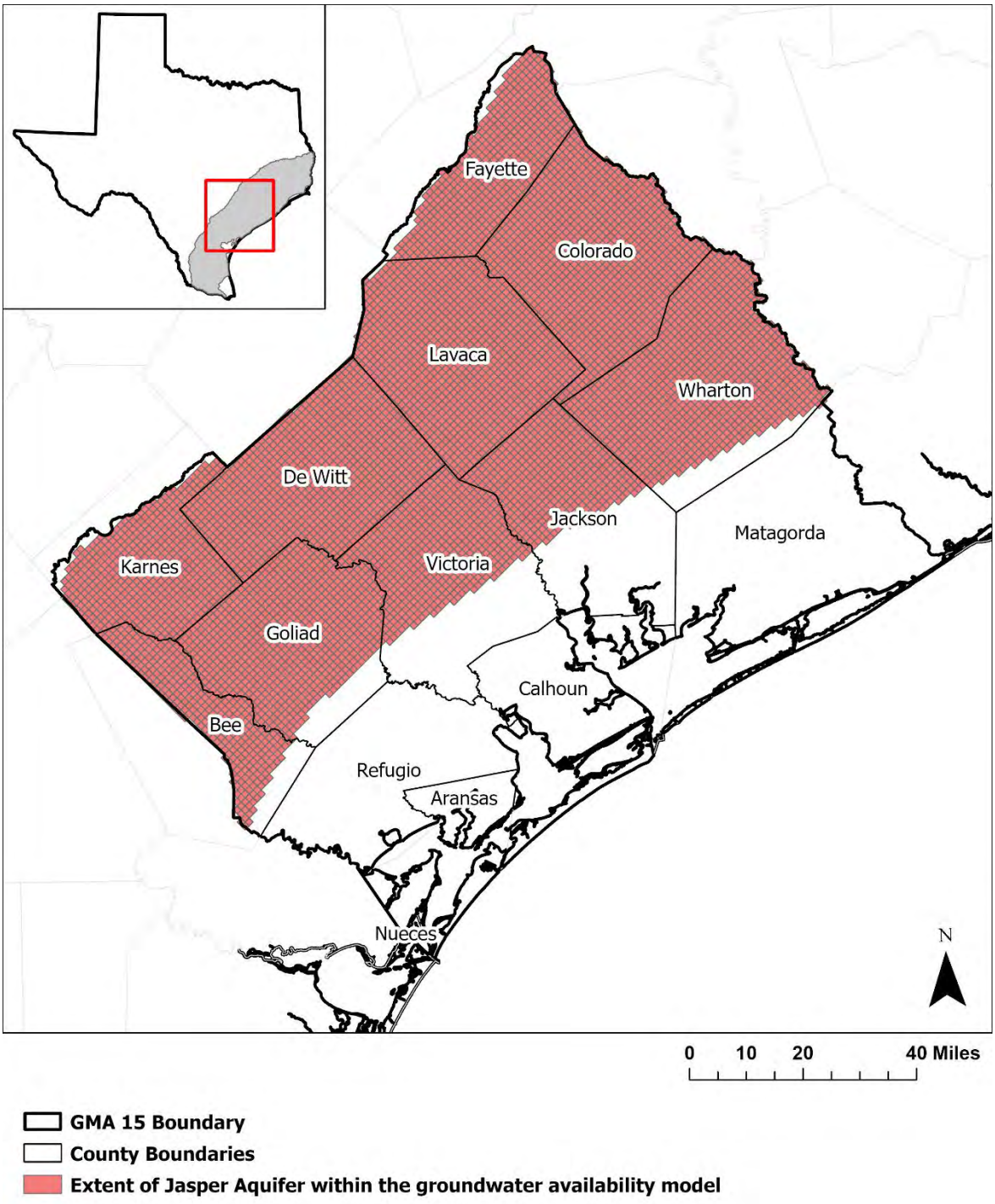


FIGURE 6. MAP SHOWING THE ACTIVE MODEL CELLS WITHIN GROUNDWATER MANAGEMENT AREA (GMA) 15 REPRESENTING THE JASPER AQUIFER AND CATAHOULA FORMATION IN DIRECT HYDROLOGIC CONNECTION WITH THE JASPER AQUIFER IN LAYER 4 OF THE CENTRAL GULF COAST AQUIFER SYSTEM GROUNDWATER AVAILABILITY MODEL.

