TEXAS WATER DEVELOPMENT BOARD

P.O. Box 13231, 1700 N. Congress Ave.
Austin, TX 78711-3231, www.twdb.texas.gov
Phone (512) 463-7847, Fax (512) 475-2053

December 20, 2024

Laura Martin
General Manager
Gonzales County Underground Water Conservation District
P.O. Box 1919
Gonzales, TX 78629

Dear Ms. Martin:

The purpose of this letter is to notify you that the groundwater management plan for the Gonzales County Underground Water Conservation District required by Texas Water Code § 36.1072 is administratively complete in accordance with Texas Water Code § 36.1071(a) and (e). The policies, plans, and opinions in the groundwater management plan represent those of the District and not those of the Texas Water Development Board.

We received the groundwater management plan for the administrative completeness review on November 13, 2024, and it was approved on December 20, 2024. Included with this letter is your District Groundwater Management Plan Certificate of Administrative Completeness.

Thank you for participating in this effort and contributing to the future of groundwater conservation and management in the state of Texas. Your next five-year management plan is due on December 20, 2029.

If you have any questions or concerns, please contact Stephen Allen of our Groundwater Technical Assistance Department at 512-463-7317 or stephen.allen@twdb.texas.gov

Sincerely,

Bryan McMath
Executive Administrator

Enclosure

c w/o enc.: Stephen Allen, P.G., Groundwater
Robert Bradley, P.G., Groundwater
Abiy Berehe, P.G., Texas Commission on Environmental Quality
Peggy Hunka, P.G., Texas Commission on Environmental Quality
Kory Talcott, Texas Commission on Environmental Quality

GONZALES COUNTY
UNDERGROUND WATER CONSERVATION DISTRICT

MANAGEMENT PLAN

Original: February 10, 1998

Revision 1.0: July 8, 2003

Revision 2.0: May 14, 2009

Revision 3.0: February 18, 2014

Revision 4.0: November 13, 2018

Revision 5.0: November 12, 2024

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APPENDICES

1.0 DISTRICT MISSION

The mission of the Gonzales County Underground Water Conservation District ("GCUWCD" or "District") is to conserve, preserve, protect, and prevent waste of groundwater resources. It shall be the policy of the Board of Directors that the most efficient use of groundwater in the District is to provide for the needs of the citizens and ensure growth for future generations. The Board of Directors, with the cooperation of the citizens of the District, shall implement this management plan and its accompanying rules to achieve this goal. If it appears this management plan, or production limits do not achieve the desired future conditions (DFC's) the District will amend the management plan, or production limits. GCUWCD shall also establish, as part of this plan, the policies of water conservation, public information and technical research by cooperation and coordination with the citizens of the District and equitable enforcement of this plan and its accompanying rules.

2.0 PURPOSE OF THE MANAGEMENT PLAN

Senate Bill 1, enacted in 1997, and Senate Bill 2, enacted in 2001, established a comprehensive statewide planning process, including requirements for Groundwater Conservation Districts ("GCDs") under the Texas Water Code Chapter 36 to manage and conserve the groundwater resources of the State of Texas. Section 36.1071, Water Code, requires that each GCD develop a management plan that 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 that impact the use and availability of groundwater, and which are impacted by the use of groundwater, (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 DFCs adopted by the District under Section 36.108.

House Bill 1763, enacted in 2005, requires joint planning among GCDs within the same Groundwater Management Area ("GMA"). These Districts must establish the DFCs of the aquifers within their respective GMAs. Through this process, the GCDs will submit the DFCs of the aquifer to the executive administrator of the Texas Water Development Board ("TWDB"). The TWDB will calculate the modeled available groundwater ("MAG") in each District within the management area based upon the submitted DFCs of the aquifer within the GMA. Technical information, such as the DFCs of the aquifers within the District's jurisdiction and the amount of MAG from such aquifers is required by statute to be included in the District's management plan and will guide the District's regulatory and management policies.

3.0 DISTRICT INFORMATION

3.1 Creation

The GCUWCD was created on an order of the Texas Commission on Environmental Quality (TCEQ), formerly the Texas Natural Resource Conservation Commission (TNRCC), on November 19, 1993. A copy of TNRCC order number 101692-DO4, approving the petition for creation of the GCUWCD, is available on the District's website at: http://www.gcuwcd.org/documentsandforms.html.

3.2 Directors

The GCUWCD Board of Directors is comprised of five (5) members elected from single member districts. The Board voted to adopt amended election procedures as stipulated in Sec.36.059, Water Code. The statute requires the District to elect directors according to the precinct method as defined by Chapter 12, page 1105, Special Laws, Acts of the 46th Legislature, Regular Session, 1939. Section 6 of Chapter 12 requires the District Directors to serve staggered terms and for the District to conduct elections every two years. The

Board of Directors meets in regular sessions on the second Tuesday each month in the City of Gonzales, Texas. All meetings of the Board of Directors are open to the public as set forth in the Texas Open Meetings Act, Title 5, Chapter 551 of the Texas Government Code, and advanced written notices of such meetings are posted as required.

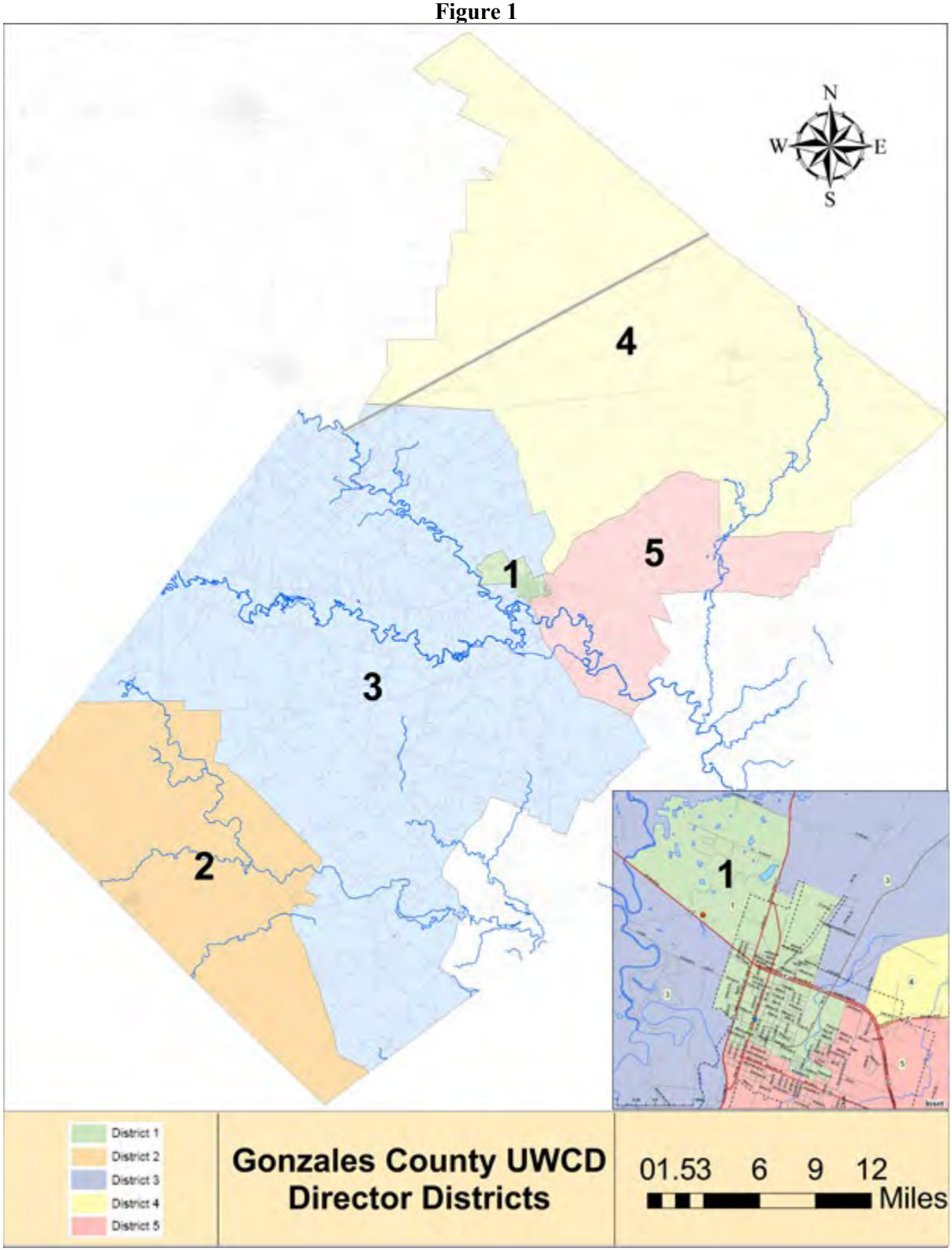
3.3 Authority of the District

As stated in TNRCC order number 101692-DO4, the GCUWCD has all the rights, powers, privileges, authority, and functions conferred by, and subject to all duties imposed by the TCEQ and the general laws of the State of Texas relating to GCD's. The District is governed by the provisions of Texas Water Code (TWC) Chapter 36 and 31 Texas Administrative Code (TAC) Chapter 356.

3.4 District Boundaries

GCUWCD serves the areas of Gonzales County and the southeast portion of Caldwell County (**Figure 1**). Gonzales County is bounded by Guadalupe, Wilson, Karnes, DeWitt, Lavaca, Fayette, and Caldwell counties. There are approximately 677,000 acres in Gonzales County, of which 101,000 acres are excluded from the District leaving 576,000 acres within the boundaries of the county. Incorporated towns within Gonzales County include Gonzales, Waelder, Nixon, and Smiley. In December 2007, GCUWCD approved a resolution to annex the southeastern portion of Caldwell County into the District. An election was held in Caldwell County on May 10, 2008, with voters approving the annexation. The Board approved the canvass of the proposition election to ratify the annexation on May 13, 2008. The annexed area of Caldwell County encompassed approximately 77,440 acres. A dispute with the Plum Creek Conservation District over portions of this annexed territory was settled through the passage of Senate Bill No. 1225 (2011) leaving approximately 72,767 acres within the GCUWCD. Delhi and Taylorsville are the principal communities in the area. The District's economy is primarily agricultural, with poultry production being the primary income producer, followed by beef cattle and farming. Oil and gas production also contributed to the local economy.

Figure 1


N
W
E
S
4
5
1
3
2
1
District 1
District 2
District 3
District 4
District 5
Gonzales County UWCD
Director Districts
01.53 6 9 12
Miles

The GCUWCD is located within GMA 13. The GMA 13 includes seventeen (17) counties and nine (9) GCDs (**Figure 2.1 and Figure 2.2**). Section 36.108, Water Code, requires joint planning among the GCDs within GMA 13. The District is actively engaged in the joint planning process and provides input to GMA 13. The District has a joint management agreement with Evergreen Underground Water Conservation District, Guadalupe County Underground Water Conservation District, Medina County Groundwater Conservation District, and Wintergarden Groundwater Conservation District. This updated agreement, signed on September 13, 2022, states that the GCDs will cooperate in managing the groundwater resources of the Carrizo Aquifer. The District has provided and will continue to provide the other GCDs in the aquifer management area with copies of its management plan and rules when changes are made.

Interlocal agreements with neighboring GCD's are renewed on a five (5) year cycle to ensure a mutually advantageous benefit of constituents to coordinate statutory duties related to scientific data collection and the associated management of groundwater resources and underlying neighboring Districts, particularly within the context of the "joint planning" process and establishment and achievement of DFC's set within GMA 13.

Figure 2.1

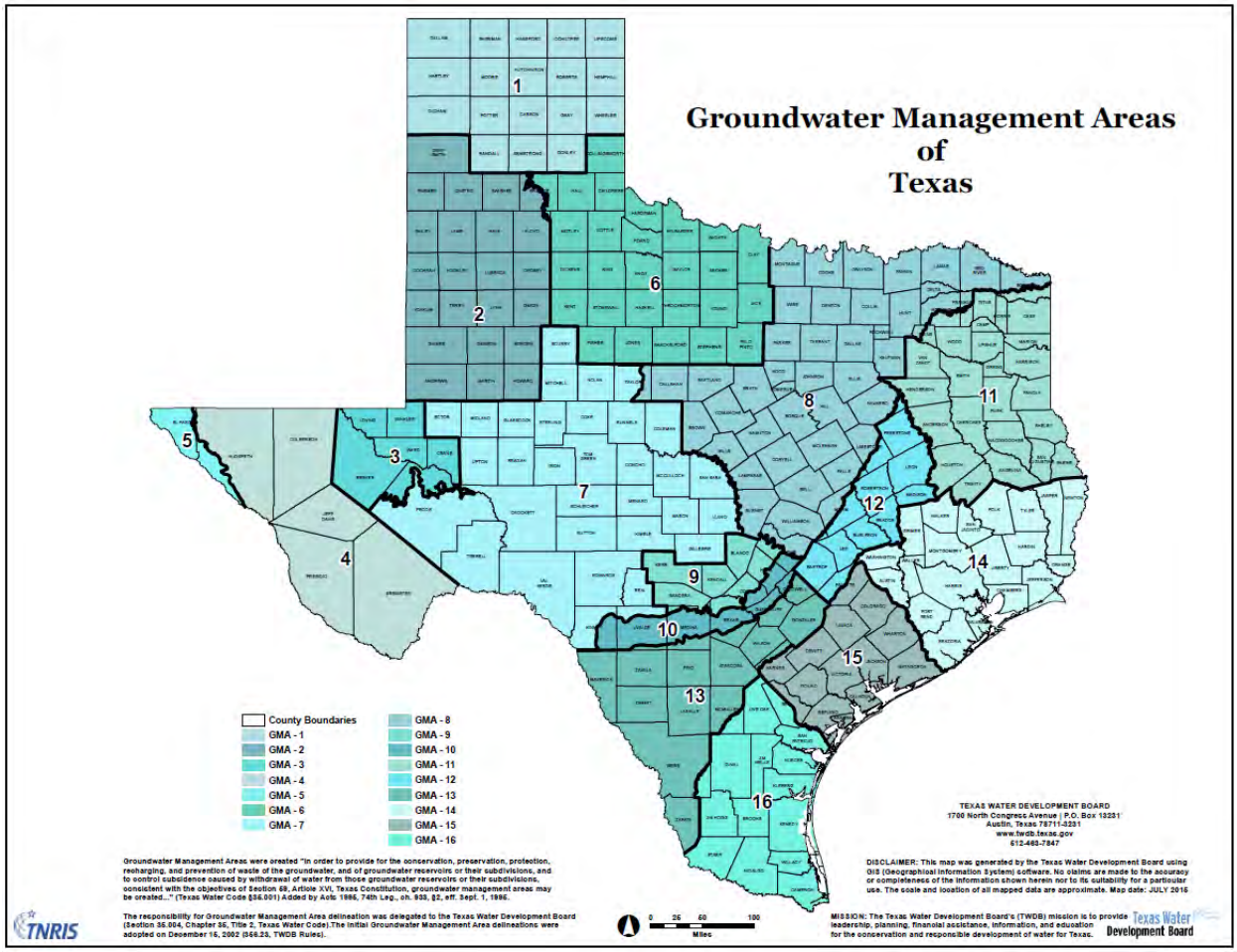
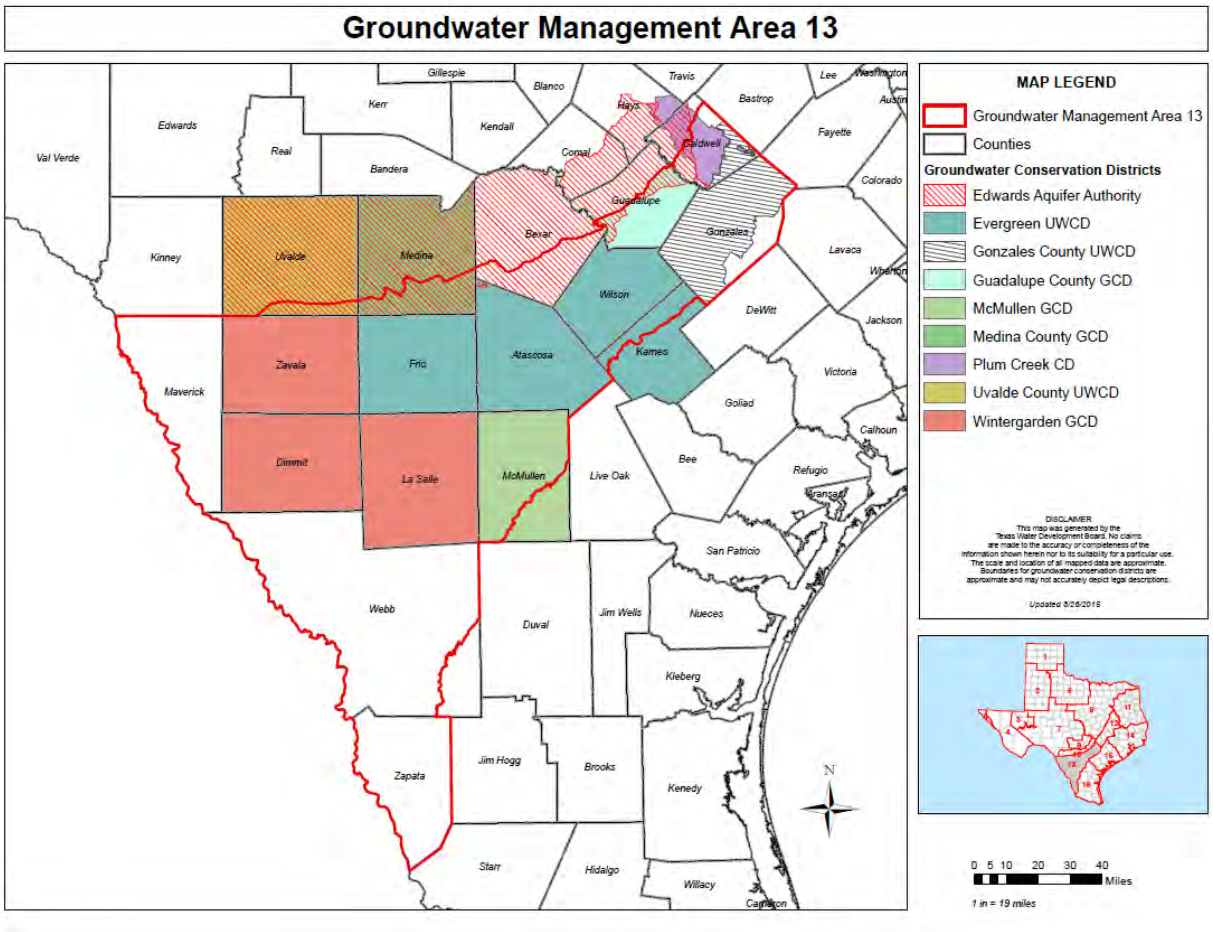


Figure 2.2


Groundwater Management Area 13
Gillespie
Blanco
Travis
Lee
Washington
Austin
Kerr
Kendall
Hays
Bastrop
Edwards
Real
Bandera
Caldwell
Fayette
Val Verde
Comal
Colorado
Guadalupe
Bexar
Gonzales
Kinney
Uvalde
Medina
Lavaca
Wharton
Wilson
DeWitt
Jackson
Zavala
Frio
Atascosa
Karnes
Victoria
Maverick
Goliad
Calhoun
Dimmit
La Salle
McMullen
Live Oak
Bee
Refugio
Aransas
San Patricio
Webb
Duval
Jim Wells
Nueces
Kleberg
Zapata
Jim Hogg
Brooks
Kenedy
Starr
Hidalgo
Willacy
Cameron
N
MAP LEGEND
Groundwater Management Area 13
Counties
Groundwater Conservation Districts
Edwards Aquifer Authority
Evergreen UWCD
Gonzales County UWCD
Guadalupe County GCD
McMullen GCD
Medina County GCD
Plum Creek CD
Uvalde County UWCD
Wintergarden GCD
DISCLAIMER
This map was generated by the Texas Water Development Board. No claims are made to the accuracy or completeness of the information shown herein nor to its suitability for a particular use. The scale and location of all mapped data are approximate. Boundaries for groundwater conservation districts are approximate and may not accurately depict legal descriptions.
Updated 8/26/2015
0 5 10 20 30 40
Miles
1 in = 19 miles

The GCUWCD is located within planning South Central Texas Regional Planning Group (SCTRWPG, Region L). Region L includes all or parts of 21 counties, portions of nine river and coastal basins, the Guadalupe Estuary, and San Antonio Bay (**Figure 3.1 and 3.2**). The Board of Directors unanimously supports the concept of a grassroots planning effort. The District will actively provide input to the regional plan and participate in the planning effort.

Figure 3.1

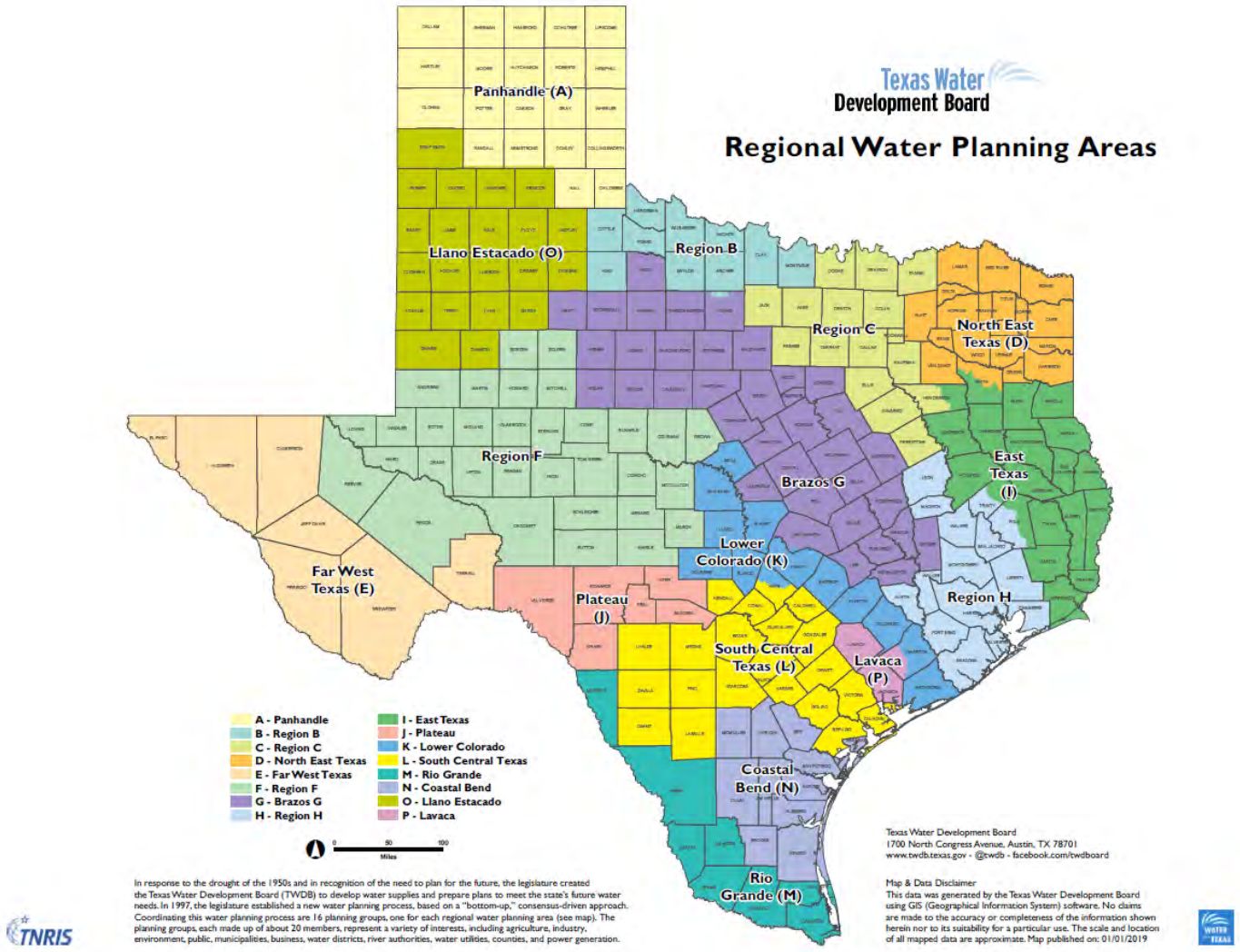
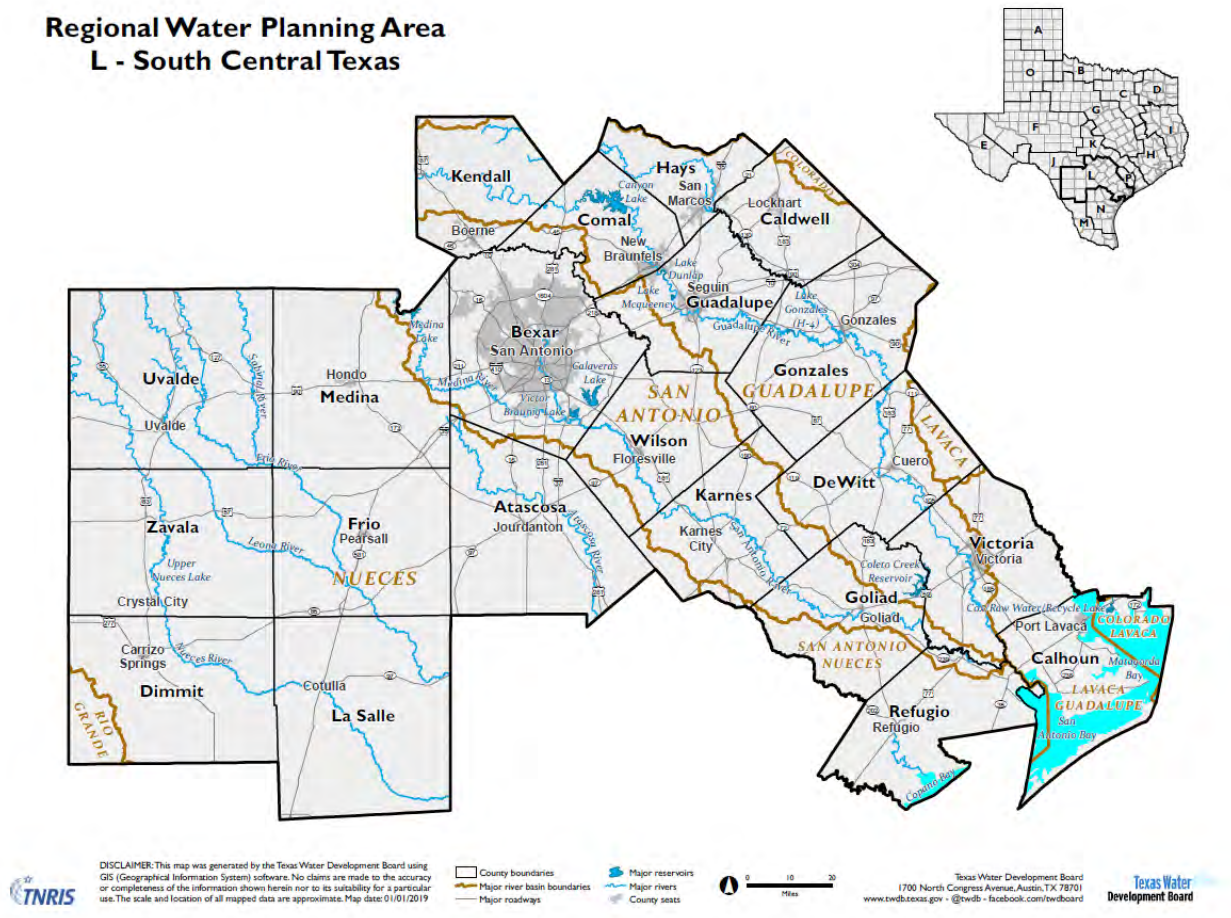


Figure 3.2


Regional Water Planning Area
L - South Central Texas
Kendall
Boerne
Comal
New Braunfels
Hays
San Marcos
Canyon Lake
Lockhart
Caldwell
Lake Dunlap
Seguin
Guadalupe
Lake McQueeney
Lake Gonzales (H-4)
Gonzales
Guadalupe River
Bexar
San Antonio
Medina Lake
Medina River
Galaveras Lake
Victor Braunig Lake
SAN ANTONIO
GUADALUPE
Gonzales
Uvalde
Hondo
Medina
Uvalde
Sabinal River
Frio River
Wilson
Floresville
Cuero
LAVACA
DeWitt
Karnes
Karnes City
San Antonio River
Atascosa
Jourdanton
Zavala
Frio
Pearsall
Leona River
Upper Nueces Lake
NUECES
Crystal City
Carrizo Springs
Nueces River
Dimmit
Cotulla
La Salle
RIO GRANDE
Victoria
Victoria
Coleto Creek Reservoir
Goliad
Goliad
SAN ANTONIO
NUECES
Port Lavaca
COLORADO
LAVACA
Calhoun
Matagorda Bay
LAVACA
GUADALUPE
San Antonio Bay
Refugio
Refugio
Copano Bay
TNRIS
DISCLAIMER: This map was generated by the Texas Water Development Board using GIS (Geographical Information System) software. No claims are made to the accuracy or completeness of the information shown herein nor to its suitability for a particular use. The scale and location of all mapped data are approximate. Map date: 01/01/2019
County boundaries
Major river basin boundaries
Major roadways
Major reservoirs
Major rivers
County seats
0 10 20
Miles
Texas Water Development Board
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Texas Water Development Board

3.5 Topography and Drainage

The GCUWCD lies within south-central Texas on the Gulf Coastal Plain. In most of the District the topography ranges from flat to rolling. However, two prominent lines of hills extend across parts of Gonzales County – one along the northwestern boundary from Ottine to about seven (7) miles northwest of Dewville and the other along the boundary of Lavaca County. In Caldwell County, the minimum elevation, about 295 feet, is at the southern tip of the County where Plum Creek joins the San Marcos River. The maximum elevation is in the area of the so-called "Iron Mountains" peaks southeast and south of McMahan.

Most of the District lies in the drainage basin of the Guadalupe River. Two small areas in the eastern and southeastern parts of the District are drained by the Colorado River. Most of the southern and southwestern parts of Gonzales County are drained by Sandies Creek, which flows southeastward and enters the Guadalupe River near Cuero in Dewitt County. Most of the northern and northeastern parts of Gonzales County are drained by Peach Creek, which flows southward, entering the Guadalupe River about ten (10) miles southeast of Gonzales. Plum Creek, the major tributary to the San Marcos River in Caldwell County, drains about 310 square miles (about 60 percent) of the County.

3.6 Groundwater Resources

The Wilcox Group yields small to moderate quantities of fresh to slightly saline water to a few wells in and near the outcrop in the northwestern part of Gonzales County. In Caldwell County, the Wilcox yields small to large quantities of water to many wells for domestic and stock purposes, public supply, and some irrigation. The Wilcox Group crops out in a small area in the GCUWCD near Ottine. The Wilcox is composed of clay, silt, fine to medium-grained sand and sandstone, sandy shale, and thin beds of lignite. The thickness of the Wilcox ranges from about 1,300 to 3,200 feet, with a maximum thickness of 2,000 feet occurring in an erosional channel in the southeastern part of the District. This erosional channel is filled largely with silty shale.

The principal water-bearing formation in the GCUWCD is the Carrizo Aquifer, which yields moderate to large quantities of fresh to slightly saline water throughout a large part of its subsurface extent. Most of the Carrizo in the GCUWCD has at least 80 percent sand. Portions of the Carrizo in the eastern half of the GCUWCD have 60 to 80 percent sand, generally corresponding to the area of the Yoakum Channel. Geologic thickness maps produced for the GCUWCD indicate that the Carrizo varies from less than 200 feet over the San Marcos Arch in the central portion of the county to more than 600 feet in the western portion of the GCUWCD and about 800 feet in the Yoakum Channel in the eastern portion of the GCUWCD. The Carrizo crops out in a small area along the western edge of Gonzales County and across the southeast portion of Caldwell County in a belt 1.5 to 3.5 miles wide. The Carrizo consists of beds of massive, commonly cross-bedded coarse sand and some minor amounts of sandstone and clay.

The Queen City Aquifer yields small to moderate quantities of fresh to slightly saline water to wells in the area of the outcrop and downdip for a distance of about 5 to 8 miles. The Queen City Aquifer crops out in a northeastward trending belt across Gonzales and Caldwell Counties about 2 to 4 miles wide and is composed of massive to thin bedded medium to fine sand and clay. The thickness of the Queen City ranges from about 400 to 825 feet where the entire section is present.

The Sparta Aquifer yields small to moderate quantities of fresh to slightly saline water in the outcrop and for a few miles downdip. The Sparta Aquifer crops out in a belt about 1-mile-wide trending northeastward across Gonzales County and consists of fine to medium grained sand with some shale. The thickness of the Sparta Aquifer averages about 100 feet.

The Yegua-Jackson Aquifer runs approximately parallel to the Gulf of Mexico coastline and is aligned across the south-central portion of the GCUWCD in a narrow band approximately 7 to 10 miles wide. In

Gonzales County, the Yegua Formation yields small quantities of slightly to moderately saline water for domestic use and for livestock. At some places in the County, sands in the Jackson also yield small quantities of fresh to slightly saline water for domestic use and for livestock. The Yegua Formation is composed of medium to fine sand, clay, silt, small amounts of gypsum, and beds of lignite. The Yegua has a maximum thickness of about 1,000 feet. The Jackson Group conformably overlies the Yegua Formation and consists of clay, silt, tuffaceous sand, sandstone, bentonitic clay, and some volcanic ash, and has a maximum thickness of at least 950 feet and possibly as much as 1,200 feet.

4.0 CRITERIA FOR PLAN APPROVAL

4.1 Planning Horizon

This plan shall be used for the ten (10) year period following approval as administratively complete by the Texas Water Development Board (TWDB) as required by *31 TAC §356.52(a)*. The GCUWCD shall implement these goals and policies for a planning period of ten (10) years and will review the plan in five (5) years or sooner as circumstances warrant.

4.2 Board Resolution

A certified copy of the GCUWCD's resolution adopting this plan as required by *31 TAC §356.53(a)(2)* is included in **Appendix 1**.

4.3 Plan Adoption

Public notices documenting that this plan was adopted following appropriate public meetings and hearings, as required by *31 TAC §356.53(a)(3)*, are included in **Appendix 2**.

4.4 Coordination with Surface Water Management Entities

Letters transmitting copies of this plan to the Guadalupe Blanco River Authority and Region L are included in **Appendix 3** as required by *31 TAC §356.51*.

5.0 DESIRED FUTURE CONDITIONS AND MODELED AVAILABLE GROUNDWATER

Section 36.108, Texas Water Code, requires joint planning among the GDC's within GMA 13. A key part of joint planning is determining DFCs that are used to calculate "modeled available groundwater" (MAG). These conditions and volumes are used for regional water plans, groundwater management plans, and permitting. DFCs are the desired, quantified conditions of groundwater resources (such as water levels, water quality, spring flows, or volumes) at a specified time or times in the future or in perpetuity.

The DFCs for the Carrizo-Wilcox, Queen City, and Sparta Aquifers described in Resolution 21-02 from Groundwater Management Area 13, adopted November 19, 2021, are:

> • *"The first desired future condition for the Carrizo-Wilcox, Queen City and Sparta Aquifers in Groundwater Management Area 13 is that 75 percent of the saturated thickness in the outcrop at the end of 2012 remains in 2080. Due to the limitations of the current Groundwater Availability Model, this desired future condition cannot be simulated as documented during 2016 Joint Planning in GMA 13 Technical Memorandum 16-08 (Hutchison, 2017a)."*

> • *"In addition, a secondary proposed desired future condition for the Carrizo-Wilcox, Queen City, and Sparta Aquifers in Groundwater Management Area 13 is an average drawdown of 49 feet (+/- 5 feet) for all of GMA 13. The drawdown is calculated from the end of 2012 conditions to the year 2080. This desired future condition is consistent with simulation "GMA13_2019_001" summarized during a meeting of Groundwater Management Area 13 members on March 19, 2021."*

The desired future conditions for the Yegua-Jackson Aquifer described in Resolution 21-03 from Groundwater Management Area 13, adopted November 19, 2021, are:

> *"For Gonzales County, the average drawdown from 2010 to 2080 is 3 feet (+/- 1 foot)."* The Edwards (Balcones Fault Zone), Gulf Coast, and Trinity Aquifers were declared not relevant for purposes of joint planning by Groundwater Management Area 13 in Resolution 21-01

For each aquifer, the DFC average drawdowns encompass the full extent of the aquifers within the District, from the outcrop to the downdip limit of the aquifer within the District boundary. The GMA13 wide DFCs for the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson Aquifers equate to drawdowns in the District's aquifers as shown in **Table 1** below.

Table 1
Desired Future Conditions
Appendix 4: GMA 13 Technical Memorandums GMA13-2019-001
Gonzales County Underground Water Conservation District

Aquifer	Average Drawdown (feet)
Wilcox (Upper)	120
Wilcox (Middle)	129
Wilcox (Lower)	145
Carrizo-	120
Queen City	31
Sparta	23
Yegua-Jackson	3

Modeled Available Groundwater (MAG) is defined in the Texas Water Code, Section 36.001, Subsection (25) as "the amount of water that the executive administrator determines may be produced on an average annual basis to achieve a DFC established under Section 36.108." MAG estimates for the Wilcox, Carrizo, Queen City, Sparta and Yegua-Jackson Aquifers were received from the TWDB in October 2023. Presentation of this data in the management plan is required by *31 TAC §356.52 (a)(5)(A)*.

Table 2
Modeled Available Groundwater
Gonzales County Underground Water Conservation District
Appendix 5: GAM Run 21-018 MAG

Aquifer	Year						
	2020 (ac-ft/yr)	**2030 (ac-ft/yr)**	**2040 (ac-ft/yr)**	**2050 (ac-ft/yr)**	**2060 (ac-ft/yr)**	**2070 (ac-ft/yr)**	**2080 (ac-ft/yr)**
Carrizo-Caldwell County	453	9,457	16,386	25,495	30,072	30,072	30,072
Carrizo-Gonzales County	47,131	51,908	55,242	55,832	56,206	57,166	49,620
Carrizo Total	**47,584**	**61,365**	**71,628**	**81,327**	**86,278**	**87,238**	**79,692**
Upper Wilcox	15	15	15	15	15	15	15
Middle Wlicox	11,096	15,563	20,114	24,556	24,556	24,556	24,556
Lower Wilcox	2,204	8,794	15,432	21,985	21,985	21,985	21,985
Wilcox Total	**13,315**	**24,372**	**35,561**	**46,556**	**46,556**	**46,556**	**46,556**
Queen City	9,815	9,789	9,530	9,505	9,505	8,477	8,477
Sparta	3,524	2,451	2,457	2,451	2,451	2,451	2,451
Yegua Jackson	4,728	4,728	4,728	4,728	4,728	4,728	4,728

The GAM run used to determine the MAG included all groundwater from the outcrop to the downdip extent within the GCUWCD for all the aquifers. The quality of the water was not considered so the MAG volumes include water with total dissolved solids concentrations (TDS) up to and possibly exceeding 3,000 ppm.

According to information included in the Final Reports of Groundwater Availability Models for the Carrizo-Wilcox, Queen City and Sparta Aquifers, prepared for the TWDB, limitations are intrinsic to models. Model limitations can be grouped into several categories including: (1) limitations in the data supporting a model, (2) limitations in the implementation of a model which may include assumptions inherent to the model application, and (3) limitations regarding model applicability. The report also states that the GAMs were developed on a regional scale and are applicable for assessing regional aquifer conditions resulting from groundwater development over a fifty-year period. At this scale, the models are not capable of precisely predicting aquifer responses at specific points such as a particular well. Thus, the estimation of available groundwater calculated by the Southern Carrizo-Wilcox Queen City and Sparta (SCWQCS) GAM should be considered as a tool to assist the District in managing the aquifers to comply with the District's adopted DFCs.

Drawdown averages and modeled available groundwater values were based on the TWDB defined aquifer boundaries rather than the model extent. Drawdowns for cells that became dry during the simulation (water level dropped below the base of the cell) were calculated as the reference year water level elevation minus the elevation of the model cell bottom. Pumping in dry cells was excluded from the modeled available groundwater calculations for the decades after the cell went dry. A tolerance of five feet was assumed when comparing DFCs to modeled drawdown results. This tolerance was specified by the GMA in their definition

of the DFCs. Estimates of modeled available groundwater from the model simulation were rounded to the nearest whole number. The verification calculation for the DFCs is based on an average of all model layers (Layers 1 through 8). The modeled available groundwater calculations are based on Layer 1 for the Sparta Aquifer, Layer 3 for the Queen City Aquifer, and the sum of Layers 5 through 8 for the Carrizo-Wilcox Aquifer.

6.0 Estimated Historical Groundwater Use and 2022 State Water Plan Datasets

The TWDB provides a package of data reports (Parts 1 and 2) to GCD's to assist them in meeting the requirements for approval of their five-year groundwater Management Plan. Each report in the package addresses a specific numbered requirement in the TWDB's Groundwater Management Plan checklist. The five reports are:

1. **Estimated Historical Groundwater Use** - the TWDB Uses Unit operates an annual survey of ground and surface water use by municipal and industrial entities within the state of Texas. This survey collects the volume of both ground and surface water used, the source of the water, water sales and other pertinent data from the users. The data provides an important source of information in helping guide water supply studies and regional and state water planning. Presentation of this data in the management plan is required by *§36.1071(e)(3)(B), Texas Water Code.*
2. **Projected Surface Water Supplies** - estimates of projected water supplies represent the estimated capacity of water systems to deliver water to meet user needs on an annual basis. Estimates of projected water supplies are compared with estimates of projected water demand to determine if the existing infrastructure can meet the expected needs of the water user group. Presentation of this data in the management plan is required by *§36.1071(e)(3)(F), Texas Water Code.*
3. **Projected Water Demands** - the projected water demand estimates are derived from the TWDB Estimated Historical Groundwater use And 2022 State Water Plan Datasets (Appendix 6). These water demand projections are separated into the following designated uses: municipal, manufacturing, steam electric, irrigation, mining, and livestock. Water demand is the total volume of water required to meet the needs of the specified user groups located within the District's planning area. Municipal needs in Gonzales County exist for the following water user groups (WUGs): In Caldwell County: Aqua WSC, Caldwell County-Other, County Line SUD, ,. Creedmoor-Maha WSC, Goforth SUD, Gonzales County WSC, Caldwell-Irrigation, Livestock, Manufacturing, and Minning, Polonia WSC, Tri Community WSC. In Gonzales County: Gonzales County-Other, City of Gonzales, City of Lockhart, City of Luling, City of Nixon, City of San Marcos, City of Smiley, City of Waelder, Gonzales County WSC, Gonzales-Irrigation, Livestock, Manufacturing, and Minning. Additional demands from 2020-2070 in Calwell County increase from 6,264 ac-ft to 12,068 ac-ft while need reflects -140 to -3,060. An overall demand in reduction of conservation has been presented as a management strategy to meet demand. (Appendix 6). Presentation of this data in the management plan is required by *§36.1071(e)(3)(G), Texas Water Code.*
4. **Projected Water Supply Needs** - the projected water supply needs estimates are derived from the 2022 State Water Plan. Estimates of Projected Water Supplies are compared with estimates of Projected Water Demand to determine if the existing infrastructure can meet the expected Water Supply Needs of the water user group. Presentation of Water Supply Needs in the management plan is required by *§36.1071(e)(4), Texas Water Code.* The Texas Water Development Board (TWDB) projects that total water demand will increase from 17.7 million acre-feet in 2020 to 19.2 million acre-feet in 2070. Municipal demand is expected to increase due to population growth and surpass irrigation demand by 2060. Aqua WSC, Canyon Lake Water Service Company, City of Buda, City of Cibolo, City of Kyle, City of La Vernia, City of Marion, City of San Marcos, City of

Schertz, City of Seguin, City of Selma, County Line WSC, Crystal Clear WSC, East Central WSC, Green Valley SUD, Martindale WSC, Maxwell WSC, San Antonio Water System, Spring Hill Water Company, S.S. WSC, Water Services Incorporated. Additional demands from 2020-2070 in Calwell County increase from 6,264 ac-ft to 12,068 ac-ft while need reflects -140 to -3,060. An overall demand in reduction of conservation has been presented as a management strategy to meet demand. (Appendix 6).

5. **Projected Water Management Strategies** - water management strategies are specific plans to increase water supply or maximize existing supply to meet a specific need. Municipal water conservation strategies focus on reducing conservation. Local Carrizo-Wilcox temporary overdraft strategies involve temporarily over-drafting the aquifer during drought conditions to supplement water supplies, direct reuse, and demand reduction. Aqua WSC, County Line SUD, Alliance Regional Water Authority Phase 2, Goforth SUD, Guadalupe-Blanco River Authority, City of Lockhart, City of Luling, Martindale WSC, Canyon Regional Water Authority, Maxwell WSC, Polonia WSC, City of San Marcos, Tri Community WSC, Gonzales County Water Supply Corporation, City of Nixon, City of Smiley, City of Waelder. Presentation of water management strategies in the management plan is required by *§36.1071(e)(4), Texas Water Code.*

The data package reports are included in **Appendix 6**.

7.0 Groundwater Availability Model Report

TWDB data package includes the Groundwater Availability Model report. Texas Water Code, Section 36.1071, Subsection (h) states that, in developing a Groundwater Management Plan, GCDs shall use groundwater availability modeling provided by the TWDB. Information derived from the groundwater availability models that shall be included in the management plan includes:

1. the annual amount of recharge from precipitation, if any, to the groundwater resources within the District – required by *§36.1071(e)(3)(E), Texas Water Code.*
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 – required by *§36.1071(e)(3)(E), Texas Water Code.*
3. the annual volume of flow into and out of the District within each aquifer and between aquifers in the District – required by *§36.1071(e)(3)(E), Texas Water Code.*

The TWDB ran a groundwater availability model (GAM Run 23-018) for the central and southern Carrizo-Wilcox, Queen City, and Sparta Aquifers, the Yegua-Jackson Aquifer, and the central portion of the Gulf Coast Aquifer to create a groundwater budget. A groundwater budget summarizes water entering and leaving the aquifer according to input parameters assigned in the models to simulate the groundwater flow system. The components of the water budgets include:

1. **Precipitation Recharge** – this is the aerially distributed recharge sourced from precipitation falling on the outcrop areas of the aquifers (where the aquifer is exposed at the land surface) within the District.
2. **Surface Water Outflow** – this is the total water exiting the aquifer (outflow) to surface water features such as streams, reservoirs, and drains (springs).
3. **Flow into and Out of District** – this component describes lateral flow within the aquifer between the District and adjacent counties.

4. **Flow Between Aquifers** – this describes the vertical flow, or leakage, between aquifers or confining units. Inflow to an aquifer from an overlying aquifer will always equal the outflow from the other aquifer.

The Part 2 data package is included in **Appendix 7**.

8.0 MANAGEMENT OF GROUNDWATER RESOURCES

The GCUWCD will manage groundwater resources consistent with the intent and purpose of the District to conserve, preserve, protect and prevent waste of groundwater resources so that the economy of the areas within the District will be ensured of growth for future generations. Details of how the District will manage groundwater supplies, as required by *31 TAC 356.52(a)(4)*, as well as the actions, procedures, performance and avoidance necessary to effectuate the management plan, including specifications and the proposed rules, as required by *§36.1071(e)(2), Texas Water Code* are presented below.