TABLE 2. MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 15 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR. (UWCD = UNDERGROUND WATER CONSERVATION DISTRICT; ND = NO DISTRICT))

Groundwater Conservation District	County	Portion of Gulf Coast Aquifer System	2020	2030	2040	2050	2060	2070	2080
Bee GCD	Bee	Total	8,017	8,018	8,020	8,000	8,002	8,003	7,989
Calhoun County GCD	Calhoun	Total	7,611	7,611	7,611	7,611	7,611	7,611	7,611
Coastal Bend GCD	Wharton	Chicot and Evangeline	181,446	181,446	181,446	181,446	181,446	181,446	181,446
Coastal Plains GCD	Matagorda	Chicot and Evangeline	38,892	38,892	38,892	38,892	38,892	38,892	38,892
Colorado County GCD	Colorado	Chicot and Evangeline	71,665	71,665	71,665	71,665	71,665	71,665	71,665
	Colorado	Jasper	918	918	918	918	918	918	918
Colorado County GCD Total	**Colorado**	**Total**	**72,583**	**72,583**	**72,583**	**72,583**	**72,583**	**72,583**	**72,583**
Evergreen UWCD	Karnes	Total	10,694	10,525	3,404	3,399	3,227	2,952	2,949
Fayette County GCD	Fayette	Total	7,168	7,394	7,683	8,011	8,387	8,660	8,590
Goliad County GCD	Goliad	Chicot	418	421	426	430	432	436	436
	Goliad	Evangeline	4,983	5,044	5,105	5,165	5,225	5,287	5,287
	Goliad	Burkeville	425	451	478	505	532	559	559
	Goliad	Jasper	250	338	427	515	602	690	690
Goliad County GCD Total	**Goliad**	**Total**	**6,076**	**6,254**	**6,436**	**6,615**	**6,791**	**6,972**	**6,972**
Pecan Valley GCD	DeWitt	Total	17,993	17,958	17,912	17,827	17,806	17,784	17,772
Refugio GCD	Refugio	Total	5,858	5,858	5,858	5,858	5,858	5,858	5,858
Texana GCD	Jackson	Total	90,571	90,571	90,571	90,571	90,571	90,571	90,571
Victoria County GCD	Victoria	Total	59,948	59,948	59,948	59,948	59,948	59,948	59,948
Total (GCDs)		**Total**	**506,857**	**507,058**	**500,364**	**500,761**	**501,122**	**501,280**	**501,181**

TABLE 2. CONTINUED: MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 15 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR. (UWCD = UNDERGROUND WATER CONSERVATION DISTRICT; ND = NO DISTRICT))

Groundwater Conservation District	County	Portion of Gulf Coast Aquifer System	2020	2030	2040	2050	2060	2070	2080
ND Aransas	Aransas	Total	1,547	1,547	1,547	1,547	1,547	1,547	1,547
ND Bee	Bee	Total	9	9	9	9	9	9	9
ND Lavaca	Lavaca	Total	20,384	20,384	20,379	20,379	20,372	20,368	20,350
ND Refugio	Refugio	Total	8	8	8	8	8	8	8
No District-County Total		**Total**	**21,948**	**21,948**	**21,943**	**21,943**	**21,936**	**21,932**	**21,914**
GMA 15 Total		**Total**	**528,805**	**529,006**	**522,307**	**522,704**	**523,058**	**523,212**	**523,095**

TABLE 3. MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 15. RESULTS ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE FROM 2030 TO 2080. VALUES ARE IN ACRE-FEET PER YEAR.