8.1 Regulatory Action Plan

Pursuant to Chapter 36 of the Texas Water Code, the District has adopted rules limiting groundwater production based on tract size and the spacing of wells, to provide for conserving, preserving, protecting, preventing degradation of water quality, and to prevent the waste of groundwater. This District will enforce the rules of the District to meet the goals of regulating the production of groundwater within the District. These rules will govern the permitting of wells to be drilled and the production of water from permitted wells. The rules shall be adhered to and shall be based on the best technical evidence available. Copies of the District's Rules and the Management Plan shall be available at the District's office at no charge to residents of the District. A copy of the District's Rules and Management Plan are also available on the District's website at www.gcuwcd.org.

The District will monitor water levels in selected observation wells and evaluate whether the annual change in water levels is in conformance with the DFCs adopted by GMA 13 for each aquifer. The District will use information readily available (Groundwater Availability Models, TWDB reports, etc.) or install observation wells to assess the saturated thickness of the outcrops for the Carrizo-Wilcox, Queen City, and Sparta Aquifers. The District will use the saturated thickness of the approximate center of the outcrop as the monitoring location for the DFC. Water levels will be collected from nearby observation wells to monitor the saturated thickness levels of the aquifers.

For the Yegua-Jackson Aquifer the starting water level date for the District's DFC is January 2010. The District will measure water levels in designated observation wells during the winter months (November through February). Water level measurements will be obtained by automatic or manual water level monitoring equipment. The District will calculate the average yearly change in water level based on all of the wells in the observation well network. These changes will be summed each year over the DFC planning period. The average water level declines over time will be compared to production amounts to assist in predicting future water level declines.

The District will estimate total annual groundwater production for each aquifer based on water use reports, estimated exempt use, and other relevant information and compare these production estimates to the MAGs. The District will base future permitting decisions on the amount of existing water permitted, amount existing water being produced, and the condition of the aquifer (water level drawdowns) at the time the permit application is filed in order to achieve the DFC.

8.2 Permits and Enforcement

The District may deny permits or limit groundwater withdrawals following the guidelines stated in the rules of the District and this plan. In determining whether to issue a permit or limit groundwater withdrawal, the District will consider the public benefit against individual hardship after considering all relevant evidence, appropriate testimony and all relevant factors.

In carrying out its purpose, the District may require the reduction of groundwater withdrawal to amounts that will not cause the water table or artesian pressure to drop to a level that would cause harm to the aquifer or exceed the specified drawdown limitations under the adopted DFCs. To achieve this purpose the District may, at its discretion and based on information obtained through its groundwater monitoring procedures, amend or revoke any permits after notice and hearing. The monitoring procedures include calculation of yearly average drawdowns which will ensure that the District and permit holders are fully aware of the condition of the aquifers and corrective action measures can be reasonably implemented over appropriate intervals without causing harm to human health.

The District will enforce the terms and conditions of permits and its rules by enjoining the permittee in a court of competent jurisdiction as provided for in Section 36.102 of the Texas Water Code.

8.3 Exempt Use Wells

This plan and its accompanying rules shall exempt certain uses from the permit requirement as provided for in Section 36.117 of the Texas Water Code. The District, by rule, also provides exemptions for other categories of groundwater use including agricultural use, fracking use, and monitoring wells.

8.4 Permit Fees

The District will assess reasonable fees for processing a permit application to drill a test hole, for processing drilling and production permit applications, for processing export permit applications, and for processing permit applications to rework, re-equip, or alter a water well. No application fees are required for registering and recording the location of an existing well with the District.

8.5 Equity and Discretion

The District shall treat all citizens and entities of the District equally. Upon applying for a permit to drill a water well or a permit to increase the capacity of an existing well, the Board of Directors shall take into consideration all circumstances concerning the applicant's situation. The Board may grant an exception to the rules of the District when granting permits to prevent hardship or economic loss, also taking into consideration hydrological, physical or geophysical characteristics. Therefore, temporary exceptions to the general rule for a specific area may be necessary if an economic hardship will be created that is significantly greater for one person than for others in the District. In considering a request for an exception, the Board will also consider any potential adverse impacts on adjacent landowners. The exercising of discretion by the Board may not be construed to limit the power of the Board.

8.6 Spacing Requirements

Spacing of wells from the property line shall be in accordance with the rules of the District.

8.7 Production Ratios

The District may adopt rules to regulate groundwater withdrawals by means of production limits. The District may deny a well permit or limit groundwater withdrawals in accordance with guidelines stated in the rules of the District. In deciding to deny a permit or reduce the amount of groundwater withdrawals authorized in an existing permit, the District may weigh the public benefit in managing the aquifer to be derived from denial of a groundwater withdrawal permit or the reduction of the amount of authorized groundwater withdrawals against the individual hardship imposed by the permit denial or authorization reduction.

8.8 Cooperation and Coordination

Public cooperation is essential for this plan to accomplish its objectives. The District will work with the public and local and state governments to achieve the goals set forth in this plan. The District will coordinate activities with all public water suppliers, private water suppliers, industrial users and agricultural users to help them conserve groundwater. The Guadalupe Blanco River Authority (GBRA) is the local entity regulating all surface water in the District, and the District will work closely with this agency to achieve our mutual water related goals. The TCEQ is the agency charged with protecting the state's water resources, and the TWDB is the agency responsible for water resources planning and promotion of water conservation practices. The District will continue to work with both agencies to conserve, preserve and protect water resources, and to prevent waste as outlined in this plan. GCUWCD met with GBRA to discuss surface

8.9 Subsidence

Subsidence is not a relevant factor with the aquifers managed by this District according to regional groundwater management planning: the District includes a portion of the Gulf Coast Aquifer, which is known for its susceptibility to subsidence, but the District's creation order does not give the District any jurisdiction over the Gulf Coast Aquifer. In the report "Identification of the Vulnerability of the Major and Minor Aquifers of Texas to Subsidence with Regard to Groundwater Pumping-TWDB Contract Number 164830262"

> *the Subsidence Risk Value (SRV) in the Carrizo-Wilcox Aquifer as an aggregate scored a medium-high vulnerability score of 4.7, the total subsidence risk to be represented by a value between 0 and 10 (inclusive) with the higher values being at the greatest risk. Subsidence investigations at the local level may be appropriate for areas identified as medium, or high risk with critical infrastructure that would be sensitive to land surface elevation changes and/or land surface fissures. The objective of further investigating subsurface characteristics that lead to subsidence is to provide data that can inform a more accurate evaluation of subsidence risk or that can contribute to more accurate subsidence predictions. This is a regional study and should not be used for local subsidence risk analysis. The results of this study may provide a qualitative indication of local risk, but greater data uncertainty at the local level increases the uncertainty of the results. While the results may inform stakeholders of the risk for potential subsidence, site specific investigations of aquifer properties affecting subsidence would be needed for local scale analysis.*

No subsidence has been observed in the District. The District will conduct a subsidence study at the local level during this planning cycle to investigate the local vulnerability to provide a more accurate evaluation of subsidence risk. Subsidence investigation methods will include lithologic; geotechnical, and/or geophysical borings; geophysical surveys; and survey benchmark re-leveling.

8.10 Transportation of Water from the District

In accordance with Section 36.122 of the Texas Water Code, if the proposed use of a water well or wells is for transportation of water outside the District additional information shall be required and an export permit must be obtained from the Board before operating a transportation facility. The District may, in considering renewal of an export permit, review the amount of water that may be transferred out of the District. At any time during the term of an export permit, the District may revise or revoke a permit if the use of water unreasonably affects existing groundwater and surface water resources, or existing Permit Holders.

8.11 Groundwater Protection

Section 26.401 of the Texas Water Code states that: "In order to safeguard present and future groundwater supplies, usable and potential usable groundwater must be protected and maintained."

Groundwater contamination may result from many sources, including current and past oil and gas production, agricultural activities, industrial and manufacturing processes, commercial and business endeavors, domestic activities and natural sources that may be influenced by or may result from human activities. The District will take appropriate measures to monitor activities that are either causing, or have the potential threat to cause groundwater contamination. Due to permeability of aquifer outcrops and recharge zones, there is a greater threat of groundwater contamination from surface pollution in recharge and outcrop regions, and the District will monitor those areas more closely.

8.12 Drought Management

Periodic drought is a condition that plagues the GCUWCD. The Board of Directors of the District is very concerned that water will be available for the needs of the citizens during times of drought. The General Manager of the District will update the Board at every monthly meeting on drought conditions in the District. The General Manager will report the Palmer Drought Severity Index to the Board during the manager's report for the month. The Board of Directors will instruct the General Manager of the appropriate actions to be taken upon notification of moderate to severe drought. The possible actions to be taken may include public service announcements on the radio, newspaper articles on conditions of the aquifer, water conservation information, and/or notices to municipal suppliers to implement their drought plan.

8.13 Technical Research and Studies

The District, in cooperation with the TWDB and the TCEQ, will conduct studies to monitor the water level in the Yegua Jackson, Sparta, Queen City, Carrizo, and Wilcox Aquifers to determine if there is any danger of damaging these aquifers due to over production. The District will also establish water quality monitoring wells throughout the District to determine if any degradation of water quality is occurring. The District is currently cooperating with the Texas Water Development Board with its monitoring of the Wilcox, Carrizo, Queen City, Sparta and Yegua Jackson Aquifers.

8.14 Groundwater Recharge

The GCUWCD is prohibited from financing any groundwater recharge enhancement projects by order of the Texas Natural Resource Conservation Commission number 101692-DO4. The District has adopted rules to regulate Managed Aquifer Recharge projects.

8.15 Public Information

A well-informed public is vital to the proper operation of a GCD. The District is in compliance with the Open Meetings Act of the Texas Government Code Chapter 551 to keep Texas government transparent, open, and accountable to the people. The District will keep the citizens of the District informed by means of a website, timely newspaper articles and/or public service radio announcements, and informational handouts in the District's office. As part of the public information program the directors of the District and the District manager will make presentations to public gatherings, as requested, to keep the citizens informed about District activities and to promote proper use of available groundwater. The District conducts community outreach in the form of providing rain gauges and informational presentations at community group events. A water quality fair will be held for citizens to test their well water quality.

8.16 Conservation and Natural Resource Issues

Water is the most precious natural resource on Earth. The District will promote conservation as a way of life in order to conserve fresh water for future generations. The District will require wells in areas that are in danger of over producing groundwater and damaging the aquifers to restrict production by means of production permits and metering of the amount of water produced. The District will work with water utilities, agricultural and industrial users to promote the efficient use of water so that we may conserve water. The District will keep abreast of developments in water conservation and update requirements as needed. The District will, upon request, provide information on wells and water levels to the Natural Resources Conservation Service to develop waste management plans for the poultry producers.

Abandoned oil wells pose the greatest threat to the aquifers of the District. District personnel will monitor oilfield activity and notify the public that they may report abandoned oil wells and other problems associated with oil production to the District.

9.0 METHODOLOGY FOR TRACKING DISTRICT PROGRESS IN ACHIEVING MANAGEMENT GOALS

The District manager will prepare and present an Annual Report to the Board of Directors on District performance in regards to achieving management goals and objectives. The Annual Report will be presented to the Board on or before March 31st of each new year. The Board will maintain the report on file for public inspection at the District's offices upon adoption.

10.0 GOALS, MANAGEMENT OBJECTIVES, PERFORMANCE STANDARDS AND METHODOLOGY FOR TRACKING PROGRESS

The District's management goals, objectives, performance standards, and methodology for tracking progress, as specified in *36.1071(e)(2), Texas Water Code* are addressed below.

10.1 Plan Elements Required by State Law and Rule

Providing the Most Efficient Use of Groundwater
31 TAC 356.52(a)(1)(A)

The District's goal is to provide for the most efficient use of the groundwater resources of the GCUWCD.

Management Objective 1: The District will register at least 20 exempt use wells and will compile the data into a database.

> **Performance:** Record the date and number of exempt use wells registered in a database and include the information in the District's Annual Report.

Management Objective 2: The District will measure water levels in at least 40 observation wells to provide coverage across the Wilcox, Carrizo, Queen City, Sparta, and Yegua-Jackson Aquifers three times a year and will compile the water level data into a database.

> **Performance:** Record the number of wells and water level measurements measured for each aquifer annually in a database and include this information in the District's Annual Report.

Management Objective 3: The District will meet with the cities of Gonzales, Nixon, Smiley, and Waelder, and the Gonzales Area Development Corporation at least once a year to inform them on water availability for economic development.

> **Performance:** Record the date and number of meetings annually and include a copy of the meeting attendee's sheet and information on the topics of discussion with each entity in the District's Annual Report.

Management Objective 4: The District will gather water production data from local public water suppliers including the Gonzales County Water Supply Corporation, City of Gonzales, City of Nixon, City of Smiley, and City of Waelder, ten permitted or registered irrigation wells, and two livestock production facilities annually and compile the data into a database.

> **Performance:** Record the amount of water used by each public water supplier, irrigation well, and livestock production facility and include the information into the District's Annual Report.

Controlling and Preventing Waste of Groundwater
31 TAC 356.52(a)(1)(B)

Management Objective 1: The District will provide educational resources to citizens within the District on controlling and preventing waste of groundwater. The District will, at least annually, submit an information article on controlling and preventing waste of groundwater within the District for publication in a newspaper of general circulation in the District or may publish the article on the District's website.

The District may also make a presentation to the public through local service organizations or public schools describing measures that can be taken by water users within the District.

> **Performance:** Record the dates of each control and prevention of waste article submitted for publication, published on the District's website, or presentation made to the public and include this information in the District's Annual Report.

Controlling and Preventing Subsidence
31 TAC 356.52(a)(1)(C)

Because of the rigid geologic framework of the aquifers regulated by the District subsidence is not a relevant issue within the GCUWCD. The District includes a portion of the Gulf Coast Aquifer, which is known for its susceptibility to subsidence, but the District's creation order does not give the District any jurisdiction over the Gulf Coast Aquifer. Therefore, the management goal is not relevant or applicable.

Conjunctive Surface Water Management
31 TAC 356.52(a)(1)(D)

The District's goal is to maximize the efficient use of groundwater and surface water for the benefit of the residents of the District.

Management Objective 1: The District will meet with the staff of the Guadalupe Blanco River Authority ("GBRA"), at least once a year, to share information updates about conjunctive use potential.

> **Performance:** Record the number of GBRA meetings attended annually and include a copy of the meeting attendee's sheet and information on the topics of discussion in the District's Annual Report.

Management Objective 2: The District will attend at least one Regional Water Planning Group ("RWPG") meeting annually to share information updates about conjunctive use potential.

> **Performance:** Record the number of RWPG meetings attended annually and include a copy of each RWPG meeting agenda and a copy of the meeting minutes in the District's Annual Report.

Addressing Natural Resource Issues
31 TAC 356.52(a)(1)(E)

The District's goal is to protect the Natural Resources of the GCUWCD. The District believes that preventing the contamination of groundwater is the single most important waste prevention activity it can undertake.

Management Objective 1: The District will collect water quality data in at least 20 wells annually at locations throughout the District and will compile the data into a database. In selecting wells the District will emphasize the wells at or near the zone of bad water or potential pollution sources based on best available data. The District may conduct field measurements using hand held meters and/or collect samples for laboratory analysis from each well.

Performance: Record the number of wells in which water quality measurements were collected and the water quality results for each well and include this information in the District's Annual Report.

Management Objective 2: The District will monitor new facilities and activities on the recharge zones of the Carrizo/Wilcox, Queen City, Sparta, and Yegua-Jackson Aquifers on at least an annual basis for point source and non-point source pollution and compile this data into a database.

Performance: Record the date and results of the visual survey of all recharge zones for point source and nonpoint source activities and facilities and include the information in the District's Annual Report.

Management Objective 3: The District will meet with the local Texas Railroad Commission ("TRC") engineering technician at least once annually to review oil well permits and oil related activity that could endanger the aquifers and coordinate its efforts with this agency in locating abandoned or deteriorated oil wells.

Performance: Record the date and number of meetings with the TRC, the number of oil related activities that endangered the aquifers, the number of abandoned or deteriorated wells filed with the District and include the information in the District's Annual Report.

Management Objective 4: The District will meet with Natural Resources Conservation Service representatives to exchange information on irrigation demands, NRCS programs, and wells and water levels at least once annually.

Performance: Record the date and number of meetings with the Natural Resources Conservation Service representatives and include the information in the District's Annual Report.

Addressing Drought Conditions
31 TAC 356.52(a)(1)(F)

The District's goal is to provide information and coordinate an appropriate response with local water users and water managers regarding the existence of extreme drought events in the District.

Management Objective 1: The General Manager will access the National Weather Service – Climate Prediction Center website (http://www.cpc.ncep.noaa.gov/products/monitoring_and_data/drought.shtml) to determine the Palmer Drought Severity Index and will submit a report to the Board of Directors monthly. The District will provide information to and coordinate with local water users and water managers regarding drought response activities.

Performance: Record the number of monthly reports made to the District Board of Directors and the date and number of times when the District was under extreme drought conditions and the number of times letters were sent to public water suppliers. Include this information in the District's Annual Report.

Addressing Conservation, Recharge Enhancement, Rainwater Harvesting, Precipitation Enhancement, Brush Control
31 TAC 356.52(a)(1)(G)

The District believes that the most efficient and effective ways to facilitate conservation within the District are through sound data collection, dissemination, and the distribution of public information about the groundwater resources in the GCUWCD, its current use and more effective ways to use it.

Management Objective 1: The District will, at least annually, submit an information article describing conservation measures that can be taken by water users within the District for publication in a newspaper of general circulation in the District or may publish the article on the District's website.

Performance: Record the dates of each conservation article submitted for publication or published on the District's website and include this information in the District's Annual Report.

Management Objective 2: The District will, at least annually, submit an information article describing recharge enhancement measures for publication in a newspaper of general circulation in the District or may publish the article on the District's website.

Performance: Record the dates of each recharge enhancement article submitted for publication or published on the District's website and include this information in the District's Annual Report.

Management Objective 3: The District will, at least annually, submit an information article describing rainwater harvesting measures that can be taken by water users within the District for publication in a newspaper of general circulation in the District or may publish the article on the District's website.

Performance: Record the dates of each rainwater harvesting article submitted for publication or published on the District's website and include this information in the District's Annual Report.

Management Objective 4: Precipitation Enhancement is no an applicable goal of the district due to the burdensome cost and lack of significant scientific evidence of the benefit.

Performance: The District will continue to monitor the costs and scientific benefit of precipitation enhancement by researching articles and studies related to precipitation enhancement and at least annually post to the district's website.

Management Objective 5: The District will publish an information article in a publication of wide circulation in the District or on its website, at least annually, describing brush control measures that can be used by landowners within the District

Performance: Record the date and number of brush control articles published and include this information in the Annual Report.

Addressing the Desired Future Conditions of the Groundwater Resources
31 TAC 356.52(a)(1)(H)

Management Objective 1: A District representative will attend all Groundwater Management Area 13 meetings annually.

Performance: Record the number of GMA13 meetings attended annually and include a copy of each GMA13 meeting agenda and a copy of the meeting minutes in the District's Annual Report.

Management Objective 2: The District will monitor water levels and evaluate whether the change in water levels is in conformance with the DFCs adopted by the District. The District will estimate total annual

groundwater production for each aquifer based on water use reports, estimated exempt use, and other relevant information and compare these production estimates to the MAGs.

Performance: Record the water level data and annual change in water levels for each aquifer and compare to the DFCs. Include this information in the District's Annual Report.

Performance: Record the total estimated annual production for each aquifer and compare these amounts to the MAG. Include this information in the District's Annual Report.

10.2 Plan Elements Developed at the Discretion of the District

Transportation of Water from the District

The District will seek an accurate accounting of water transported from the District to users outside its boundaries.

Management Objective: The District will obtain monthly usage reports from individuals or entities that transport groundwater out of the District and will compile this data into a database.

Performance: Record the monthly transporter usage reports and present the results in the District's Annual Report.

This Management Plan is approved by resolution on January 09, 2024. This Management Plan takes effect on approval by the Texas Water Development Board. **Appendix 1**

Location of District Office:

Gonzales County UWCD
522 Saint Matthew Street
P.O. Box 1919
Gonzales, TX 78629

Telephone: 830.672.1047
Fax: 830.672.1387

Email: generalmanager@gcuwcd.org, admin@gcuwcd.org
Website: www.gcuwcd.org

APPENDIX 1

Copy of GCUWCD Resolution Adopting Management Plan

Gonzales County Underground
Water Conservation District

Board Resolution 10-10-2023

Resolution Adopting the 2023 Management Plan

WHEREAS, §§36.1071 and 36.1073, Water Code, require the Gonzales County Underground Water Conservation District to develop and adopt a Management Plan that 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, or brush control, where appropriate and cost-effective; and
(8) addressing the desired future conditions adopted by the district;

WHEREAS, §36.1072(e), Water Code, requires each groundwater conservation district to review and re-adopt the Management Plan at least every five years; and

WHEREAS, after providing notice and holding a public hearing, the Board of Directors of the Gonzales County Underground Water Conservation District has developed a Management Plan in accordance with the statutory requirements and utilizing the best available science, attached hereto and incorporated herein for purposes.

NOW THEREFORE, BE IT RESOLVED:

1) The Board of Directors of the Gonzales County Underground Water Conservation District do hereby adopt the attached 2023 Management Plan pursuant to §36.1071, Water Code.

2) The General Manager is hereby ordered to file the adopted Management Plan with the Texas Water Development Board for certification as administratively complete.

3) The General Manager is hereby authorized to take any and all reasonable action necessary for the implementation of this resolution.

This Resolution shall become effective on _____.

Adopted this 10th day of October, 2023.

_____
Bruce Tieken, President
Gonzales County Underground

_____
Barry Miller, Secretary
Gonzales County Underground

Water Conservation District

Gonzales County Underground
Water Conservation District

Board Resolution 2024-11-12c

Resolution Adopting the 2024 Revised Management Plan

WHEREAS, §§36.1071 and 36.1073, Water Code, require the Gonzales County Underground Water Conservation District to develop and adopt a Management Plan that 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;

WHEREAS, §36.1072(e), Water Code, requires each groundwater conservation district to review and re-adopt the Management Plan at least every five years; and

WHEREAS, after providing notice and holding a public hearing, the Board of Directors of the Gonzales County Underground Water Conservation District has developed a Revised Management Plan in accordance with the statutory requirements and utilizing the best available science, attached hereto, and incorporated herein for purposes.

NOW THEREFORE, BE IT RESOLVED:

1) The Board of Directors of the Gonzales County Underground Water Conservation District do hereby adopt the attached 2024 Management Plan pursuant to §36.1071, Water Code.

2) The General Manager is hereby ordered to file the adopted Management Plan with the Texas Water Development Board for certification as administratively complete.

3) The General Manager is hereby authorized to take any and all reasonable action necessary for the implementation of this resolution.

This Resolution shall become effective on _____.

Adopted this 12th day of November, 2024.

_____
Bruce Tieken, President
Gonzales County Underground Water Conservation District

_____
Barry Miller, Secretary
Gonzales County Underground Water Conservation District

APPENDIX 2

Public Notices for Adoption of Management Plan

NOTICE OF PUBLIC HEARING
OF
GONZALES COUNTY UNDERGROUND
WATER CONSERVATION DISTRICT
On Proposed Additions and Amendments to the
District's Management Plan

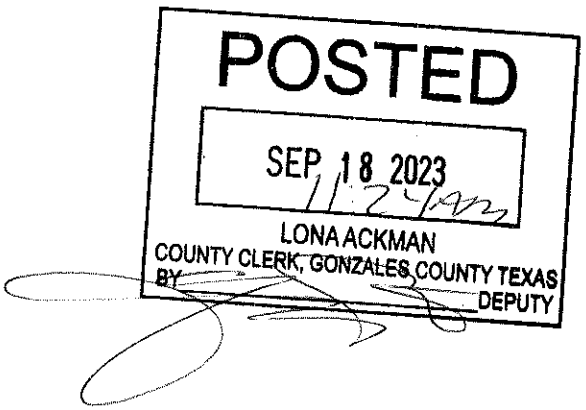
The Gonzales County Underground Water Conservation District ("the District) will hold a public hearing for the purpose of receiving comments on proposed additions and amendments to the Management Plan of the District.

The Board of Directors will take public comments on the proposed amendments to the Management Plan on Tuesday, October 10, 2023, at the District office located at 522 Saint Matthew Street, Gonzales, Texas. The public hearing will begin at 5:30 p.m. Agenda is as follows:

1. Call to order.
2. President of the Board to make comments.
3. Receive comments from the public on the District's proposed Management Plan.
4. Discussion of other items of interest by the Board and direction to management.
5. Adjourn.

Copies of the proposed additions and amendments to the Management Plan of the District are available at the offices of the Gonzales County Underground Water Conservation District, 522 Saint Matthew Street, Gonzales, Texas, from 8:00 a.m. to 5:00 p.m., Monday through Friday.

Written comments should be submitted to the General Manager, PO Box 1919, Gonzales, Texas 78629 by October 10, 2023 at 12:00 p.m. or presented at the hearing.



NOTICE OF PUBLIC HEARING
OF
GONZALES COUNTY UNDERGROUND
WATER CONSERVATION DISTRICT
On Proposed Additions and Amendments to the
District's Management Plan

The Gonzales County Underground Water Conservation District ("the District) will hold a public hearing for the purpose of receiving comments on proposed additions and amendments to the Management Plan of the District.

The Board of Directors will take public comments on the proposed amendments to the Management Plan on Tuesday, October 10, 2023, at the District office located at 522 Saint Matthew Street, Gonzales, Texas. The public hearing will begin at 5:30 p.m. Agenda is as follows:

1. Call to order.
2. President of the Board to make comments.
3. Receive comments from the public on the District's proposed Management Plan.
4. Discussion of other items of interest by the Board and direction to management.
5. Adjourn.

Copies of the proposed additions and amendments to the Management Plan of the District are available at the offices of the Gonzales County Underground Water Conservation District, 522 Saint Matthew Street, Gonzales, Texas, from 8:00 a.m. to 5:00 p.m., Monday through Friday.

Written comments should be submitted to the General Manager, PO Box 1919, Gonzales, Texas 78629 by October 10, 2023 at 12:00 p.m. or presented at the hearing.

Filed this 19th day of Sept 2023
1:53 PM
TERESA RODRIGUEZ
COUNTY CLERK, CALDWELL COUNTY, TEXAS
By Sandra Guerra Deputy
Sandra Guerra

NOTICE OF PUBLIC HEARING
OF
GONZALES COUNTY UNDERGROUND
WATER CONSERVATION DISTRICT
On Proposed Additions and Amendments to the
District's Management Plan

The Gonzales County Underground Water Conservation District ("the District) will hold a public hearing for the purpose of receiving comments on proposed additions and amendments to the Management Plan of the District.

The Board of Directors will take public comments on the proposed amendments to the Management Plan on Tuesday, November 14, 2023, at the District office located at 522 Saint Matthew Street, Gonzales, Texas. The public hearing will begin at 5:30 p.m. Agenda is as follows:

1. Call to order.
2. President of the Board to make comments.
3. Receive comments from the public on the District's proposed Management Plan.
4. Discussion of other items of interest by the Board and direction to management.
5. Adjourn.

Copies of the proposed additions and amendments to the Management Plan of the District are available at the offices of the Gonzales County Underground Water Conservation District, 522 Saint Matthew Street, Gonzales, Texas, from 8:00 a.m. to 5:00 p.m., Monday through Friday, or on the District's website at www.gcuwcd.org.

Written comments should be submitted to the General Manager, PO Box 1919, Gonzales, Texas 78629 by November 14, 2023 at 12:00 p.m. or presented at the hearing.

NOTICE OF PUBLIC HEARING
OF
GONZALES COUNTY UNDERGROUND
WATER CONSERVATION DISTRICT
On Proposed Additions and Amendments to the
District's Management Plan

The Gonzales County Underground Water Conservation District ("the District) will hold a public hearing for the purpose of receiving comments on proposed additions and amendments to the Management Plan of the District.

The Board of Directors will take public comments on the proposed amendments to the Management Plan on Tuesday, November 14, 2023, at the District office located at 522 Saint Matthew Street, Gonzales, Texas. The public hearing will begin at 5:30 p.m. Agenda is as follows:

1. Call to order.
2. President of the Board to make comments.
3. Receive comments from the public on the District's proposed Management Plan.
4. Discussion of other items of interest by the Board and direction to management.
5. Adjourn.

Copies of the proposed additions and amendments to the Management Plan of the District are available at the offices of the Gonzales County Underground Water Conservation District, 522 Saint Matthew Street, Gonzales, Texas, from 8:00 a.m. to 5:00 p.m., Monday through Friday, or on the District's website at www.gcuwcd.org.

Written comments should be submitted to the General Manager, PO Box 1919, Gonzales, Texas 78629 by November 14, 2023 at 12:00 p.m. or presented at the hearing.

Filed this 17th day of Oct 2023
11:56 AM
TERESA RODRIGUEZ
COUNTY CLERK, CALDWELL COUNTY, TEXAS
By Reyna Mijares Deputy
Reyna Mijares

NOTICE OF PUBLIC HEARING
OF
GONZALES COUNTY UNDERGROUND
WATER CONSERVATION DISTRICT
On Proposed Additions and Amendments to the
District's Management Plan

The Gonzales County Underground Water Conservation District ("the District) will hold a public hearing for the purpose of receiving comments on proposed additions and amendments to the Management Plan of the District.

The Board of Directors will take public comments on the proposed amendments to the Management Plan on Tuesday, January 09, 2024, at the District office located at 522 Saint Matthew Street, Gonzales, Texas. The public hearing will begin at 5:30 p.m. Agenda is as follows:

1. Call to order.
2. President of the Board to make comments.
3. Receive comments from the public on the District's proposed Management Plan.
4. Discussion of other items of interest by the Board and direction to management.
5. Adjourn.

Copies of the proposed additions and amendments to the Management Plan of the District are available at the offices of the Gonzales County Underground Water Conservation District, 522 Saint Matthew Street, Gonzales, Texas, from 8:00 a.m. to 5:00 p.m., Monday through Friday.

Written comments should be submitted to the General Manager, PO Box 1919, Gonzales, Texas 78629 by January 09, 2024 at 12:00 p.m., or presented at the hearing.

NOTICE OF PUBLIC HEARING
OF
GONZALES COUNTY UNDERGROUND
WATER CONSERVATION DISTRICT
On Proposed Additions and Amendments to the
District's Management Plan

The Gonzales County Underground Water Conservation District ("the District) will hold a public hearing for the purpose of receiving comments on proposed additions and amendments to the Management Plan of the District.

The Board of Directors will take public comments on the proposed amendments to the Management Plan on Tuesday, January 09, 2024, at the District office located at 522 Saint Matthew Street, Gonzales, Texas. The public hearing will begin at 5:30 p.m. Agenda is as follows:

1. Call to order.
2. President of the Board to make comments.
3. Receive comments from the public on the District's proposed Management Plan.
4. Discussion of other items of interest by the Board and direction to management.
5. Adjourn.

Copies of the proposed additions and amendments to the Management Plan of the District are available at the offices of the Gonzales County Underground Water Conservation District, 522 Saint Matthew Street, Gonzales, Texas, from 8:00 a.m. to 5:00 p.m., Monday through Friday.

Written comments should be submitted to the General Manager, PO Box 1919, Gonzales, Texas 78629 by January 09, 2024 at 12:00 p.m., or presented at the hearing.

Filed this 19th day of Dec 2023
2:57 PM
TERESA RODRIGUEZ
COUNTY CLERK, CALDWELL COUNTY, TEXAS
By Lydia Alexander Deputy
Lydia Alexander

NOTICE OF PUBLIC HEARING
OF
GONZALES COUNTY UNDERGROUND
WATER CONSERVATION DISTRICT
On Proposed Additions and Amendments to the
District's Management Plan

The Gonzales County Underground Water Conservation District ("the District) will hold a public hearing for the purpose of receiving comments on proposed additions and amendments to the Management Plan of the District.

Note: A member of the public shall be allowed to address the GCUWCD Board of Directors regarding an agenda item during public comments via video or conference call with a written notice to the GCUWCD office before 5:00 pm. the day of the meeting. Forms will be made available on the District's website or at the District's office in which to request the submission of one's comments regarding a Board agenda item. The president of the Board reserves rights to place a time limit on comments. The audio and video conference opens 5 minutes before the 5:30 p.m. beginning of the meeting.

The Board of Directors will take public comments on the proposed additions and amendments to the Management Plan on Tuesday, November 12, 2024, at the District office located at 522 Saint Matthew Street, Gonzales, Texas. The public hearing will begin at 5:30 p.m. Agenda is as follows:

GCUWCD November 12, 2024, Public Hearing Management Plan
Nov 12, 2024, 5:30 – 7:30 PM (America/Chicago)
Please join my meeting from your computer, tablet or smartphone.
https://meet.goto.com/144228501
You can also dial in using your phone.
Access Code: 144-228-501
United States (Toll Free): 1 866 899 4679
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POSTED
OCT 02 2024
3:50 P
LONA ACKMAN
COUNTY CLERK, GONZALES COUNTY TEXAS
BY Maria Macias DEPUTY

1. Call to order.
2. President of the Board to make comments.
3. Receive comments from the public on the District's proposed Management Plan.
4. Discussion of other items of interest by the Board and direction to management.
5. Adjourn.

Copies of the proposed additions and amendments to the Management Plan of the District are available at the offices of the Gonzales County Underground Water Conservation District, 522 Saint Matthew Street, Gonzales, Texas, from 8:00 a.m. to 5:00 p.m., Monday through Friday, or on the District's website at www.gcuwcd.org.

Written comments should be submitted to the General Manager, PO Box 1919, Gonzales, Texas 78629 by November 12, 2024, at 5:00 p.m. or presented at the hearing.

POSTED THIS THE 2nd DAY OF OCTOBER 2024 AT _____ O'CLOCK by _____.

APPENDIX 3

Certified Mail Receipts from Surface Water Management Entities

FW: Gonzales County UWCD management plan items

LM
Laura Martin <generalmanager@gcuwcd.org>
To Charles Hickman; R. Brian Perkins, P.E.; Peter Newell, P.E.
Cc Robert Bradley; Stephen Allen; Peggy Hunka

Reply | Reply All | Forward

Fri 12/13/2024 9:50 AM

Retention Policy Default 2 Year permanent Delete (2 years) Expires 12/13/2026

You replied to this message on 12/13/2024 12:41 PM.

External: Beware of links/attachments.

Mr. Hickman,
Hello & Good Morning! Attached is the GCUWCD Management Plan revised version submitted to Texas Water Development Board on November 13, 2024. The most recent revision was approved by resolution by the GCUWCD Board of Directors on November 12, 2024. https://www.dropbox.com/scl/fi/33w80h9lk23q9bcplyqx3/23-24-Management-Plan_DRAFT-VS-4.pdf?rlkey=rapq8ke5g9roork98q9cyoqx7&st=nkidz5k5&dl=0

Thank you,

Laura Martin
General Manager
Gonzales County UWCD
522 Saint Matthew Street
P.O. Box 1919
Gonzales, TX 78629
830.672.1047 office
830.339.0893 cell
www.gcuwcd.org

Gonzales County Underground Water Conservation District

522 Saint Matthew Street
P.O. Box 1919
Gonzales, Texas 78629
Phone 830 672 1047

March 4, 2024

Mr. Darrell Nicols General Manager, CEO
Guadalupe-Blanco River Authority
933 Court Street
Seguin, Tx 78155

RE: Transmittal of Gonzales County Underground Water Conservation District Management Plan to Surface Water Management Entities

Dear Mr. Nicols:

In accordance with 31 TAC 356.6(a)(4) and TWC 36.1071(a), the Gonzales County Underground Water Conservation District (GCUWCD) is submitting our amended Management Plan which was adopted by the Board of Directors on January 09, 20224.

If you have any questions concerning this Management Plan please contact me at 830-672-1047 office or 830-339-0893 cell.

Sincerely,

Laura Martin
General Manager
Gonzales County UWCD

Enclosure

Gonzales County Underground
Water Conservation District
PO Box 1919
Gonzales, Tx 78629

CERTIFIED MAIL®

7016 0340 0000 6661 4185

Mr. Darrell Nicols General Manager,
CEO
Guadalupe-Blanco River Authority
933 Court Street
Seguin, Tx 78155

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Mr. Darrell Nicols General Manager,
CEO
Guadalupe-Blanco River Authority
933 Court Street
Seguin, Tx 78155

COMPLETE THIS SECTION ON DELIVERY

A. Signature

X ☐ Agent ☐ Addressee

B. Received by *(Printed Name)* | C. Date of Delivery

D. Is delivery address different from item 1? ☐ Yes
If YES, enter delivery address below: ☐ No

3. Service Type ☐ Priority Mail Express®

U.S. Postal Service™
CERTIFIED MAIL® RECEIPT
Domestic Mail Only

For delivery information, visit our website at www.usps.com®.

Seguin, TX 78155

OFFICIAL USE

Certified Mail Fee $4.40

Extra Services & Fees (check box, add fee as appropriate)
- ☐ Return Receipt (hardcopy) $
- ☐ Return Receipt (electronic) $
- ☐ Certified Mail Restricted Delivery $
- ☐ Adult Signature Required $
- ☐ Adult Signature Restricted Delivery $

Postage $1.29

Total Postage and $9.44

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City, State, ZIP+4®

PS Form 3800, A

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MAR 05 2024
GONZALES TX 78629
03/07/2024

Mr. Darrell Nicols General Manager,
CEO
Guadalupe-Blanco River Authority
933 Court Street
Seguin, Tx 78155

7016 0340 0000 6661 4185
9590 9402 4249 8121 2410 46

UNITED STATES POSTAL SERVICE.

GONZALES
920 N SAINT JOSEPH ST STE 105
GONZALES, TX 78629-9998
(800)275-8777

03/07/2024 10:14 AM

Product	Qty	Unit Price	Price
First-Class Mail® Large Envelope	1		$1.39
Seguin, TX 78155			
Weight: 0 lb 0.90 oz			
Estimated Delivery Date			
Sat 03/09/2024			
Certified Mail®			$4.40
Tracking #:			
70160340000066614185			
Return Receipt			$3.65
Tracking #:			
9590 9402 4249 8121 2410 46			
Total			$9.44
Grand Total:			$9.44
Debit Card Remit			$9.44

Card Name: MasterCard
Account #: XXXXXXXXXXXX2945
Approval #
Transaction #: 608
Receipt #: 030943
Debit Card Purchase: $9.44
AID: A0000000042203 Chip
AL: Debit
PIN: Verified

Text your tracking number to 28777 (2USPS)

APPENDIX 4

Technical Memorandums LRE Water: Discussion of Aquifer Uses and Conditions February 07, 2020, and Groundwater Availability Modeling Technical Elements January 14, 2022

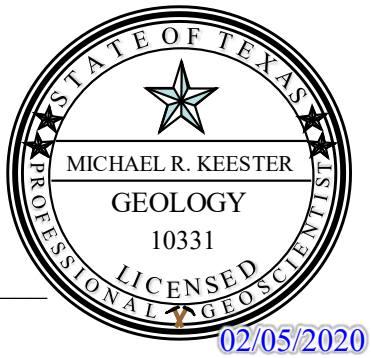
use). Table 2 summarizes the estimated annual groundwater use within each county from relevant aquifers in GMA 13 by type for 2016. Table 3 summarizes the percent of each use within each county from relevant aquifers in GMA 13 for 2016.

Based on information from the TWDB Groundwater Database (TWDB, 2019a) and the Submitted Driller's Report database (TWDB, 2019c), wells identified as domestic or livestock for the proposed use are most common throughout GMA 13. Using the aquifer code, depth, and/or completion data for each well in the databases, we determined the GMA 13 relevant aquifer in which each well was likely producing. We found that most of the irrigation and public supply wells are completed in the Carrizo Aquifer as the total groundwater production information suggests. Figure 2 through Figure 6 illustrate the wells completed in each GMA 13 relevant aquifer. Figure 7 illustrates the distribution of wells completed in a relevant aquifer by type of use in each county within GMA 13. Importantly, these figures only show wells from the two identified databases that are completed in one of the relevant aquifers and do not reflect all wells within GMA 13. However, the distribution of wells and use does reasonably reflect the aquifer uses and conditions within GMA 13

Geoscientist Seal

This report documents the work of the following licensed professional geoscientists with LRE Water, LLC, a licensed professional geoscientist firm in the State of Texas (License No. 50516).

Pocket Seal



02/05/2020

Michael R. Keester, P.G.
Project Manager / Hydrogeologist

References

Deeds, N.E., Yan, T., Singh, A., Jones, T.L., Kelley, V.A., Knox, P.R., and Young, S.C., 2010, Groundwater availability model for the Yegua-Jackson Aquifer: Contract report for the Texas Water Development Board, 582 p.

Hutchison, W.R., 2017a, Desired Future Condition Explanatory Report (Final) Carrizo-Wilcox/Queen City/Sparta Aquifers for Groundwater Management Area 13: DFC Explanatory Report, 23 p.

Hutchison, W.R., 2017b, Extension of GAM Calibration Period for Carrizo-Wilcox, Queen City, and Sparta Aquifers: GMA 13 Technical Memorandum 17-01, 10 p.

Hutchison, W.R., 2017c, GMA 13 Explanatory Report - Final - Yegua-Jackson Aquifer: DFC Explanatory Report, 12 p.

Kelley, V.A., Deeds, N.E., Fryar, D.G., and Nicot, J.P., 2004, Final Report: Groundwater Availability Models for the Queen City and Sparta Aquifers: Contract report for the Texas Water Development Board, 867 p.

Texas Water Development Board, 2015, Projected Exempt Groundwater Use Estimates for GMA 13, http://www.twdb.texas.gov/groundwater/management_areas/exempt_use/GMA_13_ExemptUse_2015.pdf, accessed June 2019.

Texas Water Development Board, 2019a, Groundwater Database Reports, http://www.twdb.texas.gov/groundwater/data/gwdbrpt.asp, accessed February 2019.

Texas Water Development Board, 2019b, Historical Groundwater Pumpage - SumFinal_CountySumPumpage, http://www.twdb.texas.gov/waterplanning/waterusesurvey/historical-pumpage.asp, accessed February 2019.

Texas Water Development Board, 2019c, Submitted Drillers Reports Database Download, http://www.twdb.state.tx.us/groundwater/data/drillersdb.asp, accessed February 2019.

Table 1. Summary of GMA 13 historical pumping from the relevant aquifers.

GMA 13 Historical Pumping, Acre-Feet per Year							
County	Year	Carrizo	Wilcox	Queen City	Sparta	Yegua-Jackson	Total
Atascosa	2000	35,725	1,767	249	64	383	38,188
	2005	19,463	962	135	441	420	21,421
	2010	60,705	3,001	1,114	430	493	65,744
	2011	60,705	3,001	1,115	428	599	65,849
	2012	40,225	1,349	2,978	877	395	45,824
	2013	44,473	1,630	3,717	964	470	51,253
	2014	39,681	1,490	3,560	747	439	45,917
	2015	30,229	1,175	3,156	671	358	35,589
	2016	28,431	1,236	2,868	646	325	33,506
Bexar	2000	2,396	8,906	0	0	0	11,302
	2005	1,305	4,852	0	0	0	6,157
	2010	4,071	15,133	0	0	0	19,204
	2011	4,071	15,133	0	0	0	19,205
	2012	4,808	1,185	0	0	0	5,993
	2013	6,928	931	0	0	0	7,858
	2014	9,373	801	0	0	0	10,173
	2015	3,913	739	0	0	0	4,652
	2016	629	1,338	0	0	0	1,967
Caldwell	2000	0	664	0	0	0	664
	2005	0	665	0	0	0	665
	2010	483	1,341	0	0	0	1,824
	2011	538	2,605	0	0	0	3,143
	2012	814	2,245	0	0	0	3,059
	2013	774	1,970	0	0	0	2,744
	2014	1,125	2,198	0	0	0	3,323
	2015	918	2,044	0	0	0	2,961
	2016	891	1,844	0	0	0	2,735
Dimmit	2000	1,984	1,050	0	0	0	3,034
	2005	1,081	572	0	0	0	1,653
	2010	3,372	1,784	0	0	0	5,156
	2011	3,372	1,784	0	0	0	5,156
	2012	5,584	2,960	0	0	0	8,544
	2013	4,609	2,443	0	0	0	7,052
	2014	4,253	2,253	0	0	0	6,506
	2015	3,626	1,922	0	0	0	5,548
	2016	3,377	1,790	0	0	0	5,166

Table 1. Summary of GMA 13 historical pumping (continued).

GMA 13 Historical Pumping, Acre-Feet per Year							
County	Year	Carrizo	Wilcox	Queen City	Sparta	Yegua-Jackson	Total
Frio	2000	68,043	6,957	17	10	0	75,027
	2005	37,070	3,790	10	69	0	40,939
	2010	115,621	11,820	77	66	0	127,585
	2011	115,621	11,820	77	66	0	127,585
	2012	81,455	540	2,286	1,187	0	85,468
	2013	84,482	556	2,211	1,205	0	88,455
	2014	74,623	502	1,819	1,121	0	78,066
	2015	61,436	426	1,618	997	0	64,478
	2016	64,197	438	1,650	1,024	0	67,309
Gonzales	2000	3,380	221	484	106	167	4,358
	2005	12,506	213	503	125	696	14,044
	2010	15,963	222	1,232	127	1,516	19,060
	2011	20,126	223	1,526	185	1,594	23,654
	2012	32,524	6,419	2,146	951	1,388	43,428
	2013	34,679	6,879	2,131	891	1,421	46,001
	2014	61,471	10,290	2,346	803	1,459	76,369
	2015	61,470	10,482	1,801	799	1,364	75,916
	2016	52,013	9,256	1,734	764	1,405	65,172
Guadalupe	2000	835	3,302	0	0	0	4,137
	2005	455	1,799	0	0	0	2,254
	2010	1,756	5,603	0	0	0	7,360
	2011	1,933	5,611	0	0	0	7,544
	2012	1,085	2,652	0	0	0	3,737
	2013	989	2,251	0	0	0	3,240
	2014	1,337	2,435	0	0	0	3,772
	2015	1,549	3,224	0	0	0	4,773
	2016	1,212	2,406	0	0	0	3,618
Karnes	2000	199	0	0	0	100	299
	2005	108	0	0	0	299	408
	2010	338	0	0	0	417	755
	2011	338	0	0	0	453	792
	2012	112	0	0	0	288	401
	2013	114	1	0	0	244	359
	2014	578	0	0	0	287	865
	2015	1,009	0	0	0	220	1,229
	2016	814	0	0	0	243	1,057

Table 1. Summary of GMA 13 historical pumping (continued).

GMA 13 Historical Pumping, Acre-Feet per Year							
GCD/County	Year	Carrizo	Wilcox	Queen City	Sparta	Yegua-Jackson	Total
La Salle	2000	3,879	1,787	0	168	13	5,848
	2005	2,113	974	0	1,178	51	4,316
	2010	6,590	3,037	2	1,097	60	10,786
	2011	6,590	3,037	2	1,097	62	10,788
	2012	7,282	1,094	17	2,025	54	10,473
	2013	6,883	1,004	14	1,927	43	9,871
	2014	5,682	697	14	1,548	44	7,984
	2015	3,693	476	13	849	43	5,074
	2016	4,489	643	11	1,048	44	6,235
Maverick	2000	406	1,843	0	0	0	2,249
	2005	221	1,004	0	0	0	1,225
	2010	690	3,131	0	0	0	3,821
	2011	690	3,131	0	0	0	3,821
	2012	11	4	0	0	0	15
	2013	9	4	0	0	0	13
	2014	14	4	0	0	0	19
	2015	38	7	0	0	0	45
	2016	46	8	0	0	0	54
McMullen	2000	103	0	1	0	7	111
	2005	56	0	0	1	26	84
	2010	173	1	3	1	36	213
	2011	173	1	3	1	30	207
	2012	3,210	4,423	5	0	29	7,667
	2013	3,845	5,414	5	0	23	9,287
	2014	3,731	5,316	5	0	22	9,074
	2015	1,847	2,239	5	0	23	4,113
	2016	1,215	1,369	4	0	22	2,611
Medina	2000	1,024	2,409	0	0	0	3,432
	2005	558	1,312	0	0	0	1,870
	2010	1,739	4,093	0	0	0	5,832
	2011	1,739	4,093	0	0	0	5,832
	2012	1,938	3,597	0	0	0	5,535
	2013	1,847	3,343	0	0	0	5,190
	2014	2,012	3,858	0	0	0	5,870
	2015	1,159	2,012	0	0	0	3,170
	2016	1,366	2,463	0	0	0	3,829

Table 1. Summary of GMA 13 historical pumping (continued).

GMA 13 Historical Pumping, Acre-Feet per Year							
GCD/County	Year	Carrizo	Wilcox	Queen City	Sparta	Yegua-Jackson	Total
Uvalde	2000	244	131	0	0	0	375
	2005	133	71	0	0	0	204
	2010	415	223	0	0	0	637
	2011	415	223	0	0	0	637
	2012	15	6	0	0	0	21
	2013	14	6	0	0	0	20
	2014	13	6	0	0	0	19
	2015	12	5	0	0	0	17
	2016	8	3	0	0	0	11
Webb	2000	613	14	0	0	3	630
	2005	329	6	0	0	0	336
	2010	1,038	25	0	0	4	1,067
	2011	1,038	23	0	0	4	1,065
	2012	18	409	53	44	4	528
	2013	23	144	53	44	4	268
	2014	18	37	53	44	4	156
	2015	17	40	53	44	4	159
	2016	18	36	53	44	4	156
Wilson	2000	10,899	947	44	61	112	12,063
	2005	5,938	516	23	452	235	7,164
	2010	18,519	1,609	197	421	288	21,034
	2011	18,519	1,609	196	421	317	21,063
	2012	20,446	3,758	2,449	585	180	27,418
	2013	18,826	3,470	2,093	571	174	25,135
	2014	19,385	3,434	1,969	571	182	25,541
	2015	16,018	2,948	1,597	500	170	21,232
	2016	16,254	3,285	1,615	500	174	21,828
Zapata	2000	0	0	0	0	67	67
	2005	0	0	0	0	218	218
	2010	0	0	0	0	185	185
	2011	0	0	0	0	183	183
	2012	0	0	0	0	158	158
	2013	0	0	0	0	182	182
	2014	0	0	0	0	184	184
	2015	0	0	0	0	154	154
	2000	0	0	0	0	161	161

Table 1. Summary of GMA 13 historical pumping (continued).

GMA 13 Historical Pumping, Acre-Feet per Year							
GCD/County	Year	Carrizo	Wilcox	Queen City	Sparta	Yegua-Jackson	Total
Zavala	2000	23,685	9,556	0	0	0	33,241
	2005	12,904	5,205	0	0	0	18,109
	2010	40,246	16,237	0	0	0	56,483
	2011	40,246	16,237	0	0	0	56,483
	2012	32,423	13,084	0	0	0	45,507
	2013	29,861	12,050	0	0	0	41,912
	2014	30,430	12,279	0	0	0	42,709
	2015	22,219	8,965	0	0	0	31,184
	2016	22,664	9,144	0	0	0	31,808
Total	2000	153,416	39,552	794	410	852	195,025
	2005	94,241	21,942	672	2,266	1,946	121,066
	2010	271,720	67,259	2,625	2,143	3,000	346,747
	2011	276,115	68,531	2,919	2,199	3,243	353,007
	2012	231,951	43,725	9,933	5,669	2,496	293,774
	2013	238,356	42,094	10,226	5,603	2,563	298,841
	2014	253,726	45,601	9,765	4,836	2,620	316,548
	2015	209,152	36,703	8,242	3,861	2,337	260,294
	2016	197,623	35,258	7,935	4,026	2,379	247,221

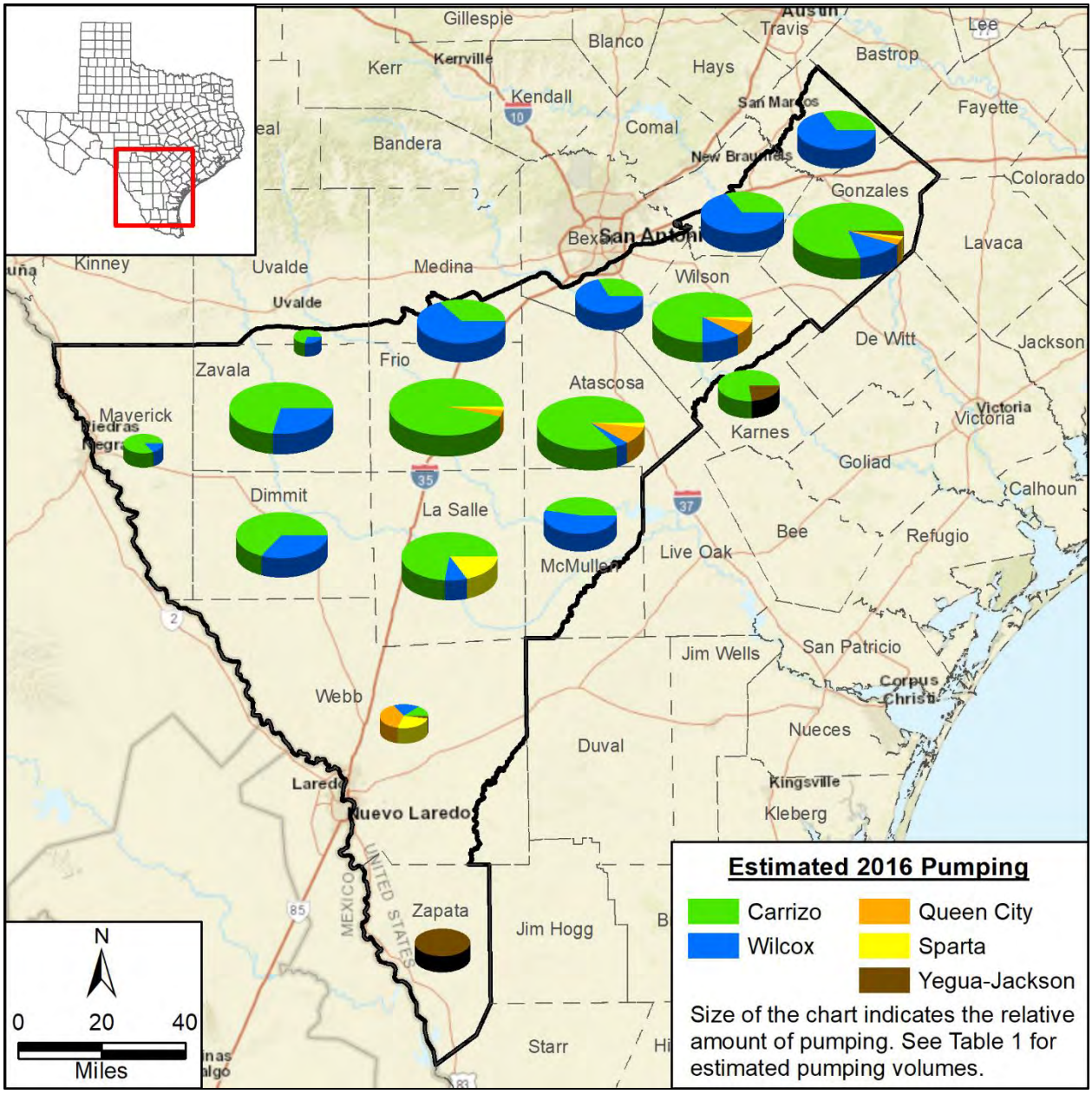


Figure 1. Estimated 2016 pumping from the relevant aquifers within GMA 13.

Table 2. Summary of GMA 13 estimated groundwater use in acre-feet in 2016.

County	Irrigation	Municipal	Livestock	Man./Pwr	Mining	Domestic	Total
Atascosa	19,193	6,238	1,156	5,317	293	1,310	33,506
Bexar	1,089	347	37	7	356	130	1,967
Caldwell	134	2,242	26	111	0	222	2,735
Dimmit	2,705	1,786	133	0	0	543	5,166
Frio	61,924	3,260	794	41	0	1,290	67,309
Gonzales	3,069	51,701	9,395	767	0	240	65,172
Guadalupe	282	2,727	363	2	11	233	3,618
Karnes	30	146	27	0	0	854	1,057
La Salle	3,200	2,143	219	0	0	673	6,235
Maverick	7	19	25	0	0	4	54
McMullen	0	955	150	1,494	0	12	2,611
Medina	3,025	502	88	5	0	208	3,829
Uvalde	0	0	0	0	0	11	11
Webb	1	21	49	6	0	79	156
Wilson	11,919	7,599	949	62	0	1,299	21,828
Zapata	0	14	50	0	0	97	161
Zavala	28,149	2,146	301	651	0	562	31,808
Total	**134,726**	**81,844**	**13,761**	**8,463**	**661**	**7,767**	**247,221**

Table 3. Summary of GMA 13 percentage by type of groundwater use in 2016.

County	Irrigation	Municipal	Livestock	Man./Pwr	Mining	Domestic
Atascosa	57%	19%	3%	16%	1%	4%
Bexar	55%	18%	2%	0%	18%	7%
Caldwell	5%	82%	1%	4%	0%	8%
Dimmit	52%	35%	3%	0%	0%	11%
Frio	92%	5%	1%	0%	0%	2%
Gonzales	5%	79%	14%	1%	0%	0%
Guadalupe	8%	75%	10%	0%	0%	6%
Karnes	3%	14%	3%	0%	0%	81%
La Salle	51%	34%	4%	0%	0%	11%
Maverick	13%	34%	47%	0%	0%	6%
McMullen	0%	37%	6%	57%	0%	0%
Medina	79%	13%	2%	0%	0%	5%
Uvalde	0%	0%	0%	0%	0%	100%
Webb	0%	13%	31%	4%	0%	51%
Wilson	55%	35%	4%	0%	0%	6%
Zapata	0%	9%	31%	0%	0%	60%
Zavala	88%	7%	1%	2%	0%	2%
Total	**54%**	**33%**	**6%**	**3%**	**0%**	**3%**

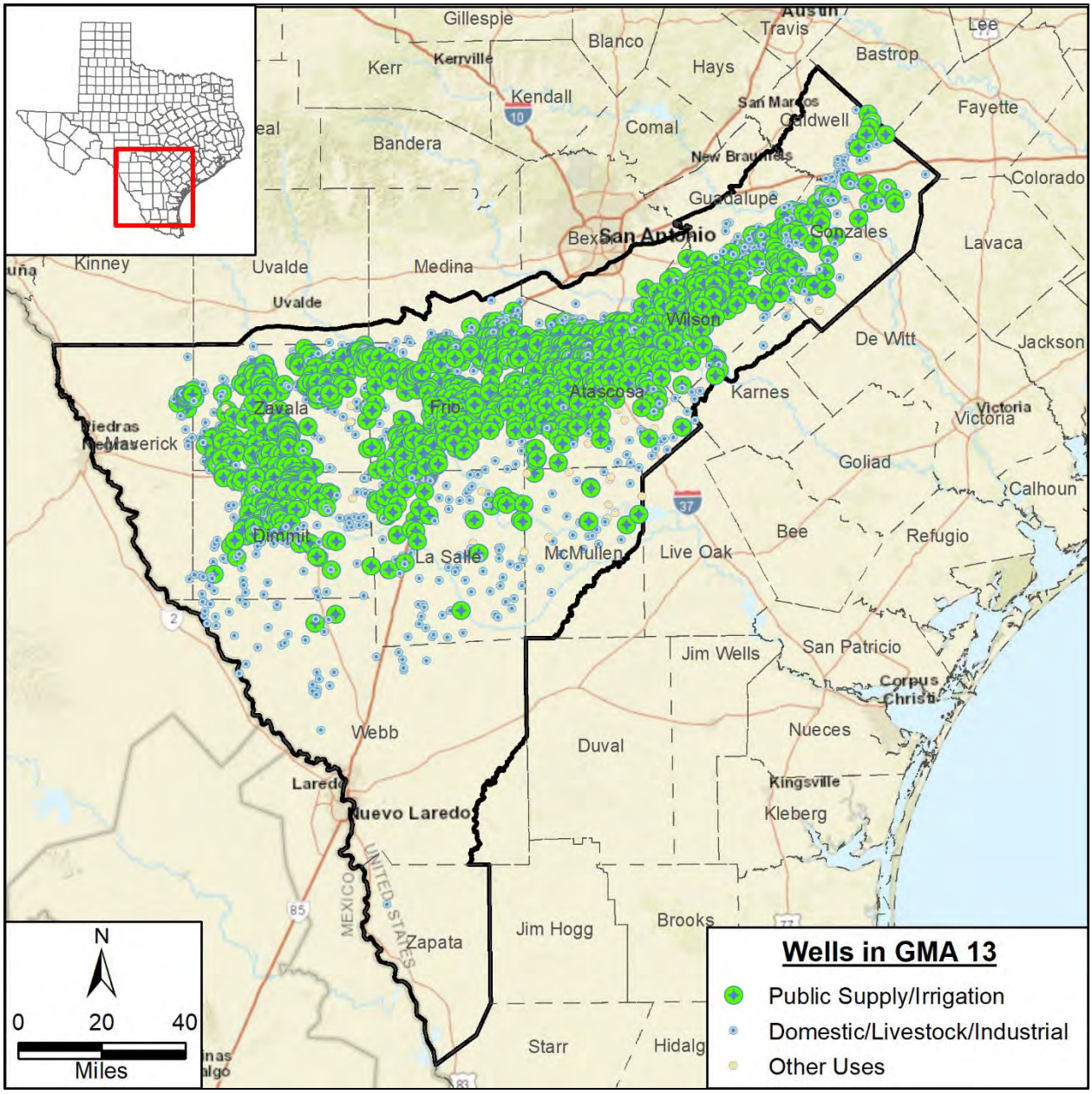


Figure 2. Wells from the TWDB Groundwater Database (TWDB, 2019a) and the Submitted Driller's Report database (TWDB, 2019c) completed in the Carrizo Aquifer. Figure only shows wells from the two identified databases that are completed in the aquifer and does not reflect all wells within GMA 13.

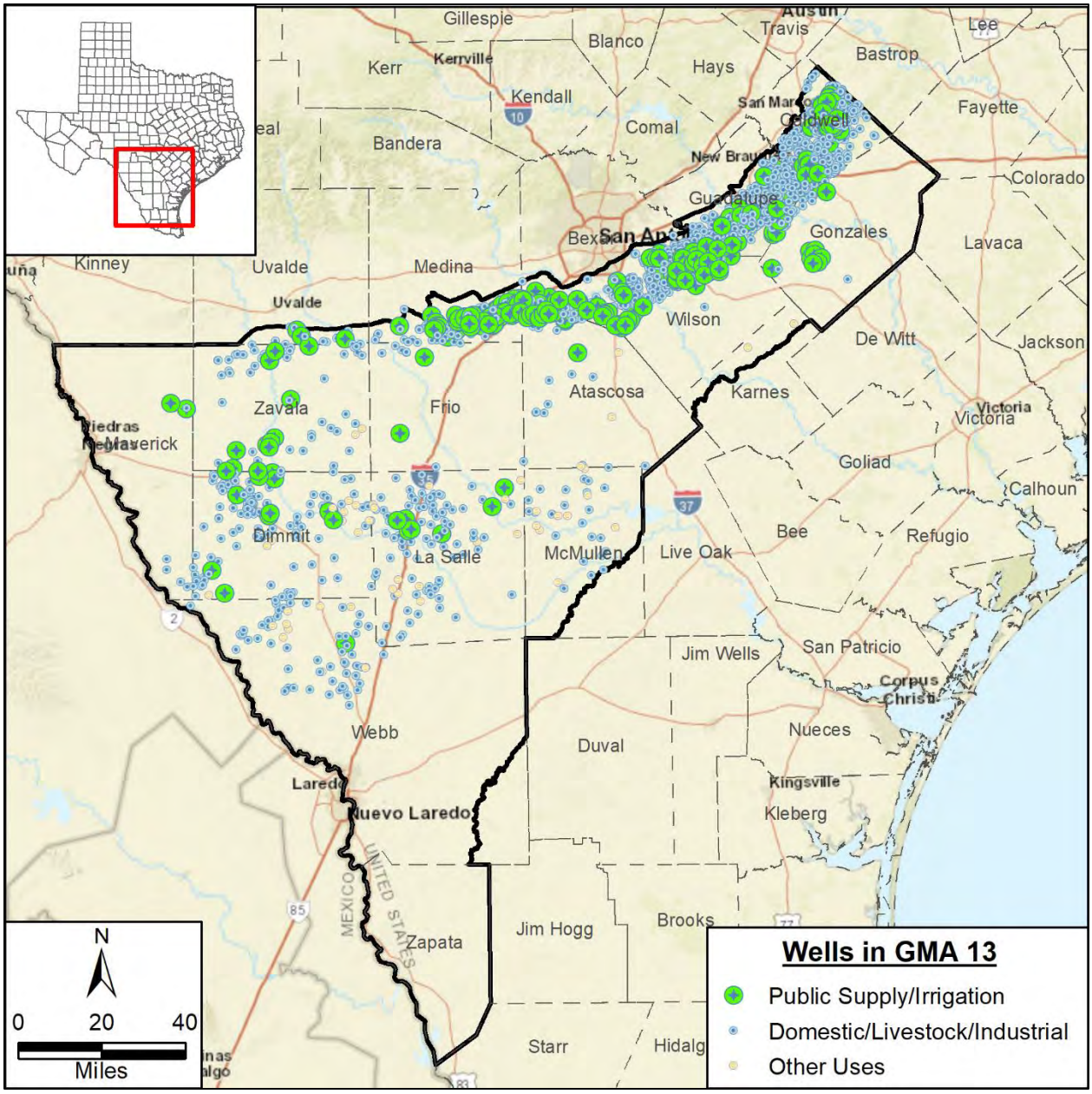


Figure 3. Wells from the TWDB Groundwater Database (TWDB, 2019a) and the Submitted Driller's Report database (TWDB, 2019c) completed in the Wilcox. Figure only shows wells from the two identified databases that are completed in the aquifer and does not reflect all wells within GMA 13.

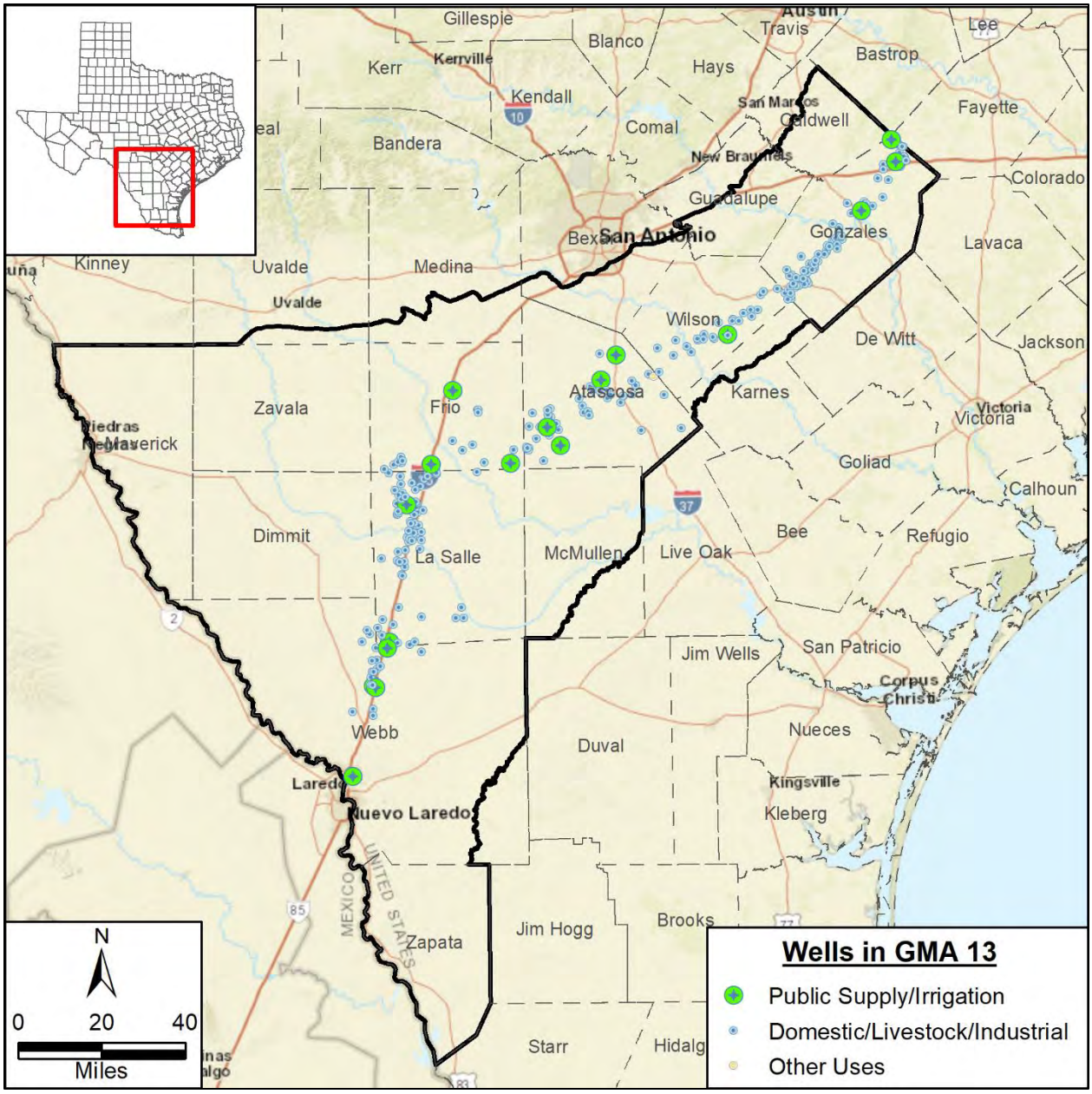


Figure 4. Wells from the TWDB Groundwater Database (TWDB, 2019a) and the Submitted Driller's Report database (TWDB, 2019c) completed in the Sparta. Figure only shows wells from the two identified databases that are completed in the aquifer and does not reflect all wells within GMA 13.

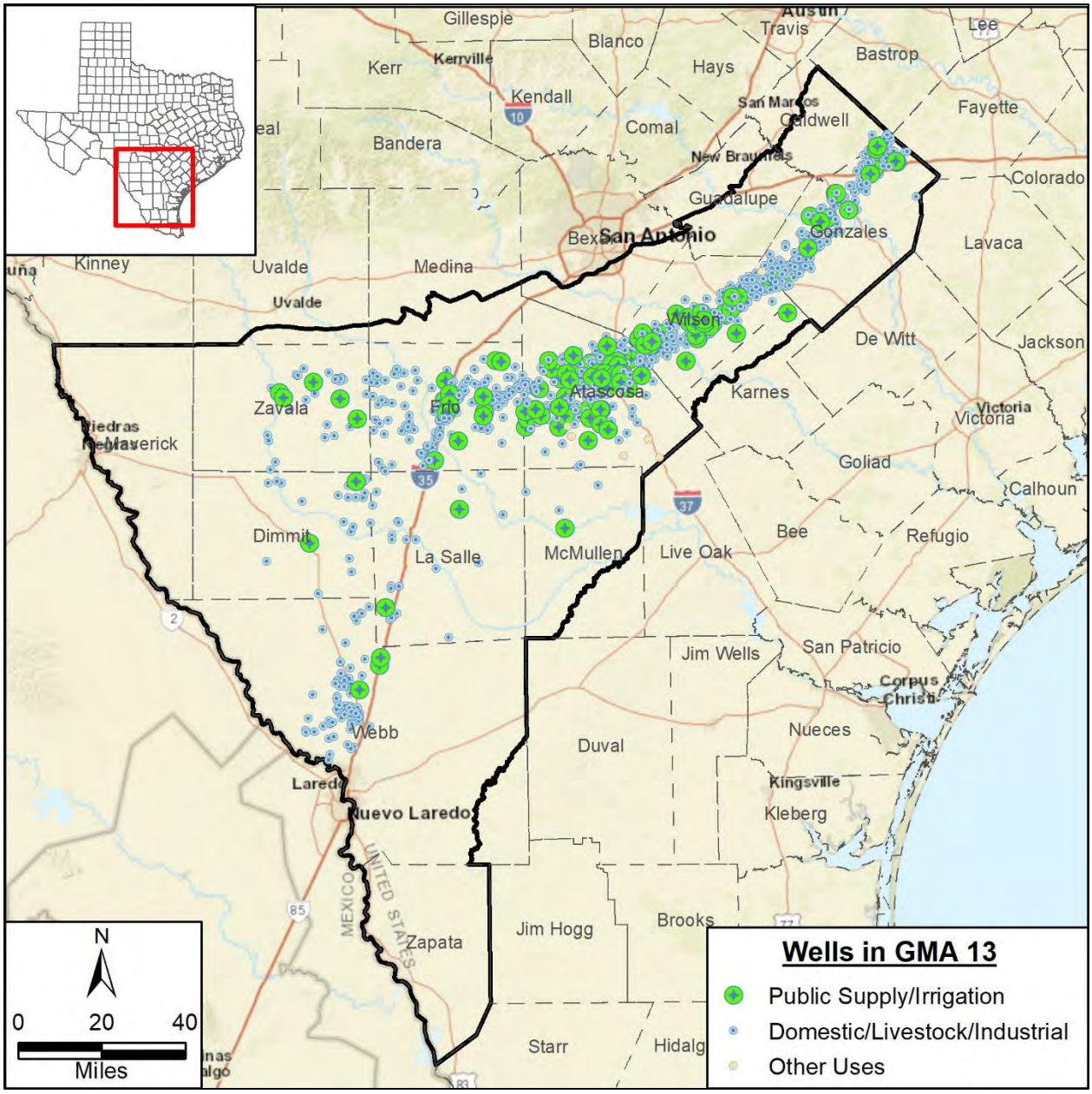


Figure 5. Wells from the TWDB Groundwater Database (TWDB, 2019a) and the Submitted Driller's Report database (TWDB, 2019c) completed in the Queen City. Figure only shows wells from the two identified databases that are completed in the aquifer and does not reflect all wells within GMA 13.

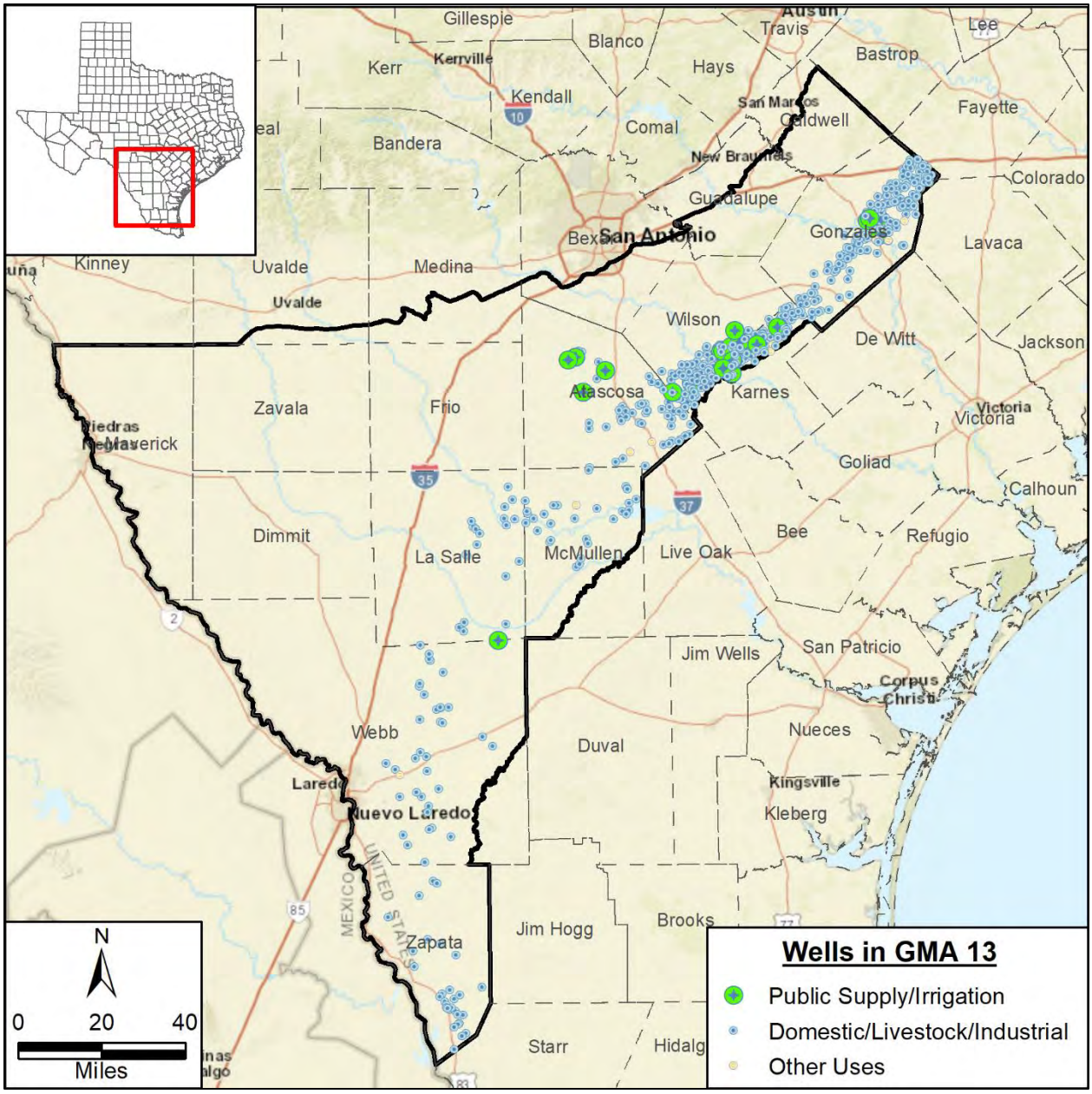


Figure 6. Wells from the TWDB Groundwater Database (TWDB, 2019a) and the Submitted Driller's Report database (TWDB, 2019c) completed in the Yegua-Jackson. Figure only shows wells from the two identified databases that are completed in the aquifer and does not reflect all wells within GMA 13.

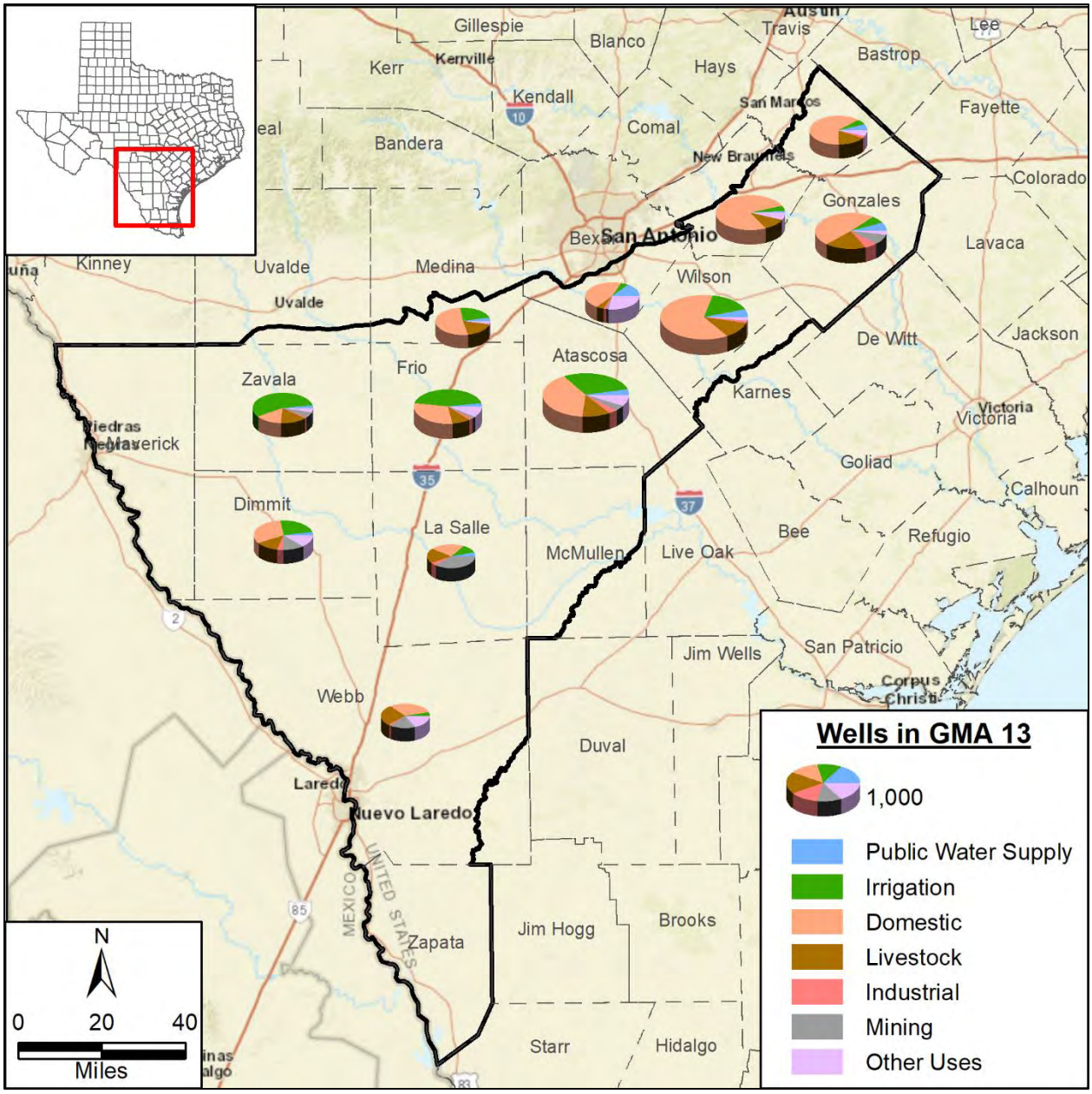


Figure 7. Distribution of wells in each county completed in the relevant aquifers in GMA 13 by type of use from the TWDB Groundwater Database (TWDB, 2019a) and the Submitted Driller's Report database (TWDB, 2019c). Figure only shows distribution of wells from the two identified databases that are completed in a relevant aquifer and does not reflect all wells within GMA 13.

DISCUSSION OF FACTORS FOR CONSIDERATION RELATIVE TO POTENTIAL DFCS

February 5, 2021

PROJECT UPDATE

- Wrapping up discussions of factors
- Prepare GAM simulation report
- Prepare draft explanatory report

Discussion	Date
Aquifer uses/condition	02/07/2020
Water needs/strategies	02/07/2020
Hydrological conditions	06/26/2020
Environmental conditions	06/26/2020
Subsidence	11/11/2020
Socioeconomic impacts	11/11/2020
Private property	11/11/2020
DFC feasibility	02/05/2021
Other information	02/05/2021

DISCUSSION OF DFC FEASIBILITY

February 5, 2021

CONSIDERATION

- Texas Water Code Section 36.108(d)(8)
- Feasibility of achieving the DFCs
- Can GMA members manage the aquifers in a manner that will allow them to not exceed the DFCs?

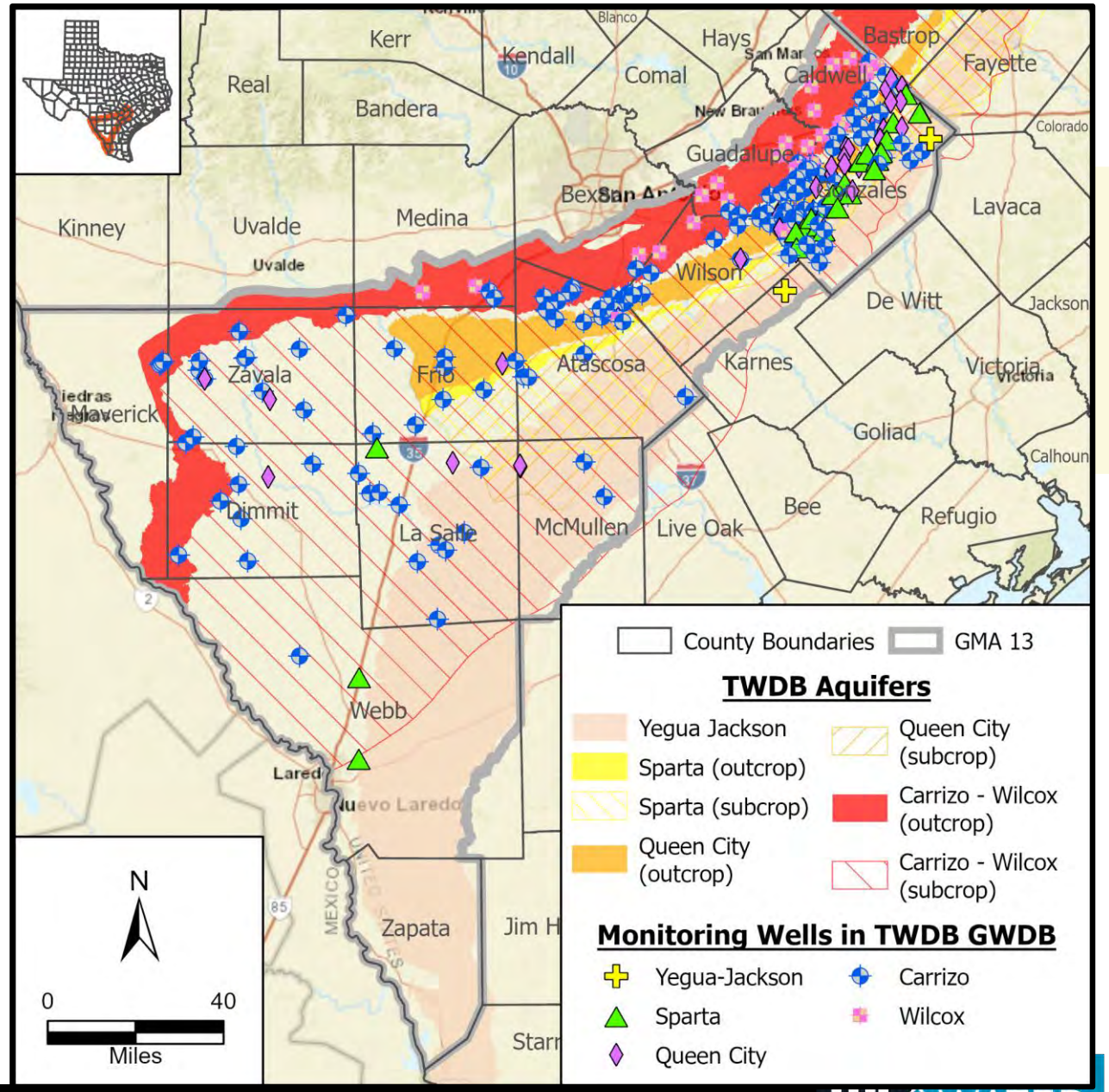
2016 CONSIDERATIONS SUMMARY

- Reference to measurement of water levels

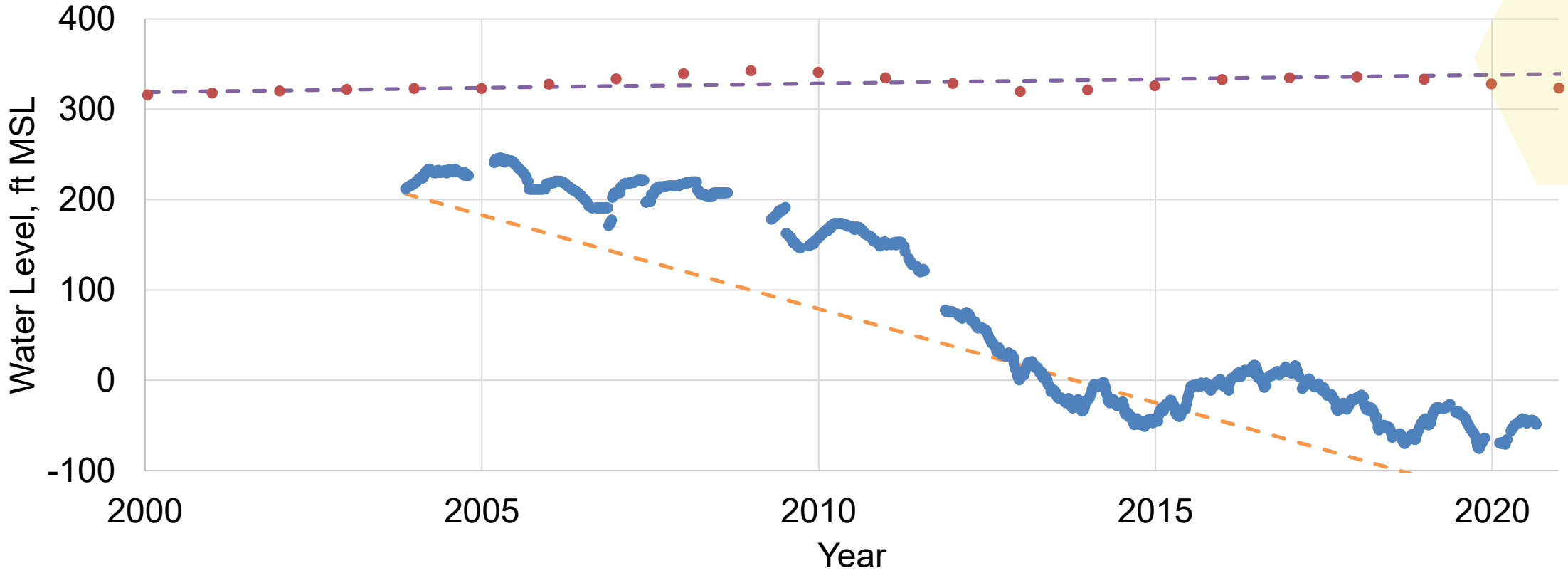
- Data evaluation and comparison to DFCs covered in each **District's management plan**

QUANTITATIVE CONSIDERATIONS

- Pumping updated from 2000 through 2016
- 229 observation or recorder wells from TWDB database
- Evaluate trend of simulated versus measured water levels
  - ➢ Reflects recent change in water levels
  - ➢ Reflects ability of model to simulate observed changes
- Are trends consistent (going in the same direction)?
- What is the error between the trends?