County	RWPA	River Basin	Portion of Gulf Coast Aquifer System	2030	2040	2050	2060	2070	2080
Aransas	N	San Antonio-Nueces	Total	1,547	1,547	1,547	1,547	1,547	1,547
Bee	N	Nueces	Total	26	26	26	26	26	26
	N	San Antonio-Nueces	Total	8,001	8,003	7,983	7,985	7,986	7,972
Calhoun	L	Colorado-Lavaca	Total	5,221	5,221	5,221	5,221	5,221	5,221
	L	Guadalupe	Total	18	18	18	18	18	18
	L	Lavaca-Guadalupe	Total	2,365	2,365	2,365	2,365	2,365	2,365
	L	San Antonio-Nueces	Total	7	7	7	7	7	7
Colorado	K	Brazos-Colorado	Chicot and Evangeline	15,352	15,352	15,352	15,352	15,352	15,352
	K	Colorado	Chicot and Evangeline	20,079	20,079	20,079	20,079	20,079	20,079
	K	Lavaca	Chicot and Evangeline	36,234	36,234	36,234	36,234	36,234	36,234
	K	Brazos-Colorado	Jasper	49	49	49	49	49	49
	K	Colorado	Jasper	273	273	273	273	273	273
	K	Lavaca	Jasper	596	596	596	596	596	596
DeWitt	L	Guadalupe	Total	14,055	14,042	13,966	13,946	13,927	13,917
	L	Lavaca	Total	2,638	2,626	2,620	2,620	2,620	2,620
	L	Lavaca-Guadalupe	Total	298	298	298	298	298	298
	L	San Antonio	Total	967	946	943	942	939	937
Fayette	K	Brazos	Total	19	21	22	24	26	26
	K	Colorado	Total	4,894	5,041	5,196	5,370	5,406	5,392
	K	Lavaca	Total	2,481	2,621	2,793	2,993	3,228	3,172

TABLE 3. CONTINUED: MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 15. RESULTS ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE FROM 2030 TO 2080. VALUES ARE IN ACRE-FEET PER YEAR.

County	RWPA	River Basin	Portion of Gulf Coast Aquifer System	2030	2040	2050	2060	2070	2080
Goliad	L	Guadalupe	Chicot	10	11	11	11	11	11
	L	San Antonio	Chicot	136	137	139	140	141	141
	L	San Antonio-Nueces	Chicot	275	278	280	281	284	284
	L	Guadalupe	Evangeline	2,056	2,081	2,105	2,129	2,155	2,155
	L	San Antonio	Evangeline	2,660	2,692	2,724	2,755	2,788	2,788
	L	San Antonio-Nueces	Evangeline	328	332	336	341	344	344
	L	Guadalupe	Burkeville	0	0	0	0	0	0
	L	San Antonio	Burkeville	451	478	505	532	559	559
	L	San Antonio-Nueces	Burkeville	0	0	0	0	0	0
	L	Guadalupe	Jasper	0	1	1	1	1	1
	L	San Antonio	Jasper	338	426	514	601	689	689
	L	San Antonio-Nueces	Jasper	0	0	0	0	0	0
Jackson	P	Colorado-Lavaca	Total	28,157	28,157	28,157	28,157	28,157	28,157
	P	Lavaca	Total	49,484	49,484	49,484	49,484	49,484	49,484
	P	Lavaca-Guadalupe	Total	12,930	12,930	12,930	12,930	12,930	12,930
Karnes	L	Guadalupe	Total	18	18	18	18	18	18
	L	Nueces	Total	1,059	79	79	79	79	79
	L	San Antonio	Total	9,362	3,221	3,217	3,050	2,781	2,780
	L	San Antonio-Nueces	Total	86	86	85	80	74	72
Lavaca	P	Guadalupe	Total	41	41	41	41	41	41
	P	Lavaca	Total	19,942	19,937	19,937	19,930	19,926	19,908
	P	Lavaca-Guadalupe	Total	401	401	401	401	401	401

TABLE 3. CONTINUED: MODELED AVAILABLE GROUNDWATER FOR THE GULF COAST AQUIFER SYSTEM IN GROUNDWATER MANAGEMENT AREA 15. RESULTS ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), AND RIVER BASIN FOR EACH DECADE FROM 2030 TO 2080. VALUES ARE IN ACRE-FEET PER YEAR.

County	RWPA	River Basin	Portion of Gulf Coast Aquifer System	2030	2040	2050	2060	2070	2080
Matagorda	K	Brazos-Colorado	Chicot and Evangeline	15,321	15,321	15,321	15,321	15,321	15,321
	K	Colorado	Chicot and Evangeline	3,219	3,219	3,219	3,219	3,219	3,219
	K	Colorado-Lavaca	Chicot and Evangeline	20,352	20,352	20,352	20,352	20,352	20,352
Refugio	L	San Antonio	Total	329	329	329	329	329	329
	L	San Antonio-Nueces	Total	5,537	5,537	5,537	5,537	5,537	5,537
Victoria	L	Guadalupe	Total	27,611	27,611	27,611	27,611	27,611	27,611
	L	Lavaca	Total	234	234	234	234	234	234
	L	Lavaca-Guadalupe	Total	30,421	30,421	30,421	30,421	30,421	30,421
	L	San Antonio	Total	1,682	1,682	1,682	1,682	1,682	1,682
Wharton	K	Brazos-Colorado	Chicot and Evangeline	50,560	50,560	50,560	50,560	50,560	50,560
	K	Colorado	Chicot and Evangeline	35,934	35,934	35,934	35,934	35,934	35,934
	K	Colorado-Lavaca	Chicot and Evangeline	16,207	16,207	16,207	16,207	16,207	16,207
	K	Lavaca	Chicot and Evangeline	579	579	579	579	579	579
	P	Colorado	Chicot and Evangeline	874	874	874	874	874	874
	P	Colorado-Lavaca	Chicot and Evangeline	14,100	14,100	14,100	14,100	14,100	14,100
	P	Lavaca	Chicot and Evangeline	63,193	63,193	63,193	63,193	63,193	63,193
GMA 15 Total				**529,007**	**522,308**	**522,705**	**523,059**	**523,213**	**523,096**

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:

Chowdhury, Ali. H., Wade, S., Mace, R.E., and Ridgeway, C., 2004, Groundwater Availability Model of the Central Gulf Coast Aquifer System: Numerical Simulations through 1999- Model Report, 114 p., http://www.twdb.texas.gov/groundwater/models/gam/glfc_c/TWDB_Recalibration_Report.pdf.

Harbaugh, A. W., 2009, Zonebudget Version 3.01, A computer program for computing sub-regional water budgets for MODFLOW ground-water flow models, U.S. Geological Survey Groundwater Software.

Harbaugh, A. W., and McDonald, M. G., 1996, User's documentation for MODFLOW-96, an update to the U.S. Geological Survey modular finite-difference groundwater-water flow model: U.S. Geological Survey Open-File Report 96-485, 56 p.

Keester, M., Danielson, V., Donnelly, A., 2021, GMA 15 2021 Joint Planning Desired Future Conditions Explanatory Report, 1047 p.

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.

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

Wade, S., 2010, GAM Run 10-008 Addendum: Texas Water Development Board, 8 p., https://www.twdb.texas.gov/groundwater/docs/GAMruns/GR10-08addendum.pdf

Appendix D. Public Notices Regarding Hearings Related to Plan Adoption

Public Hearing Notice

Pursuant to Chapter 36, Texas Water Code, the Texana Groundwater Conservation District will conduct a public hearing on the Management Plan of the District with proposed revisions 8:30 AM at the County Services Building, 411 N. Wells, Edna, Texas. The hearing will be conducted to receive comments and suggestions from the public concerning the proposed management plan.

The Management Plan of the District with proposed revisions was developed using the best available data and addresses the following management goals, as applicable: (1) providing the most efficient use of groundwater; (2) controlling and preventing waste of groundwater; (3) controlling and preventing subsidence; (4) addressing conjunctive surface water management issues; (5) addressing natural resource issues; (6) addressing drought conditions; (7) addressing conservation, recharge enhancement, rainwater harvesting, precipitation enhancement, or brush control, where appropriate and cost-effective; and (8) addressing the desired future conditions adopted by the district under Section 36.108.