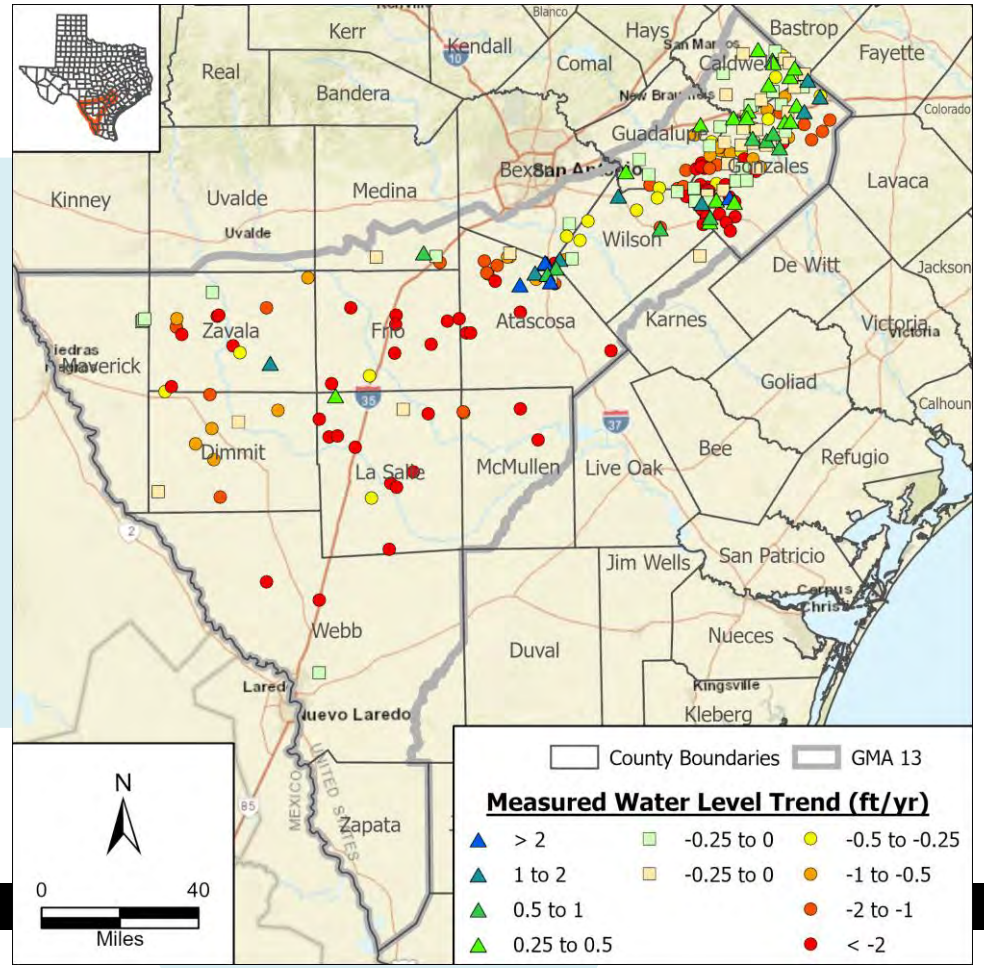


TREND COMPARISON

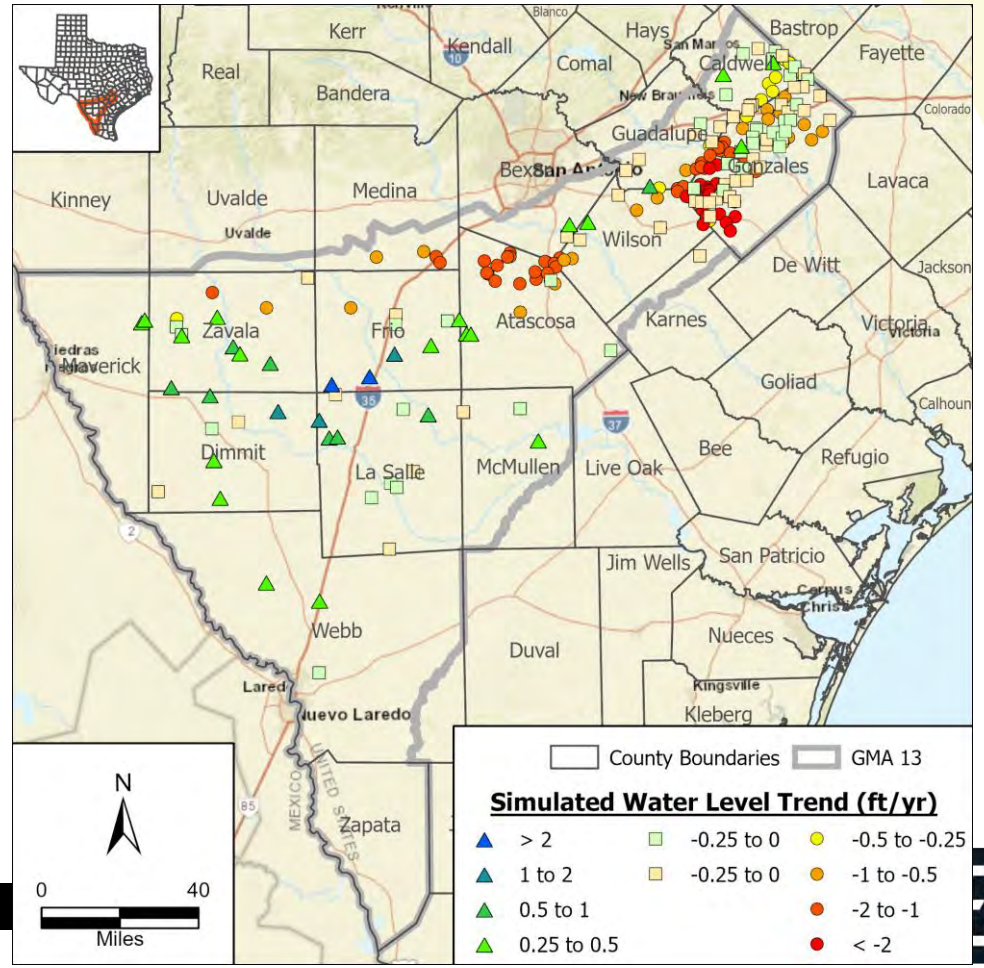


WATER LEVEL TRENDS (2000-2016)

Measured



Simulated

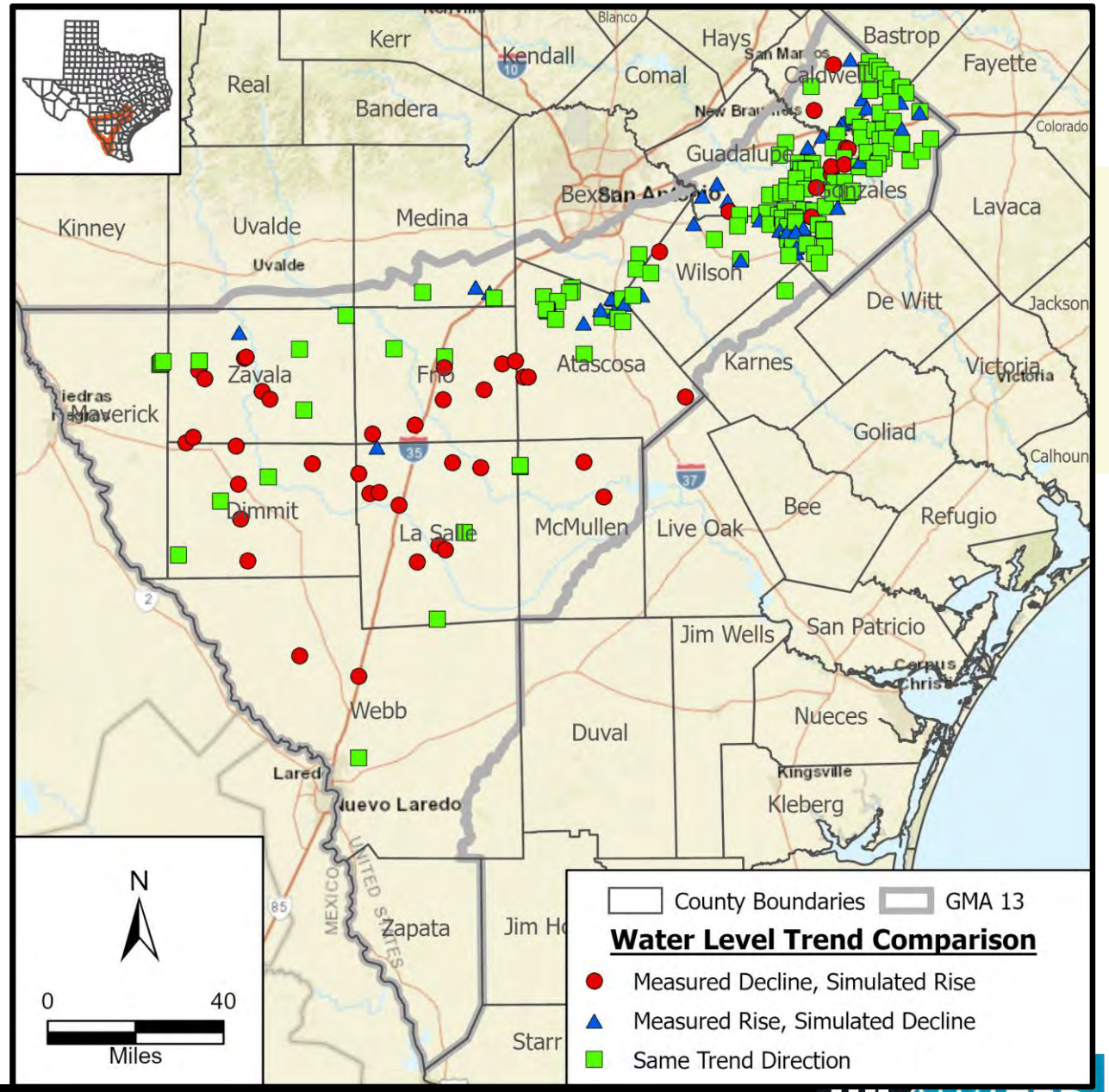


GMA 13 OBSERVATIONS

- Carrizo-Wilcox, Queen City, and Sparta aquifers (227 wells)
  - Average measured trend = -1.99 ft/yr
  - Average simulated trend = -0.76 ft/yr
- Yegua-Jackson Aquifer (2 wells)
  - Average measured trend = -0.76 ft/yr
  - Average simulated trend = -0.03 ft/yr

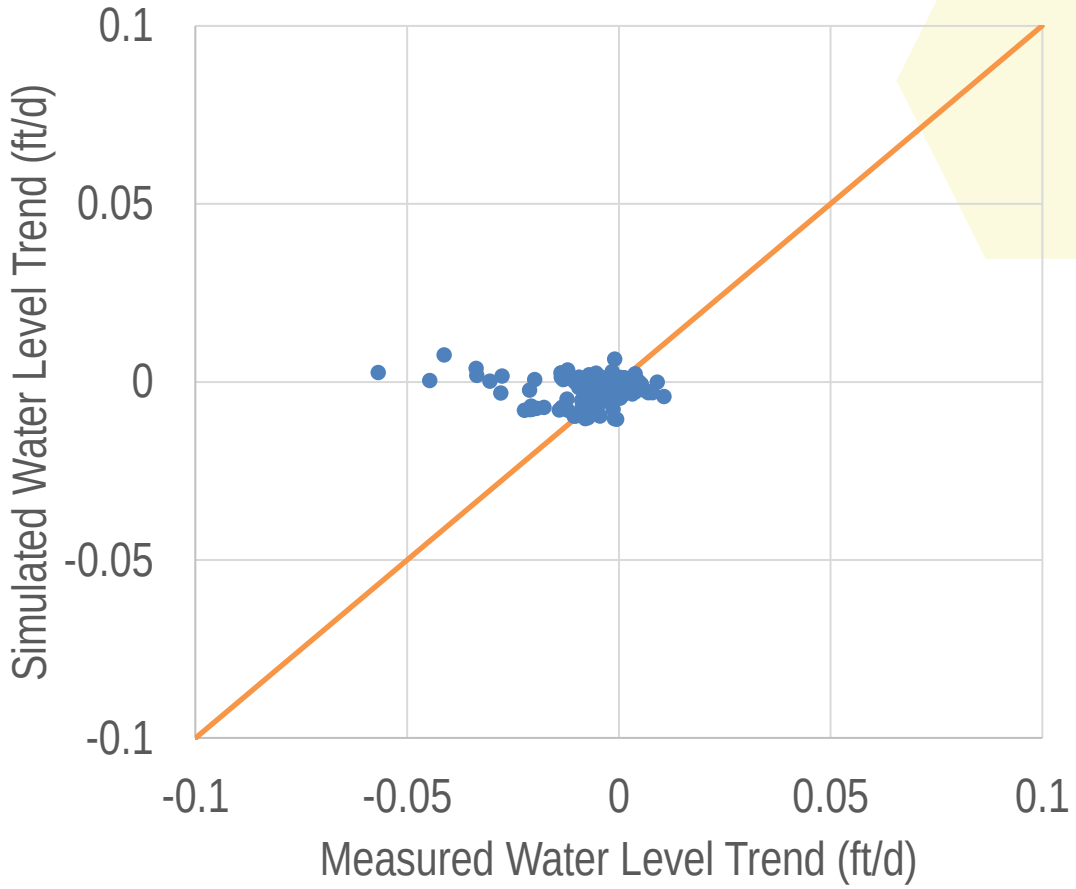
TREND COMPARISON

- Trend suggests potential future water level decline
- Measured and modeled water levels may not match, but trends should be similar
- Trends in different directions can be problematic
  - Measured decline, simulated rise: 49 wells
  - Measured rise, simulated decline: 43 wells
  - Same trend direction: 137 wells



GAM UNCERTAINTY

- Used root mean square error (RMSE) to quantify trend error
- RMSE is a measure of how far on average the error is from zero
- Tells you how concentrated the data pairs are around the line of best fit



RMSE BETWEEN TRENDS (FT/YR)

County	Sparta	Queen City	Carrizo	Wilcox	Carrizo-Wilcox/ Sparta/ Queen City	Yegua-Jackson
Atascosa	—	0.03	2.57	0.32	2.46	—
Bexar	—	—	0.21	0.40	0.32	—
Caldwell	—	0.15	0.35	0.34	0.32	—
Dimmit	—	0.17	1.56	—	1.47	—
Frio	—	2.37	7.95	—	7.54	—
Gonzales	0.97	0.52	2.05	1.17	1.56	1.34
Guadalupe	—	—	0.92	0.40	0.73	—
Karnes	—	—	—	—	—	0.12
La Salle	0.57	0.13	11.21	—	10.23	—
Maverick	—	—	0.22	—	0.22	—
McMullen	—	1.04	3.01	—	2.25	—
Medina	—	—	1.39	0.87	1.16	—
Uvalde	—	—	—	—	—	—
Webb	2.26	—	2.38	—	2.30	—
Wilson	—	0.58	3.13	1.11	2.78	—
Zavala	—	2.73	4.31	—	4.11	—
GMA 13	1.12	0.92	4.18	0.66	3.34	0.95

DISCUSSION

- Comparison of trends indicates significant model uncertainty in some areas
- Evaluation is not applicable to the Carrizo-Wilcox, Sparta, and Queen City aquifers primary DFC
- Potential average drawdown error
  - About 3 ft/yr for the Carrizo-Wilcox, Sparta, and Queen City aquifers
  - About 1 ft/yr for the Yegua-Jackson Aquifer

QUESTIONS/COMMENTS

Discussion of DFC Feasibility

February 5, 2021

DISCUSSION OF YEGUA-JACKSON AQUIFER HYDROLOGICAL CONDITIONS

February 5, 2021

CONSIDERATION

- Texas Water Code Section 36.108(d)(3)
- Total Estimated Recoverable Storage (TERS)
- Recharge
- Inflows
- Discharge

TERS – YEGUA-JACKSON AQUIFER

- Calculated by TWDB (GAM Task 13-036)
- Total for GMA 13 = 543 million acre-feet
  - 25% = 136 million acre-feet
  - 75% = 407 million acre-feet
- Based on GAM structure and properties
- No consideration for water quality

INFLOWS/OUTFLOWS

- Estimates based on model results
- Primary outflow is to streams (> 100,000 acre-feet per year)
- Average recharge of more than 85,000 acre-feet per year

CHANGE IN STORAGE

- Storage decline of about 26,000 acre-feet per year from 2020 through 2080

- 61-year storage reduction
  - < 0.3 percent of 100% TERS estimate
  - < 1.2 percent of 25% TERS estimate

DISCUSSION

- Modeling suggests greatest outflow is to streams
  - Magnitude of outflow is relative
  - GAM is not a good tool for simulating effects on surface water
- Predicted pumping is greater than historical use
- Modeled storage reduction is relatively small

QUESTIONS/DISCUSSION

Discussion of Yegua-Jackson Aquifer Hydrological Conditions

February 5, 2021

Meeting and project files available at: http://bit.ly/GMA_13_3rd_Round

LRE WATER

DISCUSSION OF YEGUA-JACKSON AQUIFER ENVIRONMENTAL IMPACTS

GMA 13 Agenda Item 8

June 26, 2020

LRE WATER

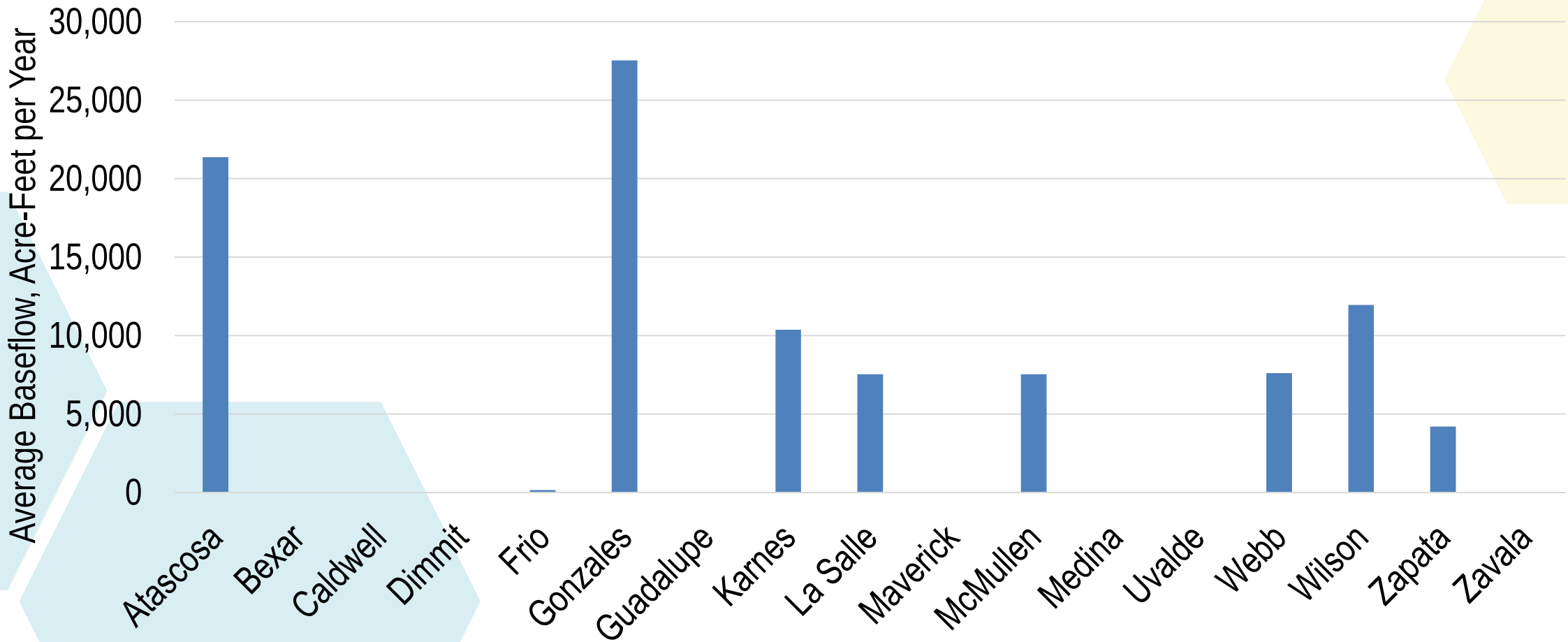
CONSIDERATION

- Texas Water Code Section 36.108(d)(4)
- Impact on streamflow as it relates to the interaction between surface water and groundwater
- GAM is limited in its ability to simulate

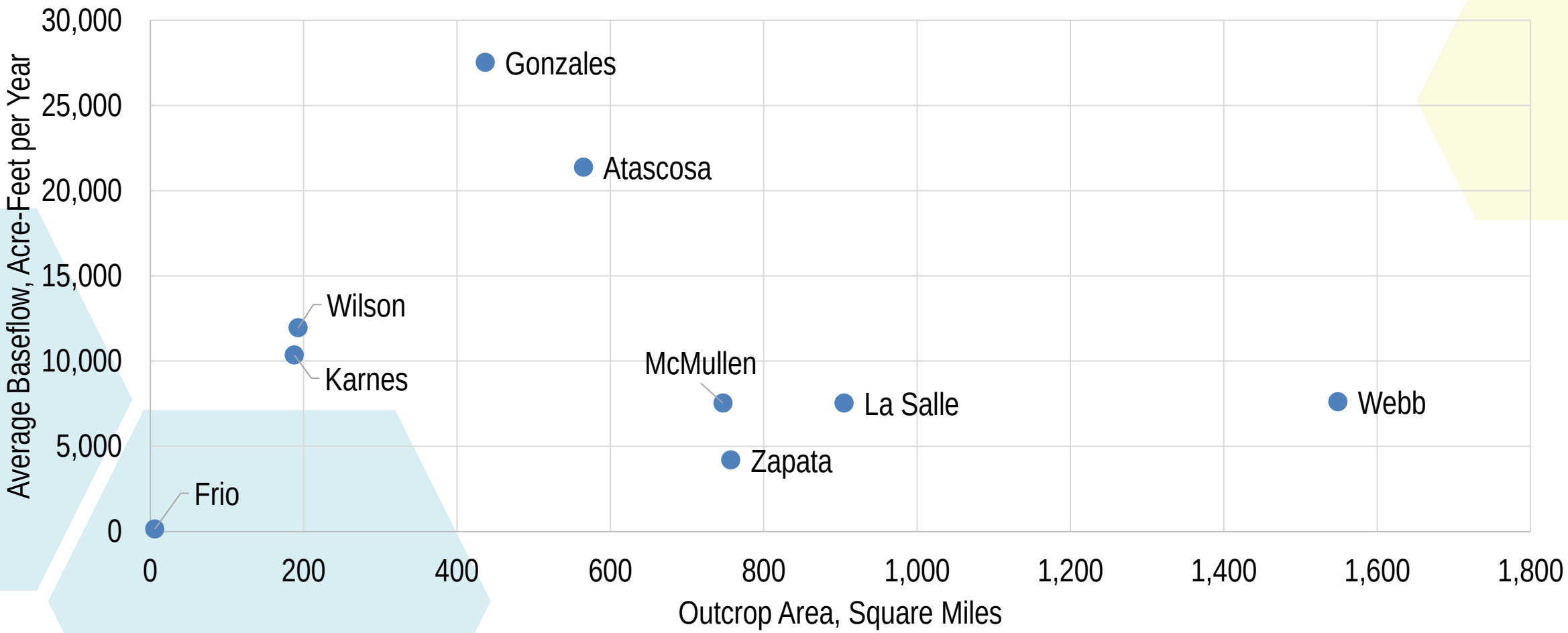
2016 TEXAS AQUIFERS STUDY

- Study conducted by the TWDB
- Used USGS stream gage data to assess contributions of groundwater to stream baseflow
- Approximately 700,000 acre-feet per year of groundwater discharges from the Yegua-Jackson Aquifer to surface water
  - Approximately 100,000 acre-feet per year in GMA 13

AVERAGE BASEFLOW



AVERAGE BASEFLOW



DISCUSSION

- Estimated average baseflow is less than, but similar to, the stream outflow in the GAM
- Possible decline in baseflow associated with water level declines
- Limiting decrease in saturated thickness in outcrop areas will minimize impact to baseflow

QUESTIONS/DISCUSSION

Discussion of Yegua-Jackson Aquifer Environmental Impacts

February 5, 2021

Meeting and project files available at: http://bit.ly/GMA_13_3rd_Round

LRE WATER

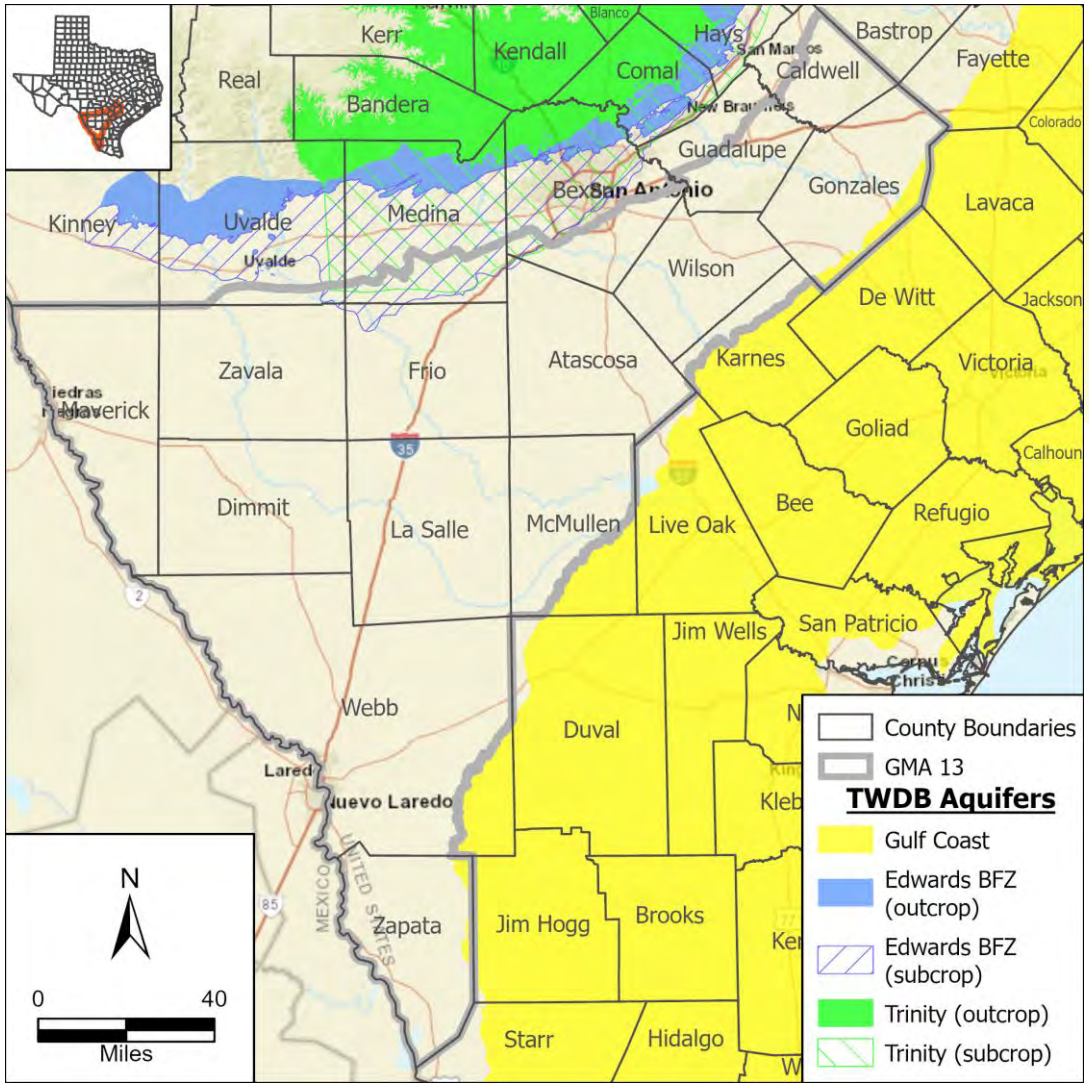
DISCUSSION OF POTENTIALLY NON-RELEVANT AQUIFERS FOR GMA 13 JOINT PLANNING

February 5, 2021

TRINITY AQUIFER IN GMA 13

- Counties: Atascosa, Bexar, Medina (GMA 9), Uvalde (GMA 7)
- Characteristics – Deep, brackish to saline
- Use & demands – none to negligible
- TERS (GAM Task 13-036)

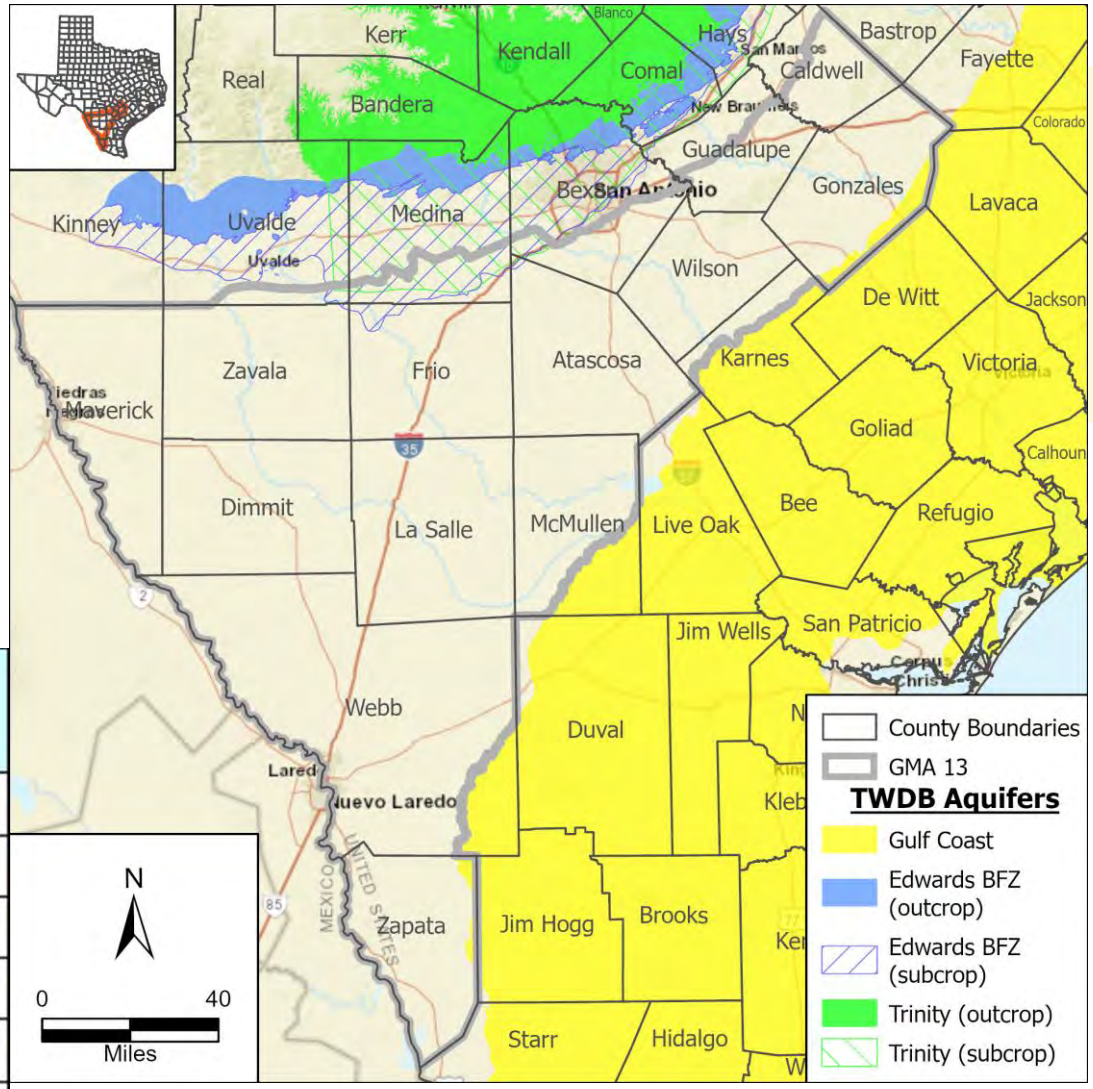
County	*Total Storage (acre-feet)*	*25% of Total Storage (acre-feet)*	*75% of Total Storage (acre-feet)*
Atascosa	35,000	8,750	26,250
Bexar	660,000	165,000	495,000
Medina	3,900,000	975,000	2,925,000
Uvalde	110,000	27,500	82,500
Total	4,705,000	1,176,250	3,528,750



EDWARDS (BFZ) AQUIFER IN GMA 13

- Counties: Atascosa, Bexar, Frio, Medina (GMA 10), Uvalde (GMA 10), Zavala
- Characteristics – Deep, brackish to saline
- Use & demands – none to negligible
- TERS (GAM Task 13-036)

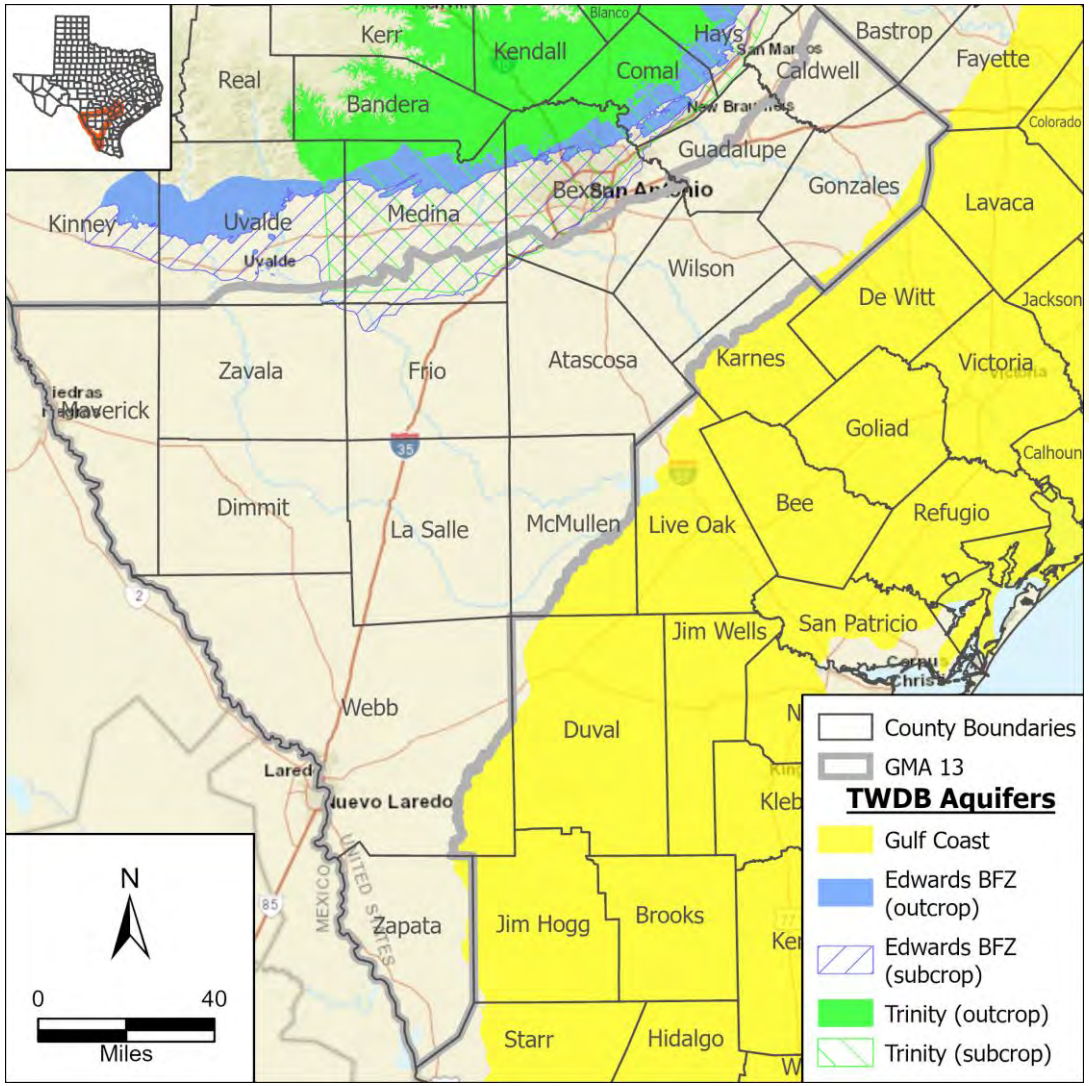
County	Total Storage (acre-feet)	25% of Total Storage (acre-feet)	75% of Total Storage (acre-feet)
Atascosa	29,000	7,250	21,750
Bexar	130,000	32,500	97,500
Frio	240,000	60,000	180,000
Medina	1,200,000	300,000	900,000
Uvalde	110,000	27,500	82,500
Zavala	9,400	2,350	7,050
Total	1,718,400	429,600	1,288,800



GULF COAST AQUIFER SYSTEM IN GMA 13

- Counties: Gonzales, Zapata
- Characteristics – Shallow outcrop
- Use & demands – none to negligible
- TERS (GAM Task 13-036)

County	Total Storage (acre-feet)	25% of Total Storage (acre-feet)	75% of Total Storage (acre-feet)
Gonzales	360,000	90,000	270,000
Zapata	2,100,000	525,000	1,575,000
Total	2,460,000	615,000	1,845,000



SUMMARY

- Trinity, Edwards (BFZ), and Gulf Coast aquifers each have a small footprint in GMA 13
- Some portions of aquifers managed as part of other GMAs
- Recommend these aquifers declared non-relevant for GMA 13 joint planning purposes

NEXT STEPS / REMAINING QUESTIONS

- Provide brief memo summarizing modeling results
- Next meeting – Mid-March
- Address any remaining questions
- Take information to Boards for discussion
- Adopt proposed DFCs by May 1, 2021

Meeting and project files available at: http://bit.ly/GMA_13_3rd_Round

LRE WATER
CONNECTING WATER TO LIFE

Technical Memorandum

To:	Groundwater Management Area 13
From:	Michael R. Keester, P.G.
Date:	November 13, 2020
Project:	2021 Joint Planning
Subject:	Discussion of Socioeconomic Impacts

Per Texas Water Code Section (TWC) 36.108(d)(6) districts within each groundwater management area shall consider "socioeconomic impacts reasonably expected to occur" as they relate to proposed desired future conditions. This section contains the only guidance provided in the TWC regarding "consideration" of this factor, leaving the Groundwater Management Areas (GMAs) and Groundwater Conservation Districts (GCDs) to use their best judgment in developing and considering this factor during the Desired Future Condition (DFC) joint planning process. Given the lack of information available to GCDs regarding socioeconomic impacts relevant to the DFC joint planning process, GMAs look to the analyses conducted by the Texas Water Development Board (TWDB) to support the regional and state water planning processes. Also, while these TWDB analyses are not directly on point for the question before GMAs and GCDs, the DFC joint planning process has an indirect relationship to the regional and state water planning processes because the adopted DFCs result in modeled available groundwater (MAG) amounts that are given to the GCDs and the regional water planning groups (RWPGs). Those MAGS are then one of the considered potential water supplies for meeting water supply needs in each region.

Regional and State Water Plan Socioeconomic Considerations

Regional and state water planning in Texas considers socioeconomic impacts as required by statute. TWC §16.051(a) directs the TWDB to prepare and adopt a comprehensive state water plan that incorporates the regional water plans adopted under TWC §16.053. The state water plan is to provide for water resources development, management, and conservation and drought preparedness so that enough water is available at a reasonable cost to ensure public health and safety, further economic development, and protect the state's agricultural and natural resources. TWC §16.053(a) requires each RWPG to prepare a regional water plan to meet these same objectives for each region.

The TWDB rules administer the state and regional water planning processes and include requirements for the RWPGs to evaluate the socioeconomic impacts of not meeting water

supply needs. Specifically, 31 Texas Administrative Code (TAC) §357.11(j) states that the TWDB Executive Administrator will provide technical assistance to the RWPGs with certain analyses, including methods to evaluate the social and economic impacts of not meeting needs, when requested. Further, 31 TAC §357.33(c) requires that each RWPG evaluate the social and economic impacts of not meeting water needs and report on them for that region.

To carry out this requirement, the TWDB staff prepares regional water planning analyses of social and economic impacts based on water supply needs from the regional water plans. These impacts are summarized in the state water plan. In summary, the RWPGs, based upon projected water demands and existing water supplies, identify projected water needs that could occur under a repeat of a drought of record. TWDB staff then estimate the socioeconomic impacts of those water needs if they are not met for a single year of the drought of record in each planning decade.

For the socioeconomic impact analyses, TWDB examines multiple impacts. Financial transfer impacts include tax losses (state, local, and utility tax collections), water trucking costs, and utility revenue losses. Social impacts include lost consumer surplus (a welfare economics measure of consumer wellbeing), and population and school enrollment losses. These results are incorporated into the regional water plans, and ultimately summarized in the state water plan.

The TWDB prepared information for use by all RWPGs for the 2016 regional water plans, including Regions L, M, and N, the three RWPGs that cover some portion of GMA 13. TWDB staff have also prepared information for use by RWPGs for the 2021 RWPG regional water plans that are currently being reviewed and revised, as appropriate, in light of comments received during the public comment period. New to the 2021 planning cycle, the TWDB developed an interactive dashboard to view regional and county-level socioeconomic impacts.

It is important to note that some members of GMA 13 and representatives of the GMA 13 GCDs are appointed to the three RWPGs. These members receive information related to these planning groups' meetings and regularly attend and contribute to these RWPGs. Also, GMA 13 routinely includes an item on their meeting agendas to receive reports and consider possible action related to reports and communication from GMA 13's member GCDs and GMA 13 representatives to the RWPGs as a means to discuss and share GCD updates and information of interest provided from the RWPGs.

While TWDB assessments are useful to understand the importance of meeting projected water needs, these analyses **do not** evaluate socioeconomic impacts of proposed DFCs

at the GMA level, and such an analysis is not conducted by TWDB. It is important to keep in mind, though, that the DFCs result in groundwater availability amounts for potential water management strategies that can meet some of the water supply needs and, therefore, are indirectly tied to the socioeconomic analysis discussion for regional and state water planning.

2016 DFCs Socioeconomic Impacts Factor Discussion

Similar to the discussion above, Hutchison (2017a; 2017b) referred to the socioeconomic reports developed by the TWDB during the previous round of joint planning. These reports quantified the socioeconomic impact of not meeting needs identified in the regional water plans. In addition, Hutchison (2017a; 2017b) pointed out that there are two active mitigation programs in GMA 13 that are in place to address impacts of groundwater development on local landowners.

2022 DFCs Socioeconomic Impacts Factor Discussion

The information presented in the explanatory reports prepared for the 2016 DFCs remains applicable for the current round of joint planning. To update the evaluation and provide a quantitative estimate of the socioeconomic impacts, we reviewed the information developed by Dr. John Ellis (2019a; 2019b; 2019c) for the 2021 regional water plans for Regions L, M, and N. Within these reports, the estimated socioeconomic impact for not meeting identified projected water needs for each county is calculated In terms of income losses and job losses. Figure 1 and Table 1 provide the estimated income losses associated with not meeting the projected water needs. Figure 2 and Table 2 provided the estimated job losses associated with not meeting the projected water needs.

Ellis (2019a; 2019b; 2019c) indicates that the highest income losses through 2060 would be associated with not meeting mining water needs. Not meet mining water use needs also has the highest number of job losses through 2050. The next highest income and job losses are associated with not meeting municipal water use needs.

To estimate the socioeconomic impact associated with the potential DFCs, we reviewed the identified strategies from the 2017 State Water Plan that were associated with the aquifers in GMA 13, were discussed during the GMA 13 meeting on February 7, 2020, and summarized in the technical memorandum also dated February 7, 2020 (http://bit.ly/GMA_13_3rd_Round). Some of these groundwater strategies are expected to change in the 2022 State Water Plan. However, the values presented provide a general

and relative reference for possible socioeconomic impacts associated with the potential DFCs.

To estimate the socioeconomic impact associated with the groundwater strategies, we used the total strategies to calculate the income losses and job losses per acre-foot of water and then multiplied the value by the groundwater strategy. While the TWDB's calculation of the potential socioeconomic impact is much more complicated, the method we applied provides an indication of the relative socioeconomic impact associated with groundwater strategies from the 2017 State Water Plan along with an indication of the socioeconomic impact associated with the potential DFCs and corresponding MAG as these values are reflected in the model pumping files. Figure 3 and Table 3 provide the estimated income losses associated with not meeting the projected water needs that may be met with groundwater strategies. Figure 4 and Table 4 provide the estimated job losses associated with not meeting the projected water needs that may be met with groundwater strategies.

The only significant projected income and job losses are associated with groundwater strategies are for not meeting municipal needs. Most other uses did not have strategies, the amounts were very small, or Ellis (2019a; 2019b; 2019c) did not report any socioeconomic impact associated with the use. Once again, these estimated socioeconomic impacts are relative to one another. As Ellis (2019a; 2019b; 2019c) states, "**[t]he results must be interpreted carefully. It is the general and relative magnitudes of impacts as well as the changes of these impacts over time that should be the focus rather than the absolute numbers.**" Estimated socioeconomic impact values for each county and water use type are provided in Table 5 through Table 8. For counties and use types with no water needs per the 2017 State Water Plan or with no groundwater strategies, there is no estimated socioeconomic impact associated with the potential DFCs.

If you have any questions, please let me know.

References

Ellis, J.R., 2019a, Socioeconomic Impacts of Projected Water Shortages for the Coastal Bend (Region N) Regional Water Planning Area: Prepared in Support of the 2021 Region N Regional Water Plan, 23 p.

Ellis, J.R., 2019b, Socioeconomic Impacts of Projected Water Shortages for the Rio Grande (Region M) Regional Water Planning Area: Prepared in Support of the 2021 Region M Regional Water Plan, 23 p.

Ellis, J.R., 2019c, Socioeconomic Impacts of Projected Water Shortages for the South Central Texas (Region L) Regional Water Planning Area: Prepared in Support of the 2021 Region L Regional Water Plan, 24 p.

Hutchison, W.R., 2017a, Desired Future Condition Explanatory Report (Final) Carrizo-Wilcox/Queen City/Sparta Aquifers for Groundwater Management Area 13: DFC Explanatory Report, 23 p.

Hutchison, W.R., 2017b, GMA 13 Explanatory Report - Final - Yegua-Jackson Aquifer: DFC Explanatory Report, 12 p.