The Management Plan of the District with proposed revisions (1) identifies the performance standards and management objectives under which the district will operate to achieve the management goals ; (2) specifies the actions, procedures, performance, and avoidance that are or may be necessary to effect the plan; (3) includes estimates of (A) modeled available groundwater in the district based on the desired future condition established under Section 36.108; (B) the amount of groundwater being used within the district on an annual basis; (C) the annual amount of recharge from precipitation, if any, to the groundwater resources within the district; (D) for each aquifer, the annual volume of water that discharges from the aquifer to springs and any surface water bodies, including lakes, streams, and rivers; (E) 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; (F) the projected surface water supply in the district according to the most recently adopted state water plan; and (G) the projected total demand for water in the district according to the most recently adopted state water plan; and (4) considers the water supply needs and water management strategies included in the adopted state water plan.

A copy of the Management Plan of the District with proposed revisions may be reviewed or copied at the District's office located at 411 N. Wells St., Room 118, Edna, TX 77957 in Jackson County. The Management Plan of the District with proposed revisions is available on the District's website at www.ccgcd.org. Questions or comments should be directed to Tim Andruss, General Manager at Texana Groundwater Conservation District, 411 N. Wells St., Room 118, Edna, TX 77957 or admin@texanagcd.org or (361) 781-0624.

FILED
Katherine R. Brooks, Clerk of County Court
JACKSON COUNTY, TEXAS
BY
4-4-23 9:19 am

Texana Groundwater Conservation District
Meeting Notice and Agenda

Notice is hereby given in accordance with the Open Meetings Act, Chapter 551, Government Code and Section 36.064 of the Texas Water Code that the Texana Groundwater Conservation District Board of Directors will hold a meeting on April 20, 2023, at 8:30 AM at the County Services Building, 411 N. Wells, Edna, Texas.

AGENDA

1. Call the meeting to order and welcome guests.
2. Receive public comments.
3. Consideration of and possible action on matters related to groundwater management including the efforts and activities of the District regarding permitting, complaints, investigations, violations, and enforcement cases associated with permitting.
    - Permit Hearing - Mr. Darryl R. Hammond for The Ranches at Mustang Creek, LLC seeks, under permitting request case PRC-20220928-01, a historic use production permit authorizing production of groundwater for irrigation of crops and lake maintenance at rates not to exceed 2,500 gallons per minute or 945 acre-feet per year from grandfathered well GW-00569. The subject well is be located on a 322.65-acre tract of land near the intersection of U.S. Highway 59 North and County Road 202 in Jackson County, Texas.
    - Permit Hearing - Mr. Reed Bowers for Bowers and Saha Aquaculture LLC seeks, under permitting request case PRC-20230321-01, amendments to waiver WV-20191219-01 to revise the monitoring requirements, the performance criteria, and performance responses, and curtailment requirements established within the waiver. The subject well field is located near the intersection of County Road 477 and County Road 479 in Jackson County, Texas.
4. Consideration of and possible action on matters related to groundwater protection including complaints, investigations, violations, and enforcement cases related to groundwater contamination and waste.
    - Consideration and possible action regarding the use and reporting of well NW-00605 permitted for operation by the Lavaca Navidad River Authority for pump test uses at rates not to exceed 250 gallons per minute or 5 acre-feet per year.
5. Consideration of and possible action on matters related to groundwater monitoring.
6. Consideration of and possible action on matters related to groundwater conservation.
7. Consideration of and possible action on matters related to groundwater resource planning including Groundwater Management Area 15 Joint Planning and regional water planning.
8. Consideration of and possible action on matters related to groundwater policy including the Management Plan of the District, the proposed Management Plan of the District, the Rules of the District, and fee schedule.
    - Hearing on Proposed Management Plan of the District.
9. Consideration of and possible action on matters related to meeting management including minutes of previous meetings.
10. Consideration of and possible action on matters related to financial management including the annual budget of the district, financial audits, bank accounts, investments, financial reports of the district, bills and invoices of the district.
11. Consideration of and possible action on matters related to office administration and management including management goals and objectives of the district, annual report of the district, administrative policies, staffing, consultant agreements, interlocal cooperation agreements, and support services provided to and from other groundwater conservation districts.

Texana Groundwater Conservation District
Meeting Notice and Agenda

Notice is hereby given in accordance with the Open Meetings Act, Chapter 551, Government Code and Section 36.064 of the Texas Water Code that the Texana Groundwater Conservation District Board of Directors will hold a meeting on April 20, 2023, at 8:30 AM at the County Services Building, 411 N. Wells, Edna, Texas.

12. Consideration of and possible action on matters related to vacancy in the office of director of the Texana Groundwater Conservation District.
13. Consideration of and possible action on matters related to legal counsel report.
14. Adjourn.

The Texana Groundwater Conservation District may close the meeting, if necessary, to conduct private consultation with legal counsel regarding matters protected by the attorney-client privilege pursuant to Section 551.071 of the Government Code or to discuss matters regarding personnel pursuant to Section 551.074 of the Government Code. The Texana Groundwater Conservation District will return to open meeting, if necessary, to take any action deemed necessary based on discussion in closed meeting pursuant to Section 551.102 of the Government Code.

In Accordance with Title III of the Americans with Disabilities Act, we invite all attendees to advise us of any special accommodations due to disability. Please submit your request as far as possible in advance of event you wish to attend.

FILED
Katherine R. Brooks, Clerk of County Court
JACKSON COUNTY, TEXAS
BY
4-4-23 9:19 AM

Appendix E. Letters Coordinating with Regional Surface Water Management Entities

Texana Groundwater Conservation District

411 N. Wells St., Room 118, Edna, Texas 77957
P.O. Box 1098, Edna, Texas 77957
Phone (361) 781-0624 | Fax (361) 781-0453 | www.texanagcd.org

May 16, 2023

Via Certified Mail: 7021 0350 0000 2790 8178

Lavaca-Navidad River Authority
P.O. Box 429
Edna, Texas 77957

RE: Management Plan of the District

To whom it may concern,

On April 20, 2023, the Board of Directors of the Texana Groundwater Conservation District adopted a revised management plan for the district. A copy of the adopted management plan is attached to this letter for your review.

If you have any questions or comments regarding the plan, please contact me at your convenience.

Regards,

Tim Andruss
General Manager

Texana Groundwater Conservation District

411 N. Wells St., Room 118, Edna, Texas 77957
P.O. Box 1098, Edna, Texas 77957
Phone (361) 781-0624 | Fax (361) 781-0453 | www.texanagcd.org

May 16, 2023

Via Certified Mail: 7021 0350 0000 2790 8185

Texas Water Development Board
P.O. Box 13231
Austin, Texas 78711-3231

RE: Management Plan of the District

To whom it may concern,

On April 20, 2023, the Board of Directors of the Texana Groundwater Conservation District adopted a revised management plan for the district. A copy of the adopted management plan is attached to this letter for your review.

If you have any questions or comments regarding the plan, please contact me at your convenience.

Regards,

Tim Andruss
General Manager

Appendix F. Texana Groundwater Conservation District Board of Director Resolution Adopting Management Plan

RESOLUTION

Resolution Adopting the Texana Groundwater Conservation District Management Plan

WHEREAS on April 4, 2023, a Notice of Hearing was posted with the County Clerk of Jackson County, regarding the public hearing on the Management Plan of the District with proposed revisions; and

WHEREAS on April 7, 2023, a Notice of Hearing was published in the Victoria Advocate, a newspaper paper with general circulation within Jackson County, regarding the public hearing on the Management Plan of the District with proposed revisions; and

WHEREAS on April 20, 2023, the Texana Groundwater Conservation District Board of Directors with a quorum being present, conducted a public hearing regarding the adoption of the Texana Groundwater Conservation District Management Plan; and

WHEREAS, the Texana Groundwater Conservation District Management Plan had been developed in coordination with surface water management entities and other interested parties;

NOW THEREFORE BE IT RESOLVED that the Texana Groundwater Conservation District Management Plan is ADOPTED as described in the Texana Groundwater Conservation District Management Plan attached hereto and made part hereof for all purposes and that said management plan shall be submitted to the Executive Administrator of the Texas Water Development Board for review and approval with all necessary documentation.