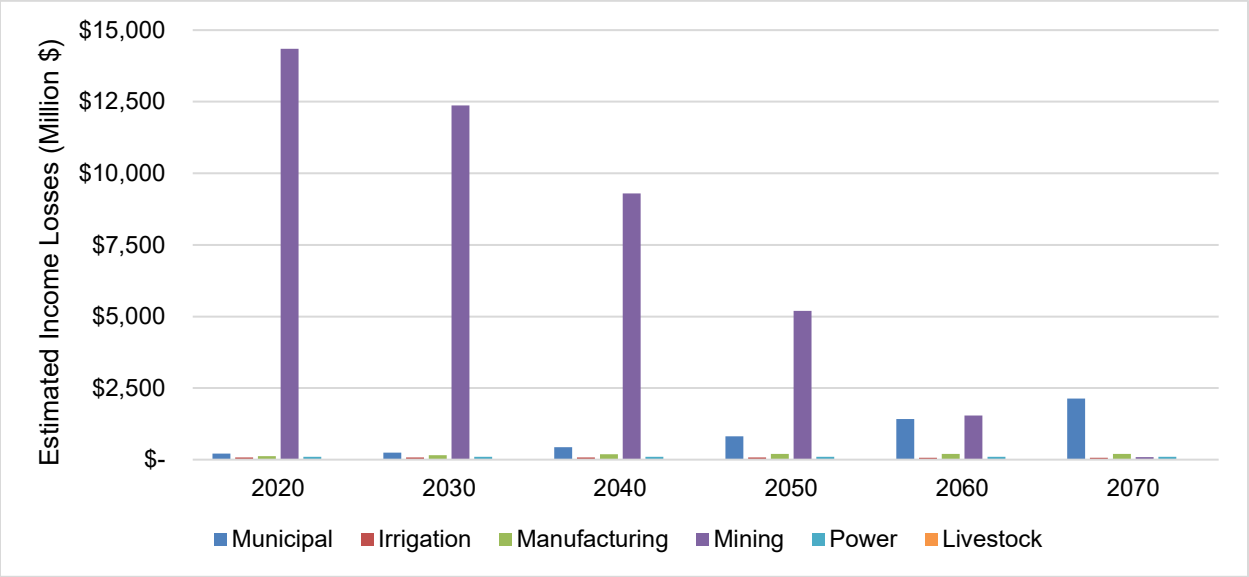


Figure 1. **Summary of estimated income losses within GMA 13 if projected water needs are not met. Estimates are for whole counties (including areas outside of GMA 13). Values from Ellis (2019a; 2019b; 2019c).**

Table 1. **Summary of estimated income losses (million $) within GMA 13 if projected water needs are not met. Estimates are for whole counties (including areas outside of GMA 13). Values from Ellis (2019a; 2019b; 2019c).**

Use	2020	2030	2040	2050	2060	2070
Municipal	$ 207.66	$ 247.36	$ 434.02	$ 812.25	$ 1,423.43	$ 2,138.21
Irrigation	$ 79.16	$ 76.87	$ 74.88	$ 72.73	$ 71.05	$ 70.72
Manufacturing	$ 118.02	$ 157.76	$ 192.13	$ 204.90	$ 204.90	$ 204.90
Mining	$14,346.91	$12,366.74	$ 9,296.53	$ 5,200.30	$ 1,544.93	$ 88.33
Power	$ 94.79	$ 94.79	$ 94.79	$ 94.79	$ 94.79	$ 94.79
Livestock	$ 6.63	$ 6.53	$ 8.33	$ 9.44	$ 10.67	$ 10.67
Total	**$14,853.17**	**$12,950.05**	**$10,100.68**	**$ 6,394.41**	**$ 3,349.77**	**$ 2,607.62**

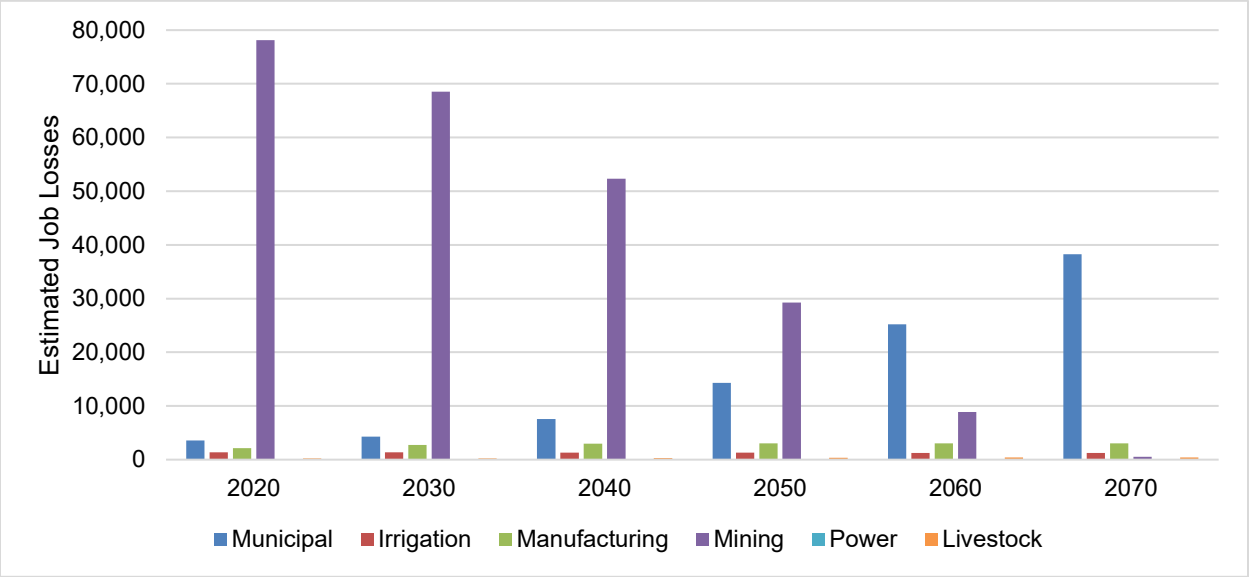


Figure 2. **Summary of estimated job losses within GMA 13 if projected water needs are not met. Estimates are for whole counties (including areas outside of GMA 13). Values from Ellis (2019a; 2019b; 2019c).**

Table 2. **Summary of estimated job losses within GMA 13 if projected water needs are not met. Estimates are for whole counties (including areas outside of GMA 13). Values from Ellis (2019a; 2019b; 2019c).**

Use	2020	2030	2040	2050	2060	2070
Municipal	3,593	4,311	7,586	14,286	25,219	38,269
Irrigation	1,371	1,339	1,312	1,282	1,262	1,264
Manufacturing	2,152	2,720	2,952	3,039	3,039	3,039
Mining	78,114	68,551	52,313	29,249	8,860	513
Power	0	0	0	0	0	0
Livestock	257	253	323	365	412	412
Total	**85,487**	**77,174**	**64,486**	**48,221**	**38,792**	**43,497**

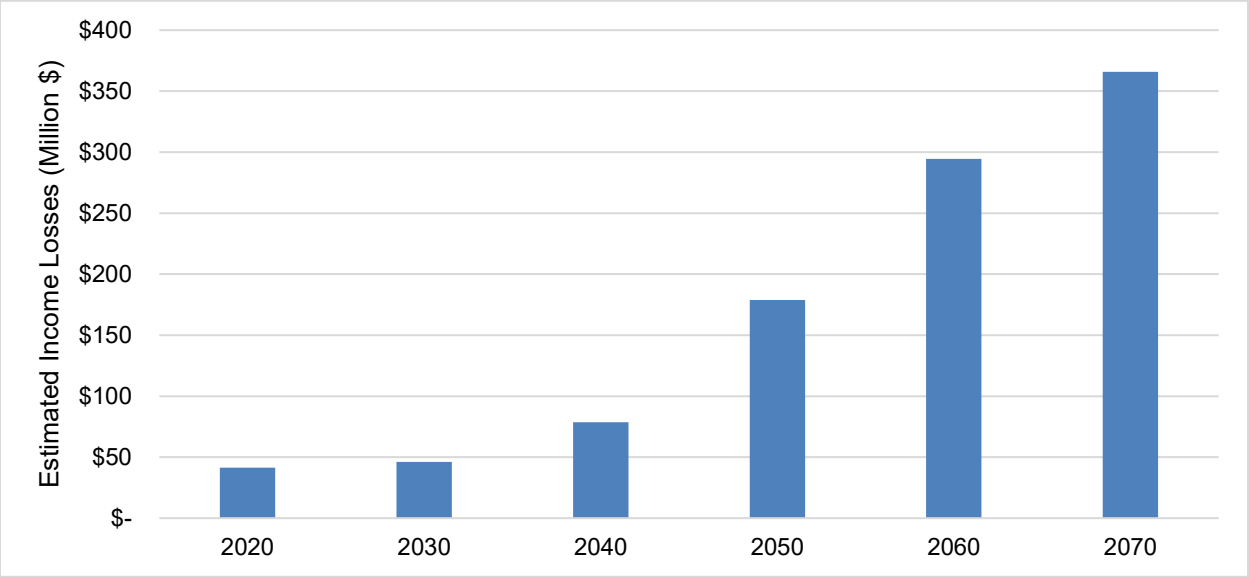


Figure 3. **Summary of estimated income losses within GMA 13 if projected municipal water needs associated with groundwater strategies are not met. Estimates are for whole counties (including areas outside of GMA 13).**

Table 3. **Summary of estimated income losses (million $) within GMA 13 if projected municipal water needs associated with groundwater strategies are not met. Estimates are for whole counties (including areas outside of GMA 13).**

Use	2020	2030	2040	2050	2060	2070
Municipal	$ 41.49	$ 46.19	$ 78.76	$ 178.76	$ 294.54	$ 365.77
Irrigation	$ -	$ -	$ -	$ -	$ -	$ -
Manufacturing	$ 0.21	$ 0.21	$ 0.21	$ 0.21	$ 0.21	$ 0.21
Mining	$ -	$ -	$ -	$ -	$ -	$ -
Power	$ -	$ -	$ -	$ -	$ -	$ -
Livestock	$ -	$ -	$ -	$ -	$ -	$ -
Total	**$ 41.70**	**$ 46.40**	**$ 78.97**	**$ 178.97**	**$ 294.75**	**$ 365.98**

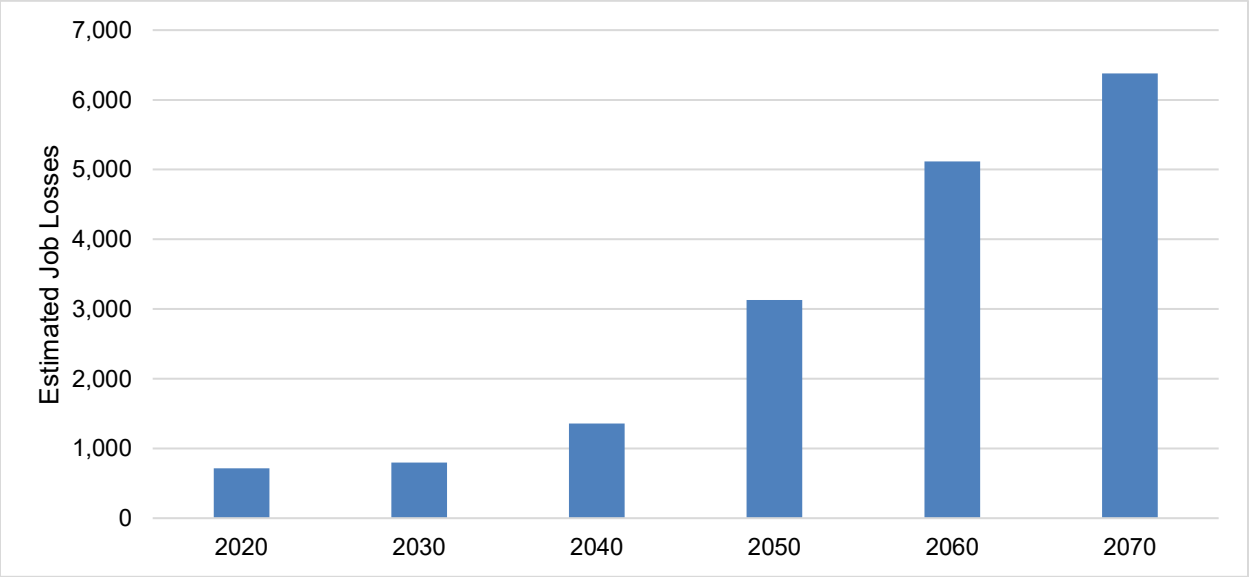


Figure 4. **Summary of estimated job losses within GMA 13 if projected municipal water needs associated with groundwater strategies are not met. Estimates are for whole counties (including areas outside of GMA 13).**

Table 4. **Summary of estimated job losses within GMA 13 if projected municipal water needs associated with groundwater strategies are not met. Estimates are for whole counties (including areas outside of GMA 13).**

Use	2020	2030	2040	2050	2060	2070
Municipal	716	798	1,359	3,131	5,116	6,380
Irrigation	0	0	0	0	0	0
Manufacturing	2	2	2	2	2	2
Mining	0	0	0	0	0	0
Power	0	0	0	0	0	0
Livestock	0	0	0	0	0	0
Total	718	800	1,361	3,133	5,118	6,382

Table 5. Summary of estimated income losses (million $) for counties within GMA 13 if projected water needs are not met. Values from Ellis (2019a; 2019b; 2019c).

County	Region	Water Use	2020	2030	2040	2050	2060	2070
Atascosa	L	Municipal	$6.52	$8.70	$12.68	$16.54	$20.57	$24.16
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Bexar*	L	Municipal	$102.48	$113.74	$254.91	$517.90	$907.12	$1,401.82
		Irrigation	$0.92	$0.92	$0.92	$0.92	$0.92	$0.92
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	$94.79	$94.79	$94.79	$94.79	$94.79	$94.79
		Livestock	NI	NI	NI	NI	NI	NI
Caldwell*	L	Municipal	$1.21	$1.61	$4.71	$10.35	$22.89	$38.76
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Dimmit	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	$3.97	$3.97	$3.97	$3.97	$3.97	$3.97
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	$4,116.25	$4,202.00	$3,558.84	$2,089.31	$622.70	$18.57
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Frio	L	Municipal	$10.81	$16.41	$21.97	$26.05	$29.61	$32.90
		Irrigation	$0.00	$0.00	$0.00	$0.00	$0.30	$0.91
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Gonzales	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Guadalupe*	L	Municipal	$0.03	$0.05	$8.19	$58.02	$144.05	$205.33
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	$0.00	$17.48	$17.48	$17.48	$17.48	$17.48
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Karnes*	L	Municipal	$5.16	$5.08	$4.66	$4.57	$6.57	$6.40
		Irrigation	$0.13	$0.13	$0.68	$0.68	$0.68	$0.68
		Manufacturing	$0.00	$0.00	$34.37	$47.14	$47.14	$47.14
		Mining	$1,879.79	$1,319.99	$743.71	$109.72	$11.62	$0.97
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
LaSalle	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	$0.19	$0.19	$0.20	$0.21	$0.22	$0.23
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	$3,983.72	$4,134.76	$3,638.75	$2,231.58	$829.29	$68.54
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI

Table 5 (cont.). Summary of estimated income losses (million $) for counties within GMA 13 if projected water needs are not met. Values from Ellis (2019a; 2019b; 2019c).

County	Region	Water Use	2020	2030	2040	2050	2060	2070
Maverick	M	Municipal	$2.57	$7.99	$18.23	$33.51	$52.05	$64.03
		Irrigation	$12.02	$9.62	$7.43	$5.46	$3.73	$2.29
		Manufacturing	$0.23	$0.23	$0.23	$0.23	$0.23	$0.23
		Mining	$362.84	$1,154.08	$1,323.37	$769.69	$81.32	$0.00
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
McMullen*	N	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Medina*	L	Municipal	$16.32	$20.84	$25.35	$30.35	$34.73	$38.37
		Irrigation	$18.46	$18.63	$18.60	$18.76	$18.85	$19.40
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	$0.00	$0.00	$0.00	$0.00	$0.00	$0.25
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Uvalde*	L	Municipal	$60.80	$68.72	$75.60	$83.44	$91.59	$99.55
		Irrigation	$25.48	$25.64	$25.72	$25.87	$26.05	$26.25
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	$5.38	$5.28	$6.53	$8.19	$9.42	$9.42
Webb*	M	Municipal	$0.27	$0.42	$0.62	$16.45	$87.80	$188.59
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	$115.50	$137.76	$137.76	$137.76	$137.76	$137.76
		Mining	$4,004.31	$1,555.91	$31.86	$0.00	$0.00	$0.00
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Wilson	L	Municipal	$1.13	$2.85	$4.96	$11.07	$20.87	$31.14
		Irrigation	$0.82	$0.83	$0.84	$0.85	$0.93	$1.12
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	$1.25	$1.25	$1.80	$1.25	$1.25	$1.25
Zapata	M	Municipal	$0.36	$0.95	$2.14	$4.00	$5.58	$7.16
		Irrigation	$5.43	$5.14	$4.85	$4.55	$4.26	$3.97
		Manufacturing	$2.29	$2.29	$2.29	$2.29	$2.29	$2.29
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Zavala	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	$11.74	$11.80	$11.67	$11.46	$11.14	$10.98
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
GMA 13		Municipal	$207.66	$247.36	$434.02	$812.25	$1,423.43	$2,138.21
		Irrigation	$79.16	$76.87	$74.88	$72.73	$71.05	$70.72
		Manufacturing	$118.02	$157.76	$192.13	$204.90	$204.90	$204.90
		Mining	$14,346.91	$12,366.74	$9,296.53	$5,200.30	$1,544.93	$88.33
		Power	$94.79	$94.79	$94.79	$94.79	$94.79	$94.79
		Livestock	$6.63	$6.53	$8.33	$9.44	$10.67	$10.67

"NI" = No estimated impact

*Estimates for whole county includes area outside of GMA 13

Table 6. Summary of estimated job losses for counties within GMA 13 if projected water needs are not met. Values from Ellis (2019a; 2019b; 2019c).

County	Region	Water Use	2020	2030	2040	2050	2060	2070
Atascosa	L	Municipal	112	150	218	285	354	416
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Bexar*	L	Municipal	1,765	1,958	4,389	8,918	15,620	24,139
		Irrigation	19	19	19	19	19	19
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	0	0	0	0	0	0
		Livestock	NI	NI	NI	NI	NI	NI
Caldwell*	L	Municipal	20	26	77	174	289	662
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Dimmit	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	65	65	65	65	65	65
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	23,860	24,357	20,629	12,111	3,609	108
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Frio	L	Municipal	186	283	378	449	510	567
		Irrigation	0	0	0	0	7	20
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Gonzales	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Guadalupe*	L	Municipal	1	1	141	999	2,480	3,536
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	0	179	179	179	179	179
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Karnes*	L	Municipal	89	88	80	79	113	110
		Irrigation	2	2	12	12	12	12
		Manufacturing	0	0	232	319	319	319
		Mining	10,879	7,651	4,311	636	67	6
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
LaSalle	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	6	6	6	7	7	7
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	23,092	23,967	21,092	12,935	4,807	397
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI

Table 6 (cont.). Summary of estimated job losses for counties within GMA 13 if projected water needs are not met. Values from Ellis (2019a; 2019b; 2019c).

County	Region	Water Use	2020	2030	2040	2050	2060	2070
Maverick	M	Municipal	59	182	416	765	1,188	1,461
		Irrigation	176	141	109	80	55	33
		Manufacturing	2	2	2	2	2	2
		Mining	1,682	5,349	6,133	3,567	377	0
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
McMullen*	N	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Medina*	L	Municipal	281	359	437	523	598	661
		Irrigation	353	356	355	359	360	371
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	0	0	0	0	0	2
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Uvalde*	L	Municipal	1,047	1,183	1,302	1,437	1,577	1,714
		Irrigation	455	458	460	462	466	469
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	207	203	251	315	362	362
Webb*	M	Municipal	6	10	14	375	2,004	4,304
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	2,017	2,406	2,406	2,406	2,406	2,406
		Mining	18,601	7,227	148	0	0	0
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Wilson	L	Municipal	19	49	85	191	359	536
		Irrigation	18	18	18	18	20	24
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	50	50	72	50	50	50
Zapata	M	Municipal	8	22	49	91	127	163
		Irrigation	72	68	64	60	56	52
		Manufacturing	133	133	133	133	133	133
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Zavala	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	205	206	204	200	195	192
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
GMA 13		Municipal	3,593	4,311	7,586	14,286	25,219	38,269
		Irrigation	1,371	1,339	1,312	1,282	1,262	1,264
		Manufacturing	2,152	2,720	2,952	3,039	3,039	3,039
		Mining	78,114	68,551	52,313	29,249	8,860	513
		Power	0	0	0	0	0	0
		Livestock	257	253	323	365	412	412

"NI" = No estimated impact

*Estimates for whole county includes area outside of GMA 13

Table 7. Summary of estimated income losses (million $) for counties within GMA 13 if projected water needs associated with groundwater strategies are not met.

County	Region	Water Use	2020	2030	2040	2050	2060	2070
Atascosa	L	Municipal	$1.83	$2.49	$2.07	$2.69	$3.56	$4.58
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Bexar*	L	Municipal	$35.81	$36.21	$59.15	$103.70	$148.06	$187.49
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		Livestock	NI	NI	NI	NI	NI	NI
Caldwell*	L	Municipal	$1.15	$1.59	$4.62	$10.22	$7.20	$6.31
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Dimmit	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NS	NS	NS	NS	NS	NS
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Frio	L	Municipal	$0.00	$0.00	$0.00	$0.00	$0.00	$0.66
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Gonzales	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Guadalupe*	L	Municipal	$0.02	$0.04	$5.81	$43.04	$107.92	$133.04
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NS	NS	NS	$0.00	$0.00	$0.00
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Karnes*	L	Municipal	$1.91	$1.57	$1.19	$1.04	$1.32	$1.18
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NS	NS	NS	NS	NS	NS
		Mining	NS	NS	NS	NS	NS	NS
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
LaSalle	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NS	NS	NS	NS	NS	NS
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI

Table 7 (cont.). Summary of estimated income losses (million $) for counties within GMA 13 if projected water needs associated with groundwater strategies are not met.

County	Region	Water Use	2020	2030	2040	2050	2060	2070
Maverick	M	Municipal	$0.00	$0.00	$0.00	$7.87	$10.23	$9.97
		Irrigation	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		Manufacturing	$0.21	$0.21	$0.21	$0.21	$0.21	$0.21
		Mining	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
McMullen*	N	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Medina*	L	Municipal	$0.45	$1.50	$1.52	$2.24	$2.93	$3.71
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NS	NS	NS	NS	NS	NS
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Uvalde*	L	Municipal	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NS	NS	NS	NS	NS	NS
Webb*	M	Municipal	$0.00	$0.00	$0.00	$0.00	$1.03	$1.56
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		Mining	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Wilson	L	Municipal	$0.00	$2.08	$3.03	$5.75	$9.57	$14.10
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NS	NS	NS	NS	NS	NS
Zapata	M	Municipal	$0.33	$0.71	$1.37	$2.23	$2.73	$3.17
		Irrigation	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		Manufacturing	NS	NS	NS	NS	NS	NS
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Zavala	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
GMA 13		Municipal	$41.49	$46.19	$78.76	$178.76	$294.54	$365.77
		Irrigation	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		Manufacturing	$0.21	$0.21	$0.21	$0.21	$0.21	$0.21
		Mining	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		Power	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
		Livestock	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00

"NI" = No estimated impact
"NS" = No strategies
*Estimates for whole county includes area outside of GMA 13

Table 8. Summary of estimated job losses for counties within GMA 13 if projected water needs associated with groundwater strategies are not met.

County	Region	Water Use	2020	2030	2040	2050	2060	2070
Atascosa	L	Municipal	31	43	36	46	61	79
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Bexar*	L	Municipal	617	623	1,018	1,786	2,549	3,228
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	0	0	0	0	0	0
		Livestock	NI	NI	NI	NI	NI	NI
Caldwell*	L	Municipal	19	26	76	172	91	108
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Dimmit	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NS	NS	NS	NS	NS	NS
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Frio	L	Municipal	0	0	0	0	0	11
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Gonzales	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Guadalupe*	L	Municipal	1	1	100	741	1,858	2,291
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NS	NS	NS	0	0	0
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Karnes*	L	Municipal	33	27	20	18	23	20
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NS	NS	NS	NS	NS	NS
		Mining	NS	NS	NS	NS	NS	NS
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
LaSalle	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NS	NS	NS	NS	NS	NS
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI

Table 8 (cont.). Summary of estimated job losses for counties within GMA 13 if projected water needs associated with groundwater strategies are not met.

County	Region	Water Use	2020	2030	2040	2050	2060	2070
Maverick	M	Municipal	0	0	0	180	234	228
		Irrigation	0	0	0	0	0	0
		Manufacturing	2	2	2	2	2	2
		Mining	0	0	0	0	0	0
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
McMullen*	N	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Medina*	L	Municipal	8	26	26	39	50	64
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NS	NS	NS	NS	NS	NS
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Uvalde*	L	Municipal	0	0	0	0	0	0
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NS	NS	NS	NS	NS	NS
Webb*	M	Municipal	0	0	0	0	24	36
		Irrigation	NI	NI	NI	NI	NI	NI
		Manufacturing	0	0	0	0	0	0
		Mining	0	0	0	0	0	0
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Wilson	L	Municipal	0	36	52	99	165	243
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NS	NS	NS	NS	NS	NS
Zapata	M	Municipal	7	16	31	51	62	72
		Irrigation	0	0	0	0	0	0
		Manufacturing	NS	NS	NS	NS	NS	NS
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
Zavala	L	Municipal	NI	NI	NI	NI	NI	NI
		Irrigation	NS	NS	NS	NS	NS	NS
		Manufacturing	NI	NI	NI	NI	NI	NI
		Mining	NI	NI	NI	NI	NI	NI
		Power	NI	NI	NI	NI	NI	NI
		Livestock	NI	NI	NI	NI	NI	NI
GMA 13		Municipal	716	798	1,359	3,131	5,116	6,380
		Irrigation	0	0	0	0	0	0
		Manufacturing	2	2	2	2	2	2
		Mining	0	0	0	0	0	0
		Power	0	0	0	0	0	0
		Livestock	0	0	0	0	0	0

"NI" = No estimated impact

"NS" = No strategies

*Estimates for whole county includes area outside of GMA 13

LRE WATER
CONNECTING WATER TO LIFE

Technical Memorandum

To:	Groundwater Management Area 13
From:	Michael R. Keester, P.G.
Date:	November 13, 2020
Project:	2021 Joint Planning
Subject:	Discussion of the Impacts of Desired Future Conditions on the Interests and Rights in Private Property

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Per Texas Water Code Section (TWC) 36.108(d)(7), districts within each groundwater management area shall consider "the impact on the interests and rights in private property, including ownership and the rights of management area landowners and their lessees and assigns in groundwater as recognized under [TWC] Section 36.002" as they relate to proposed desired future conditions. Per TWC 36.002, "a landowner owns the groundwater below the surface of the landowner's land as real property." While it is clear that a landowner owns the groundwater under the statute, the TWC does not entitle the landowner "the right to capture a specific amount of groundwater."

During the 2016 joint planning cycle, the Groundwater Management Area 13 (GMA 13) members considered the impact on private property rights within the context of the inclusion of proposed Region L water management strategies in the adopted pumping scenarios used in the model simulations that were the basis for the desired future condition. According to Hutchison (2017a; 2017b), GMA 13 considered the potential impacts on existing wells owners and surface water resources caused by increased pumping associated with Region L water management strategies as balanced with the increasing water demand in the GMA 13 area.

For the 2022 joint planning cycle, we have continued to work with the GMA 13 members and stakeholders to include all of the proposed water management strategies using groundwater resources in the model simulations. As discussed during GMA 13 meetings on November 8, 2019 and February 7, 2020, not all pumping inputs are realized in the final model outputs due to the model limitations. However, the GMA 13 members have sought to provide land owners or lessees the opportunity to produce the groundwater beneath their property.

The adopted desired future conditions (DFCs) require a balance between the highest practicable level of groundwater production and the conservation, preservation, protection, recharging and prevention of waste of groundwater, and control of subsidence

in the management area. On one side of this balance is the production of groundwater. Through the GMA's consideration of various pumping scenarios, which included amounts to meet projected demands, the GMA 13 members have considered predictive pumping scenarios that reasonable reflect the highest practicable level of groundwater production. While it may be possible to produce greater amounts of groundwater from the aquifers, for this consideration we can assume the practicable amount to be that which is able to be used to meet projected demand (that is, projected beneficial use).

The other side of the balance includes many items, one of which (namely, the prevention of waste) suggests it is appropriate to consider the projected demand as a limitation on the highest practicable level of groundwater production. The other items can also be directly tied to considering the amount of pumping included in the various pumping scenarios, but can also be easily considered with respect to hydrogeologic conditions. Because water level change (that is, drawdown) is directly related to pumping, GMA 13 members are able to evaluate the model results for various scenarios to consider this side of the DFC balance. In addition, incorporating the uncertainty of model predictions (that is, predictive error) into the results from an adopted pumping scenario will help to improve how well potential DFCs based on model simulation results will help achieve the real-world conservation, preservation, protection, recharging and prevention of waste of groundwater, and control of subsidence.

For the GMA 13 DFC of 75 percent remaining saturated thickness remaining, the impact on private property cannot be considered within the context of a simulation using the existing groundwater availability model due to its inability to reasonably simulate the applicable aquifer conditions (Hutchison, 2017c). With the proposed pumping included in the model simulations causing a greater decrease in the saturated thickness than measured data suggest would occur, the impacts to private property with regard to water level declines may be less than simulations with the current model suggest.

With regard to private property rights and the ownership of groundwater, the pumping scenarios considered by GMA 13 do not appear to create a restriction on a landowners ability to produce their groundwater to meet projected beneficial use demands. With potential DFCs being based on model results using one of the GMA 13 pumping scenarios, it does not appear that there would be any significant impact on private property rights. In addition, inclusion of variances to the DFCs that are reflective of the observed error in model results will help address considerations related to a DFC that may appear restrictive to private property rights.

If you have any questions, please let us know.

References

Hutchison, W.R., 2017a, Desired Future Condition Explanatory Report (Final) Carrizo-Wilcox/Queen City/Sparta Aquifers for Groundwater Management Area 13: DFC Explanatory Report, 23 p.

Hutchison, W.R., 2017b, GMA 13 Explanatory Report - Final - Yegua-Jackson Aquifer: DFC Explanatory Report, 12 p.

Hutchison, W.R., 2017c, Sparta, Queen City, and Carrizo-Wilcox Aquifers: Summary of Scenario 9 Drawdown and Outcrop Results: GMA 13 Technical Memorandum 16-08, Final, 10 p.

DISCUSSION OF HYDROLOGICAL CONDITIONS

GMA 13 Agenda Item 8

June 26, 2020

LRE WATER

CONSIDERATION

- Texas Water Code Section 36.108(d)(3)
- Total Estimated Recoverable Storage (TERS)
- Recharge
- Inflows
- Discharge

TERS – SPARTA, QUEEN CITY, & CARRIZO-WILCOX

- Calculated by TWDB
- Total for GMA 13 = 2.2 billion acre-feet
  - 25% = 551 million acre-feet
  - 75% = 1.65 billion acre-feet
- Based on GAM structure and properties
- No consideration for water quality
- Will likely change with new model

INFLOWS/OUTFLOWS

- Estimates based on model results
- Primary outflow is pumping (> 475,000 acre-feet per year)
- Average of more than 200,000 acre-feet per year (~0.3 inches per year)
- Stream leakage is the highest inflow (net inflow > 50,000 acre-feet per year in planning period)
  - Highly uncertain
  - Does not accurately reflect other recent research by TWDB

CHANGE IN STORAGE

- Storage decline of 180,000 to 230,000 acre-feet per year from 2020 through 2080

- 61-year storage reduction
  - < 1 percent of 100% TERS estimate
  - < 3 percent of 25% TERS estimate

DISCUSSION

- Pumping will continue to be the greatest outflow
  - Current pumping file simulates more than 500,000 acre-feet per year
- Modeling suggests additional inflow from streams will occur
  - Magnitude of inflow is relative
  - GAM is not a good tool for simulating effects on surface water
- Modeled storage reduction is relatively small
- Values will change with new model

QUESTIONS/DISCUSSION

Discussion of Hydrological Conditions

GMA 13 Agenda Item 8
June 26, 2020

Meeting and project files available at: http://bit.ly/GMA_13_3rd_Round

LRE WATER

DISCUSSION OF ENVIRONMENTAL IMPACTS

GMA 13 Agenda Item 8

June 26, 2020

LRE WATER

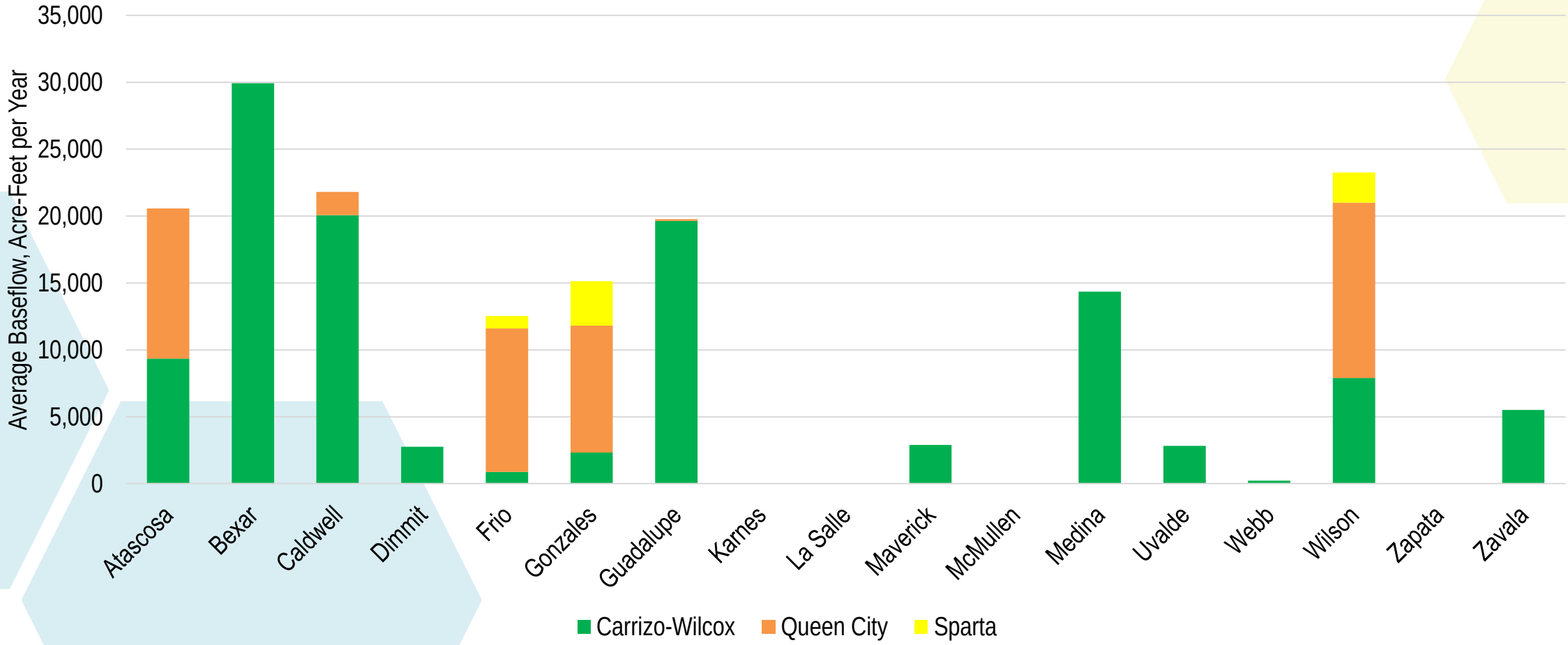
CONSIDERATION

- Texas Water Code Section 36.108(d)(4)
- Impact on streamflow as it relates to the interaction between surface water and groundwater
- Not possible to model with the GAM

2016 TEXAS AQUIFERS STUDY

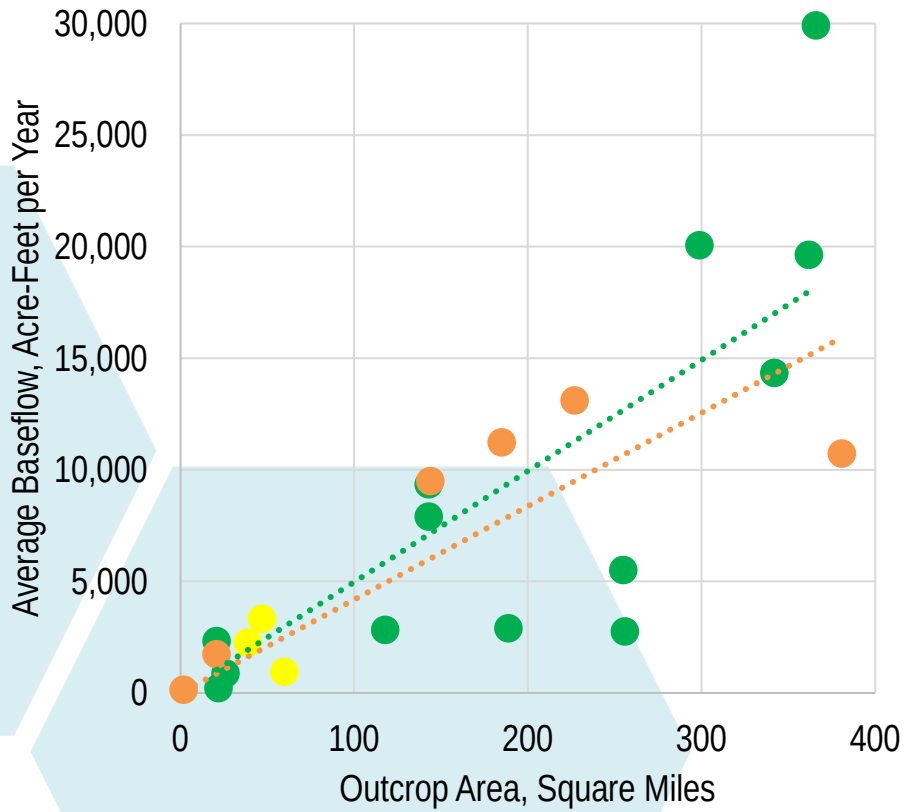
- Study conducted by the TWDB
- Used USGS stream gage data to assess contributions of groundwater to stream baseflow
- Approximately 2.34 million acre-feet per year of groundwater discharges from the Sparta, Queen City, and Carrizo-Wilcox aquifers to surface water
  - Approximately 170,000 acre-feet per year in GMA 13

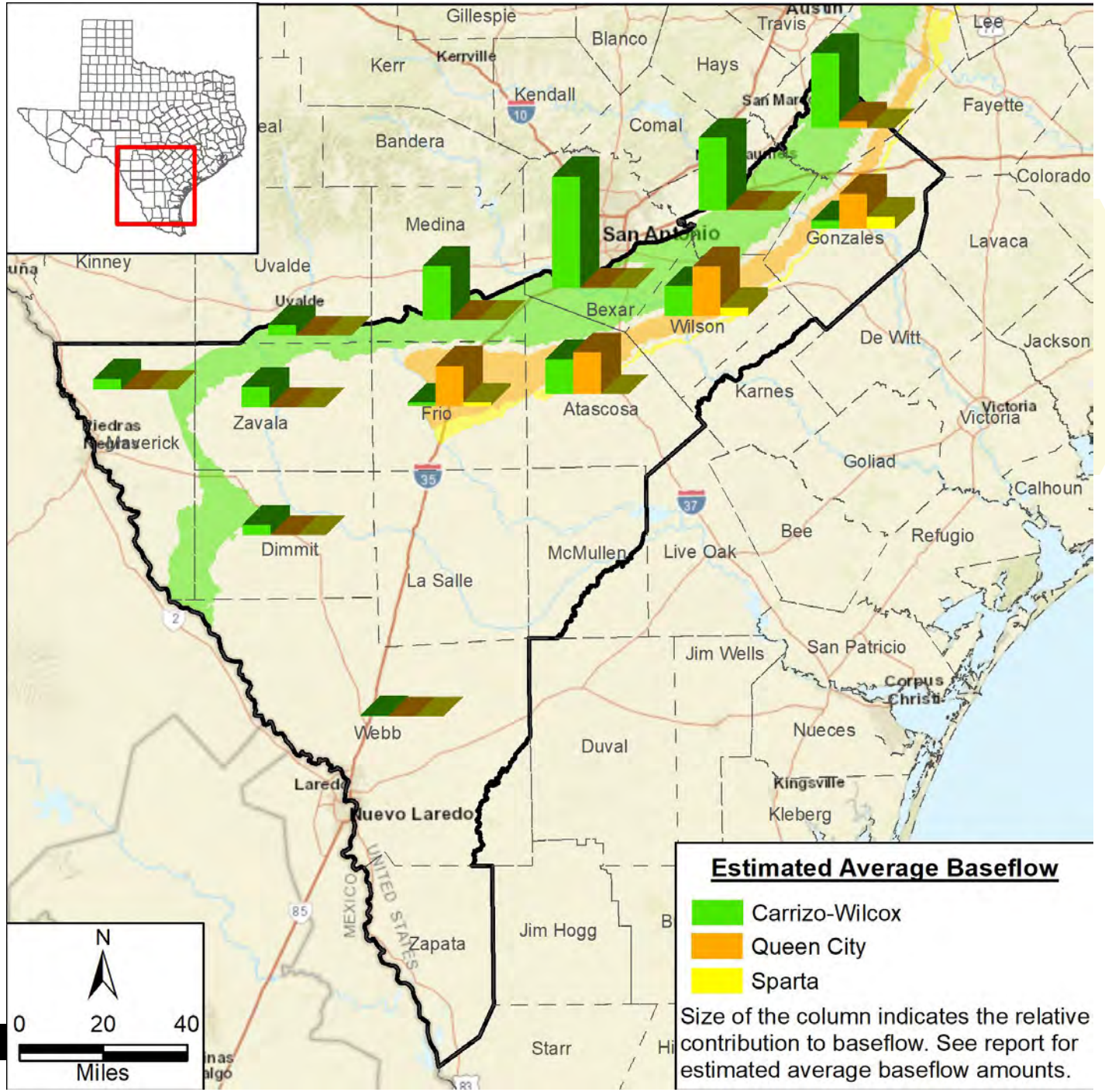
AVERAGE BASEFLOW



AVERAGE BASEFLOW

Generally, more outcrop = more baseflow





DISCUSSION

- Estimated baseflow is much greater than represented in the GAM
- Some possible decline in baseflow associated with water level declines
- Limiting decrease in saturated thickness in outcrop areas will minimize impact to baseflow

QUESTIONS/DISCUSSION

Discussion of Environmental Impacts

GMA 13 Agenda Item 8
June 26, 2020

Meeting and project files available at: http://bit.ly/GMA_13_3rd_Round

LRE WATER

TECHNICAL MEMORANDUM

TO:	Groundwater Management Area 13
FROM:	Michael R. Keester, P.G.
SUBJECT:	Discussion of Water Supply Needs and Water Management Strategies
DATE:	February 7, 2020

Per Texas Water Code Section 36.108(d)(2) districts within each groundwater management area shall consider "the water supply needs and water management strategies included in the state water plan." GMA 13 covers parts of Regional Water Planning Areas L, M, and N. Representatives from GMA 13 regularly attend and contribute to the planning meetings for each of the planning areas that are part of the GMA and report back on the regional water planning activities.

We began consideration of the needs and strategies across GMA 13 early in the process through our conversations with district representatives and stakeholders regarding the projected amount and locations of pumping. Through consultation with the regional and state water plans, district representatives and stakeholders provided guidance regarding the groundwater pumping that should be included in the model simulations. The goal of the process was to represent existing supplies and potential strategies based on the best available information within the pumping files used to evaluate potential DFCs.

According to the 2017 State Water Plan the projected demand for the counties within GMA 13 is 948,828 acre-feet in 2020 and increases to 1,149,496 acre-feet in 2070. Review of the adopted demand projections for the 2021 regional plans and 2022 State Water Plan shows a projected demand for the counties within GMA 13 is 970,054 acre-feet in 2020 and increases to 1,160,829 acre-feet in 2070. That is, revised projections for the current planning cycle indicate an increase in the projected demand of 11,333 acre-feet in 2070 with the largest increase in demand in Frio County and the largest demand reduction in Bexar County. Table 1 summarizes the projected water demand in 2070 for each county in GMA 13.

Most of the projected water demand is in Bexar County where the 2070 demand is expected to be 471,297 acre-feet according to the adopted values for the 2022 State Water Plan. Projected 2070 demands in other counties in GMA 13 are significantly less and range from 1,978 acre-feet in McMullen County to 96,389 acre-feet in Webb County. Figure 1 illustrates the relative demands for each county.

Much of the water demand will be met with existing surface water and groundwater supplies. Total existing surface water and groundwater supplies (according to the 2017 State Water Plan) are projected to be 869,129 acre-feet in 2070 within the counties in GMA 13 with 266,527 (31%) of the total supplies coming from the primary GMA 13 aquifers (namely, the Sparta, Queen City, Carrizo-Wilcox, and Yegua-Jackson). In several counties in GMA 13, the existing primary

groundwater supplies make up a significant portion of the total supplies (see Figure 2). The portion of water demand that cannot be met with existing supplies (that is, water supply need) is projected to be 330,005 acre-feet in 2070 within the counties in GMA 13 according to the 2017 State Water Plan. To meet the projected water supply need, strategies that will utilize groundwater from Sparta, Queen City, Carrizo-Wilcox, or Yegua-Jackson total 65,656 acre-feet in 2070. Table 2 summarizes the 2070 supplies, demands, needs, and strategies.

Table 1. Projected 2070 water demands (acre-feet) from the 2017 State Water Plan and adopted amounts for the 2021 regional plans and 2022 State Water Plan.

County	2017 SWP	2021 RWPs, 2022 SWP	Difference
Atascosa	46,695	55,263	8,568
Bexar*	543,989	471,297	-72,692
Caldwell*	13,557	13,415	-142
Dimmit	8,798	9,484	686
Frio	65,913	84,626	18,713
Gonzales	15,247	24,336	9,089
Guadalupe*	68,632	67,827	-805
Karnes*	5,247	5,829	582
La Salle	7,719	9,469	1,750
Maverick	67,651	70,294	2,643
McMullen*	1,801	1,978	177
Medina*	61,252	74,822	13,570
Uvalde*	67,179	76,818	9,639
Webb*	97,438	96,389	-1,049
Wilson	25,080	36,116	11,036
Zapata	10,249	10,733	484
Zavala	43,049	52,133	9,084
Total	1,149,496	1,160,829	11,333

*Projected demands are for the entire county and not just the portion within GMA 13

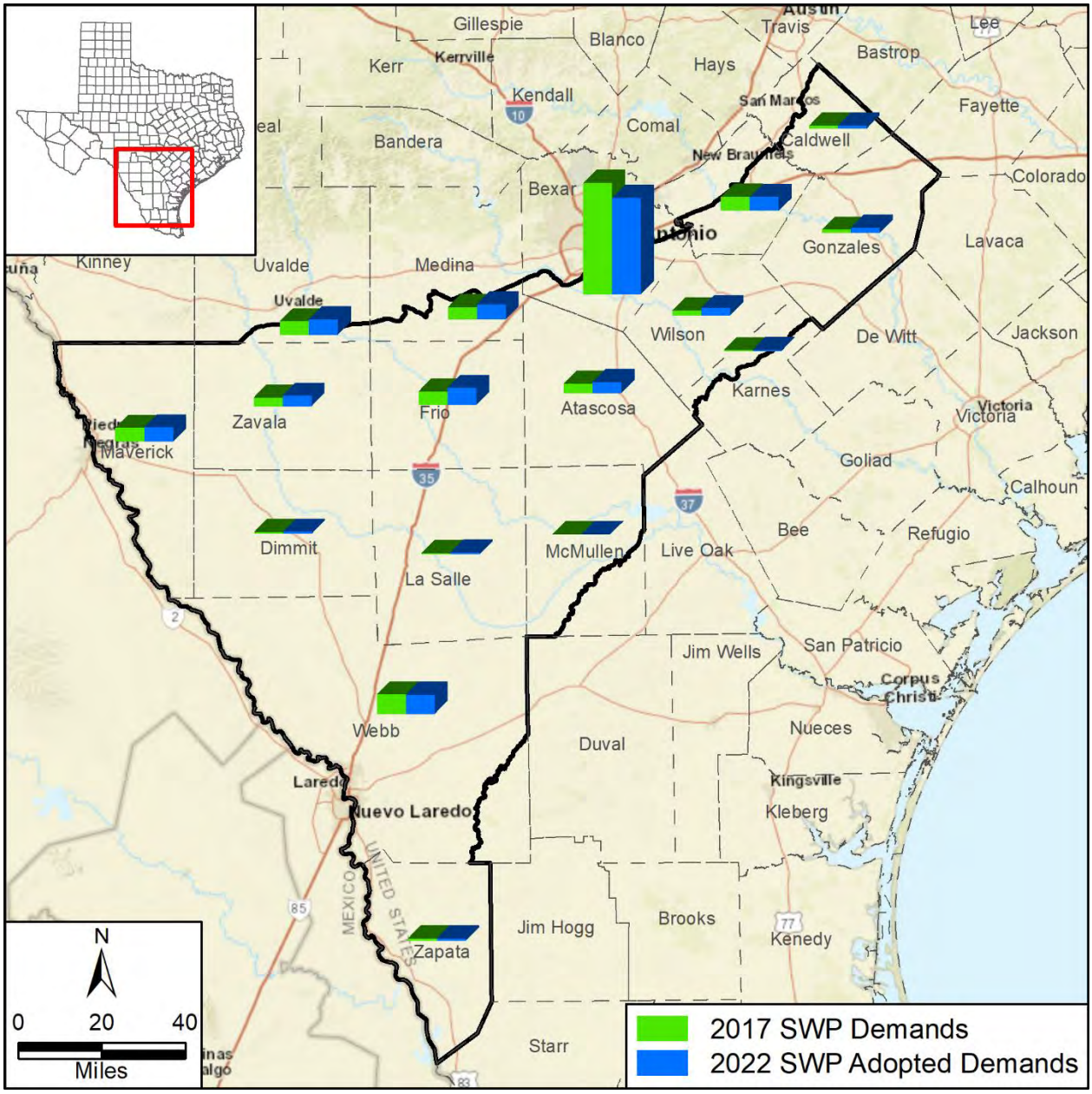


Figure 1. Relative demands from the 2017 State Water Plan and adopted demands for the 2021 regional plans and 2022 State Water Plan.

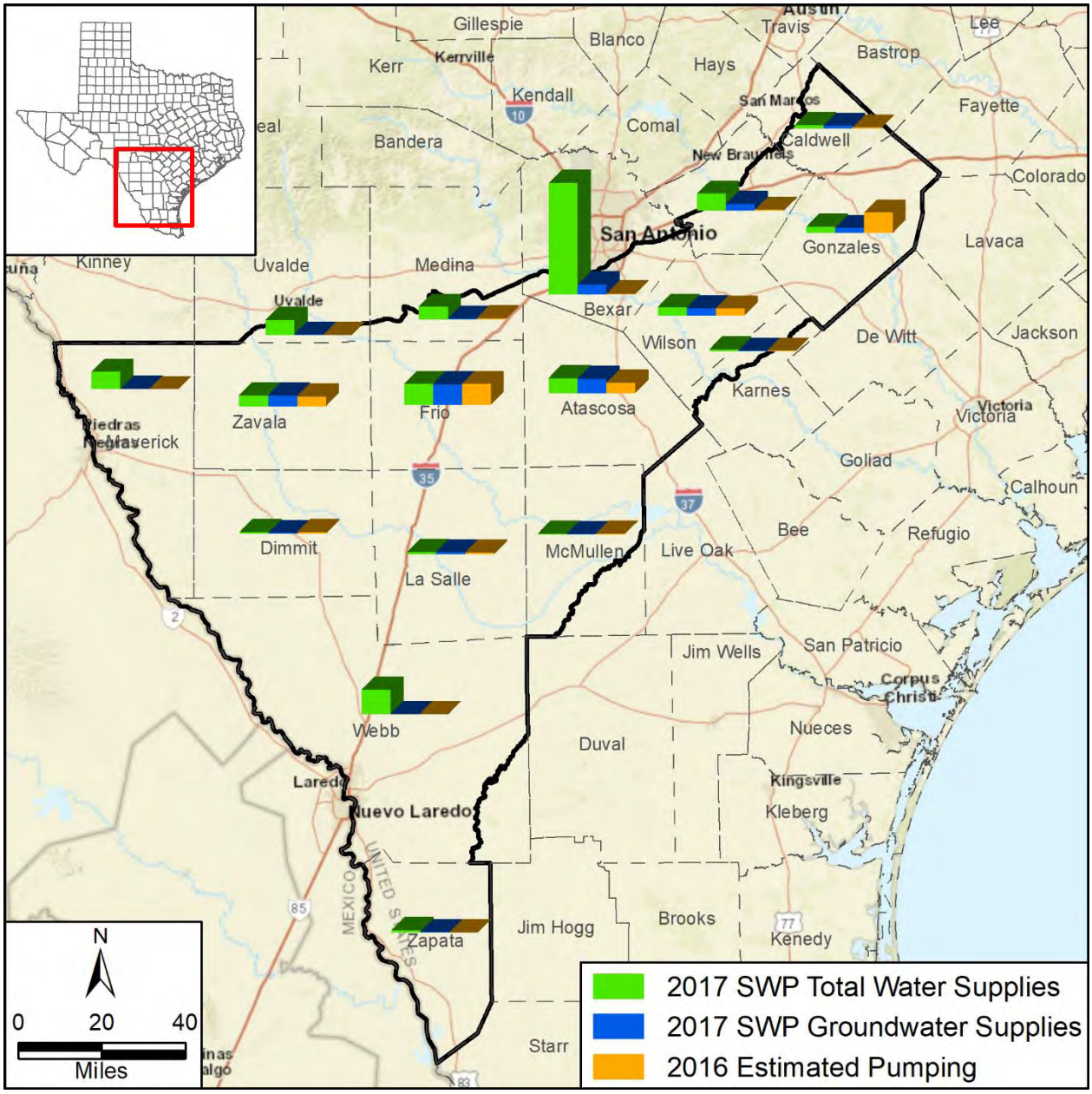


Figure 2. **Relative total and groundwater supplies from the 2017 State Water Plan along with the estimated actual groundwater pumping in 2016. Groundwater pumping values only include pumping from the Sparta, Queen City, Carrizo-Wilcox, and Yegua-Jackson.**

Table 2. 2017 State Water Plan year 2070 identified projected demands, total existing supplies, projected needs, and strategies using groundwater (all values in acre-feet).