Adopted by a vote of 4 ayes and 0 nays on this 20th day of April 2023.

President, Texana Groundwater Conservation District

I, the undersigned, do hereby certify that the above resolution was adopted by the Board of Directors of the Texana Groundwater Conservation District on the 20th day of April 2023.

Director, Texana Groundwater Conservation District

Appendix G. Minutes of Texana Groundwater Conservation District Board of Director Meeting related to the public hearings for and adoption of the Management Plan

Appendix H. Texana Groundwater Conservation District Contact Information

Groundwater Conservation District
Registration Form

Legal Name of District	Texana Groundwater Conservation District					
Mailing Address	PO Box 1098	City	Edna	TX	Zip Code (9 Digits)	77957
Physical Address	411 N. Wells St.	City	Edna	TX	Zip Code (9 Digits)	77957
Phone Number	361-781-0624	Website	www.texanagcd.org			
District E-mail	admin@texanagcd.org					

BOARD MEMBERS

TITLE	FULL NAME (First Middle Last)	ADDRESS	BUSINESS PHONE	HOME PHONE	E or A	TERM BEGINS (mm/dd/yyyy)	TERM ENDS (mm/dd/yyyy)
President	Michael Skalicky	PO Box 428, Ganado, TX 77962		361-771-5816	E	11/2022	11/2026
Vice President	Johnny Dugger	1918 CR 303, Edna, TX 77957		361-782-8435	E	11/2022	11/2026
Secretary	James Revel	326 Trout St., Palacios, TX 77465		281-883-7640	E	11/2020	11/2024
Treasurer	Kenneth Koop	1422 CR 110, Edna, TX 77957		210-410-4540	E	11/2020	11/2024
Director	Robert Gendke, Jr.	PO Box 7, Banderbilt, TX 77991		361-771-6330	E	11/2022	11/2026
Director	Fredrick Woodland	20740 State Hwy 172, Port Lavaca, TX 77979		361-920-1526	E	11/2022	11/2026
Director	Clifford Born	PO Box 97, Vanderbilt, TX 77991		361-235-2865	E	11/2020	11/2024

All information provided herein is subject to the Public Information Act and will be made available on the TCEQ Website

Groundwater Conservation District
Registration Form

CONSULTANTS and REPRESENTATIVES

POSITION	FULL NAME	FIRM / ORGANIZATION	ADDRESS	BUSINESS PHONE	FAX
General Manager	Tim Andruss	Texana Groundwater Conservation District	PO Box 1098, Edna, TX 77957	361-781-0624	
Attorney	James Allison	Allison, Bass & Magee, LLP	402 W. 12th St., Austin, TX 78701	512-482-0701	

☑ I certify that the information contained herein is correct and complete to the best of my knowledge.

Signature: Caitlynn Davenport Date Signed: 2/20/23

Printed Name/Title: Caitlynn Davenport / Administrative Coordinator

Individuals are entitled to request and review personal information the TCEQ gathers on its forms.
For assistance with this form or to request your personal information and correct any errors, contact us at (512) 239-2789

STATUTORY AND RULE REQUIREMENTS

Texas Water Code statutory requirements can be found at TWC Chapter 36.
Texas Administrative Code Section 293.20 rule requirements can be found at TAC 293.20.

To submit your completed form: Press the SUBMIT button (if using electronic signature); E-mail to GPAT@tceq.texas.gov; Fax to (512) 239-2214; or, Mail to:

Texas Commission on Environmental Quality
Groundwater Planning & Assessment
MC-147, PO Box 13087
Austin, Texas 78711-3087

SUBMIT

All information provided herein is subject to the Public Information Act and will be made available on the TCEQ website