County	Projected Demands	Total Supplies	Reported Needs**	Groundwater Strategies
Atascosa	46,695	48,008	1,063	541
Bexar*	543,989	354,936	199,085	33,570
Caldwell*	13,557	10,660	4,080	864
Dimmit	8,798	5,865	3,169	0
Frio	65,913	67,292	20	23
Gonzales	15,247	19,807	367	378
Guadalupe*	68,632	54,696	22,356	23,671
Karnes*	5,247	5,721	402	252
La Salle	7,719	8,543	147	456
Maverick	67,651	54,777	13,709	800
McMullen*	1,801	2,436	51	854
Medina*	61,252	40,768	23,445	475
Uvalde*	67,179	47,742	21,744	0
Webb*	97,438	78,701	25,450	200
Wilson	25,080	26,186	1,885	1,892
Zapata	10,249	7,428	3,589	1,680
Zavala	43,049	35,563	9,443	0
Total	1,149,496	869,129	330,005	65,656

*Projected demands are for the entire county and not just the portion within GMA 13

**Need values as reported in the 2017 SWP datasets. Values do not necessarily reflect the difference between the demands and total supplies. See the 2017 SWP and applicable regional water plans for more details.

Proposed strategies from 2017 State Water Plan will result in additional groundwater production from the relevant aquifers in GMA 13 coming from Atascosa, Bexar, Caldwell, Frio, Gonzales, Guadalupe, Karnes, La Salle, Maverick, McMullen, Medina, Webb, Wilson, and Zapata counties. Table 3 compares the current MAG based on the adopted DFCs, 2016 estimated pumping, and the 2070 strategies for the relevant aquifers. As Table 3 shows, the 2016 pumping plus the strategies is below the MAG in most cases. However, estimated 2016 pumping from relevant aquifers in Dimmit and Medina counties appears to already exceed the MAG. Dimmit County does not have any strategies identified that utilize the relevant aquifers, but the strategy in Medina County may not be feasible with the current MAG.

Table 3. Current MAG values for all relevant aquifers for counties within GMA 13, estimated 2016 pumping, and year 2070 strategies using groundwater from the relevant aquifers in GMA 13.

County	Current MAG (All Aquifers)	2016 Pumping (All Aquifers)	2070 Groundwater Strategies
Atascosa	81,189	33,506	541
Bexar*	78,807	1,967	33,570
Caldwell*	54,496	2,735	864
Dimmit	4,129	5,166	0
Frio	82,090	67,309	23
Gonzales	99,389	65,172	378
Guadalupe*	47,833	3,618	23,671
Karnes*	3,354	1,057	252
La Salle	7,848	6,438	456
Maverick	1,531	54	800
McMullen*	4,628	2,611	854
Medina*	2,646	3,829	475
Uvalde*	828	11	0
Webb*	916	156	200
Wilson	112,194	21,828	1,892
Zapata	Not Relevant	161	1,680
Zavala	34,695	31,808	0
Total	616,573	247,424	65,656

As shown in Table 1, there is a small overall increase in the projected demand from the 2017 to the 2022 State Water Plan for GMA 13. The largest increases are in Frio and Medina counties which may result in increases in the 2070 water management strategies in those counties. While 2016 pumping in two counties exceeds the current MAG, overall the combined pumping and strategies are well below the total MAG for GMA 13. With minimal changes expected for the pumping scenario during this third round of joint planning, it appears there is groundwater available under potential DFCs to help meet the identified demands in the Regional and State Water Plans.

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1/14/2022
TBPE Firm 14368

Technical Memorandum

To:	Groundwater Management Area 13
From:	Jordan Furnans, PhD, PE, PG
Date:	January 14, 2022
Project:	2021 Joint Planning
Subject:	Groundwater Availability Modeling Technical Elements

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The purpose of this memo is to meet the requirements of "Desired Future Condition Submission Packet Checklist - Groundwater Availability Modeling Technical Elements (part 4)" checklist. All modeling was conducted at the direction of Groundwater Management Area (GMA) 13 members.

Description of Desired Future Condition (DFC) - Carrizo-Wilcox, Queen City, and Sparta Aquifers

As described in Section 2 of the Explanatory Report, for the Carrizo-Wilcox, Queen City, and Sparta Aquifers two desired future conditions were proposed. The primary desired future condition is that 75 percent of the saturated thickness in the outcrop at the end of 2012 remains at the end of 2080. The secondary desired future condition is that the average drawdown of 49 feet (+/- 5 feet) be achieved for all of Groundwater Management Area 13, as calculated for the entire period from 2012 through 2080.

Modeling Approach

GAM version: The Southern Portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers as represented in Kelley and others (2004).

Stress periods: 81 stress periods of 365.25 days each. The first stress period begins on January 1, 2000 and the last stress period (81) ends on December 31, 2080. The first stress period corresponds to the end of the calibration period.

Recharge: Average recharge applied throughout the predictive period

Predictive pumping: Details on the modifications to the predictive pumping are documented in the technical memorandums in Appendix 4 of the Explanatory Report.

Version of TWDB "model grid" file: "qcsp_s_grid05132019.csv" available at http://www.twdb.texas.gov/groundwater/models/gam/gam_grids/qcsp_s.zip as of the date of this technical memorandum.

Evaluation method: To extract data from the model and calculate average drawdown we used a script written using the Julia programming language available at https://julialang.org/. The script is named “Calc_avg_dd_GMA13_2019_001.jl” and is included with the modeling files. We calculated average drawdown for GMA 13 as a whole with the following assumptions:

- Calculations only occur within the active aquifer footprint as defined in the “model grid” file (AQ_Active[#] == 1; where [#] is the layer number)
- Drawdown = starting head – head for the stress period of interest
    - For the DFCs, the stress period of interest = 81
    - Starting head = simulated head at the end of the calibration period (12/31/1999)
    - If a cell goes dry, drawdown = starting head – bottom of the aquifer
- Average drawdown = sum of drawdown in each model cell within area of interest divided by the number of model cells within the area of interest

Results: Summarized below. Also, see Appendix 4.5 in Explanatory Report.

Table 1. Abbreviated summary of the pumping input values for portions of counties located within GMA 13.

Current Draft Pumping Input (i.e.,Well File), Acre-Feet per Year							
GCD/County	**Layer**	**2020**	**2030**	**2040**	**2050**	**2060**	**2070**
Evergreen UWCD	Sparta	2,739	2,183	2,071	1,974	1,888	1,814
	Queen City	13,614	10,797	10,455	10,134	9,724	9,358
	Carrizo	201,458	173,264	173,397	174,659	175,888	177,356
	Upper Wilcox	374	374	374	374	374	374
	Middle Wilcox	374	374	374	374	374	374
	Lower Wilcox	3,071	6,571	10,421	34,081	69,931	87,931
	Total	221,630	193,563	197,092	221,596	258,179	277,207
Gonzales County UWCD	Sparta	3,554	3,554	3,554	3,554	3,554	3,554
	Queen City	10,183	10,183	10,183	10,183	10,183	10,183
	Carrizo	47,486	61,408	71,481	81,382	86,337	87,298
	Upper Wilcox	15	15	15	15	15	15
	Middle Wilcox	11,216	15,716	20,216	24,716	24,716	24,716
	Lower Wilcox	2,200	8,800	15,400	22,000	22,000	22,000
	Total	74,654	99,675	120,848	141,850	146,805	147,765
Guadalupe County GCD	Sparta	0	0	0	0	0	0
	Queen City	0	0	0	0	0	0
	Carrizo	28,883	25,411	26,053	26,395	26,685	27,084
	Upper Wilcox	0	0	0	0	0	0
	Middle Wilcox	6,690	7,090	9,200	11,268	11,268	11,268
	Lower Wilcox	21,215	21,215	22,188	23,164	23,164	23,164
	Total	56,788	53,716	57,441	60,826	61,117	61,516
McMullen GCD	Sparta	0	0	0	0	0	0
	Queen City	3	3	3	3	3	3
	Carrizo	7,773	7,773	4,857	4,857	4,857	4,857
	Upper Wilcox	1,280	1,280	1,280	1,280	1,280	1,280
	Middle Wilcox	88	88	88	88	88	88
	Lower Wilcox	0	0	0	0	0	0
	Total	9,144	9,144	6,228	6,228	6,228	6,228
Medina County GCD	Sparta	0	0	0	0	0	0
	Queen City	0	0	0	0	0	0
	Carrizo	515	515	515	515	515	515
	Upper Wilcox	0	0	0	0	0	0
	Middle Wilcox	1,250	1,250	1,250	1,250	1,250	1,250
	Lower Wilcox	1,250	1,250	1,250	1,250	1,250	1,250
	Total	3,015	3,015	3,015	3,015	3,015	3,015
Plum Creek CD	Sparta	0	0	0	0	0	0
	Queen City	0	0	0	0	0	0
	Carrizo	0	1,991	5,037	5,712	6,050	10,000
	Upper Wilcox	0	0	0	0	0	0
	Middle Wilcox	5,702	5,702	5,702	5,702	5,702	5,702
	Lower Wilcox	11,916	11,916	11,916	11,916	11,916	11,916
	Total	17,617	19,609	22,655	23,330	23,667	27,617
Uvalde County UWCD	Sparta	0	0	0	0	0	0
	Queen City	0	0	0	0	0	0
	Carrizo	0	1,991	5,037	5,712	6,050	10,000
	Upper Wilcox	0	0	0	0	0	0
	Middle Wilcox	5,702	5,702	5,702	5,702	5,702	5,702
	Lower Wilcox	11,916	11,916	11,916	11,916	11,916	11,916
	Total	17,617	19,609	22,655	23,330	23,667	27,617
Wintergarden GCD	Sparta	987	987	987	987	987	987
	Queen City	11	11	11	11	11	11
	Carrizo	35,724	35,724	35,724	35,724	35,724	35,724
	Upper Wilcox	9,417	9,417	9,417	9,417	9,417	9,417
	Middle Wilcox	3,818	3,818	3,818	3,818	3,818	3,818
	Lower Wilcox	415	415	415	415	415	415
	Total	50,372	50,372	50,372	50,372	50,372	50,372

Table 2. Calculated simulated average drawdown from January 1, 2000 through December 31, 2080.

Current Draft Average Drawdown from 12/31/2012, Feet							
	Layer	2020	2030	2040	2050	2060	2070
Districts in GMA 13	Sparta	3	6	8	11	13	15
	Queen City	3	7	11	15	18	22
	Carrizo	13	27	39	51	61	72
	Upper Wilcox	12	27	38	50	60	71
	Middle Wilcox	3	11	21	32	43	55
	Lower Wilcox	3	12	22	36	50	73
	Total	7	18	28	39	50	63
All of GMA 13	Sparta	3	6	8	11	13	15
	Queen City	3	7	11	15	18	22
	Carrizo	11	22	32	41	50	59
	Upper Wilcox	10	22	31	41	50	58
	Middle Wilcox	2	9	17	27	36	46
	Lower Wilcox	3	11	19	31	43	62
	Total	6	15	23	33	42	53

Description of Desired Future Condition (DFC) - Carrizo-Wilcox, Queen City, and Sparta Aquifers

As described in Section 2 of the Explanatory Report, for the Yegua-Jackson Aquifer, relevancy was established only for Gonzales and Karnes Counties. The desired future conditions determined for the Yegua-Jackson Aquifer are:

- Gonzales County: Average drawdown from the end of 2010 through 2080 is 3 feet (+/- 1 foot).
- Karnes County: Average drawdown from the end of 2010 through 2080 is 1 foot (+/- 1 foot).

Modeling Approach

GAM version: The Yegua-Jackson Aquifer as represented in Deeds and others (2010).

Stress periods: 81 stress periods of 365.25 days each. The first stress period begins on January 1, 2000 and the last stress period (81) ends on December 31, 2080. The first stress period corresponds to the end of the calibration period.

Recharge: Average recharge applied throughout the predictive period

Predictive pumping: Details on the modifications to the predictive pumping are documented in the technical memorandums in Appendix 4 of the Explanatory Report.

Version of TWDB "model grid" file: "ygjk_grid_poly070920.csv" available at http://www.twdb.texas.gov/groundwater/models/gam/gam_grids/ygjk.zip as of the date of this technical memorandum.

Evaluation method: To extract data from the model and calculate average drawdown we used a script written using the Julia programming language available at https://julialang.org/. The script is named "Calc_avg_dd_GMA13_YJ_2020_001.jl" and is included with the modeling files. We calculated average drawdown for Gonzales County and Karnes County within GMA-13 with the following assumptions:

- Calculations only occur within the active aquifer footprint as defined in the "model grid" file (AQ_Active[#] == 1; where [#] is the layer number)
- Drawdown = starting head – head for the stress period of interest
    - For the DFCs, the stress period of interest = 81
    - Starting head = simulated head at the end of the calibration period (12/31/1999)
    - If a cell goes dry, drawdown = starting head – bottom of the aquifer
- Average drawdown = sum of drawdown in each model cell within area of interest divided by the number of model cells within the area of interest

Modeling Contact Information

Jordan Furnans, PhD, PE, P.G.
LRE Water, LLC
(512) 736-6485
Jordan.Furnans@LREWater.com

**Modeling was performed by Mike Keester prior to his resignation on 12/30/2021. As of 1/14/2022, Mr. Keester may be contacted at:

Mike Keester, PG
RW Harden & Associates, Inc.
(512) 962-7660
mike.keester@rwharden.com

APPENDIX 5

GAM Run 21-018 MAG

GAM RUN 21-018 MAG:
MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX, QUEEN CITY, SPARTA, AND YEGUA-JACKSON AQUIFERS IN GROUNDWATER MANAGEMENT AREA 13

Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Department
(512) 936-0883
July 25, 2022

Shirley C. Wade
7/25/22

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GAM RUN 21-018 MAG: MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX, QUEEN CITY, SPARTA, AND YEGUA-JACKSON AQUIFERS IN GROUNDWATER MANAGEMENT AREA 13

Shirley C. Wade, Ph.D., P.G.
Texas Water Development Board
Groundwater Division
Groundwater Availability Modeling Department
(512) 936-0883
July 25, 2022

EXECUTIVE SUMMARY:

The modeled available groundwater for Groundwater Management Area 13 for the Carrizo-Wilcox, Queen City, Sparta, and Yegua-Jackson aquifers is summarized by decade for the groundwater conservation districts (Tables 1 through 4 respectively) and for use in the regional water planning process (Tables 5 through 8 respectively). The modeled available groundwater estimates for the Carrizo-Wilcox Aquifer range from approximately 470,000 acre-feet per year in 2020 to approximately 575,000 acre-feet per year in 2080 (Table 1). The modeled available groundwater estimates for the Queen City Aquifer range from approximately 23,000 acre-feet per year in 2020 to approximately 18,000 acre-feet per year in 2080 (Table 2). The modeled available groundwater estimates for the Sparta Aquifer range from approximately 6,000 acre-feet per year in 2020 to approximately 4,000 acre-feet per year in 2080 (Table 3). The estimates for the Carrizo-Wilcox, Queen City, and Sparta Aquifers were extracted from the results of a model run using the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers (version 2.01). The modeled available groundwater estimates for the Yegua-Jackson Aquifer are approximately 6,700 acre-feet per year from 2020 to 2080 (Table 4). The estimates for the Yegua-Jackson Aquifer were extracted from the results of a model run using the groundwater availability model for the Yegua-Jackson Aquifer (version 1.01). The explanatory report and other materials submitted to the TWDB were determined to be administratively complete on April 15, 2022.

REQUESTOR:

Ms. Kelley Cochran, coordinator of Groundwater Management Area 13.

DESCRIPTION OF REQUEST:

The desired future conditions for the Carrizo-Wilcox, Queen City, and Sparta aquifers described in Resolution 21-02 from Groundwater Management Area 13, adopted November 19, 2021, are:

- *"The first desired future condition for the Carrizo-Wilcox, Queen City and Sparta aquifers in Groundwater Management Area 13 is that 75 percent of the saturated thickness in the outcrop at the end of 2012 remains in 2080. Due to the limitations of the current Groundwater Availability Model, this desired future condition cannot be simulated as documented during 2016 Joint Planning in GMA 13 Technical Memorandum 16-08 (Hutchison, 2017a)."*
- *"In addition, a secondary proposed desired future condition for the Carrizo-Wilcox, Queen City, and Sparta aquifers in Groundwater Management Area 13 is an average drawdown of 49 feet (+/- 5 feet) for all of GMA 13. The drawdown is calculated from the end of 2012 conditions to the year 2080. This desired future condition is consistent with simulation "GMA13_2019_001" summarized during a meeting of Groundwater Management Area 13 members on March 19, 2021."*

The desired future conditions for the Yegua-Jackson Aquifer described in Resolution 21-03 from Groundwater Management Area 13, adopted November 19, 2021 are:

- *"For Gonzales County, the average drawdown from 2010 to 2080 is 3 feet (+/- 1 foot)."*
- *"For Karnes County, the average drawdown from 2010 to 2080 is 1 foot (+/- 1 foot)."*
- *"For all other counties in GMA 13, the Yegua-Jackson is classified as not relevant for purposes of joint planning."*

The Edwards (Balcones Fault Zone), Gulf Coast, and Trinity aquifers were declared not relevant for purposes of joint planning by Groundwater Management Area 13 in Resolution 21-01 (Groundwater Management Area 13 Joint Planning Committee and others, 2022; Appendix B).

On January 14, 2022, Dr. Jordan Furnans, on behalf of Groundwater Management Area 13, submitted the Desired Future Conditions Packet to the TWDB. TWDB staff reviewed the model files associated with the desired future conditions and received clarifications on procedures and assumptions from the Groundwater Management Area 13 Technical Coordinator on March 3, 2022, and on March 7, 2022. Groundwater Management Area 13 adopted two desired future conditions for the Carrizo-Wilcox, Queen City, and Sparta Aquifers and they were not mutually compatible in the groundwater availability model. The

technical coordinator for the groundwater management area confirmed that their intention was for the modeled available groundwater values to be based on the secondary desired future condition and MODFLOW pumping simulation GMA13_2019_001 (Groundwater Management Area 13 Joint Planning Committee and others, 2022; Appendix 2). The first proposed desired future condition was not intended for the calculation of modeled available groundwater.

The model run pumping file, which meets the secondary desired future condition adopted by district representatives of Groundwater Management Area 13 for the Carrizo-Wilcox, Queen City, and Sparta Aquifers, was submitted to the TWDB as supplemental information for the original submittal on February 9, 2022. The model run files, which meet the desired future conditions adopted by district representatives of Groundwater Management Area 13 for the Yegua-Jackson Aquifer, were submitted to the TWDB on January 14, 2022, as part of the Desired Future Conditions Explanatory Report for Groundwater Management Area 13.

In an email dated March 3, 2022, the Technical Coordinator and consultant for Groundwater Management Area 13 confirmed that they intended to use the end of 2011 as the reference year for the drawdown calculations for the Carrizo-Wilcox, Queen City, and Sparta aquifers and they intended to use the end of 2009 as the reference year for the Yegua-Jackson Aquifer. In an email dated March 7, 2022, they also confirmed that the confining unit model layers representing the Reklaw and Weches formations should be included in the desired future condition calculation of average drawdown for the combined Carrizo-Wilcox, Queen City, and Sparta aquifers.

All clarifications are included in the Parameters and Assumptions Section of this report.

METHODS:

The groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers (Figures 1 through 3) was run using the model files submitted with the explanatory reports (Groundwater Management Area 13 Joint Planning Committee and others, 2022) on January 14 and February 9, 2022. Model-calculated water levels were extracted for the years 2011 (stress period 12) and 2080 (stress period 81). An overall drawdown average was calculated for the entire Groundwater Management Area 13 using all model layers in the average. As described in the Technical Memorandum submitted with the Explanatory Report on January 14, 2022 (Furnans, 2022) drawdowns for cells that became dry during the simulation (water level dropped below the base of the cell) were calculated as the reference year water level elevation minus the elevation of the model cell bottom. The calculated drawdown average was compared with the desired future condition of 49 feet to verify that the pumping scenario achieved the desired future conditions within the stated tolerance of five feet.

The groundwater availability model for the Yegua-Jackson Aquifer (Figure 4) was run using the model files submitted on January 14, 2022. Model-calculated water levels were extracted for the years 2009 (stress period 39) and 2080 (stress period 110). County-wide average drawdowns were calculated for Gonzales and Karnes counties within Groundwater Management Area 13 by averaging the drawdown values for all model layers. There were no dry cells in Karnes County or Gonzales County, so no additional dry cell calculations were needed. The calculated drawdown averages were compared with the desired future conditions for Gonzales and Karnes counties to verify that the pumping scenario achieved the desired future conditions within the stated tolerance of one foot.

The 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 by county and groundwater conservation district, subtotaled by groundwater conservation district, and then summed for Groundwater Management Area 13 (Tables 1 through 4). Annual pumping rates by aquifer are also presented by county, river basin, and regional water planning area within Groundwater Management Area 13 (Tables 5 through 8) in order to be consistent with the format used in the regional water planning process.

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:

Carrizo-Wilcox, Queen City, and Sparta aquifers

- We used Version 2.01 of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers. See Deeds and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater availability model for the southern part of the Carrizo-Wilcox, Queen City, and Sparta aquifers.
- This groundwater availability model includes eight layers, which generally represent the Sparta Aquifer (Layer 1), the Weches Confining Unit (Layer 2), the Queen City Aquifer (Layer 3), the Reklaw Confining Unit (Layer 4), the Carrizo (Layer 5), the Upper Wilcox (Layer 6), the Middle Wilcox (Layer 7), and the Lower Wilcox (Layer 8). Since the model extends beyond the official TWDB aquifer extents, please note that model layers 1 and 3 instead represent geologic units equivalent to the Sparta and Queen City aquifers, respectively, in those areas falling outside of the official aquifer extents.
- The model was run with MODFLOW-96 (Harbaugh and McDonald, 1996).
- Although the original groundwater availability model was only calibrated to 1999, an analysis during the second round of joint planning (Hutchison, 2017b) verified that the model satisfactorily matched measured water levels for the period from 1999 to 2011. For this reason, TWDB considers it acceptable to use the end of 2011 as the reference year for drawdown calculations.
- Drawdown averages and modeled available groundwater values were based on the TWDB defined aquifer boundaries rather than the model extent.
- Drawdowns for cells that became dry during the simulation (water level dropped below the base of the cell) were calculated as the reference year water level elevation minus the elevation of the model cell bottom. Pumping in dry cells was excluded from the modeled available groundwater calculations for the decades after the cell went dry.
- A tolerance of five feet was assumed when comparing desired future conditions to modeled drawdown results. This tolerance was specified by the GMA in their definition of the desired future conditions.
- Estimates of modeled available groundwater from the model simulation were rounded to the nearest whole number.
- The verification calculation for the desired future conditions is based on an average of all model layers (Layers 1 through 8). The modeled available groundwater

calculations are based on Layer 1 for the Sparta Aquifer, Layer 3 for the Queen City Aquifer, and the sum of Layers 5 through 8 for the Carrizo-Wilcox Aquifer.

Yegua-Jackson Aquifer

- We used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer. See Deeds and others (2010) for assumptions and limitations of the groundwater availability model.
- This groundwater availability model includes five layers which represent the outcrop of the Yegua-Jackson Aquifer and younger overlying units—the Catahoula Formation (Layer 1), the upper portion of the Jackson Group (Layer 2), the lower portion of the Jackson Group (Layer 3), the upper portion of the Yegua Group (Layer 4), and the lower portion of the Yegua Group (Layer 5).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).
- Although the original groundwater availability model was only calibrated to 1997, a TWDB analysis (Oliver, 2010) verified that the model satisfactorily matched measured water levels for the period from 1997 to 2009. For this reason, TWDB considers it acceptable to use the end of 2009 as the reference year for drawdown calculations.
- Drawdown averages and modeled available groundwater values were based on the TWDB-defined aquifer boundaries rather than the model extent.
- No dry cells occurred in the simulation in Gonzales County or Karnes County. As these were the only counties with defined desired future conditions, no dry cell considerations were required during the verification calculation for the desired future conditions. Pumping in dry cells was excluded from the modeled available groundwater calculations for the decades after the cell went dry.
- A tolerance of one foot was assumed when comparing desired future conditions to modeled drawdown results. This tolerance was specified by the GMA in their definition of the desired future conditions.
- Estimates of modeled available groundwater from the model simulation were rounded to the nearest whole number.
- The verification calculation for the desired future conditions is based on an average of all model layers representing the Yegua or Jackson formations (Layers 1 through 5). The modeled available groundwater calculations are the sum of all model layers representing the Yegua or Jackson formations (Layers 1 through 5).

RESULTS:

The modeled available groundwater estimates for the Carrizo-Wilcox Aquifer range from approximately 470,000 acre-feet per year in 2020 to approximately 575,000 acre-feet per year in 2080 (Table 1). The modeled available groundwater estimates for the Queen City Aquifer range from approximately 23,000 acre-feet per year in 2020 to approximately 18,000 acre-feet per year in 2080 (Table 2). The modeled available groundwater estimate for the Sparta Aquifer ranges from approximately 6,000 acre-feet per year in 2020 to approximately 4,000 acre-feet per year in 2080 (Table 3). The modeled available groundwater is summarized by groundwater conservation district and county for the Carrizo-Wilcox, Queen City, and Sparta aquifers (Tables 1, 2, and 3 respectively). The modeled available groundwater has also been summarized by county, river basin, and regional water planning area for use in the regional water planning process for the Carrizo-Wilcox, Queen City, and Sparta aquifers (Tables 5, 6, and 7 respectively). Small differences in values between table summaries are due to rounding.

The modeled available groundwater estimate for the Yegua-Jackson Aquifer is approximately 7,000 acre-feet per year from 2020 to 2080 (Table 4). The modeled available groundwater for the Yegua-Jackson Aquifer is summarized by groundwater conservation district and county (Table 4) and by county, river basin, and regional water planning area for use in the regional water planning process (Table 8). Small differences of values between table summaries are due to rounding.

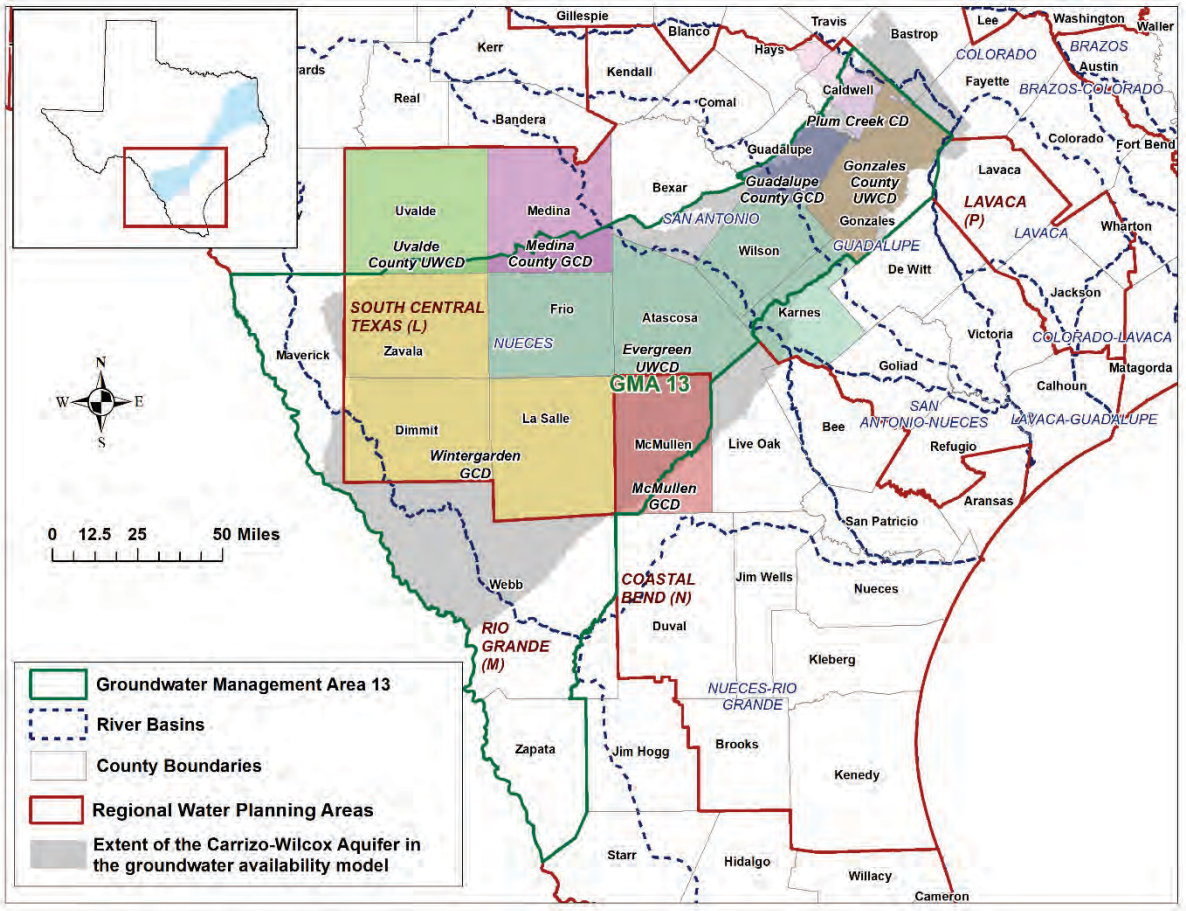


FIGURE 1. GROUNDWATER MANAGEMENT AREA (GMA) 13 BOUNDARY, REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE CARRIZO-WILCOX AQUIFER.

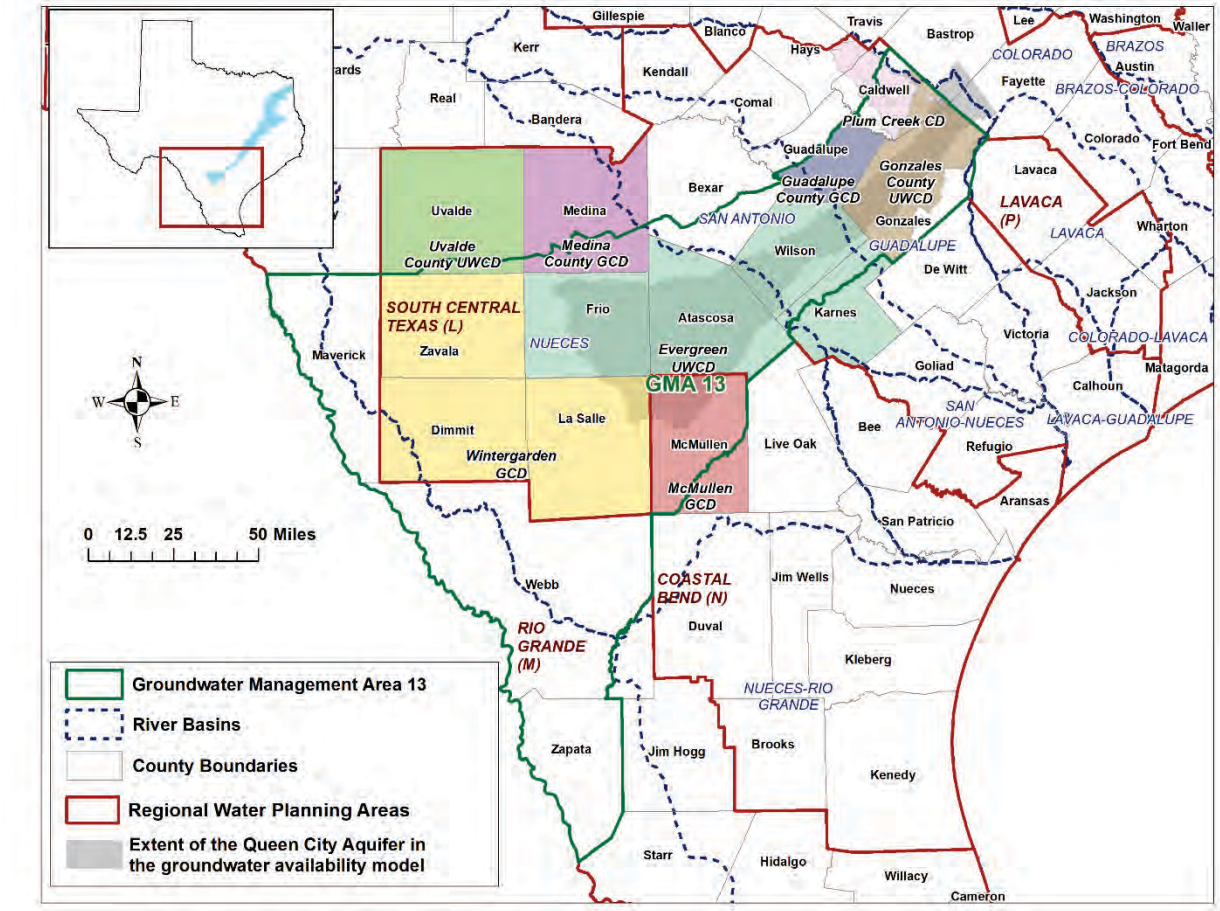


FIGURE 2. GROUNDWATER MANAGEMENT AREA (GMA) 13 BOUNDARY, REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE QUEEN CITY AQUIFER.

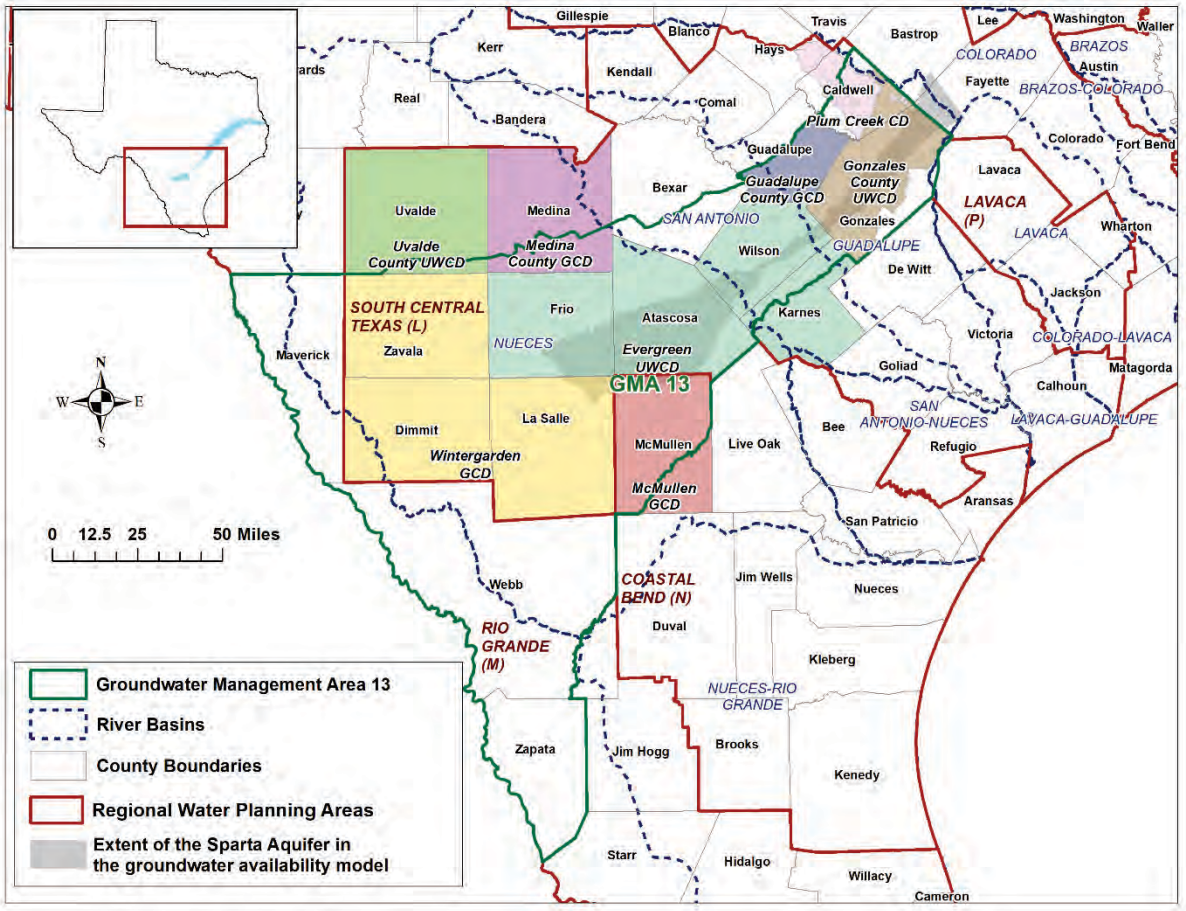


FIGURE 3. GROUNDWATER MANAGEMENT AREA (GMA) 13 BOUNDARY, REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE SPARTA AQUIFER.

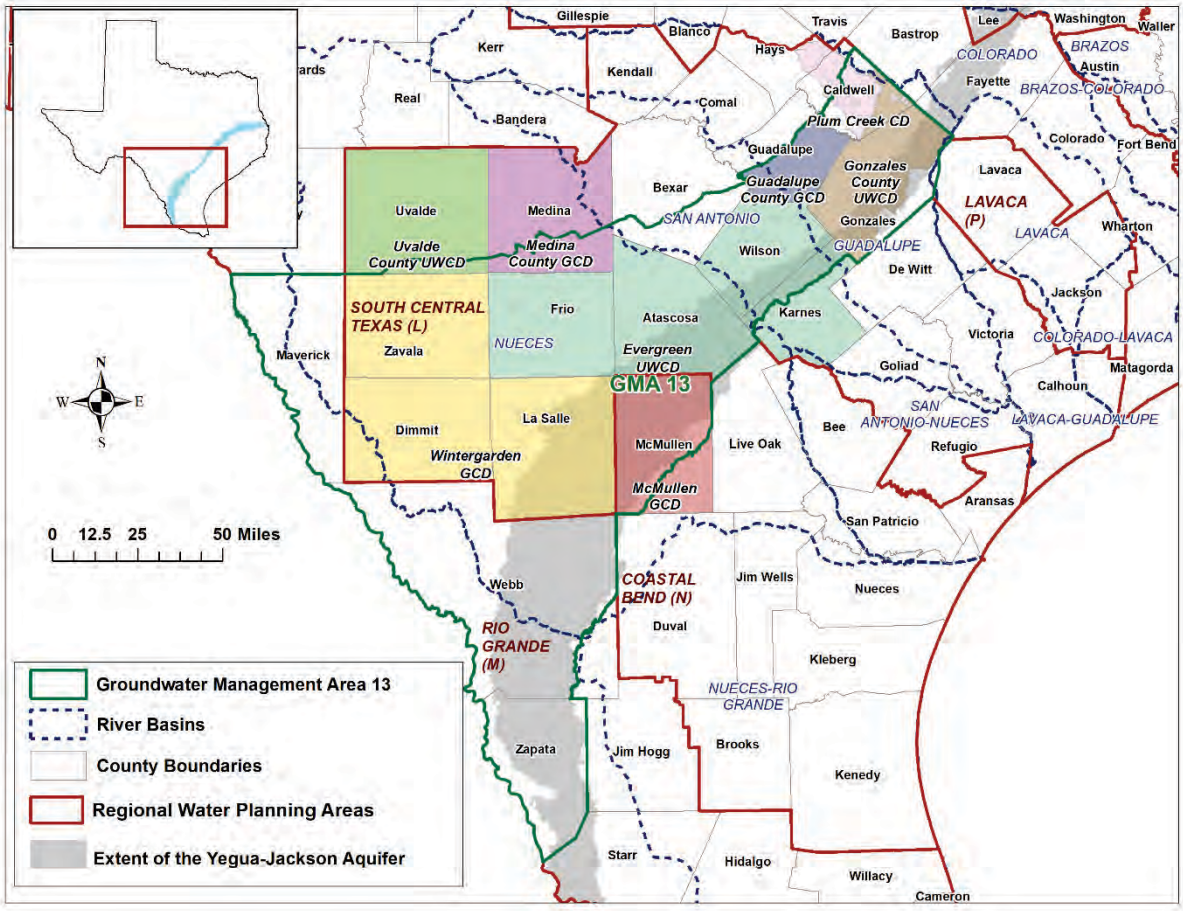


FIGURE 4. GROUNDWATER MANAGEMENT AREA (GMA) 13 BOUNDARY, REGIONAL WATER PLANNING AREAS (RWPAS), RIVER BASINS, GROUNDWATER CONSERVATION DISTRICTS (GCDS), AND COUNTIES OVERLAIN ON THE EXTENT OF THE YEGUA-JACKSON AQUIFER.

TABLE 1. MODELED AVAILABLE GROUNDWATER FOR THE CARRIZO-WILCOX AQUIFER IN GROUNDWATER MANAGEMENT AREA 13 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Evergreen UWCD	Atascosa	Carrizo-Wilcox	51,924	54,397	55,329	56,828	58,406	59,982	59,982
Evergreen UWCD	Frio	Carrizo-Wilcox	114,827	86,995	85,143	82,950	81,018	79,131	79,131
Evergreen UWCD	Karnes	Carrizo-Wilcox	693	758	843	931	1,001	1,043	1,043
Evergreen UWCD	Wilson	Carrizo-Wilcox	38,229	38,284	43,604	68,609	105,947	125,670	125,670
Evergreen UWCD Total		**Carrizo-Wilcox**	**205,673**	**180,434**	**184,919**	**209,318**	**246,372**	**265,826**	**265,826**
Gonzales County UWCD	Caldwell	Carrizo-Wilcox	468	9,472	16,401	25,510	30,087	30,087	30,087
Gonzales County UWCD	Gonzales	Carrizo-Wilcox	60,431	76,265	90,788	102,373	102,747	103,707	96,161
Gonzales County UWCD Total		**Carrizo-Wilcox**	**60,899**	**85,737**	**107,189**	**127,883**	**132,834**	**133,794**	**126,248**
Guadalupe County GCD	**Guadalupe**	**Carrizo-Wilcox**	**55,637**	**39,563**	**41,668**	**43,315**	**42,118**	**42,199**	**41,659**
McMullen GCD	**McMullen**	**Carrizo-Wilcox**	**7,789**	**7,768**	**4,867**	**4,854**	**4,854**	**4,854**	**4,854**
Medina County GCD	**Medina**	**Carrizo-Wilcox**	**2,635**	**2,628**	**2,635**	**2,628**	**2,628**	**2,628**	**2,628**
Plum Creek CD	**Caldwell**	**Carrizo-Wilcox**	**17,673**	**15,366**	**16,335**	**16,965**	**15,562**	**19,509**	**19,468**
Uvalde County UWCD	**Uvalde**	**Carrizo-Wilcox**	**0**[1]	**0**	**0**	**0**	**0**	**0**	**0**

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

TABLE 1 (CONTINUED)

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Wintergarden GCD	Dimmit	Carrizo-Wilcox	**3,895**	**3,885**	**3,895**	**3,885**	**3,885**	**3,885**	**3,885**
Wintergarden GCD	La Salle	Carrizo-Wilcox	**6,554**	**6,536**	**6,554**	**6,536**	**6,536**	**6,536**	**6,536**
Wintergarden GCD	Zavala	Carrizo-Wilcox	**38,303**	**36,675**	**35,399**	**35,204**	**35,006**	**34,831**	**34,540**
Wintergarden GCD Total		**Carrizo-Wilcox**	**48,752**	**47,096**	**45,848**	**45,625**	**45,427**	**45,252**	**44,961**
No District-County	Bexar	Carrizo-Wilcox	69,727	68,451	68,928	68,739	67,653	67,849	67,849
No District-County	Caldwell	Carrizo-Wilcox	39	39	39	39	39	39	39
No District-County	Gonzales	Carrizo-Wilcox	0[2]	0	0	0	0	0	0
No District-County	Maverick	Carrizo-Wilcox	547	545	547	545	545	276	276
No District-County	Webb	Carrizo-Wilcox	912	910	912	910	910	910	910
No District-County Total		**Carrizo-Wilcox**	**71,225**	**69,945**	**70,426**	**70,233**	**69,147**	**69,074**	**69,074**
Total for GMA 13		**Carrizo-Wilcox**	**470,283**	**448,537**	**473,887**	**520,821**	**558,942**	**583,136**	**574,718**

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

TABLE 2. MODELED AVAILABLE GROUNDWATER FOR THE QUEEN CITY AQUIFER IN GROUNDWATER MANAGEMENT AREA 13 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Evergreen UWCD	Atascosa	Queen City	4,070	4,525	4,537	4,495	4,390	4,285	4,285
Evergreen UWCD	Frio	Queen City	6,702	4,533	4,380	4,231	4,066	3,927	3,927
Evergreen UWCD	Wilson	Queen City	2,631	1,423	1,267	1,123	1,000	892	892
Evergreen UWCD Total		**Queen City**	**13,403**	**10,481**	**10,184**	**9,849**	**9,456**	**9,104**	**9,104**
Gonzales County UWCD	Caldwell	Queen City	4,842	4,829	4,557	4,545	4,545	3,977	3,977
Gonzales County UWCD	Gonzales	Queen City	4,973	4,960	4,973	4,960	4,960	4,500	4,500
Gonzales County UWCD Total		**Queen City**	**9,815**	**9,789**	**9,530**	**9,505**	**9,505**	**8,477**	**8,477**
Guadalupe County GCD	**Guadalupe**	**Queen City**	**0**[3]	**0**	**0**	**0**	**0**	**0**	**0**
McMullen GCD	**McMullen**	**Queen City**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
Plum Creek CD	**Caldwell**	**Queen City**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Wintergarden GCD	**La Salle**	**Queen City**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Total for GMA 13		**Queen City**	**23,222**	**20,274**	**19,718**	**19,358**	**18,965**	**17,585**	**17,585**

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

TABLE 3. MODELED AVAILABLE GROUNDWATER FOR THE SPARTA AQUIFER IN GROUNDWATER MANAGEMENT AREA 13 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Evergreen UWCD	Atascosa	Sparta	1,218	1,187	1,043	998	961	932	932
Evergreen UWCD	Frio	Sparta	897	623	603	576	557	534	534
Evergreen UWCD	Wilson	Sparta	335	182	163	144	128	114	114
Evergreen UWCD Total		**Sparta**	**2,450**	**1,992**	**1,809**	**1,718**	**1,646**	**1,580**	**1,580**
Gonzales County UWCD	**Gonzales**	**Sparta**	**3,524**	**2,451**	**2,457**	**2,451**	**2,451**	**2,451**	**2,451**
McMullen GCD	**McMullen**	**Sparta**	**0**[4]	**0**	**0**	**0**	**0**	**0**	**0**
Wintergarden GCD	**La Salle**	**Sparta**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total for GMA 13		**Sparta**	**5,974**	**4,443**	**4,266**	**4,169**	**4,097**	**4,031**	**4,031**

TABLE 4. MODELED AVAILABLE GROUNDWATER FOR THE YEGUA-JACKSON AQUIFER IN GROUNDWATER MANAGEMENT AREA 13 SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

Groundwater Conservation District	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Evergreen UWCD	Karnes	Yegua-Jackson	2,013	2,013	2,013	2,013	2,013	2,013	2,013
Gonzales County UWCD	Gonzales	Yegua-Jackson	4,155	4,155	4,155	4,155	4,155	4,155	4,155
No District-County	Gonzales	Yegua-Jackson	573	573	573	573	573	573	573
Total for GMA 13		**Yegua-Jackson**	**6,741**	**6,741**	**6,741**	**6,741**	**6,741**	**6,741**	**6,741**

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

TABLE 5. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE CARRIZO-WILCOX AQUIFER IN GROUNDWATER MANAGEMENT AREA 13. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

County	RWPA	River Basin	Aquifer	2030	2040	2050	2060	2070	2080
Atascosa	L	Nueces	Carrizo-Wilcox	54,310	55,241	56,739	58,316	59,890	59,890
Atascosa	L	San Antonio	Carrizo-Wilcox	87	88	89	90	92	92
Bexar	L	Nueces	Carrizo-Wilcox	38,762	38,993	39,134	39,134	39,287	39,287
Bexar	L	San Antonio	Carrizo-Wilcox	29,689	29,935	29,605	28,519	28,562	28,562
Caldwell	L	Colorado	Carrizo-Wilcox	0[5]	0	0	0	0	0
Caldwell	L	Guadalupe	Carrizo-Wilcox	24,877	32,775	42,514	45,688	49,635	49,594
Dimmit	L	Nueces	Carrizo-Wilcox	3,765	3,775	3,765	3,765	3,765	3,765
Dimmit	L	Rio Grande	Carrizo-Wilcox	120	120	120	120	120	120
Frio	L	Nueces	Carrizo-Wilcox	86,995	85,143	82,950	81,018	79,131	79,131
Gonzales	L	Guadalupe	Carrizo-Wilcox	76,265	90,788	102,373	102,747	103,707	96,161
Gonzales	L	Lavaca	Carrizo-Wilcox	0	0	0	0	0	0
Guadalupe	L	Guadalupe	Carrizo-Wilcox	32,400	34,200	35,631	34,655	34,736	34,345
Guadalupe	L	San Antonio	Carrizo-Wilcox	7,163	7,468	7,684	7,463	7,463	7,314
Karnes	L	Guadalupe	Carrizo-Wilcox	0	0	0	0	0	0
Karnes	L	Nueces	Carrizo-Wilcox	0	0	0	0	0	0
Karnes	L	San Antonio	Carrizo-Wilcox	758	843	931	1,001	1,043	1,043
La Salle	L	Nueces	Carrizo-Wilcox	6,536	6,554	6,536	6,536	6,536	6,536
Medina	L	Nueces	Carrizo-Wilcox	2,623	2,630	2,623	2,623	2,623	2,623

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

TABLE 5 (CONTINUED)

County	RWPA	River Basin	Aquifer	2030	2040	2050	2060	2070	2080
Medina	L	San Antonio	Carrizo-Wilcox	5	5	5	5	5	5
Uvalde	L	Nueces	Carrizo-Wilcox	0[6]	0	0	0	0	0
Wilson	L	Guadalupe	Carrizo-Wilcox	443	653	762	3,870	3,982	3,982
Wilson	L	Nueces	Carrizo-Wilcox	10,774	11,171	11,578	12,027	12,546	12,546
Wilson	L	San Antonio	Carrizo-Wilcox	27,067	31,780	56,269	90,050	109,142	109,142
Zavala	L	Nueces	Carrizo-Wilcox	36,675	35,399	35,204	35,006	34,831	34,540
Maverick	M	Nueces	Carrizo-Wilcox	542	544	542	542	273	273
Maverick	M	Rio Grande	Carrizo-Wilcox	3	3	3	3	3	3
Webb	M	Nueces	Carrizo-Wilcox	890	892	890	890	890	890
Webb	M	Rio Grande	Carrizo-Wilcox	20	20	20	20	20	20
McMullen	N	Nueces	Carrizo-Wilcox	7,768	4,867	4,854	4,854	4,854	4,854
GMA 13 Total			**Carrizo-Wilcox**	**448,537**	**473,887**	**520,821**	**558,942**	**583,136**	**574,718**

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

TABLE 6. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE QUEEN CITY AQUIFER IN GROUNDWATER MANAGEMENT AREA 13. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

County	RWPA	River Basin	Aquifer	2030	2040	2050	2060	2070	2080
Atascosa	L	Nueces	Queen City	4,525	4,537	4,495	4,390	4,285	4,285
Caldwell	L	Guadalupe	Queen City	4,829	4,557	4,545	4,545	3,977	3,977
Frio	L	Nueces	Queen City	4,533	4,380	4,231	4,066	3,927	3,927
Gonzales	L	Guadalupe	Queen City	4,960	4,973	4,960	4,960	4,500	4,500
Guadalupe	L	Guadalupe	Queen City	0[7]	0	0	0	0	0
La Salle	L	Nueces	Queen City	1	1	1	1	1	1
Wilson	L	Guadalupe	Queen City	106	95	84	75	67	67
Wilson	L	Nueces	Queen City	181	161	143	127	114	114
Wilson	L	San Antonio	Queen City	1,136	1,011	896	798	711	711
McMullen	N	Nueces	Queen City	3	3	3	3	3	3
GMA 13 Total			**Queen City**	**20,274**	**19,718**	**19,358**	**18,965**	**17,585**	**17,585**

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

TABLE 7. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE SPARTA AQUIFER IN GROUNDWATER MANAGEMENT AREA 13. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

County	RWPA	River Basin	Aquifer	2030	2040	2050	2060	2070	2080
Atascosa	L	Nueces	Sparta	1,187	1,043	998	961	932	932
Frio	L	Nueces	Sparta	623	603	576	557	534	534
Gonzales	L	Guadalupe	Sparta	2,451	2,457	2,451	2,451	2,451	2,451
La Salle	L	Nueces	Sparta	0[8]	0	0	0	0	0
Wilson	L	Guadalupe	Sparta	12	11	10	9	8	8
Wilson	L	Nueces	Sparta	19	17	15	13	12	12
Wilson	L	San Antonio	Sparta	151	135	119	106	94	94
McMullen	N	Nueces	Sparta	0	0	0	0	0	0
GMA 13 Total			**Sparta**	**4,443**	**4,266**	**4,169**	**4,097**	**4,031**	**4,031**

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

TABLE 8. MODELED AVAILABLE GROUNDWATER BY DECADE FOR THE YEGUA-JACKSON AQUIFER IN GROUNDWATER MANAGEMENT AREA 13. RESULTS ARE IN ACRE-FEET PER YEAR AND ARE SUMMARIZED BY COUNTY, REGIONAL WATER PLANNING AREA (RWPA), RIVER BASIN, AND AQUIFER.

County	RWPA	River Basin	Aquifer	2030	2040	2050	2060	2070	2080
Atascosa	L	Nueces	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Frio	L	Nueces	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Gonzales	L	Guadalupe	Yegua-Jackson	4,709	4,709	4,709	4,709	4,709	4,709
Gonzales	L	Lavaca	Yegua-Jackson	19	19	19	19	19	19
Karnes	L	Guadalupe	Yegua-Jackson	292	292	292	292	292	292
Karnes	L	Nueces	Yegua-Jackson	91	91	91	91	91	91
Karnes	L	San Antonio	Yegua-Jackson	1,630	1,630	1,630	1,630	1,630	1,630
La Salle	L	Nueces	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Wilson	L	Guadalupe	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Wilson	L	Nueces	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Wilson	L	San Antonio	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Webb	M	Nueces	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Webb	M	Rio Grande	Yegua-Jackson	NR	NR	NR	NR	NR	NR
Zapata	M	Rio Grande	Yegua-Jackson	NR	NR	NR	NR	NR	NR
McMullen	N	Nueces	Yegua-Jackson	NR	NR	NR	NR	NR	NR
GMA 13 Total			**Yegua-Jackson**	**6,741**	**6,741**	**6,741**	**6,741**	**6,741**	**6,741**

NR: Groundwater Management Area 13 declared the Yegua-Jackson Aquifer not relevant in these areas.

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:

Deeds, N., Kelley, V., Fryar, D., Jones, T., Whallon, A.J., and Dean, K.E., 2003, Groundwater Availability Model for the Southern Carrizo-Wilcox Aquifer: Contract report to the Texas Water Development Board, 452 p., http://www.twdb.texas.gov/groundwater/models/gam/czwx_s/CZWX_S_Full_Report.pdf.

Deeds, N. E., Yan, T., Singh, A., Jones, T. L., Kelley, V. A., Knox, P. R., and Young, S. C., 2010, Groundwater availability model for the Yegua-Jackson Aquifer: Final report prepared for the Texas Water Development Board by INTERA, Inc., 582 p., http://www.twdb.texas.gov/groundwater/models/gam/ygjk/YGJK_Model_Report.pdf.

Furnans, J., 2022, Technical Memorandum: Groundwater Availability Modeling Technical Elements, Memo to Groundwater Management Area 13, 5p.

Groundwater Management Area 13 Joint Planning Committee, Furnans, J., and Keester, M., 2022, 2021 Joint Planning Desired Future Conditions Explanatory Report, 510 p.

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 Ground-Water Flow Model: U.S. Geological Survey, Open-File Report 96-485.

Harbaugh, A. W., Banta, E. R., Hill, M. C., and McDonald, M. G., 2000, MODFLOW-2000, the U.S. Geological Survey modular ground-water model -- User guide to modularization concepts and the Ground-Water Flow Process: U.S. Geological Survey Open-File Report 00-92, 121 p.

Hutchison, W.R., 2017a, GMA 13 Technical Memorandum 16-08 Final, Sparta, Queen City, and Carrizo-Wilcox Aquifers: Summary of Scenario 9 Drawdown and Outcrop Results, 13 p.

Hutchison, W.R., 2017b, GMA 13 Technical Memorandum 17-01 Final, Extension of GAM Calibration Period for Carrizo-Wilcox, Queen City, and Sparta Aquifers, 81p.

Kelley, V.A., Deeds, N.E., Fryar, D.G., and Nicot, J.P., 2004, Groundwater availability models for the Queen City and Sparta aquifers: Contract report to the Texas Water Development Board, 867 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.

Oliver, W., 2010, GAM Task 10-012 Model Run Report: Texas Water Development Board, GAM Task 10-012 Report, 48 p., http://www.twdb.texas.gov/groundwater/docs/GAMruns/Task10-012.pdf

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

APPENDIX A

Total Pumping Associated with Modeled Available Groundwater Run for the Carrizo-Wilcox Aquifer Split by Model Layers for Groundwater Management Area 13

TABLE A.1. TOTAL PUMPING SPLIT BY MODEL LAYERS FROM THE MODELED AVAILABLE GROUNDWATER RUN FOR THE CARRIZO-WILCOX AQUIFER IN GROUNDWATER MANAGEMENT AREA 13. THE VALUES ARE SUMMARIZED BY GROUNDWATER CONSERVATION DISTRICT (GCD) AND COUNTY FOR EACH DECADE BETWEEN 2020 AND 2080. VALUES ARE IN ACRE-FEET PER YEAR.

GCD	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Evergreen UWCD	Atascosa	Carrizo	50,266	52,745	53,671	55,176	56,754	58,330	58,330
Evergreen UWCD	Atascosa	Upper Wilcox	250	249	250	249	249	249	249
Evergreen UWCD	Atascosa	Middle Wilcox	224	223	224	223	223	223	223
Evergreen UWCD	Atascosa	Lower Wilcox	1,184	1,180	1,184	1,180	1,180	1,180	1,180
Evergreen UWCD	Frio	Carrizo	114,827	86,995	85,143	82,950	81,018	79,131	79,131
Evergreen UWCD	Frio	Upper Wilcox	0[9]	0	0	0	0	0	0
Evergreen UWCD	Frio	Middle Wilcox	0	0	0	0	0	0	0
Evergreen UWCD	Frio	Lower Wilcox	0	0	0	0	0	0	0
Evergreen UWCD	Karnes	Carrizo	693	758	843	931	1,001	1,043	1,043
Evergreen UWCD	Karnes	Upper Wilcox	0	0	0	0	0	0	0
Evergreen UWCD	Karnes	Middle Wilcox	0	0	0	0	0	0	0
Evergreen UWCD	Karnes	Lower Wilcox	0	0	0	0	0	0	0
Evergreen UWCD	Wilson	Carrizo	36,086	32,648	34,096	35,482	36,994	38,730	38,730
Evergreen UWCD	Wilson	Upper Wilcox	125	125	125	125	125	125	125
Evergreen UWCD	Wilson	Middle Wilcox	125	125	125	125	125	125	125
Evergreen UWCD	Wilson	Lower Wilcox	1,893	5,386	9,258	32,877	68,703	86,690	86,690
Evergreen UWCD Total		**Carrizo-Wilcox**	**205,673**	**180,434**	**184,919**	**209,318**	**246,372**	**265,826**	**265,826**

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

TABLE A.1. (CONTINUED)

GCD	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Gonzales County UWCD	Caldwell	Carrizo	453	9,457	16,386	25,495	30,072	30,072	30,072
Gonzales County UWCD	Caldwell	Upper Wilcox	15	15	15	15	15	15	15
Gonzales County UWCD	Caldwell	Middle Wilcox	0[10]	0	0	0	0	0	0
Gonzales County UWCD	Caldwell	Lower Wilcox	0	0	0	0	0	0	0
Gonzales County UWCD	Gonzales	Carrizo	47,131	51,908	55,242	55,832	56,206	57,166	49,620
Gonzales County UWCD	Gonzales	Upper Wilcox	0	0	0	0	0	0	0
Gonzales County UWCD	Gonzales	Middle Wilcox	11,096	15,563	20,114	24,556	24,556	24,556	24,556
Gonzales County UWCD	Gonzales	Lower Wilcox	2,204	8,794	15,432	21,985	21,985	21,985	21,985
Gonzales County UWCD Total		**Carrizo-Wilcox**	**60,899**	**85,737**	**107,189**	**127,883**	**132,834**	**133,794**	**126,248**
Guadalupe County GCD	Guadalupe	Carrizo	28,943	14,834	14,627	14,532	14,224	14,624	14,624
Guadalupe County GCD	Guadalupe	Upper Wilcox	0	0	0	0	0	0	0

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

TABLE A.1 (CONTINUED)

GCD	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Guadalupe County GCD	Guadalupe	Middle Wilcox	6,609	6,373	7,926	9,428	9,207	9,075	8,986
Guadalupe County GCD	Guadalupe	Lower Wilcox	20,085	18,356	19,115	19,355	18,687	18,500	18,049
Guadalupe County GCD Total		**Carrizo-Wilcox**	**55,637**	**39,563**	**41,668**	**43,315**	**42,118**	**42,199**	**41,659**
McMullen County GCD	McMullen	Carrizo	7,789	7,768	4,867	4,854	4,854	4,854	4,854
McMullen County GCD	McMullen	Upper Wilcox	0[11]	0	0	0	0	0	0
McMullen County GCD	McMullen	Middle Wilcox	0	0	0	0	0	0	0
McMullen County GCD	McMullen	Lower Wilcox	0	0	0	0	0	0	0
McMullen County GCD Total		**Carrizo-Wilcox**	**7,789**	**7,768**	**4,867**	**4,854**	**4,854**	**4,854**	**4,854**
Medina County GCD	Medina	Carrizo	517	515	517	515	515	515	515
Medina County GCD	Medina	Upper Wilcox	0	0	0	0	0	0	0
Medina County GCD	Medina	Middle Wilcox	1,252	1,249	1,252	1,249	1,249	1,249	1,249
Medina County GCD	Medina	Lower Wilcox	866	864	866	864	864	864	864
Medina County GCD Total		**Carrizo-Wilcox**	**2,635**	**2,628**	**2,635**	**2,628**	**2,628**	**2,628**	**2,628**
Plum Creek CD	Caldwell	Carrizo	0	1,990	5,048	5,709	6,046	9,993	9,993
Plum Creek CD	Caldwell	Upper Wilcox	0	0	0	0	0	0	0
Plum Creek CD	Caldwell	Middle Wilcox	5,733	5,717	5,733	5,717	3,977	3,977	3,936
Plum Creek CD	Caldwell	Lower Wilcox	11,940	7,659	5,554	5,539	5,539	5,539	5,539
Plum Creek CD Total		**Carrizo-Wilcox**	**17,673**	**15,366**	**16,335**	**16,965**	**15,562**	**19,509**	**19,468**

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

TABLE A.1 (CONTINUED)

GCD	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
Uvalde County GCD	Uvalde	Carrizo	0[12]	0	0	0	0	0	0
Uvalde County GCD	Uvalde	Upper Wilcox	0	0	0	0	0	0	0
Uvalde County GCD	Uvalde	Middle Wilcox	0	0	0	0	0	0	0
Uvalde County GCD	Uvalde	Lower Wilcox	0	0	0	0	0	0	0
Uvalde County GCD Total		**Carrizo-Wilcox**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Wintergarden GCD	Dimmit	Carrizo	2,722	2,715	2,722	2,715	2,715	2,715	2,715
Wintergarden GCD	Dimmit	Upper Wilcox	993	990	993	990	990	990	990
Wintergarden GCD	Dimmit	Middle Wilcox	142	142	142	142	142	142	142
Wintergarden GCD	Dimmit	Lower Wilcox	38	38	38	38	38	38	38
Wintergarden GCD	La Salle	Carrizo	4,597	4,584	4,597	4,584	4,584	4,584	4,584
Wintergarden GCD	La Salle	Upper Wilcox	1,957	1,952	1,957	1,952	1,952	1,952	1,952
Wintergarden GCD	La Salle	Middle Wilcox	0	0	0	0	0	0	0
Wintergarden GCD	La Salle	Lower Wilcox	0	0	0	0	0	0	0
Wintergarden GCD	Zavala	Carrizo	27,969	26,368	25,065	24,897	24,699	24,524	24,233
Wintergarden GCD	Zavala	Upper Wilcox	6,329	6,312	6,329	6,312	6,312	6,312	6,312
Wintergarden GCD	Zavala	Middle Wilcox	3,683	3,673	3,683	3,673	3,673	3,673	3,673
Wintergarden GCD	Zavala	Lower Wilcox	322	322	322	322	322	322	322
Wintergarden GCD Total		**Carrizo-Wilcox**	**48,752**	**47,096**	**45,848**	**45,625**	**45,427**	**45,252**	**44,961**
No District-County	Bexar	Carrizo	43,057	42,939	43,346	43,227	43,227	43,423	43,423
No District-County	Bexar	Upper Wilcox	10	10	10	10	10	10	10
No District-County	Bexar	Middle Wilcox	58	58	58	58	58	58	58
No District-County	Bexar	Lower Wilcox	26,602	25,444	25,514	25,444	24,358	24,358	24,358

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

TABLE A.1 (CONTINUED)

GCD	County	Aquifer	2020	2030	2040	2050	2060	2070	2080
No District-County	Caldwell	Carrizo	NP[13]	NP	NP	NP	NP	NP	NP
No District-County	Caldwell	Upper Wilcox	NP	NP	NP	NP	NP	NP	NP
No District-County	Caldwell	Middle Wilcox	39	39	39	39	39	39	39
No District-County	Caldwell	Lower Wilcox	0[14]	0	0	0	0	0	0
No District-County	Gonzales	Carrizo	0	0	0	0	0	0	0
No District-County	Gonzales	Upper Wilcox	0	0	0	0	0	0	0
No District-County	Gonzales	Middle Wilcox	0	0	0	0	0	0	0
No District-County	Gonzales	Lower Wilcox	0	0	0	0	0	0	0
No District-County	Maverick	Carrizo	543	541	543	541	541	272	272
No District-County	Maverick	Upper Wilcox	0	0	0	0	0	0	0
No District-County	Maverick	Middle Wilcox	2	2	2	2	2	2	2
No District-County	Maverick	Lower Wilcox	2	2	2	2	2	2	2
No District-County	Web	Carrizo	898	896	898	896	896	896	896
No District-County	Web	Upper Wilcox	13	13	13	13	13	13	13
No District-County	Web	Middle Wilcox	1	1	1	1	1	1	1
No District-County	Web	Lower Wilcox	0	0	0	0	0	0	0
No District-County Total		**Carrizo-Wilcox**	**71,225**	**69,945**	**70,426**	**70,233**	**69,147**	**69,074**	**69,074**
Total for GMA 13		**Carrizo-Wilcox**	**470,283**	**448,537**	**473,887**	**520,821**	**558,942**	**583,136**	**574,718**

[13] NP: The aquifer is not present in this part of the county.
[14] A zero value indicates the groundwater availability model pumping scenario did not include any pumping in the aquifer.

APPENDIX 6

Estimated Historical Groundwater Use
And
2022 State Water Plan Datasets

Estimated Historical Groundwater Use And 2022 State Water Plan Datasets:

Gonzales County Underground Water Conservation District

Texas Water Development Board
Groundwater Division
Groundwater Technical Assistance Section
stephen.allen@twdb.texas.gov
(512) 463-7317
October 9, 2023

GROUNDWATER MANAGEMENT PLAN DATA:

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

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

The five reports included in this part are:

1. Estimated Historical Groundwater Use (checklist item 2)

   from the TWDB Historical Water Use Survey (WUS)
2. Projected Surface Water Supplies (checklist item 6)
3. Projected Water Demands (checklist item 7)
4. Projected Water Supply Needs (checklist item 8)
5. Projected Water Management Strategies (checklist item 9)

   from the 2022 Texas State Water Plan (SWP)

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

DISCLAIMER:

The data presented in this report represents the most up to date WUS and 2022 SWP data available as of 10/9/2023. Although it does not happen frequently, either of these datasets are subject to change pending the availability of more accurate WUS data or an amendment to the 2022 SWP. District personnel must review these datasets and correct any discrepancies 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 2022 SWP dataset can be verified by contacting Sabrina Anderson (sabrina.anderson@twdb.texas.gov or 512-936-0886).

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

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

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

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

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

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

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

CALDWELL COUNTY

21.83% (multiplier)

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2019	GW	393	0	0	0	104	50	547
	SW	673	3	0	0	47	203	926
2018	GW	376	0	0	0	100	50	526
	SW	704	3	0	0	32	199	938
2017	GW	423	0	0	0	85	47	555
	SW	682	0	0	0	37	188	907
2016	GW	400	0	0	0	87	31	518
	SW	668	3	0	0	18	124	813
2015	GW	396	0	0	0	88	31	515
	SW	641	2	0	0	11	122	776
2014	GW	446	0	0	0	142	34	622
	SW	644	1	0	0	12	137	794
2013	GW	443	0	0	0	126	32	601
	SW	639	1	0	0	8	129	777
2012	GW	511	0	0	0	165	32	708
	SW	684	0	0	0	17	129	830
2011	GW	655	0	0	0	223	37	915
	SW	688	0	0	0	17	145	850
2010	GW	575	0	1	0	156	37	769
	SW	669	0	1	0	8	147	825
2009	GW	593	0	0	0	32	36	661
	SW	629	0	0	0	4	143	776
2008	GW	541	0	0	0	57	38	636
	SW	685	0	0	0	249	153	1,087
2007	GW	617	0	0	0	13	45	675
	SW	674	0	0	0	257	181	1,112
2006	GW	670	0	0	0	75	42	787
	SW	590	0	0	0	0	168	758
2005	GW	479	0	0	0	66	59	604
	SW	532	0	0	0	5	236	773
2004	GW	814	0	0	0	35	17	866
	SW	298	0	0	0	5	213	516

GONZALES COUNTY

84.64% (multiplier)

All values are in acre-feet

Year	Source	Municipal	Manufacturing	Mining	Steam Electric	Irrigation	Livestock	Total
2019	GW	2,099	1,441	4,566	0	3,012	2,930	14,048
	SW	1,014	36	806	0	292	976	3,124
2018	GW	1,988	1,393	4,046	0	2,429	2,879	12,735
	SW	989	31	776	0	711	960	3,467
2017	GW	2,031	1,359	2,158	0	2,261	2,779	10,588
	SW	1,059	29	556	0	697	926	3,267
2016	GW	2,213	1,308	1,992	0	1,903	2,575	9,991
	SW	1,102	27	493	0	734	858	3,214
2015	GW	2,346	1,282	2,147	0	2,066	2,507	10,348
	SW	1,041	27	581	0	617	835	3,101
2014	GW	2,431	1,173	3,115	0	4,064	5,869	16,652
	SW	1,113	28	711	0	0	1,956	3,808
2013	GW	2,374	1,210	3,232	0	2,794	5,977	15,587
	SW	1,327	20	682	0	1,199	1,992	5,220
2012	GW	3,468	1,209	1,418	0	2,215	5,950	14,260
	SW	381	20	487	0	1,011	1,983	3,882
2011	GW	3,824	1,427	838	0	4,533	6,263	16,885
	SW	313	27	438	0	1,232	2,087	4,097
2010	GW	2,078	1,223	184	0	3,028	6,322	12,835
	SW	1,466	30	362	0	730	2,108	4,696
2009	GW	1,863	1,689	3	0	1,410	2,880	7,845
	SW	1,804	34	219	0	998	960	4,015
2008	GW	2,116	1,247	0	0	2,426	3,006	8,795
	SW	1,807	48	306	0	1,069	1,006	4,236
2007	GW	1,458	1,265	30	0	1,517	2,917	7,187
	SW	1,551	43	0	0	677	978	3,249
2006	GW	1,813	1,322	30	0	2,222	3,133	8,520
	SW	1,851	39	0	0	0	1,050	2,940
2005	GW	1,648	1,207	30	0	1,199	3,096	7,180
	SW	2,121	37	0	0	296	1,038	3,492
2004	GW	1,384	1,211	30	0	965	389	3,979
	SW	2,066	30	0	0	305	3,583	5,984

Projected Surface Water Supplies
TWDB 2022 State Water Plan Data

CALDWELL COUNTY

21.83% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
L	County Line SUD	Guadalupe	Canyon Lake/Reservoir	403	403	371	340	306	270
L	County-Other, Caldwell	Guadalupe	Guadalupe Run-of-River	0	0	0	0	0	0
L	Gonzales County WSC	Guadalupe	Canyon Lake/Reservoir	9	10	11	12	12	13
L	Livestock, Caldwell	Colorado	Colorado Livestock Local Supply	7	7	7	7	7	7
L	Livestock, Caldwell	Guadalupe	Guadalupe Livestock Local Supply	103	103	103	103	103	103
L	Martindale WSC	Guadalupe	Canyon Lake/Reservoir	226	224	222	220	218	218
L	Martindale WSC	Guadalupe	Guadalupe Run-of-River	11	11	11	11	11	11
L	Maxwell WSC	Guadalupe	Canyon Lake/Reservoir	694	710	720	724	727	727
L	Maxwell WSC	Guadalupe	Guadalupe Run-of-River	9	10	10	10	10	10
L	San Marcos	Guadalupe	Canyon Lake/Reservoir	2	2	2	3	3	3
L	Tri Community WSC	Guadalupe	Guadalupe Run-of-River	492	490	490	491	490	490
	Sum of Projected Surface Water Supplies (acre-feet)			**1,956**	**1,970**	**1,947**	**1,921**	**1,887**	**1,852**

GONZALES COUNTY

84.64% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	Source Name	2020	2030	2040	2050	2060	2070
L	Gonzales	Guadalupe	Guadalupe Run-of-River	2,240	2,240	2,240	2,240	2,240	2,240
L	Gonzales County WSC	Guadalupe	Canyon Lake/Reservoir	318	317	317	317	317	317
L	Irrigation, Gonzales	Guadalupe	Canyon Lake/Reservoir	6	6	6	6	6	6
L	Irrigation, Gonzales	Guadalupe	Guadalupe Run-of-River	0	0	0	0	0	0
L	Livestock, Gonzales	Guadalupe	Guadalupe Livestock Local Supply	3,959	3,959	3,959	3,959	3,959	3,959
L	Livestock, Gonzales	Lavaca	Guadalupe Livestock Local Supply	91	91	91	91	91	91
	Sum of Projected Surface Water Supplies (acre-feet)			**6,614**	**6,613**	**6,613**	**6,613**	**6,613**	**6,613**

Projected Water Demands
TWDB 2022 State Water Plan Data

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

CALDWELL COUNTY

21.83% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	Aqua WSC	Colorado	43	51	59	68	77	86
L	Aqua WSC	Guadalupe	241	288	336	384	434	483
L	County Line SUD	Guadalupe	226	318	384	436	468	480
L	County-Other, Caldwell	Colorado	6	3	3	3	4	5
L	County-Other, Caldwell	Guadalupe	25	13	14	14	18	21
L	Creedmoor-Maha WSC	Colorado	167	186	207	231	257	283
L	Creedmoor-Maha WSC	Guadalupe	15	17	18	21	23	25
L	Goforth SUD	Guadalupe	45	43	43	43	42	42
L	Gonzales County WSC	Guadalupe	54	65	76	87	98	110
L	Irrigation, Caldwell	Colorado	5	5	5	5	5	5
L	Irrigation, Caldwell	Guadalupe	170	170	170	170	170	170
L	Livestock, Caldwell	Colorado	12	12	12	12	12	12
L	Livestock, Caldwell	Guadalupe	160	160	160	160	160	160
L	Lockhart	Guadalupe	2,258	2,683	3,114	3,557	4,021	4,477
L	Luling	Guadalupe	956	1,131	1,309	1,493	1,688	1,879
L	Manufacturing, Caldwell	Guadalupe	1	1	1	1	1	1
L	Martindale WSC	Guadalupe	361	453	529	626	747	894
L	Maxwell WSC	Guadalupe	428	503	579	659	745	829
L	Mining, Caldwell	Colorado	2	2	1	1	0	0
L	Mining, Caldwell	Guadalupe	24	19	14	9	4	2
L	Polonia WSC	Colorado	285	338	391	447	505	562
L	Polonia WSC	Guadalupe	605	717	831	948	1,071	1,193
L	San Marcos	Guadalupe	1	2	3	4	5	6
L	Tri Community WSC	Guadalupe	174	206	239	272	308	343
	Sum of Projected Water Demands (acre-feet)		**6,264**	**7,386**	**8,498**	**9,651**	**10,863**	**12,068**

GONZALES COUNTY

84.64% (multiplier)

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	County-Other, Gonzales	Guadalupe	215	226	244	265	287	311
L	County-Other, Gonzales	Lavaca	15	15	17	19	19	21
L	Gonzales	Guadalupe	2,059	2,223	2,381	2,581	2,796	3,024
L	Gonzales County WSC	Guadalupe	1,847	2,001	2,150	2,334	2,529	2,736
L	Irrigation, Gonzales	Guadalupe	4,339	4,339	4,339	4,339	4,339	4,339

L	Livestock, Gonzales	Guadalupe	7,919	7,919	7,919	7,919	7,919	7,919
L	Livestock, Gonzales	Lavaca	183	183	183	183	183	183
L	Manufacturing, Gonzales	Guadalupe	1,846	2,054	2,054	2,054	2,054	2,054
L	Mining, Gonzales	Guadalupe	1,354	1,022	688	354	20	1
L	Nixon	Guadalupe	395	423	450	487	527	570
L	Smiley	Guadalupe	122	131	140	151	164	177
L	Waelder	Guadalupe	213	229	245	265	287	310
	Sum of Projected Water Demands (acre-feet)		**20,507**	**20,765**	**20,810**	**20,951**	**21,124**	**21,645**

Projected Water Supply Needs
TWDB 2022 State Water Plan Data

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

CALDWELL COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	Aqua WSC	Colorado	51	43	35	26	17	8
L	Aqua WSC	Guadalupe	290	243	195	147	97	48
L	County Line SUD	Guadalupe	227	135	33	-54	-124	-177
L	County-Other, Caldwell	Colorado	203	216	215	214	211	207
L	County-Other, Caldwell	Guadalupe	1,112	1,170	1,165	1,162	1,145	1,131
L	Creedmoor-Maha WSC	Colorado	0	0	0	0	0	0
L	Creedmoor-Maha WSC	Guadalupe	0	0	0	0	0	0
L	Goforth SUD	Guadalupe	-16	-23	-27	-25	-20	-18
L	Gonzales County WSC	Guadalupe	32	31	28	24	16	9
L	Irrigation, Caldwell	Colorado	0	0	0	0	0	0
L	Irrigation, Caldwell	Guadalupe	0	0	0	0	0	0
L	Livestock, Caldwell	Colorado	0	0	0	0	0	0
L	Livestock, Caldwell	Guadalupe	0	0	0	0	0	0
L	Lockhart	Guadalupe	817	392	-39	-482	-946	-1,402
L	Luling	Guadalupe	127	-49	-226	-411	-606	-796
L	Manufacturing, Caldwell	Guadalupe	0	0	0	0	0	0
L	Martindale WSC	Guadalupe	-124	-218	-296	-395	-518	-665
L	Maxwell WSC	Guadalupe	445	391	328	253	170	86
L	Mining, Caldwell	Colorado	3	2	2	1	1	0
L	Mining, Caldwell	Guadalupe	0	0	0	0	0	0
L	Polonia WSC	Colorado	508	455	398	340	276	213
L	Polonia WSC	Guadalupe	1,078	963	846	720	587	451
L	San Marcos	Guadalupe	1	0	0	0	-1	-2
L	Tri Community WSC	Guadalupe	318	284	251	219	182	147
	Sum of Projected Water Supply Needs (acre-feet)		**-140**	**-290**	**-588**	**-1,367**	**-2,215**	**-3,060**

GONZALES COUNTY

All values are in acre-feet

RWPG	WUG	WUG Basin	2020	2030	2040	2050	2060	2070
L	County-Other, Gonzales	Guadalupe	524	511	490	465	439	411
L	County-Other, Gonzales	Lavaca	30	30	28	26	25	23
L	Gonzales	Guadalupe	3,101	2,937	2,779	2,579	2,364	2,136
L	Gonzales County WSC	Guadalupe	1,118	960	808	626	433	229
L	Irrigation, Gonzales	Guadalupe	482	482	482	482	482	482
L	Livestock, Gonzales	Guadalupe	0	0	0	0	0	0

L	Livestock, Gonzales	Lavaca	0	0	0	0	0	0
L	Manufacturing, Gonzales	Guadalupe	0	0	0	0	0	0
L	Mining, Gonzales	Guadalupe	0	0	0	0	0	0
L	Nixon	Guadalupe	3,225	3,189	3,163	3,127	3,088	3,046
L	Smiley	Guadalupe	322	313	304	293	280	267
L	Waelder	Guadalupe	417	401	385	365	343	320
	Sum of Projected Water Supply Needs (acre-feet)		**0**	**0**	**0**	**0**	**0**	**0**

Projected Water Management Strategies
TWDB 2022 State Water Plan Data

CALDWELL COUNTY

WUG, Basin (RWPG) All values are in acre-feet

Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
Aqua WSC, Guadalupe (L)							
Municipal Water Conservation	DEMAND REDUCTION [Caldwell]	0	0	0	1	1	1
		0	**0**	**0**	**1**	**1**	**1**
County Line SUD, Guadalupe (L)							
ARWA - Phase 2	Carrizo-Wilcox Aquifer [Caldwell]	0	0	190	174	157	138
ARWA - Phase 3	Direct Reuse [Hays]	0	0	0	0	42	37
ARWA Shared Project (Phase 1)	Carrizo-Wilcox Aquifer [Caldwell]	148	148	135	124	112	99
County Line SUD - Brackish Edwards Wellfield	Edwards-BFZ Aquifer [Hays]	0	0	0	130	234	310
County Line SUD - Trinity Wellfield	Trinity Aquifer [Hays]	0	0	0	130	173	153
Reuse - County Line SUD	Direct Reuse [Hays]	172	345	476	582	655	695
		320	**493**	**801**	**1,140**	**1,373**	**1,432**
Goforth SUD, Guadalupe (L)							
Drought Management – Goforth SUD	DEMAND REDUCTION [Caldwell]	2	0	0	0	0	0
GBRA Shared Project (Phase 1)	Carrizo-Wilcox Aquifer [Caldwell]	32	20	15	12	10	9
GBRA Shared Project (Phase 1)	Carrizo-Wilcox Aquifer [Gonzales]	32	21	16	13	10	9
		66	**41**	**31**	**25**	**20**	**18**
Gonzales County WSC, Guadalupe (L)							
Municipal Water Conservation	DEMAND REDUCTION [Caldwell]	3	9	16	24	34	45
		3	**9**	**16**	**24**	**34**	**45**
Lockhart, Guadalupe (L)							
GBRA Shared Project (Phase 1)	Carrizo-Wilcox Aquifer [Caldwell]	1,489	1,489	1,489	1,489	1,489	1,489
GBRA Shared Project (Phase 1)	Carrizo-Wilcox Aquifer [Gonzales]	1,511	1,511	1,511	1,511	1,511	1,511
Municipal Water Conservation	DEMAND REDUCTION [Caldwell]	0	0	0	0	0	71
		3,000	**3,000**	**3,000**	**3,000**	**3,000**	**3,071**
Luling, Guadalupe (L)							
Local Carrizo Aquifer Development	Carrizo-Wilcox Aquifer [Caldwell]	0	349	350	702	702	1,056
Municipal Water Conservation	DEMAND REDUCTION [Caldwell]	0	0	0	0	0	2

		0	**349**	**350**	**702**	**702**	**1,058**
Martindale WSC, Guadalupe (L)							
CRWA - Wells Ranch (Phase 3)	Carrizo-Wilcox Aquifer [Guadalupe]	0	61	131	231	484	779
Drought Management - Martindale	DEMAND REDUCTION [Caldwell]	20	0	0	0	0	0
FE - CRWA Hays Caldwell WTP Expansion	Guadalupe Run-of-River [Hays]	242	241	238	235	233	233
Martindale WSC - Alluvial Well	San Marcos River Alluvium Aquifer [Caldwell]	0	226	224	222	219	219
		262	**528**	**593**	**688**	**936**	**1,231**
Maxwell WSC, Guadalupe (L)							
Maxwell WSC - Trinity Well Field	Trinity Aquifer [Hays]	0	0	187	188	188	188
		0	**0**	**187**	**188**	**188**	**188**
Polonia WSC, Colorado (L)							
Municipal Water Conservation	DEMAND REDUCTION [Caldwell]	0	0	0	0	0	1
		0	**0**	**0**	**0**	**0**	**1**
Polonia WSC, Guadalupe (L)							
Municipal Water Conservation	DEMAND REDUCTION [Caldwell]	0	0	0	0	0	3
		0	**0**	**0**	**0**	**0**	**3**
San Marcos, Guadalupe (L)							
ARWA - Phase 2	Carrizo-Wilcox Aquifer [Caldwell]	0	0	2	2	2	2
ARWA - Phase 3	Direct Reuse [Hays]	0	0	0	0	1	1
ARWA Shared Project (Phase 1)	Carrizo-Wilcox Aquifer [Caldwell]	0	1	1	1	1	1
FE - CRWA Hays Caldwell WTP Expansion	Direct Reuse [Hays]	0	0	0	0	0	0
Reuse - San Marcos (Non-Potable)	Direct Reuse [Hays]	0	0	0	0	0	0
Reuse - San Marcos (Potable)	Direct Reuse [Hays]	0	0	0	1	1	1
		0	**1**	**3**	**4**	**5**	**5**
Tri Community WSC, Guadalupe (L)							
Municipal Water Conservation	DEMAND REDUCTION [Caldwell]	0	0	0	0	0	2
		0	**0**	**0**	**0**	**0**	**2**
Sum of Projected Water Management Strategies (acre-feet)		**3,651**	**4,421**	**4,981**	**5,772**	**6,259**	**7,055**

GONZALES COUNTY

WUG, Basin (RWPG)

All values are in acre-feet

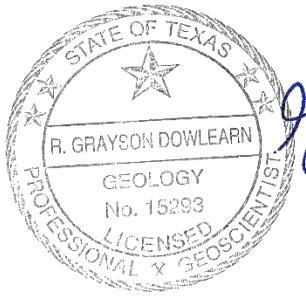
Water Management Strategy	Source Name [Origin]	2020	2030	2040	2050	2060	2070
Gonzales, Guadalupe (L)							
Municipal Water Conservation	DEMAND REDUCTION [Gonzales]	96	271	465	690	941	1,081
		96	**271**	**465**	**690**	**941**	**1,081**
Gonzales County WSC, Guadalupe (L)							

Municipal Water Conservation	DEMAND REDUCTION [Gonzales]	98	261	444	650	876	1,119
		98	**261**	**444**	**650**	**876**	**1,119**
Nixon, Guadalupe (L)							
Municipal Water Conservation	DEMAND REDUCTION [Gonzales]	1	1	3	11	23	38
		1	**1**	**3**	**11**	**23**	**38**
Smiley, Guadalupe (L)							
Municipal Water Conservation	DEMAND REDUCTION [Gonzales]	5	15	26	31	36	42
		5	**15**	**26**	**31**	**36**	**42**
Waelder, Guadalupe (L)							
Municipal Water Conservation	DEMAND REDUCTION [Gonzales]	7	18	21	27	35	44
		7	**18**	**21**	**27**	**35**	**44**
Sum of Projected Water Management Strategies (acre-feet)		**207**	**566**	**959**	**1,409**	**1,911**	**2,324**

APPENDIX 7
Groundwater Availability Model Report
GMA 23-018
Gonzales County Underground Water Conservation District
Management Plan

GAM RUN 23-018: GONZALES COUNTY UNDERGROUND WATER CONSERVATION DISTRICT MANAGEMENT PLAN

Nick Lamkey, GIT and Grayson Dowlearn, P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
512-475-1788
October 9, 2023



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GAM RUN 23-018: GONZALES COUNTY UNDERGROUND WATER CONSERVATION DISTRICT MANAGEMENT PLAN

Nick Lamkey, GIT and Grayson Dowlearn, P.G.
Texas Water Development Board
Groundwater Division
Groundwater Modeling Department
512-475-1788
October 9, 2023

EXECUTIVE SUMMARY:

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

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

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

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

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

The groundwater management plan for the Gonzales County Underground Water Conservation District should be adopted by the district on or before October 31, 2023 and submitted to the executive administrator of the TWDB on or before November 30, 2023. The current management plan for the Gonzales County Underground Water Conservation District expires on January 29, 2024.

The management plan information for the aquifers within Gonzales County Underground Water Conservation District was extracted from three groundwater availability models. We used the groundwater availability model for the southern portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers (Panday and others, 2023) to estimate management plan information for the Carrizo-Wilcox, Queen City, and Sparta aquifers. We used the groundwater availability model for the Yegua-Jackson Aquifer (Deeds and others, 2010) to estimate management plan information for the Yegua-Jackson Aquifer. We used the groundwater availability model for the central and southern portions of the Gulf Coast Aquifer System (Shi and Boghici, 2023) to estimate the management plan information for the Gulf Coast Aquifer System.

This report replaces the results of GAM Run 18-006 (Wade, 2018). Values may differ from the previous report because budget values were estimated from new models for the Carrizo-Wilcox, Queen City, Sparta, and Gulf Coast Aquifer System aquifers as well as routine updates to the spatial grid file used to define county, groundwater conservation district, and aquifer boundaries, which can impact the calculated water budget values. Additionally, the approach used for analyzing model results is reviewed during each update and may have been refined to better delineate groundwater flows. Tables 1, 2, 3, 4, and 5 summarize the groundwater availability model data required by statute. Figures 1, 3, 5, 7, and 9 show the area of the model from which the values in Tables 1, 2, 3, 4, and 5 were extracted. Figures 2, 4, 6, 8, and 10 provide a generalized diagram of the groundwater flow components provided in Tables 1, 2, 3, 4, and 5. If the Gonzales County Underground Water Conservation District determines that the district boundaries used in the assessment do not reflect current conditions after reviewing the figures, please notify the TWDB Groundwater Modeling Department at your earliest convenience.

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

METHODS:

In accordance with the provisions of the Texas Water Code § 36.1071(h), the groundwater availability models mentioned above were used to estimate information for the Gonzales County Underground Water Conservation District management plan. Water budgets were extracted for the historical model periods in the respective groundwater availability models. For the Carrizo-Wilcox, Queen City, and Sparta aquifers, water budgets were extracted over the historical calibration period (1981 through 2017) using ZONEBUDGET for MODFLOW 6 (Langevin and others, 2021). For the Yegua-Jackson Aquifer, water budgets were extracted over the historical calibration period (1980-1997) using ZONEBUDGET Version 3.01 (Harbaugh, 2009). For the Gulf Coast Aquifer System, water budgets were extracted over the historical calibration period (1981 through 2015) using ZONEBUDGET USG Version 1.00 (Panday and others, 2013). 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:

Carrizo-Wilcox, Queen City, and Sparta aquifers

- We used version 3.01 of the groundwater availability model for the southern portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers (Panday and others, 2023) to analyze the Carrizo-Wilcox, Queen City and Sparta aquifers. See Panday and others (2023) for assumptions and limitations of the model.
- The groundwater availability model for the southern portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers contains nine layers:
    - Layer 1 represents Quaternary Alluvium
    - Layer 2 represents Younger units
    - Layer 3 represents the Sparta Aquifer and equivalent units
    - Layer 4 represents the Weches Formation (confining unit)
    - Layer 5 represents the Queen City Aquifer and equivalent units
    - Layer 6 represents the Reklaw Formation (confining unit)
    - Layers 7 through 9 represent the Carrizo-Wilcox Aquifer and equivalent units

- Water budget values for the district were determined for the Carrizo-Wilcox Aquifer (Layer 7 through 9 and the portions of Layer 1 directly overlying the aquifer), the Queen City Aquifer (Layer 5 and the portions of Layer 1 directly overlying the aquifer), and the Sparta Aquifer (Layer 3 and the portions of Layer 1 directly overlying the aquifer).
- Water budget terms were averaged for the historical calibration period 1981 through 2017 (stress periods 3 through 39).
- The model was run with MODFLOW-6 (Langevin and others, 2017).

Yegua-Jackson Aquifer

- We used version 1.01 of the groundwater availability model for the Yegua-Jackson Aquifer (Deeds and others, 2010) to analyze the Yegua-Jackson Aquifer. See Deeds and others (2010) for assumptions and limitations of the model.
- The groundwater availability model for the Yegua-Jackson Aquifer contains five layers:
    - Layer 1 represents the Yegua-Jackson Aquifer outcrop, the Catahoula Formation, and other younger overlying units
    - Layer 2 represents the upper portion of the Jackson Group
    - Layer 3 represents the lower portion of the Jackson Group
    - Layer 4 represents the upper portion of the Yegua Group
    - Layer 5 represents the lower portion of the Yegua Group
- An overall water budget for the district was determined for the Yegua-Jackson Aquifer (Layers 1 through 5, collectively).
- The Catahoula Group is considered part of the Gulf Coast Aquifer System within the Gonzales County Underground Water Conservation District. The Catahoula Group was removed from calculations for the Yegua-Jackson Aquifer, however, was used to calculate flow between the Yegua-Jackson Aquifer and Gulf Coast Aquifer System.
- Water budget terms were averaged for the period 1980 through 1997 (stress periods 10 through 27).
- The model was run with MODFLOW-2000 (Harbaugh and others, 2000).

Gulf Coast Aquifer System

- We used version 1.01 of the groundwater availability model for the central and southern portions of the Gulf Coast Aquifer System (Shi and Boghici, 2023) to analyze the Gulf Coast Aquifer System. See Shi and Boghici (2023) for assumptions and limitations of the model.
- The groundwater availability model for the Gulf Coast Aquifer System contains four layers:
    - Layer 1 represents the Chicot Aquifer and younger overlying units
    - Layer 2 represents the Evangeline Aquifer
    - Layer 3 represents the Burkeville confining unit
    - Layer 4 represents the Jasper Aquifer and the upper sandy portion of the Catahoula Formation in direct hydrologic communication with the Jasper Aquifer
- Water budgets for the district were determined for the Gulf Coast Aquifer System (Layers 1 through 4, collectively).
- Water budget terms were averaged for the period 1981 through 2015 (stress periods 2 through 36).
- The model was run with MODFLOW-USG (Panday and others, 2013).

RESULTS:

A groundwater budget summarizes the amount of water entering and leaving the aquifer according to the groundwater availability model. Selected groundwater budget components listed below were extracted from the groundwater availability model results for the Carrizo-Wilcox, Queen City, and Sparta aquifers, Yegua-Jackson Aquifer, and the Gulf Coast Aquifer System located within the Gonzales County Underground Water Conservation District and averaged over the historical calibration periods, as shown in Tables 1, 2, 3, 4, and 5.

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

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

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

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

The information needed for the district's management plan is summarized in Tables 1, 2, 3, 4, and 5. Figures 1, 3, 5, 7, and 9 show the area of the model from which the values in Tables 1, 2, 3, 4, and 5 were extracted. Figures 2, 4, 6, 8, and 10 provide a generalized diagram of the groundwater flow components provided in Tables 1, 2, 3, 4, and 5. It is important to note that sub-regional water budgets are not exact. This is due to the size of the model cells and the approach used to extract data from the model. To avoid double accounting, a model cell that straddles a political boundary, such as a district or county boundary, is assigned to one side of the boundary based on the location of the centroid of the model cell. For example, if a cell contains two counties, the cell is assigned to the county where the centroid of the cell is located.

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

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Carrizo-Wilcox Aquifer	7,855
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Carrizo-Wilcox Aquifer	1,722
Estimated annual volume of flow into the district within each aquifer in the district	Carrizo-Wilcox Aquifer	17,034
Estimated annual volume of flow out of the district within each aquifer in the district	Carrizo-Wilcox Aquifer	8,243
Estimated net annual volume of flow between each aquifer in the district	From Carrizo-Wilcox Aquifer to Reklaw Confining Unit	6,097
	From Carrizo-Wilcox Aquifer to Carrizo-Wilcox equivalent units	283

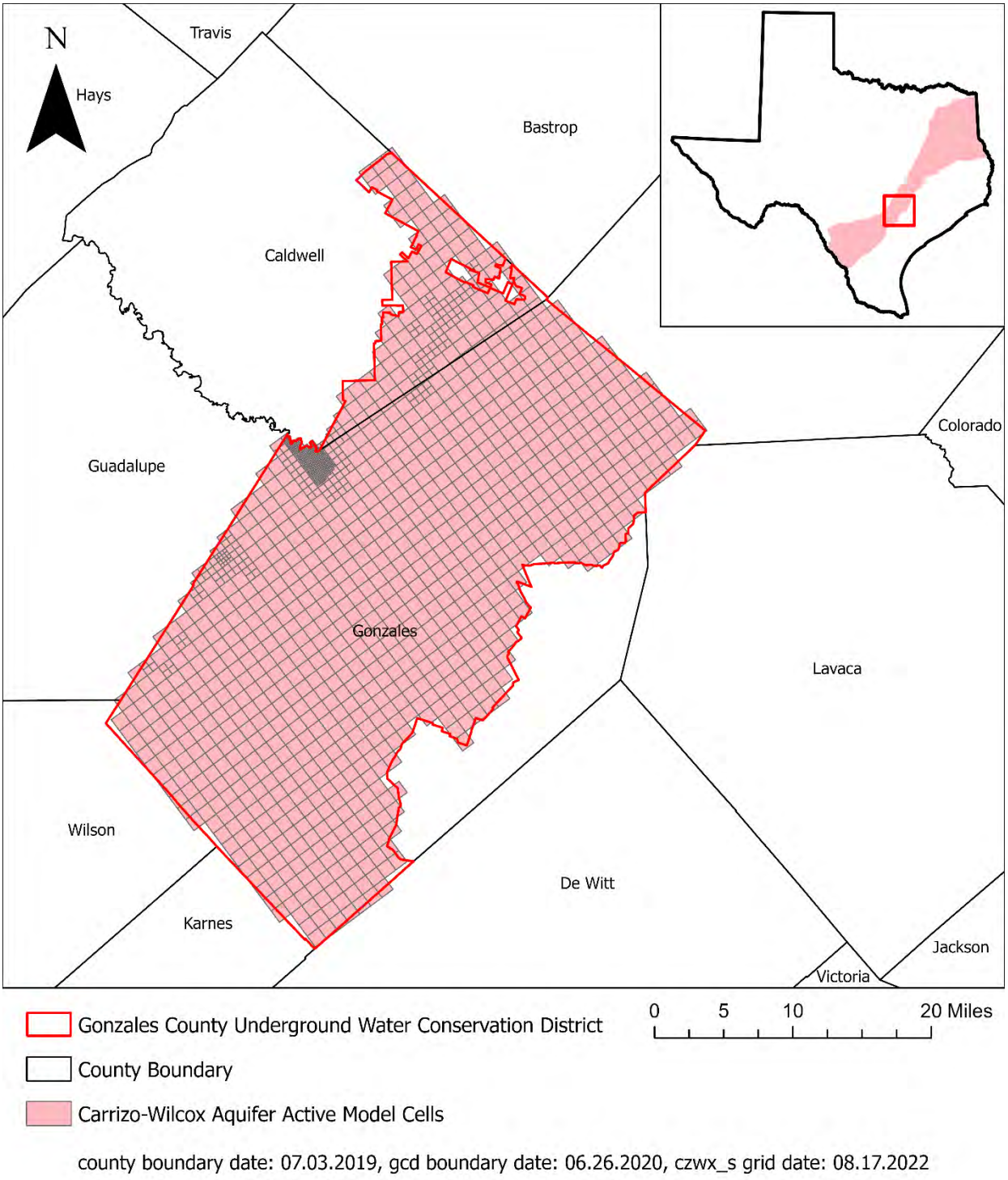
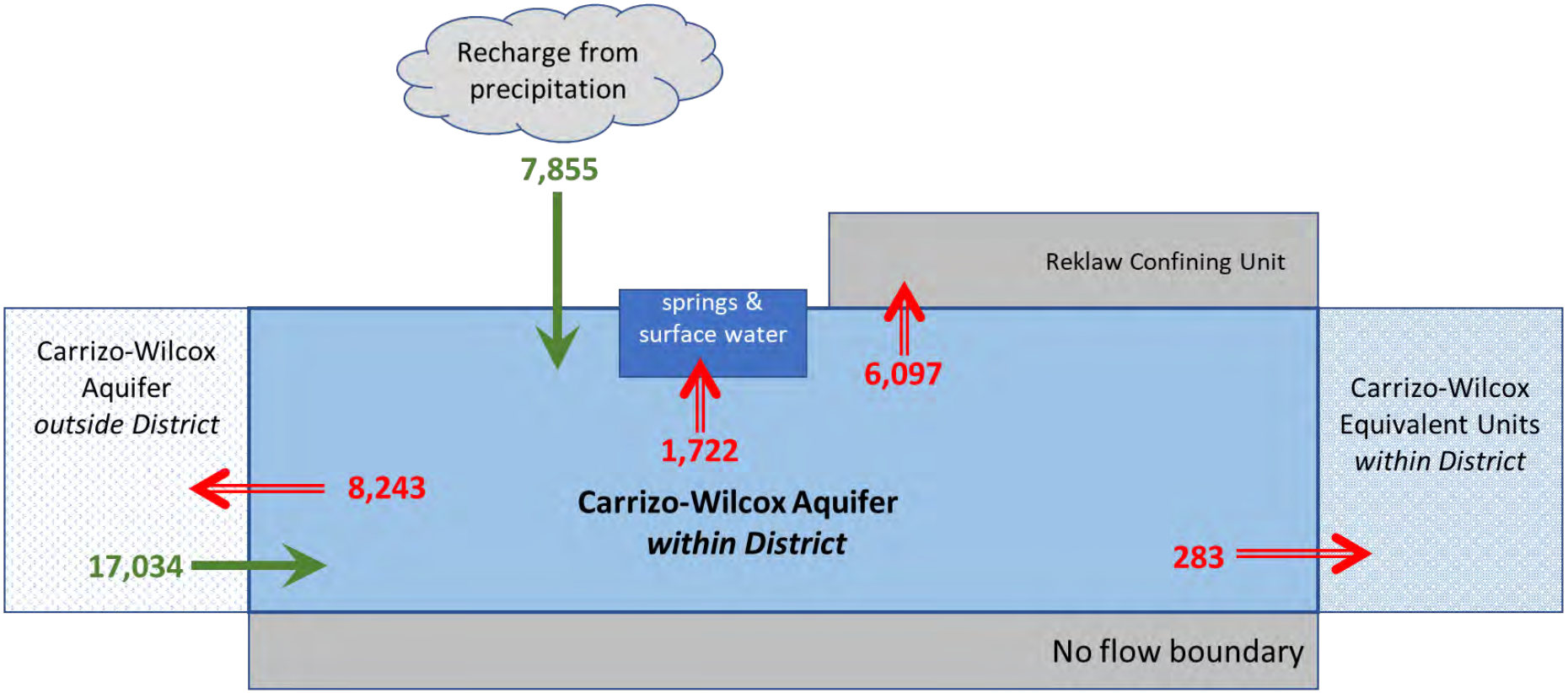


Figure 1: Area of the groundwater availability model for the southern portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers from which the information in Table 1 was extracted (the Carrizo-Wilcox Aquifer extent within the district boundary).



Caveat: This diagram only includes the water budget items provided in Table 1. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

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

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

Management Plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Queen City Aquifer	6,796
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Queen City Aquifer	119,978
Estimated annual volume of flow into the district within each aquifer in the district	Queen City Aquifer	125,472
Estimated annual volume of flow out of the district within each aquifer in the district	Queen City Aquifer	23,741
Estimated net annual volume of flow between each aquifer in the district	From Queen City Aquifer to Weches Confining Unit	1,483
	To Queen City Aquifer from Reklaw Confining Unit	5,752
	To Queen City Aquifer from Queen City Aquifer equivalent units	29,211

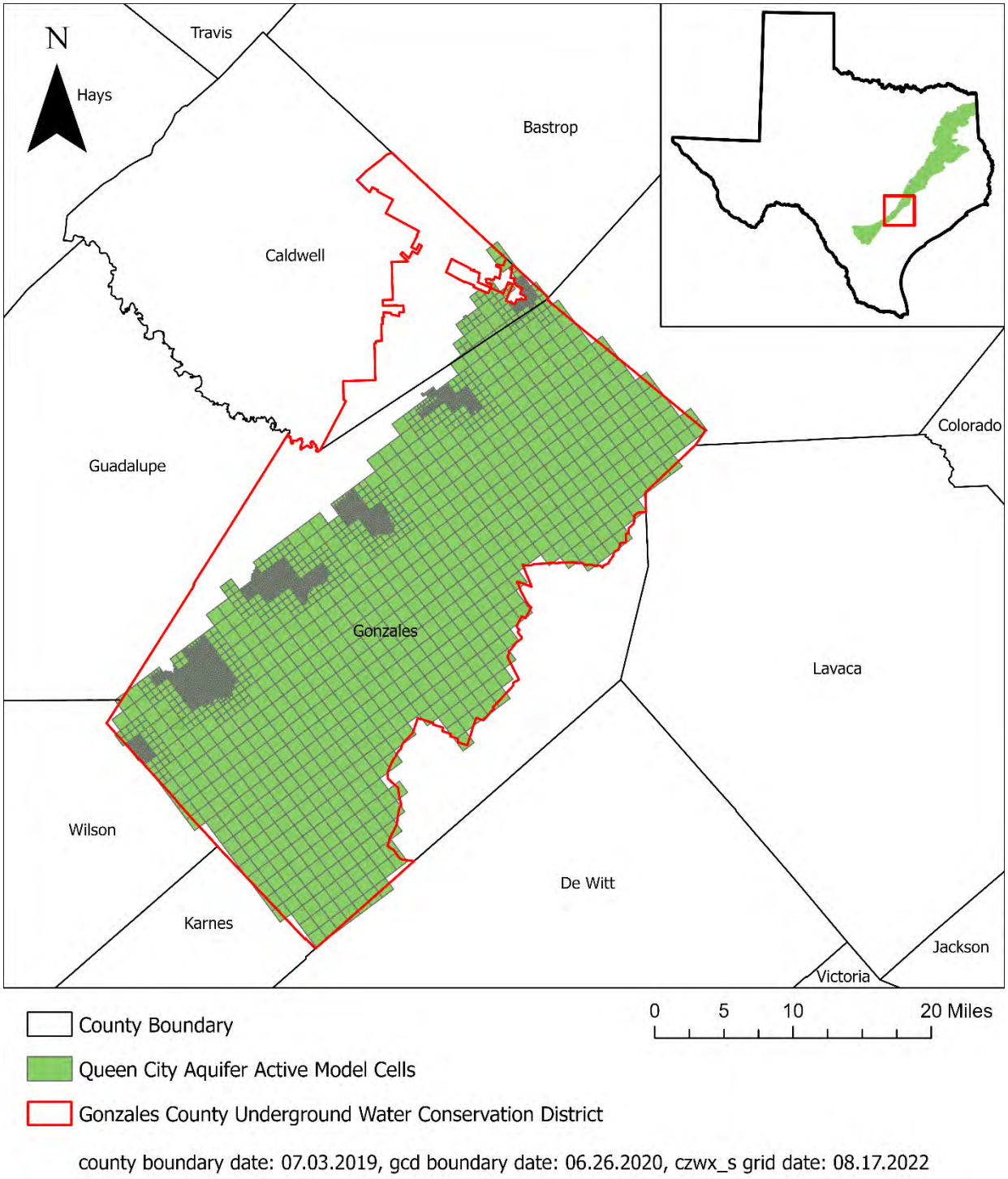
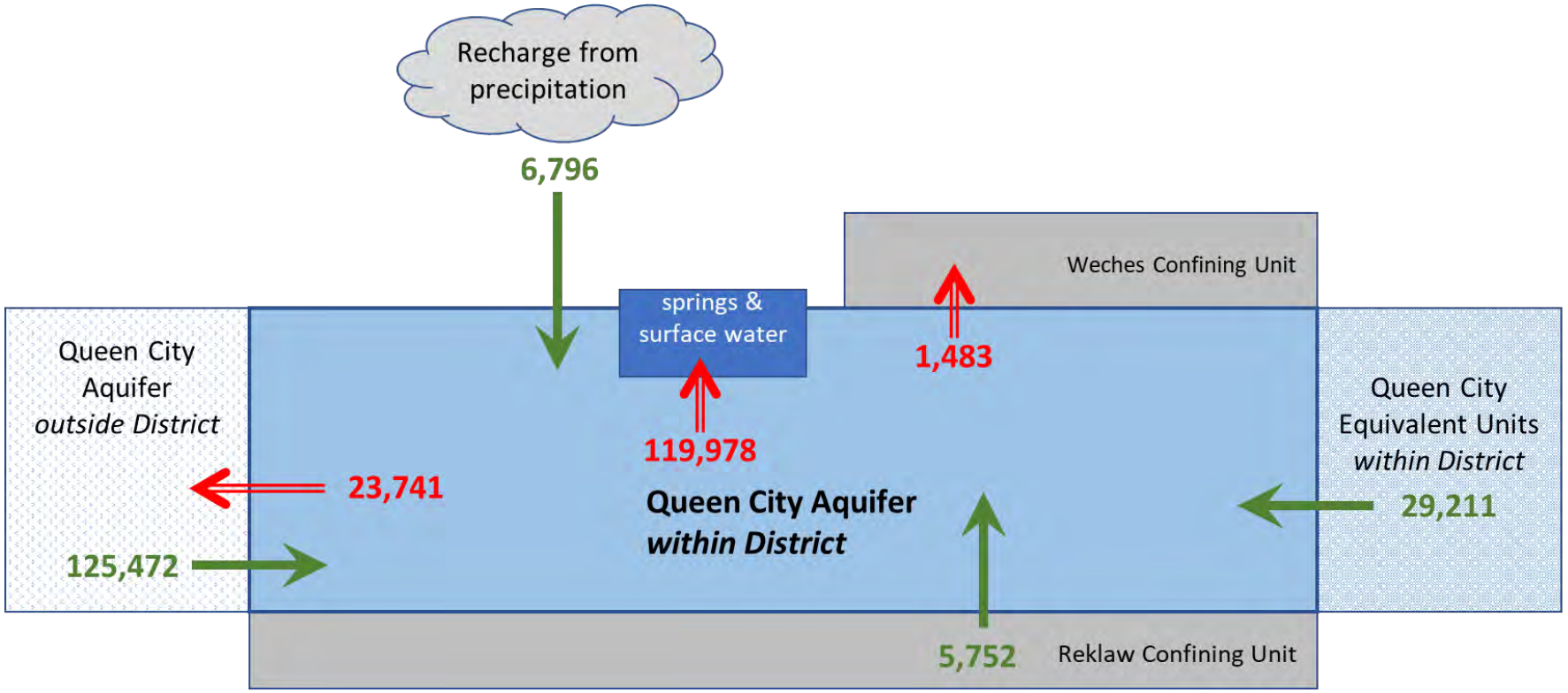


Figure 3: Area of the groundwater availability model for the southern portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers from which the information in Table 2 was extracted (the Queen City Aquifer extent within the district boundary).



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

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

Table 3: Summarized information for the Sparta Aquifer that is needed for the Gonzales County Underground Water Conservation District groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Sparta Aquifer	2,604
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Sparta Aquifer	2,167
Estimated annual volume of flow into the district within each aquifer in the district	Sparta Aquifer	203
Estimated annual volume of flow out of the district within each aquifer in the district	Sparta Aquifer	92
Estimated net annual volume of flow between each aquifer in the district	From Sparta Aquifer to younger overlying units	3,275
	To Sparta Aquifer from Weches Confining Unit	2,895
	From Sparta Aquifer to Sparta Aquifer equivalent units	140

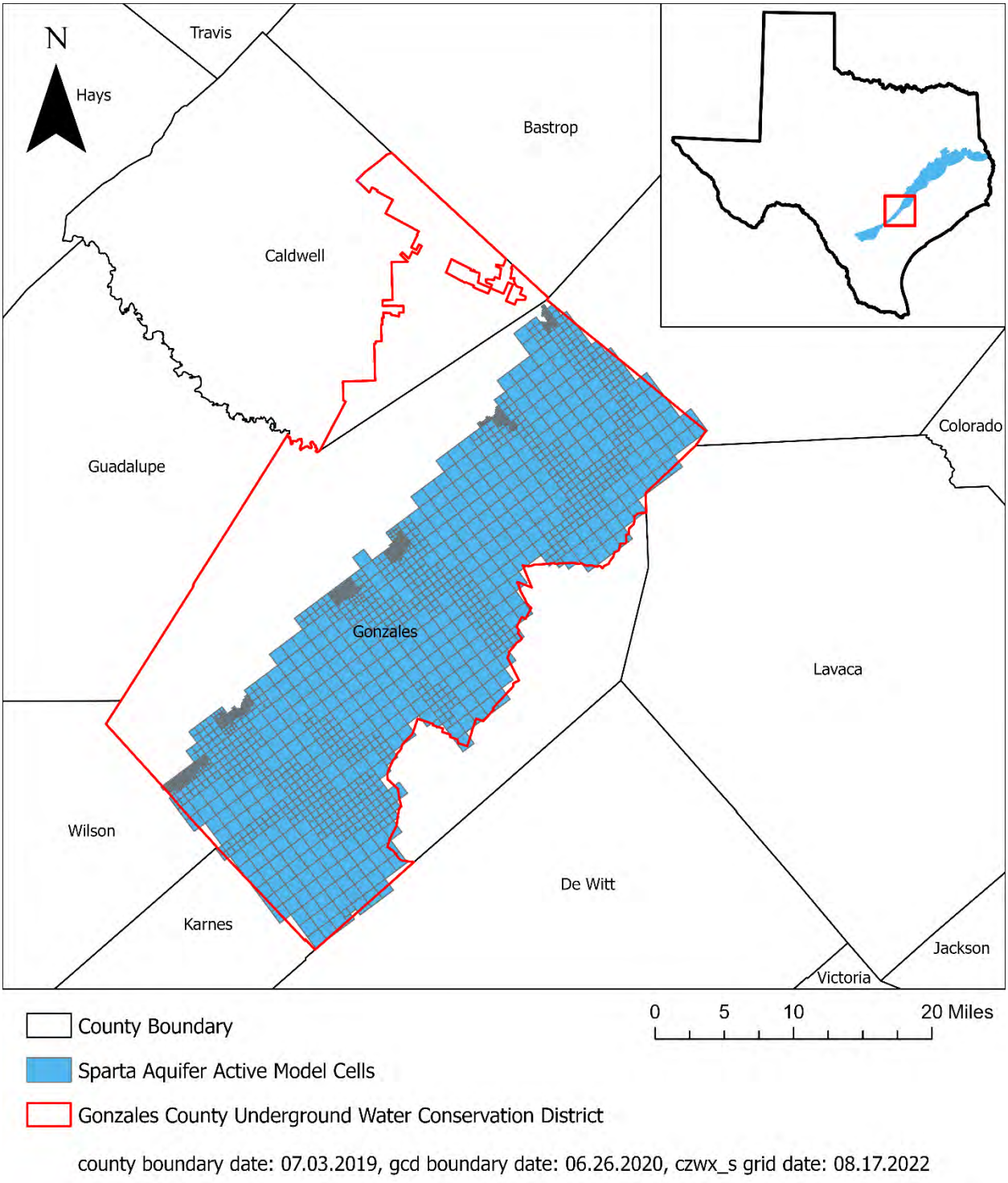
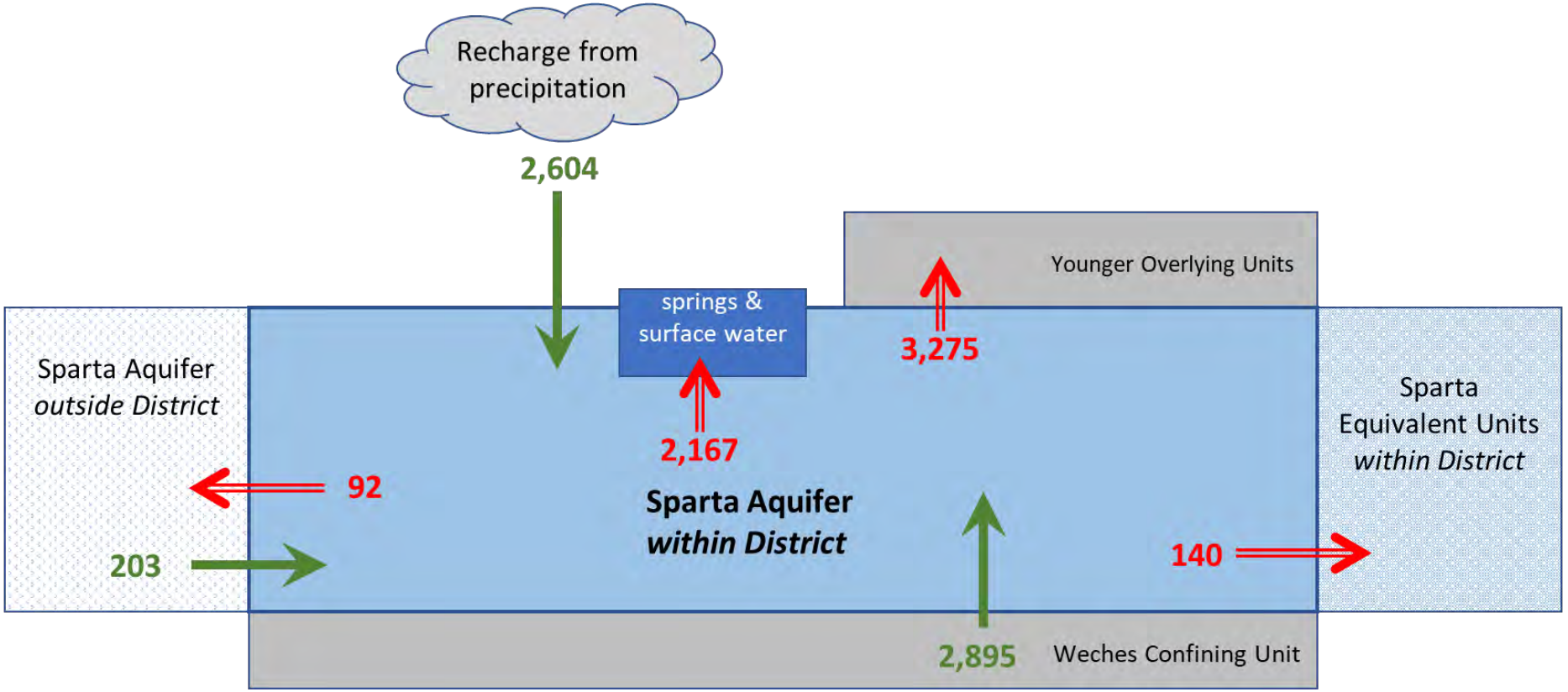


Figure 5: Area of the groundwater availability model for the southern portion of the Carrizo-Wilcox, Queen City, and Sparta aquifers from which the information in Table 3 was extracted (the Sparta Aquifer extent within the district boundary).



Caveat: This diagram only includes the water budget items provided in Table 3. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 6: Generalized diagram of the summarized budget information from Table 3, representing directions of flow for the Sparta Aquifer within the Gonzales County Underground Water Conservation District. Flow values are expressed in acre-feet per year.

Table 4: Summarized information for the Yegua-Jackson Aquifer that is needed for the Gonzales County Underground Water Conservation District groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Yegua-Jackson Aquifer	25,360
Estimated annual volume of water that discharges from the aquifer to springs and any surface water body including lakes, streams, and rivers	Yegua-Jackson Aquifer	41,092
Estimated annual volume of flow into the district within each aquifer in the district	Yegua-Jackson Aquifer	10,583
Estimated annual volume of flow out of the district within each aquifer in the district	Yegua-Jackson Aquifer	3,569
Estimated net annual volume of flow between each aquifer in the district	To Yegua-Jackson Aquifer from Gulf Coast Aquifer System	805
	To Yegua-Jackson Aquifer from Yegua-Jackson equivalent units	251

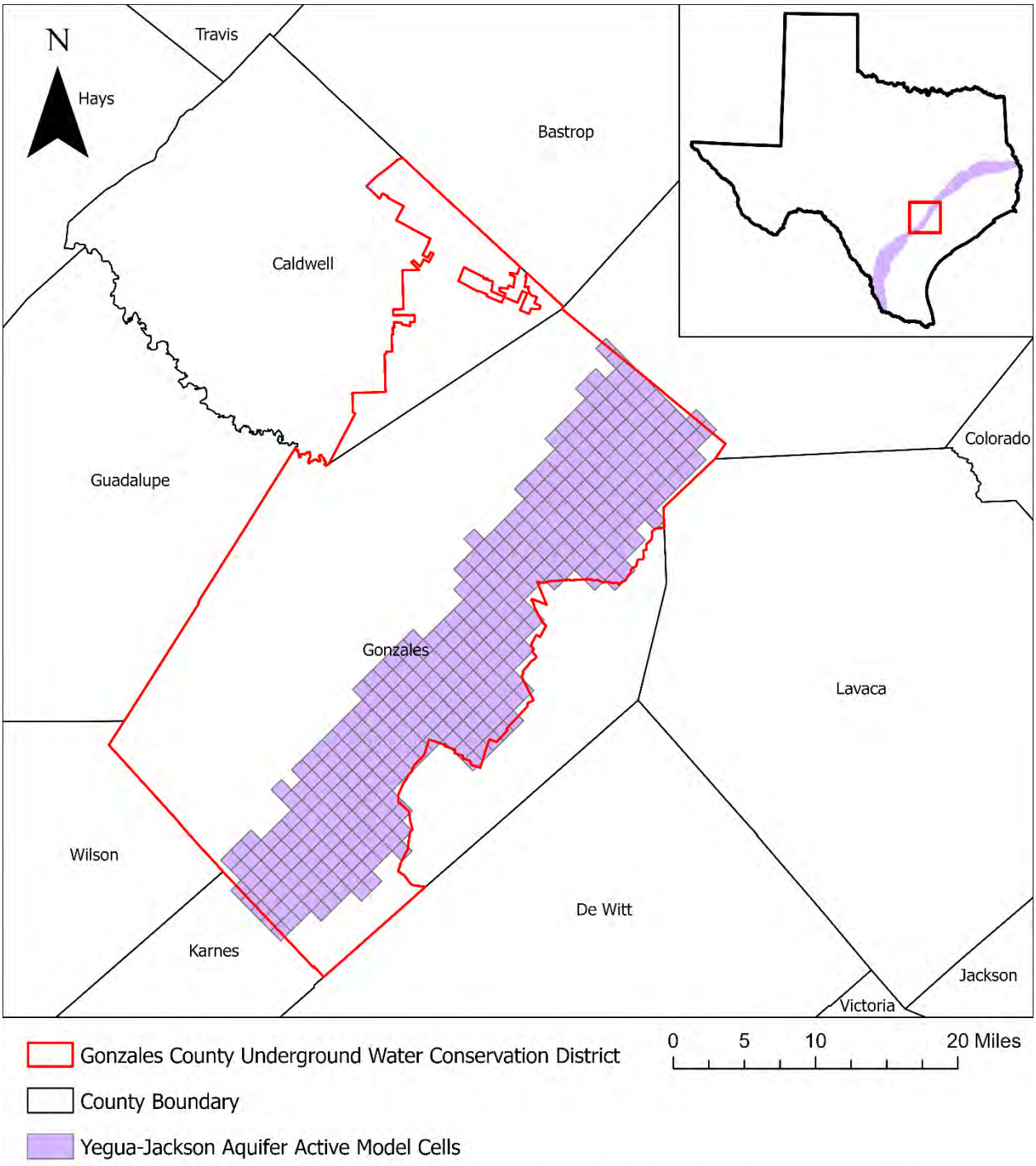
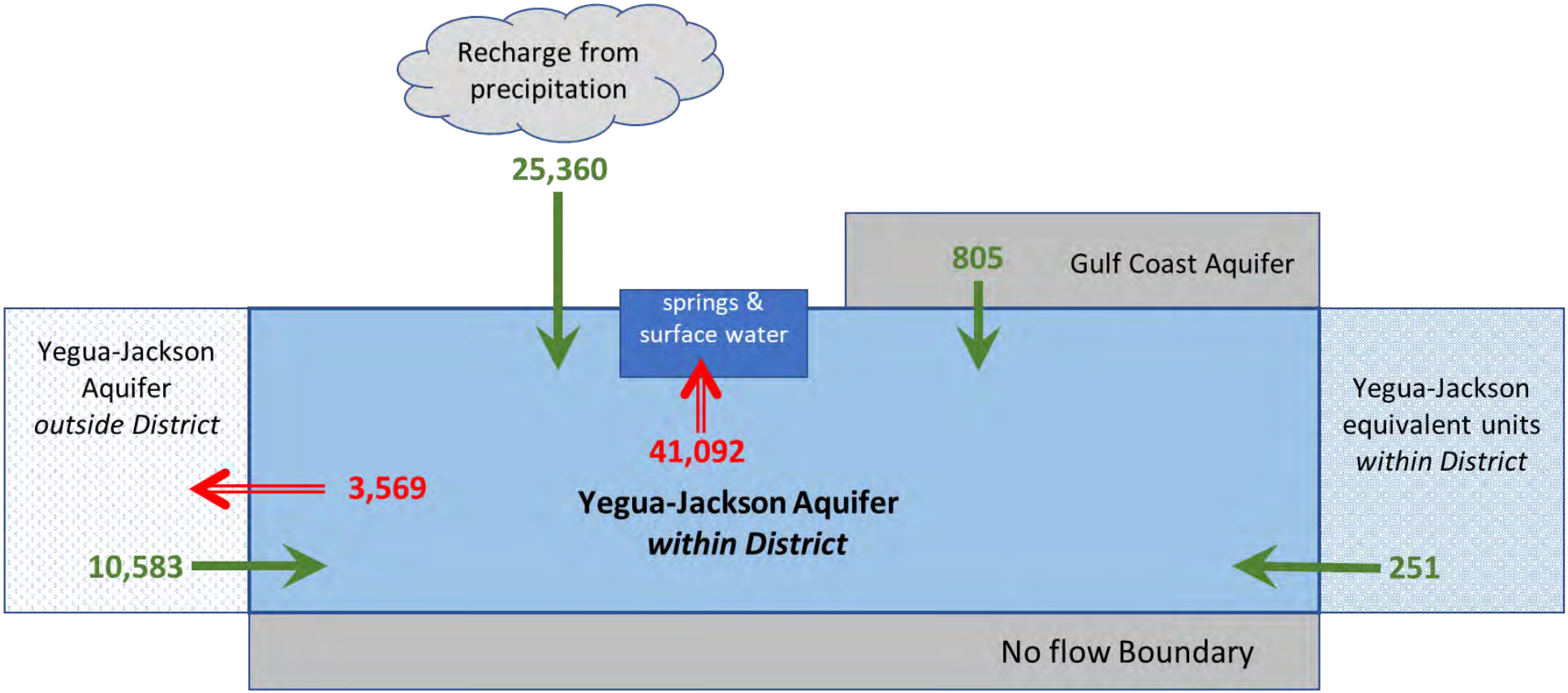


Figure 7: Area of the groundwater availability model for the Yegua-Jackson Aquifer from which the information in Table 4 was extracted (the Yegua-Jackson Aquifer extent within the district boundary).



Caveat: This diagram only includes the water budget items provided in Table 4. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 8: Generalized diagram of the summarized budget information from Table 4, representing directions of flow for the Yegua-Jackson Aquifer within the Gonzales County Underground Water Conservation District. Flow values are expressed in acre-feet per year.

Table 5: Summarized information for the Gulf Coast Aquifer System for the Gonzales County Underground Water Conservation District groundwater management plan. All values are reported in acre-feet per year and rounded to the nearest 1 acre-foot.

Management plan requirement	Aquifer or confining unit	Results
Estimated annual amount of recharge from precipitation to the district	Gulf Coast Aquifer	3,347
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	0
Estimated annual volume of flow into the district within each aquifer in the district	Gulf Coast Aquifer	4,222
Estimated annual volume of flow out of the district within each aquifer in the district	Gulf Coast Aquifer	1,201
Estimated net annual volume of flow between each aquifer in the district	From Gulf Coast Aquifer System to Yegua-Jackson Aquifer	805*
	From the Gulf Coast Aquifer System to Yegua-Jackson equivalent units	5,880

*Value of flow between the Yegua-Jackson Aquifer and Gulf Coast Aquifer System is calculated from the Yegua Jackson groundwater availability model.

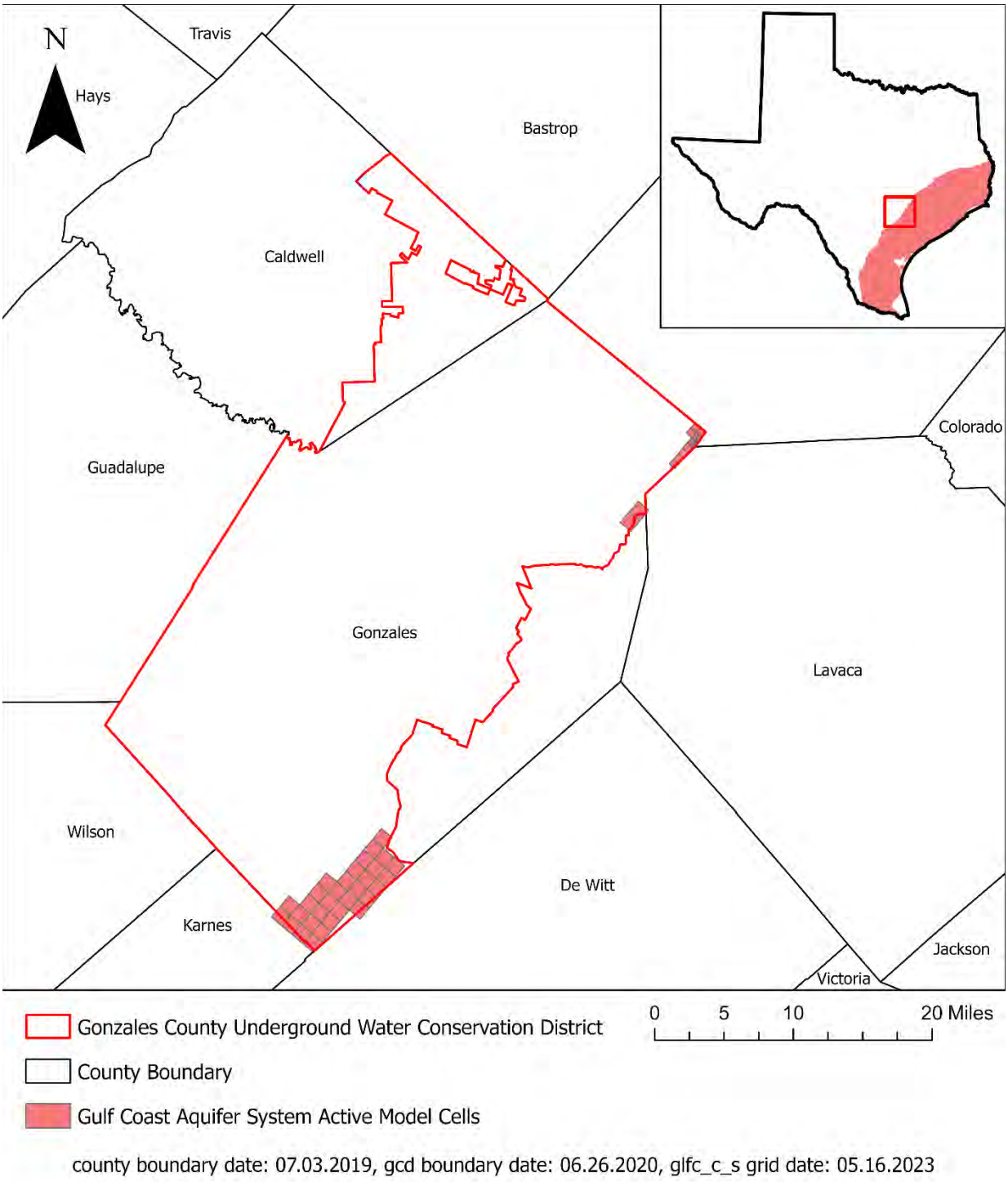
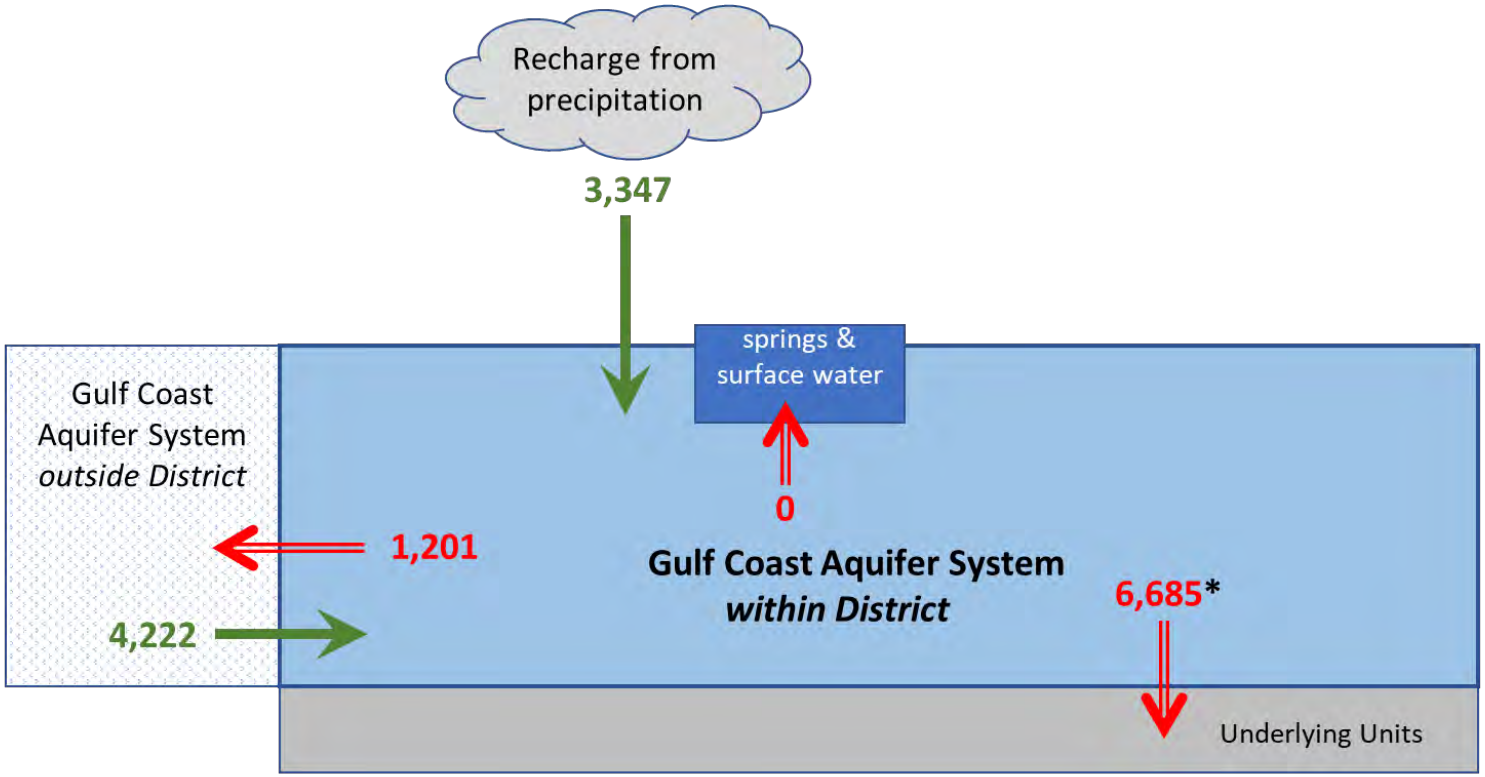


Figure 9: Area of the groundwater availability model for the central and southern portions of the Gulf Coast Aquifer System from which the information in Table 5 was extracted (the Gulf Coast Aquifer System extent with the district boundary).



* Flow to Underlying Units includes net outflow of 805 acre-feet per year to Yegua-Jackson Aquifer and net outflow of 5,880 acre-feet per year to the Yegua-Jackson equivalent units

Caveat: This diagram only includes the water budget items provided in Table 5. A complete water budget would include additional inflows and outflows. For a full groundwater budget, please submit a request in writing to the Groundwater Modeling Department.

Figure 8: Generalized diagram of the summarized budget information from Table 5, representing directions of flow for the Gulf Coast Aquifer System within the Gonzales County Underground Water Conservation District. Flow values are expressed in acre-feet per year.

LIMITATIONS:

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

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

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

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

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

REFERENCES:

Deeds, N. E., Yan, T., Singh, A., Jones, T. L., Kelley, V. A., Knox, P. R., and Young, S. C., 2010, Groundwater availability model for the Yegua-Jackson Aquifer: Final report prepared for the Texas Water Development Board by INTERA, Inc., 582 p., http://www.twdb.texas.gov/groundwater/models/gam/ygjk/YGJK_Model_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., Banta, E. R., Hill, M. C., and McDonald, M. G., 2000, MODFLOW-2000, the U.S. Geological Survey modular ground-water model -- User guide to modularization concepts and the Ground-Water Flow Process: U.S. Geological Survey Open-File Report 00-92, 121 p.

Langevin, C.D., Hughes, J.D., Banta, E.R., Provost, A.M., Niswonger, R.G., and Panday, Sorab, 2017, MODFLOW 6 Modular Hydrologic Model: U.S. Geological Survey Software, https://doi.org/10.5066/F76Q1VQV

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

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

Panday, S., Langevin, C.D., Niswonger, R.G., Ibaraki, M., and Hughes, J.D., 2013, MODFLOW–USG version 1: An unstructured grid version of MODFLOW for simulating groundwater flow and tightly coupled processes using a control volume finite-difference formulation: U.S. Geological Survey Techniques and Methods, book 6, chap. A45, 66 p.

Panday, S., Wyckoff, R., Martell, G., Schorr, S., Zivic, M., Hutchinson, W.R., and Rumbaugh, J., 2023, Update to the groundwater availability model for the southern portion of the Queen City, Sparta, and Carrizo-Wilcox aquifers: Final numerical model report prepared for the Texas Water Development Board by GSI Environmental, Inc., 388 p., http://www.twdb.texas.gov/groundwater/models/gam/czwx_s/South_QCSCW_ModelRpt_Final_w_appendicies.pdf

Shi, J. and Boghici, R., 2023, Numerical Model Report: Groundwater Availability Model for the Central and Southern Portions of the Gulf Coast Aquifer System in Texas. Texas Water Development Board, 143p.,

http://www.twdb.texas.gov/groundwater/models/gam/glfc_c_s/Central_Southern_Gulf_Coast_Aquifer_System_Numerical_Model_Report_Final.pdf

Texas Water Code § 36.1071

Wade, S., 2018, GAM Run 18-006: Gonzales County Underground Water Conservation District Groundwater Management Plan, 19 p., https://www.twdb.texas.gov/groundwater/docs/GAMruns/GR18-006.pdf

References

Deeds, N. E., Yan, T., Singh, A., Jones, T. L., Kelley, V. A., Knox, P. R., and Young, S. C., 2010, Groundwater availability model for the Yegua-Jackson Aquifer: Final report prepared for the Texas Water Development Board by INTERA, Inc., 582 p., http://www.twdb.texas.gov/groundwater/models/gam/ygjk/YGJK_Model_Report.pdf.

G.H. Shafer; 1965, *Groundwater Resources of Gonzales County, Texas*; Texas Water Development Board Report 4

C.R. Follett; 1966, *Groundwater Resources of Caldwell County, Texas*; Texas Water Development Board Report 12

Lamkey, Nick GIT and Dowlearn, Grayson P.G., TWDB Groundwater Division Groundwater Modeling Department, *GAM Run 23-018: Gonzales County Underground Water Conservation District Management Plan.*

TWDB; 2007, *Water for Texas 2007*; Texas Water Development Board Document Number GP-8-1

R. Thorkildsen and R. Price; 1991, *Ground-Water Resources of the Carrizo-Wilcox Aquifer in the Central Texas Region*; Texas Water Development Board Report No. 332

Panday, S., Wyckoff, R., Martell, G., Schorr, S., Zivic, M., Hutchinson, W.R., and Rumbaugh, J., 2023, Update to the groundwater availability model for the southern portion of the Queen City, Sparta, and Carrizo-Wilcox aquifers: Final numerical model report prepared for the Texas Water Development Board by GSI Environmental, Inc., 388 p., http://www.twdb.texas.gov/groundwater/models/gam/czwx_s/South_QCSCW_ModelRpt_Final_w_appendicies.pdf

Shi, J. and Boghici, R., 2023, Numerical Model Report: Groundwater Availability Model for the Central and Southern Portions of the Gulf Coast Aquifer System in Texas. Texas Water Development Board, 143p., GAM Run 23-018: Gonzales County Underground Water Conservation District Management Plan October 9, 2023 Page 26 of 26 http://www.twdb.texas.gov/groundwater/models/gam/glfc_c_s/Central_Southern_Gulf_Coast_Aquifer_System_Numerical_Model_Report_Final.pdf

William V. Hoyt; 1959, *Erosional Channel in the Middle Wilcox Near Yoakum, Lavaca County, Texas*; Transactions – Gulf Coast Association of Geological Societies, Volume IX